United Utilities

Strategic Environmental Assessment of the Revised Draft Water Resources Management Plan 2019

Environmental Report

August 2018

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Environment & Infrastructure UK Limited

Report for

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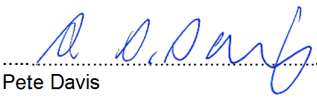

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Document revisions

No.	Details	Date
1	Draft Environmental Report	15.08.18
2	Revised Environmental Report	29.08.18

Non-Technical Summary

Introduction

United Utilities is currently finalising its Water Resources Management Plan 2019 (WRMP19). This will set out the strategy for water resource and demand management to ensure supplies of safe, clean drinking water are maintained to customers throughout the company's region over the period 2020 to 2045 and beyond.

As part of the preparation of WRMP19, United Utilities published its Draft Water Resources Management Plan (Draft WRMP) for consultation between 2nd March and 25th May 2018, following submission to Defra in December 2017. Taking into account the responses received to the consultation on the Draft WRMP from regulators, stakeholders and the public, further engagement and environmental assessment, United Utilities has prepared its Revised Draft WRMP which is being submitted to the Secretary of State for approval.

This Non-Technical Summary (NTS) provides an overview of the Environmental Report produced as part of the Strategic Environmental Assessment (SEA) of the Revised Draft WRMP. The SEA is being carried out on behalf of United Utilities by Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler, now Wood) to assess the likely significant economic, social and environmental effects of the Revised Draft WRMP and to identify ways in which adverse effects can be avoided, minimised or mitigated and how any positive effects can be enhanced.

The Environmental Report presents the findings of the SEA and is being submitted to the Secretary of State alongside the Revised Draft WRMP. The following sections of this NTS:

- provide an overview of the Revised Draft WRMP;
- describe the SEA process together with how it is being applied to WRMP19;
- describe the approach to undertaking the SEA of the Revised Draft WRMP;
- summarise the findings of the SEA of the Revised Draft WRMP; and
- set out the next steps in the SEA of WRMP19.

What is the Water Resources Management Plan?

United Utilities supplies water to some 3 million households and 200,000 business customers in Cumbria, Lancashire, Greater Manchester, Merseyside, most of Cheshire and a small part of Derbyshire. More than 90% of the water supplied by United Utilities comes from rivers and reservoirs, with the remainder from groundwater.

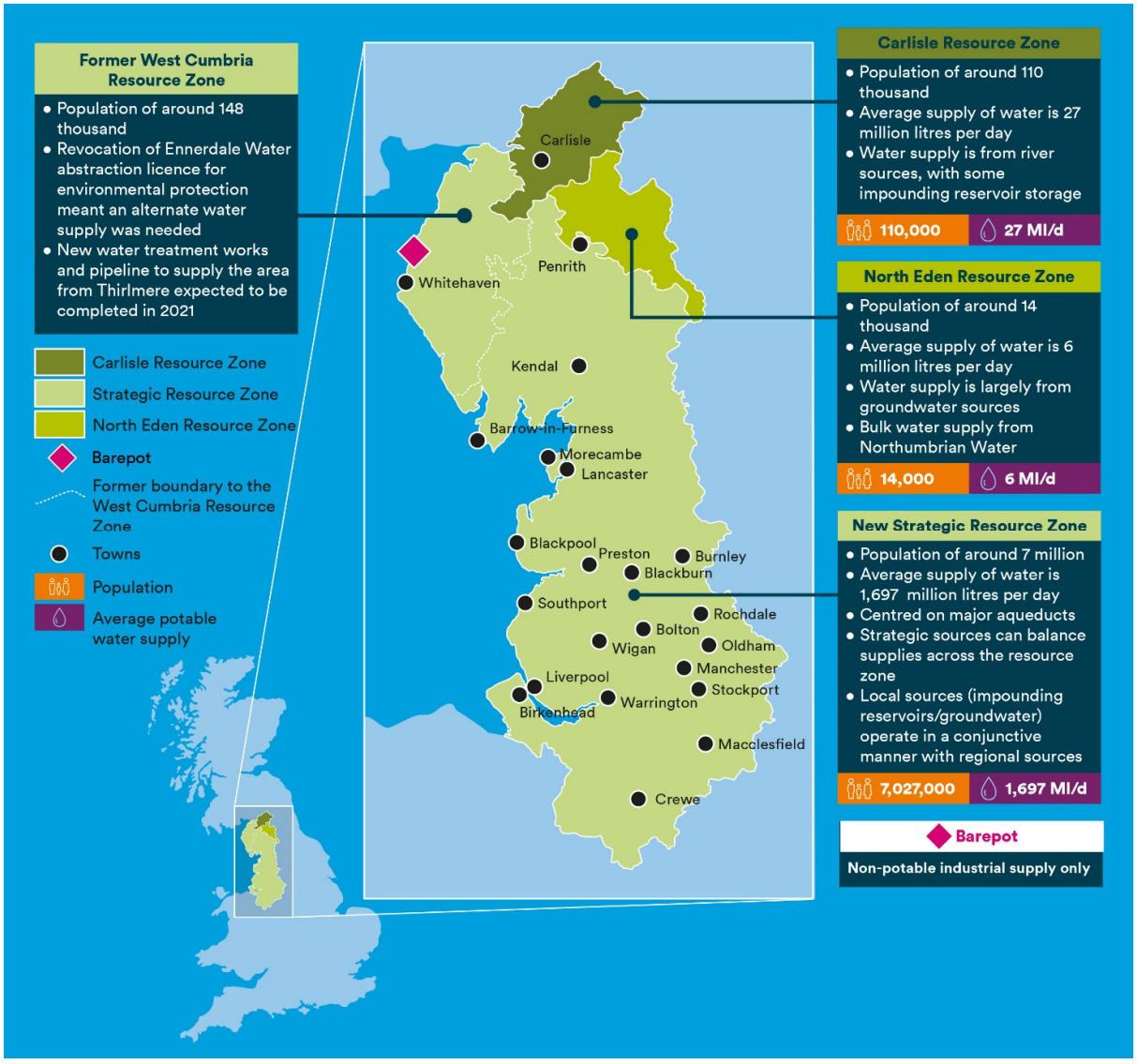
Along with all water companies in England and Wales, there is a statutory requirement for United Utilities to prepare, maintain and publish a WRMP that sets out how the balance between water supply and demand, and security of supply will be maintained over the coming 25 years in a way that is economically, socially and environmentally sustainable. These plans are reviewed on a rolling 5 year basis and United Utilities is currently preparing its WRMP for the period 2020 to 2045 and beyond, which is due to be published in 2019. Once published, WRMP19 will replace the current 2015 WRMP.

The WRMP will present management options by water resource zone (WRZ). WRZs are defined in the Water Resources Planning Guideline[1] as "*an area within which the abstraction and distribution of supply to meet demand is largely self-contained (with the exception of agreed bulk transfers)…Within a WRZ all parts of the supply system and demand centres (where water is needed) should be connected so that all customers in the WRZ should experience the same risk of supply failure and the same level of service for demand restrictions*".

[1] Environment Agency and Natural Resources Wales (2018) *Water Resources Planning Guideline: Interim Update* . Available at: https://cdn.naturalresources.wales/media/686174/interim-wrpg-update-july18-final-changes-highlighted.pdf [Accessed August 2018].

United Utilities' region is currently split into four WRZs: the Integrated Water Resource Zone covering the major conurbations; North Eden; Carlisle and West Cumbria. As a long-term 25-year strategic view, WRMP19 is being developed to reflect the merging of the West Cumbria and Integrated Resource Zones in 2022 (following the implementation of the 2015 WRMP) and which together will form the Strategic Resource Zone. A new smaller resource zone, Barepot, has also been established to reflect supplies to commercial customers located in the West Cumbria area (these are not connected into the rest of the public water supply network). As a result, WRMP19 is being developed around the four WRZs that will exist from 2022, as shown in **Figure NTS.1.** These are: the Strategic Resource Zone; the Carlisle Resource Zone; the North Eden Resource Zone; and Barepot non potable industrial supply zone.

Figure NTS.1 United Utilities' Resource Zones (from 2022 onwards)



In preparing the Revised Draft WRMP, United Utilities has forecast the future demand for water and available supply (the supply-demand balance) for the 25 year period to 2045 and has determined that there will be a very small baseline deficit (circa 3 megalitres per day (Ml/d) in the Strategic Resource Zone at the end of the planning horizon. United Utilities has determined that its demand management plans for WRMP19 offset upward pressures on demand and this deficit whilst unlocking further benefits in terms of improved levels of service for drought permits and orders.

United Utilities has additionally identified a need to enhance resilience to non-drought hazards; the largest resilience risk being that associated with the regional aqueduct system that supplies water from the Lake District to the Greater Manchester and Pennine areas including parts of Lancashire and south Cumbria. The condition of a particular aqueduct is deteriorating over time and presents a risk in terms of both water quality and water supply. This risk could, in the future, result in a widespread water quality incident (for example, advice to boil water for drinking purposes for over a million properties) or loss of supply to many thousands of properties for an extended period. The development of solutions to address the risks of aqueduct deterioration (and its consequences) to the Strategic Resource Zone is collectively referred to as 'Manchester and Pennine Resilience';

In this context, the Preferred Plan for WRMP19 set out in the Revised Draft WRMP includes the following strategic choices:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25, United Utilities plans to reduce leakage by at least 67 Ml/d, or 15%;
- Improve the level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk);
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennine Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

The Preferred Plan encompasses a combination of preferred demand management measures and resilience options designed to achieve the three strategic choices outlined above. The preferred options have been selected following a rigorous process of options identification and appraisal, environmental assessment and stakeholder engagement, including consultation on the Draft WRMP.

Development of the Revised Draft WRMP included two alternative trading options. Both alternatives included Manchester and Pennine Resilience Solution D and the leakage reduction and network metering options that comprise the Preferred Plan, alongside different portfolios of feasible resource and demand management options to facilitate the export of up to 180 Ml/d of water to the Thames Water region during periods of drought. However, it should be noted that the revised Preferred Plan does not include a water trading component. This is because a water trade from the North West is not included in the preferred plans of other water companies at this stage. However, water trading remains UU's preference and the company will continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round.

Further information in respect of the preparation of WRMP19 is set out in Section 1.4 of the Environmental Report.

What is Strategic Environmental Assessment?

Overview

SEA became a statutory requirement following the adoption of European Union Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the SEA Directive). This was transposed into legislation on 20 July 2004 as Statutory Instrument 2004 No.1633 - *The Environmental Assessment of Plans and Programmes Regulations 2004* (the SEA Regulations). The objective of SEA, as defined in Directive 2001/42/EC, is:

> ***"To provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to contributing to sustainable development."***

Throughout the course of the development of a plan or programme, SEA should seek to identify, describe and evaluate the likely significant effects on the environment of implementing the plan or programme and propose measures to avoid, manage or mitigate any significant adverse effects and to enhance any beneficial effects.

In this context, the purposes of the SEA of the Revised Draft WRMP are to:

- identify the potentially significant environmental effects of the Revised Draft WRMP;
- help identify appropriate measures to avoid, reduce or manage adverse effects and to enhance beneficial effects;
- give the statutory SEA bodies, stakeholders and the wider public the ability to see and comment upon the effects that the Revised Draft WRMP may have on them, their communities and their interests, and encourage them to make responses and suggest improvements to the Draft WRMP; and
- inform United Utilities' selection of the preferred plan and water management options for WRMP19.

The SEA process to-date

SEA comprises five key stages:

- **Stage A:** Scoping;
- **Stage B:** Develop and Refine Alternatives and Assess Effects;
- **Stage C:** Prepare Environmental Report;
- **Stage D:** Consult on the Draft Plan and Environmental Report and Prepare the Post Adoption (SEA) Statement; and
- **Stage E:** Monitoring of Environmental Effects.

The first stage of SEA **(Stage A)** is the production of a Scoping Report. This reviews plans and programmes that could affect the WRMP or be affected by it, outlines baseline information for the plan area and sets out the proposed framework for assessing potential environmental effects. United Utilities published the Scoping Report[2] for the SEA of the Draft WRMP in November 2016 for a consultation period of five weeks.

During **Stage B**, the Draft WRMP was assessed in accordance with the approach set out in the Scoping Report (as amended to reflect the consultation responses received). This comprised:

- an initial high level assessment of all feasible (constrained) water management options;
- a high level assessment of alternative plans; and
- a more detailed assessment of preferred options.

The findings of the assessments were presented in the Draft WRMP Environmental Report[3] (**Stage C**) that was published for consultation alongside the Draft WRMP itself (**Stage D**). In addition, an assessment of the Manchester and Pennine Resilience solutions identified by United Utilities was undertaken in a manner consistent with the assessment of the feasible water management options. This assessment was presented as supplementary information[4] to the Environmental Report.

Following consultation on the Draft WRMP, United Utilities has prepared the Revised Draft WRMP. To ensure that the SEA is thorough and complete, the Draft WRMP Environmental Report has been updated to take account of the changes made to United Utilities' Preferred Plan for WRMP19 alongside comments received during consultation on the Draft WRMP, ongoing engagement and new information provided by United Utilities.

The Revised Draft WRMP and the updated Environmental Report (to which this NTS relates) are being submitted to the Secretary of State. Once directed to do so, United Utilities will publish and implement the WRMP accordingly. In conjunction with publishing the Final WRMP, United Utilities will also issue a Post

[2] Amec Foster Wheeler (2016) *Strategic Environmental Assessment of the Water Resources Management Plan 2019: Scoping Report.*
[3] Amec Foster Wheeler (2018) *Strategic Environmental Assessment of the Draft Water Resources Management Plan 2019: Environmental Report.*
[4] Amec Foster Wheeler (2018) *Strategic Environmental Assessment of the Draft Water Resources Management Plan 2019 - Environmental Report Supplementary Information: Draft Resilience Options.*

Adoption Statement. This will set out the results of the consultation and SEA processes and the extent to which the findings of the SEA have been accommodated in the Final WRMP. The SEA then requires monitoring of any resulting environmental effects of the WRMP **(Stage E)**.

Section 1.5 of the Environmental Report describes the requirement for SEA of WRMPs and the SEA process in further detail, including its relationship with the preparation of WRMP19.

How has the Revised Draft WRMP been assessed?

An assessment framework has been developed to assess the economic, social and environmental effects of the Revised Draft WRMP. This framework includes 12 assessment objectives and associated guide questions that reflect the topics contained in Annex I of the SEA Directive and have been informed by:

- the SEA objectives and guide questions developed as part of the SEA of the 2015 WRMP;
- a review of relevant plans and programmes and the associated key policy objectives and messages (see **Section 2** and **Appendix B** of the Environmental Report);
- the baseline information and key sustainability issues contained in **Section 3** of the Environmental Report; and
- responses received to consultation on the SEA Scoping Report (see **Appendix G**).

By assessing each option against the SEA objectives, it is more apparent where the Revised Draft WRMP will contribute to sustainability, where it might have a negative effect and where enhancements could be made. Guide questions focus the assessment on specific aspects of the objective that reflect issues identified from the review of baseline and contextual information relating to the United Utilities area.

The assessment framework that has been used to assess the Revised Draft WRMP is shown in **Table NTS.1** below.

Table NTS.1 Assessment Framework for the SEA of the Revised Draft WRMP

Topic Area	SEA Objective	Guide Questions
Biodiversity	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	*Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?*
		Will the option protect and enhance non-designated sites and local biodiversity?
		Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?
		Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?
		Will the option protect, and enhance where appropriate, coastal and marine habitats and species?
		Will the option prevent the spread/introduction of invasive non-native species?
Geology and Soils	2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	*Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?*
		Will the option utilise previously developed land?
		Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?

Topic Area	SEA Objective	Guide Questions
		Will the option minimise the loss of best and most versatile agricultural land?
		Will the option minimise conflict with existing land use patterns?
		Will the option minimise land contamination?
		Will the option affect geomorphology?
Water – Quantity and Quality	3. To protect and enhance the quantity and quality* of surface and groundwater resources and the ecological status of water bodies.	*Will the option minimise the demand for water resources?*
		Will the option protect and improve surface, groundwater, estuarine and coastal water quality?
		Will the option result in changes to river flows?
		Will the option result in changes to groundwater levels?
		Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?
		Will the option support the achievement of protected area objectives?
		Will the option support the achievement of environmental objectives set out in River Basin Management Plans?
		Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?
Water – Flood Risk	4. To reduce the risk of flooding.	*Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?*
		Will the option have the potential to help alleviate flooding in the catchment area now or in the future?
		Will the option be at risk of flooding now or in the future?
Air Quality	5. To minimise emissions of pollutant gases and particulates and enhance air quality.	*Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates?*
		Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)?
		Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?
		Will the option reduce the need to travel or encourage sustainable modes of transport?
Climate Change	6. To limit the causes and potential consequences of climate change.	*Will the option reduce or minimise greenhouse gas emissions?*
		Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?
		Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?
		Will the option increase environmental resilience to the effects of climate change?
Human Environment - Health	7. To ensure the protection and enhancement of human health.	*Will the option ensure the continuity of a safe and secure drinking water supply?*
		Will the option affect opportunities for recreation and physical activity?

Topic Area	SEA Objective	Guide Questions
		Will the option maintain surface water and bathing water quality within statutory standards?
		Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?
Human Environment - Social and Economic Well-Being	8. To maintain and enhance the economic and social well-being of the local community.	*Will the option ensure sufficient infrastructure is in place for predicted population increases?*
		Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?
		Will the option help to meet the employment needs of local people?
		Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?
		Will the option improve access to local services and facilities (e.g. sport and recreation)?
		Will the option contribute to sustaining and growing the local and regional economy?
		Will the option avoid disruption through effects on the transport network?
		Will the option be resilient to future changes in resources (both financial and human)?
Material Assets and Resource Use - Water Resources	9. To ensure the sustainable and efficient use of water resources.	*Will the option lead to reduced leakage from the supply network?*
		Will the option improve efficiency in water consumption?
Material Assets and Resource Use – Waste and Resource Use	10. To promote the efficient use of resources.	*Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials?*
		Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?
		Will the option encourage the use of sustainable design and materials?
		Will the option reduce or minimise energy use?
Cultural Heritage	11. To conserve and enhance cultural and historic assets.	*Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?*
		Will the option avoid or minimise damage to archaeologically important sites?
		Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits?
		Will the option affect public access to, or enjoyment of, features of cultural heritage?
Landscape	12. To conserve and enhance landscape character.	*Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?*
		Will the option protect and enhance landscape character, townscape and seascape?
		Will the option affect public access to existing landscape features?
		Will the option minimise adverse visual impacts?

*Please note that water quality in this context does not concern drinking water quality but instead the quality of waterbodies.

The effects of the Revised Draft WRMP have been assessed in two stages. The first stage (undertaken as part of the SEA of the Draft WRMP and updated in the Revised Draft WRMP Environmental Report to reflect additional information provided by United Utilities and the identification of further feasible options) comprised a high level assessment of all feasible (constrained) options (including resource management and demand management options) against the 12 SEA assessment objectives. A more detailed assessment has then been undertaken of the options that comprise the Preferred Plan (the preferred options) for both the Draft WRMP and then the Revised Draft WRMP.

An important part of the SEA process is the assessment of reasonable alternatives. For the purposes of the SEA of the Revised Draft WRMP, the feasible options have been assessed as reasonable alternatives to the preferred options that comprise the Preferred Plan. In addition, reasonable alternatives to the plan as a whole have also been considered, specifically four alternative plans identified by United Utilities for the Draft WRMP and, subsequently, two alternative 'trading portfolios'.

Section 4 of the Environmental Report provides further information in relation to the approach to the assessment of the Revised Draft WRMP. Section 6 contains additional information in relation to the reasonable alternatives considered in the development of WRMP19. Detailed assessment of the feasible and preferred options are contained in Appendix D and E, with a summary of the assessment of the alternative trading portfolios contained in Appendix F.

What are the potential effects of the feasible options?

Overview

In support of the development of the Draft WRMP and, subsequently, the Revised Draft WRMP, the SEA has considered a total of 81 feasible resource management options and 65 demand management options (comprising 27 water efficiency and metering options and 38 leakage reduction and network metering options) across the Carlisle, Strategic and North Eden WRZs. In total, 146 feasible options were identified. No feasible options were identified for the Barepot WRZ. Additionally, a total of 34 resilience options, different combinations of which formed five potential Manchester and Pennine Resilience solutions, were also assessed.

Each option was assessed against the SEA objectives to identify the likely environmental effects during both construction/implementation and operation. The options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where quantified information was available for the option from United Utilities, the assessment was also informed by reference to threshold values set out in definitions of significance (see **Appendix C** to the Environmental Report).

The findings of the assessments are summarised below by option type. It should be noted that whilst leakage reduction and network metering options are a component of the suite of demand management options, for the purposes of this report, the effects of these options are summarised separately. This reflects the specific nature of the leakage reduction and network metering options and their likely effects which differ from those related to the water efficiency and metering options.

Section 5 of the Environmental Report presents the detailed results of the feasible options assessment by WRZ and Manchester and Pennine Resilience solutions.

Resource Management Options

The assessment found that the feasible resource management options identified for the Strategic and Carlisle Resource Zones (no feasible resource management options were identified for the North Eden WRZ) would be likely to have the most significant effects (both positive and negative) during construction and operation across the SEA objectives. Where significant negative effects on the SEA objectives have been identified, this principally reflects the scale of construction activity and the sensitivity of the receiving environment.

Across both the Strategic and Carlisle Resource Zones, a total of 10 feasible options were assessed as having potentially significant negative effects on biodiversity (SEA Objective 1) during construction due to the

potential for works to affect internationally and/or nationally designated conservation sites (although in some cases it may be possible to avoid or mitigate impacts on these sites and in consequence, some uncertainty remains). A total of eight options in the Strategic Resource Zone, meanwhile, were assessed as having potentially significant negative effects on this objective during operation due to the possible impacts of abstraction on designated sites. Four options in this WRZ were also considered likely to have significant negative effects on water quantity and quality (SEA Objective 3) due to associated reductions in surface and groundwater levels and potential impacts on the WFD status of waterbodies.

A total of 31 feasible options were assessed as having a negative effect on geology and soils (SEA Objective 2) which principally reflects the loss of greenfield land including that which is 'best and most versatile' (land classified as 'best and most versatile land' is generally defined as agricultural land which falls into Grades 1, 2 and 3a). One option (Option WR012) was assessed as having a significant negative effect on this objective as this option, which would involve the development of a new impounding reservoir, would result in the permanent loss of a significant area of greenfield land as well as an existing farm.

The majority of the feasible resource management options would involve the development of infrastructure and/or pipeline works within Flood Zones 2 and 3 and therefore construction activity, and in some cases new above ground infrastructure, may be vulnerable to flooding. Given the scale of works, five feasible options in the Strategic Resource Zone were assessed as having a significant negative effect on flood risk (SEA Objective 4) during construction with one option (Option WR076) assessed as having a significant negative effect on this objective during operation.

Construction activity would generate emissions to air associated with the use of plant and machinery as well as vehicle movements. The majority of the feasible options in both the Carlisle and Strategic Resource Zones were therefore assessed as having negative effects on air quality (SEA Objective 5). Reflecting the likely volume of vehicle movements and potential for works to lead to traffic congestion, five options in the Strategic Resource Zone were assessed as having a significant negative effect on this objective.

Many of the feasible options in both the Carlisle and Strategic Resource Zones were assessed as having a significant negative effect on climate change (SEA Objective 6) (related to greenhouse gas emissions) and resource use (SEA Objective 10) (given their anticipated high energy and raw material requirements) during construction with further negative effects on climate change and resource use expected during operation (related to the pumping and treatment of water).

Three options in the Strategic Resource Zone were assessed as having significant negative effects on cultural heritage (SEA Objective 11) due to potential direct and indirect impacts on designated cultural heritage assets during the construction stage. Those options involving more substantial development (for example, modifications to existing/development of new reservoirs, extensive pipeline works and new water treatment works) within the Lake District National Park and World Heritage Site and other nationally designated landscapes were also assessed as having a significant negative effect on landscape (SEA Objective 12) during the construction phase; two options involving new reservoirs were assessed as having a significant negative effect on this objective during operation.

The majority of the feasible options were assessed as having a significant positive effect on wellbeing (SEA Objective 8) during construction. This reflects the potential for capital investment to generate supply chain benefits and employment opportunities as well as increased spend in the local economy by contractors and construction workers. All of the feasible options were also assessed as having a positive or significant positive effect on this SEA objective as well as on health (SEA Objective 7) during the operational phase as they will help to ensure the continuity of a safe and secure drinking water supply which may in-turn support economic and population growth.

Those options that would involve either the reuse of final effluent or improved management of compensations flows would deliver a yield benefit/improve resilience without the need for additional abstraction of water and were assessed as having a positive effect on water resources (SEA Objective 9). The yield benefit associated with five options in the Strategic Resource Zone would be greater than 5 Ml/d and these were assessed as having a significant positive effect on this objective.

Demand Management Options

Effects associated with the enabling works for the feasible demand management options were found to be more limited in range and smaller in magnitude when compared to the feasible resource management options. This is because water efficiency and metering options would be predominantly implemented within properties such that few environmental effects are anticipated. However, there would be additional resource use and carbon emissions under these options which, in the case of nine options in the Strategic Resource Zone, was assessed as having a significant negative effect on climate change (SEA Objective 6) as well as resource use (SEA Objective 10).

Expenditure associated with the enabling works necessary for the demand management options would be relatively small and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any employment opportunities are likely to be limited. However, expenditure related to Option WR611b could be of a scale that may generate significant positive effects on wellbeing (SEA Objective 8).

Following the implementation phase, the feasible demand management options would be unlikely to have any significant adverse environmental effects. They would, however, help to reduce overall water use in the United Utilities supply area which is expected to have a positive effect on the water environment and water resources (SEA Objectives 3 and 9). Six options in the Strategic Resource Zone would generate savings in excess of 5 Ml/d and these were assessed as having a significant positive effect on SEA Objective 9. Demand reductions may also reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. Energy savings and emission reductions associated with eight options in the Strategic Resource Zone would be in excess of 1,000 tonnes of carbon dioxide equivalent (tCO_2e) per annum (on average over the first ten years of operation, although savings would gradually decline over time) and for these options, significant positive effects were identified in respect of climate change (SEA Objective 6) and resource use (SEA Objective 10).

Savings associated with the water efficiency options would help ensure a continual supply of clean drinking water and may support economic/population growth. For Strategic Resource Zone Options WR620b and WR623b, savings would be 15.99 Ml/d and 14.20 Ml/d respectively and both options were assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

Demand Management - Leakage Reduction and Network Metering Options

The assessment of the feasible leakage reduction and network metering options found that construction activity associated with leakage repair and the installation of metering equipment would be unlikely to generate significant effects across the majority of the SEA objectives. This is because works would generally be small in scale and temporary, although if located in environmentally sensitive areas (for example, designated conservation areas) there is the potential for options to have adverse impacts and in consequence, some uncertainty remains.

For the majority of the feasible leakage reduction and network metering options, there would be carbon emissions arising from embodied carbon (in, for example, materials for pipeline repair) in addition to plant and vehicle movements throughout the investigative and construction period. There would also be an increase in resource use for pipeline repair and construction waste along with fuel usage for vehicles and plant. Emissions associated with the implementation of Option WR511 in the Strategic Resource Zone would be in excess of 1,000 tCO_2e and this was assessed as having a significant negative effect on climate change (SEA Objective 6) as well as on resource use (SEA Objective 10).

Employment opportunities and supply chain benefits may be generated during the implementation of leakage reduction and network metering options. The assessment highlighted that the scale of investment that may potentially be generated by five options in the Strategic Resource Zone could be substantial and for these options, effects on wellbeing (SEA Objective 8) were assessed as significant.

The operation of leakage reduction and network metering options would result in less water being lost due to leakage and therefore lower demand for water abstraction. This would benefit the water environment and all of the feasible options were therefore assessed as having a positive effect on water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9). The potential volume of leakage reduction

associated with 13 options within the Strategic Resource Zone would be of a magnitude (i.e. above 5 Ml/d) such that effects on SEA Objective 9 could be significant. Eleven of these options were also assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8) given the potential for water savings to help ensure continuity of water supply and support population and economic growth.

Manchester and Pennine Resilience Solutions

The five Manchester and Pennine Resilience solutions identified by United Utilities offered varying degrees of risk reduction, were significantly different in terms of technical and geographical scope, and would give rise to varying levels and types of environmental effect.

The assessment identified that all of the solutions would be expected to have significant positive effects on wellbeing (SEA Objective 8) during construction, reflecting the associated capital spend, and on both wellbeing and health (SEA Objective 7) during operation, due to benefits associated with increased resilience in the regional water supply network. Solutions D and E, which would involve the rebuild of multiple tunnel sections, would be likely to provide the greatest long term resilience benefit in this regard with Solution E additionally bringing online new water sources to ensure continuity of supply whilst maintenance activities are being carried out. However, tunnel replacement would require a considerable volume of resources and generate substantial construction-related greenhouse gas emissions that would be comparatively higher than for Solutions A to C.

The type and range of adverse environmental effects on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), flood risk (SEA Objective 4), air quality (SEA Objective 5), health (SEA Objective 7), wellbeing (SEA Objective 8), cultural heritage (SEA Objective 11) and landscape (SEA Objective 12) associated with all of the resilience solutions would be broadly similar. However, for those solutions involving more extensive work and/or development in sensitive locations, the magnitude of these effects could be greater. In this regard, the assessment identified that Solutions C and E would potentially generate the greatest range and magnitude of significant environmental effects. This in part reflected the fact that these solutions would require new development in the Forest of Bowland Area of Outstanding Natural Beauty (AONB) (Solution B would also involve development in the AONB and the Yorkshire Dales National Park) and in consequence, there is the potential for significant negative effects on landscape during both construction and operation. Solution C would additionally involve development in close proximity to an Air Quality Management Area with the potential for significant adverse effects on air quality and health, although adverse impacts in this regard would be temporary and are likely to be managed through the implementation of best practice construction methods.

What are the likely significant effects of the Revised Draft WRMP?

As set out above, the Revised Draft WRMP Preferred Plan includes the following strategic choices:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25, United Utilities plans to reduce leakage by at least 67 Ml/d, or 15%;
- Improve the level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk);
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennine Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

The Preferred Plan encompasses a combination of preferred demand management measures and resilience options designed to achieve the three strategic choices outlined above.

It should be noted that the Preferred Plan contained in the Revised Draft WRMP does not include a water trading component (as was proposed in the Draft WRMP). This is because a water trade from the North West is not included in the revised WRMPs of other water companies; however, water trading remains a strategic interest for United Utilities and the company will continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round.

Table NTS.2 lists the options that comprise the Preferred Plan and summarises the findings of their assessment together with the predicted overall cumulative effect of implementing all of the preferred options.

Table NTS.2 Assessment of Preferred Options

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
37-42	Manchester and Pennine Aqueduct sections T01 to T06	C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0
WR500a	Leakage reduction stage 1	C	-/?	0	0	0	-/?	0	-/?	0	0	0	0	-/?
		O	0	0	+	0	0	+	+	+	++	+	0	0
WR500b	Leakage reduction stage 2	C	-/?	0	0	0	-/?	0	-/?	+	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500c	Leakage reduction stage 3	C	-/?	0	0	0	-/?	0	-/?	+	0	0	0	-/?

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500d	Leakage reduction stage 4	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500e	Leakage reduction stage 5	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500f	Leakage reduction stage 6	C	-/?	0	0	0	-/?	-	-/?	0	0	-	0	-/?
		O	0	0	+	0	0	+	+	+	+	+	0	0
WR500g	Leakage reduction stage 7	C	-/?	0	0	0	-/?	--	-/?	0	0	--	0	-/?
		O	0	0	+	0	0	+	+	+	++	+	0	0
WR500h	Leakage reduction stage 8	C	-/?	0	0	0	-/?	--	-/?	+	0	--	0	-/?

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500i	Leakage reduction stage 9	C	-/?	0	0	0	-/?	--	-/?	+	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500j	Leakage reduction stage 10	C	-/?	0	0	0	-/?	--	-/?	++	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500k	Leakage reduction stage 11	C	-/?	0	0	0	-/?	--	-/?	++	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR503	Monitoring of household meters to identify and fix supply pipe leaks	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR514	Logging of large customers	C	0	0	0	0	0	-	0	0	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR515	Splitting District Metering Areas	C	-/?	0	0	0	0	0	0	0	0	0	0	-/?
		O	0	0	+	0	0	+	+	+	+	+	0	0
WR517	Upstream tiles enhancements	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	C	0	0	0	0	0	-	0	+	0	-	0	0
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR907f		C	0	0	0	0	0	-	0	+	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	O	0	0	+	0	0	+	++	++	++	+	0	0
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	0	0	0	0	0	0	0	+	0	0	0	0
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR914	Third Party - Cello 4S and Regulo	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
Cumulative Effects of the Preferred Plan		C	-/?	-	-/?	-	--	--	-	++/-	0	--	0	-/?
		O	0	0	+/-/?	0	0	++/-	++	++	++	++/-	0	0

Key

Score	Description	Symbol
Significant Positive Effect	Significant positive effect of the Water Resources Management Plan option on this objective	++
Minor Positive Effect	Positive effect of the Water Resources Management Plan option on this objective	+
Neutral	Overall neutral effect of the Water Resources Management Plan option on this objective	0
Minor Negative Effect	Negative effect of the Water Resources Management Plan option on this objective	-
Significant Negative Effect	Significant negative effect of the Water Resources Management Plan option on this objective	--
No Relationship	There is no clear relationship between the Water Resources Management Plan option and the achievement of the objective or the relationship is negligible.	~
Uncertain	The Water Resources Management Plan option has an uncertain relationship to the objective or the relationship is dependent on the way in which the aspect is managed. In addition, insufficient information may be available to enable an assessment to be made.	?
Mixed Effect	Mixed positive and negative effect of the Water Resources Management Plan option on this objective	+/-

The subsections that follow provide commentary on the likely significant construction and operational effects of the Preferred Plan, taking into account the findings of the assessment of the preferred options summarised in **Table NTS.3** above.

Construction effects

Capital investment associated with the Preferred Plan would generate supply chain benefits, employment opportunities and increased spend in the local economy by contractors and construction workers. **In combination, the scale of investment associated with the preferred options would be substantial and in consequence, the Preferred Plan has been assessed as having an overall significant positive effect on wellbeing (SEA Objective 8).** However, HGV movements, pipeline/tunnel works and the provision of above ground infrastructure would be likely to cause some temporary traffic disruption and other potential impacts associated with noise and dust etc., generating a minor negative effect on this objective also.

No further significant positive effects from construction have been identified during the assessment of the Preferred Plan.

The operation of plant and machinery and vehicle movements during the construction phase of Manchester and Pennine Resilience Solution D and the leakage reduction and network metering options would generate emissions to air which could affect air quality. There would also be emissions to air related to the transportation of water efficiency devices and/or workers associated with the preferred demand management options. Reflecting the number of vehicle movements likely to be associated with Solution D in particular, the Preferred Plan has been assessed as having a significant negative effect on air quality (SEA Objective 5).

For the majority of options that comprise the Preferred Plan, there would be carbon emissions arising from embodied carbon (in, for example, construction materials and noise loggers) in addition to plant operation and vehicle movements. **Taken together, total emissions associated with the preferred options would be in excess of 1,000,000 tCO_2e and the Preferred Plan has therefore been assessed as having an overall significant negative effect on climate change (SEA Objective 6). Implementation of the Preferred Plan would also require raw materials, fuel for vehicles and plant and generate waste which has been assessed as having a significant negative effect on resource use (SEA Objective 10).**

No further significant negative effects have been identified during the assessment of the Preferred Plan.

Minor negative effects have been identified in respect of biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), health (SEA Objective 7) and landscape (SEA Objective 12). This reflects construction-related impacts including land take, emissions to air and noise as well as the introduction of plant and machinery into landscapes and views.

Operational effects

Reflecting the three strategic choices underpinning the Revised Draft WRMP, the Preferred Plan seeks to enhance leakage reduction and improve levels of service for drought permits and orders. Additionally, Manchester and Pennine Resilience Solution D will:

- reduce the future 10 year probability that 1.2 million properties could be affected by water quality problems for at least one week from 65% to less than 5%;
- reduce the future 10 year probability that that 120,000 properties could be affected by supply interruptions for up to three months from 35% to less than 5%; and
- reduce the future 10 year probability that 240,000 properties could be affected by supply interruptions for up to two weeks from 10% to 5%.

In this context, it is expected that the Preferred Plan will help to ensure continuity of water supply to United Utilities' customers and support population and economic growth; the Plan has therefore been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

Through the implementation of the preferred leakage reduction programme, the Preferred Plan would reduce the frequency of drought permits and orders from 1 in 20 years on average to 1 in 40 years on average, and help to improve the resilience of the water supply to the impacts of climate change. In terms of climate change mitigation, the lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. In this regard, total peak annual reductions associated with the preferred demand management and leakage reduction and network metering options would be approximately 3,500 tCO_2e per year, although during aqueduct outage (to facilitate the construction of new connections under Manchester and Pennine Resilience Option 112), there would be an increase in energy and resource use required to treat water. **Overall, the Preferred Plan has been assessed as having a mixed significant positive and minor negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).**

The operation of the leakage reduction programme detailed in the Revised Draft WRMP, meanwhile, is expected to generate a leakage reduction of 190 Ml/d, from a baseline position of 448.2 Ml/d to 259 Ml/d. The operation of the preferred leakage reduction programme would lower demand for water abstraction and limit the requirement to take water from the environment at times of drought; this could benefit the water environment. **Overall, this has been assessed as having a significant positive effect on water resources (SEA Objective 9) and a positive effect on water quantity and quality (SEA Objective 3).**

No further significant positive effects have been identified during the assessment of the Preferred Plan.

No significant negative effects have been identified during the assessment of the Preferred Plan.

As the tunnels associated with Manchester and Pennine Resilience Solution D would be constructed within the saturated zone of the aquifer, the presence of a low permeability linear structure may alter groundwater flows and levels (particularly where the tunnels are shallower and within the zone of active groundwater flow) and affect surface water. However, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed (and which would be subject to further investigation at implementation). Overall, a negative effect on water quantity and quality (SEA Objective 3) has been identified at this stage, although some uncertainty remains.

No operational effects are expected on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), flood risk (SEA Objective 4), air quality (SEA Objective 5), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Summary

Overall, the Preferred Plan is expected to generate significant positive effects across several of the SEA objectives including climate change (SEA Objective 6), health (SEA Objective 7), wellbeing (SEA Objective 8), water resources (SEA Objective 9) and resource use (SEA Objective 10). This reflects the operational benefits of the Plan including increased water supply resilience, climate change adaptation and mitigation, reduced demand for water and, in terms of construction, capital investment.

Where negative effects have been identified, these are expected to be minor only, although uncertainties remain. Adverse effects associated with the construction/implementation of water management measures including Manchester and Pennine Resilience Solution D would be short term and temporary and it is expected that best practice construction techniques and methods could be implemented at the project stage to help reduce the likelihood of such effects occurring and their magnitude. The exception to this is in respect of air quality (SEA Objective 5), climate change (SEA Objective 6) and resource use (SEA Objective 10) where significant negative effects have been identified during construction. However, these effects reflect the emissions to air, energy and resource use associated with the implementation of the water management measures which is to a large extent unavoidable (although effects may be reduced at the project stage through, for example, the use of renewable energy and sustainably sourced construction materials).

The detailed assessment of the Preferred Plan is contained in Section 6.3 of the Environmental Report whilst the cumulative effects of the Revised Draft WRMP in-combination with other plans and programmes are reviewed in Section 6.4. As United Utilities operates in Wales, Section 6.5 considers the contribution that the Revised Draft WRMP will make to the well-being goals for Wales contained

in the Well-being of Future Generations (Wales) Act 2015 and the objective for the sustainable management of natural resources established in Environment (Wales) Act 2016. Section 6 concludes by setting out United Utilities' reasons for selection of the preferred WRMP options and rejection of alternatives (Section 6.7).

Mitigation and enhancement

As noted above, in some cases, there is an opportunity to reduce some of the potential negative effects identified during the assessment of the Revised Draft WRMP and to enhance positive effects. The detail of this mitigation needs to be considered during the planning phases of each of the individual component schemes within the Preferred Plan.

Potential mitigation measures are included within each of the preferred option assessment matrices in Appendix E of the Environmental Report. A summary is contained in Section 6.6.

How will the effects of the WRMP be monitored?

Once the WRMP is implemented, its effects on the environment and people will need to be monitored. Monitoring the significant effects of the WRMP can help to answer questions such as:

- Were the SEA predictions of effects accurate?
- Is the WRMP contributing to the achievement of the SEA objectives?
- Are mitigation measures performing as well as expected?
- Are there any adverse effects? Are these within acceptable limits, or is remedial action desirable?

Section 7 of the Environmental Report identifies a number of potential indicators that could be used for monitoring the effects of the WRMP's implementation. Monitoring proposals will be considered further and a final monitoring framework that satisfies the requirements of the SEA Directive will be presented in the Post Adoption Statement.

What are the next steps in the SEA process?

United Utilities is submitting the Revised Draft WRMP to the Secretary of State. Once directed to do so, United Utilities will publish and implement the WRMP accordingly. In conjunction with publishing the Final WRMP, United Utilities will also issue a Post Adoption Statement. This will set out the results of the consultation and SEA processes and the extent to which the findings of the SEA have been accommodated in the Final WRMP.

Contents

Appendix G Schedule of Consultation Responses

1. Introduction

1.1 Overview

United Utilities is currently finalising its Water Resources Management 2019 (WRMP19). Once approved, the WRMP will set out the strategy for water resource and demand management to ensure supplies of safe, clean drinking water are maintained to customers throughout the company's region over the period 2020 to 2045 and beyond.

As part of the preparation of WRMP19, United Utilities published its Draft Water Resources Management Plan (Draft WRMP) for consultation between 2nd March and 25th May 2018, following submission to Defra in December 2017. The Draft WRMP set out United Utilities preferred resource management and demand management options designed to enhance leakage reduction, improve levels of service for drought permits and orders and support water trading. The Draft WRMP additionally sought to address the risk associated with the regional aqueduct system that supplies water from the Lake District to the Greater Manchester and Pennine areas including parts of Lancashire and south Cumbria (known as 'Manchester and Pennine Resilience').

In developing the Draft WRMP, United Utilities undertook a comprehensive assessment of future available water supplies and the demand for water, extensive stakeholder engagement and a rigorous process of options identification and appraisal. In this context, Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler, now Wood) was commissioned by United Utilities to undertake a Strategic Environmental Assessment (SEA) of the Draft WRMP, the findings of which were presented in an Environmental Report[5] that was published alongside the Draft WRMP for consultation in March 2018 (hereafter referred to as the 'Draft WRMP Environmental Report'). A further report[6] presenting an assessment of potential Manchester and Pennine Resilience solutions was also prepared and was available to support the consultation.

Taking into account the responses received to the consultation on the Draft WRMP from regulators, stakeholders and the public, further engagement and environmental assessment, United Utilities has selected its preferred Manchester and Pennine Resilience solution and the Preferred Plan for WRMP19. A Revised Draft Water Resources Management Plan 2019 (Revised Draft WRMP) has subsequently been prepared and is being submitted to the Secretary of State for approval. This includes further increases to the leakage reductions contained within the plan. However, potential importing companies have not selected imports from the North West in their preferred plans within the core 25-year period of the planning horizon (which defines the 'needs' in the United Utilities plan, albeit the plans are tested out to the 2080s). Therefore, to align the plan with others, water trading no longer forms part of United Utilities' Preferred Plan, even though it remains the company's preference to continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round. The strategy to facilitate a potential future trade has therefore been retained within an adaptive pathway, which could form a future preferred plan if water trading was subsequently required in future.

As part of the ongoing, iterative SEA process, the assessment contained in the Draft WRMP Environmental Report has been reviewed and updated in order to ensure that the environmental effects of the Revised Draft WRMP have been fully characterised and assessed. This updated Environmental Report presents the findings of this assessment.

The SEA is being undertaken in accordance with Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the SEA Directive) and The Environmental Assessment of Plans and Programmes Regulations 2004 (the SEA Regulations). It assesses the likely economic, social

[5] Amec Foster Wheeler (2018) *Strategic Environmental Assessment of the Draft Water Resources Management Plan 2019: Environmental Report*.
[6] Amec Foster Wheeler (2018) *Strategic Environmental Assessment of the Draft Water Resources Management Plan 2019 - Environmental Report Supplementary Information: Draft Resilience Options*.

and environmental effects of the Revised Draft WRMP and identifies ways in which adverse effects can be avoided, minimised or mitigated and how any positive effects can be enhanced.

1.2 Purpose of this Environmental Report

This Environmental Report presents the findings of the SEA of the Revised Draft WRMP. The purposes of the SEA of the Revised Draft WRMP and this Environmental Report are:

- to ensure that the likely significant environmental and socio-economic effects of the Revised Draft WRMP including preferred Manchester and Pennine Resilience solution and any reasonable alternatives are identified, characterised and assessed;
- to help identify appropriate measures to avoid, reduce or mitigate adverse effects and to enhance beneficial effects associated with the implementation of the Revised Draft WRMP wherever possible;
- to provide a framework for monitoring the potential significant effects arising from the implementation of the Revised Draft WRMP;
- to inform United Utilities' decisions on the Revised Draft WRMP; and
- to demonstrate that the WRMP has been developed in a manner consistent with the requirements of the SEA Directive and SEA Regulations.

1.3 Water Resources Management Planning

Requirements for a Water Resources Management Plan

The Water Industry Act 1991, as amended by the Water Act 2003 and the Water Act 2014, requires all water companies to prepare, maintain and publish statutory WRMPs. The plans set out how water companies intend to maintain the balance between water supply and demand and ensure security of supply over the next 25 years and beyond in a way that is economically, socially and environmentally sustainable.

Part III of the Water Industry Act 1991 states the following role for water companies in water supply:

> "*37.—(1) It shall be the duty of every water undertaker to develop and maintain an efficient and economical system of water supply within its area and to ensure that all such arrangements have been made—*
>
> *(a) for providing supplies of water to premises in that area and for making such supplies available to persons who demand them; and*
>
> *(b) for maintaining, improving and extending the water undertaker's water mains and other pipes, as are necessary for securing that the undertaker is and continues to be able to meet its obligations under this Part.*
>
> *37A.—(2) A water resources management plan is a plan for how the water undertaker will manage and develop water resources so as to be able, and continue to be able, to meet its obligations under this Part.*"

The Water Resources Planning Guideline[7] produced by the Environment Agency and Natural Resources Wales provides a framework for the development and presentation of water company plans. Ofwat also uses WRMPs to assess the supply-demand balance as part of the Periodic Review of price limits.

[7] Environment Agency and Natural Resources Wales (2018) *Water Resources Planning Guideline*. Available at: https://cdn.naturalresources.wales/media/686174/interim-wrpg-update-july18-final-changes-highlighted.pdf [Accessed August 2018].

Water Resources Management Planning Stages

The Water Resources Planning Guideline sets out the process for developing a WRMP. The Guidelines highlight the following key stages of the process:

- **Early engagement:** Before preparing its draft WRMP, the water company should undertake early engagement with its board, regulators, customers and interested parties. During this stage, the methods and approaches to the development of the WRMP should be discussed with the Environment Agency with a view to preparing a method statement.
- **Pre-consultation:** Pre-consultation must be undertaken with the Environment Agency and Secretary of State for the Environment, Food and Rural Affairs (if the plan affects sites in England) and Natural Resources Wales and Welsh Ministers (if the plan affects sites in Wales), Ofwat and any licensed water supplier that supplies water to premises in the plan area. Pre-consultation may also be undertaken with other stakeholders at this stage.
- **Write draft WRMP:** The draft WRMP is prepared taking into account issues raised during consultation and following any written direction from the Secretary of State.
- **Submit draft WRMP:** The draft WRMP is submitted to the Secretary of State, along with a statement declaring any aspects of the plan the water company believes to be commercially confidential.
- **Publish draft WRMP:** Once instructed to do so by the Secretary of State, the draft WRMP is published for public consultation in accordance with the Water Resources Management Plan Regulations 2007.
- **Carry out public consultation:** The water company has 26 weeks to consult on its draft WRMP and produce a statement of response. Typically, draft plans are consulted on over a 12 week period but this depends on the complexity of the plan.
- **Publish statement of response:** The water company is required to provide a statement of response to the representations received during consultation and any forwarded by the Secretary of State. A water company may decide to prepare a revised draft WRMP at this stage.
- **Submit revised draft WRMP:** The statement of response must be submitted to the Secretary of State together with the revised draft WRMP (if appropriate). The Secretary of State will in-turn send the response to the Environment Agency for review. The Secretary of State will review the draft plan, the representations made and statement of response, along with technical advice from the regulators and decide whether it can be published. Further work may be required before the plan is published. If necessary, a public hearing or public inquiry will be held to resolve any issues that are particularly complex or controversial or where the draft WRMP has caused particular local interest.
- **Publish final WRMP:** The final WRMP is published when the Secretary of State directs the water company to do so.
- **Review final WRMP:** The published WRMP must be reviewed every year and the review reported to the Secretary of State. Consultation with the Environment Agency is required on any material changes to the final plan, as this may require amendment and re-consultation on the changes.

Figure 1.1 shows the key elements in developing a WRMP. The process of developing a WRMP requires an estimation of baseline supply forecast to be prepared, along with an estimation of baseline demand forecast. The uncertainties and target headroom required are then estimated. The calculation of the baseline supply-demand balance for each year of the plan's period are then used to determine if there are any years or critical periods where there is likely to be a supply-demand balance deficit.

Once this information has been established, a long list of demand and supply options is considered. Options are discounted taking into account an option's: impact on the resource base (ability to increase deployable

output) or on the demand for water; performance against unalterable planning, regulatory and environmental constraints; and risk of failure or inherent uncertainty. Through this initial screening process, a feasible (constrained) list of options that could be used is identified. The capital, operating and social and environmental costs (including carbon costs) of each of the feasible options are assessed using industry standard methodologies. Investment modelling is then undertaken which takes account of the capital, operation and social and environmental costs of the options to determine a least-cost water resources strategy. Further scenario modelling and sensitivity testing is then applied to the strategy to determine the robustness of the proposals.

The final planning solution for managing supply and demand is presented in the draft WRMP for formal consultation. The preferred options in the plan are presented with a justification of their inclusion and timing for implementation. Taking into account the responses received to the consultation, a revised draft WRMP is prepared for submission to the Secretary of State.

Figure 1.1 Summary of the Water Resources Management Planning Stages

1.4 United Utilities' Revised Draft Water Resources Management Plan 2019

Legacy of the 2015 Water Resources Management Plan

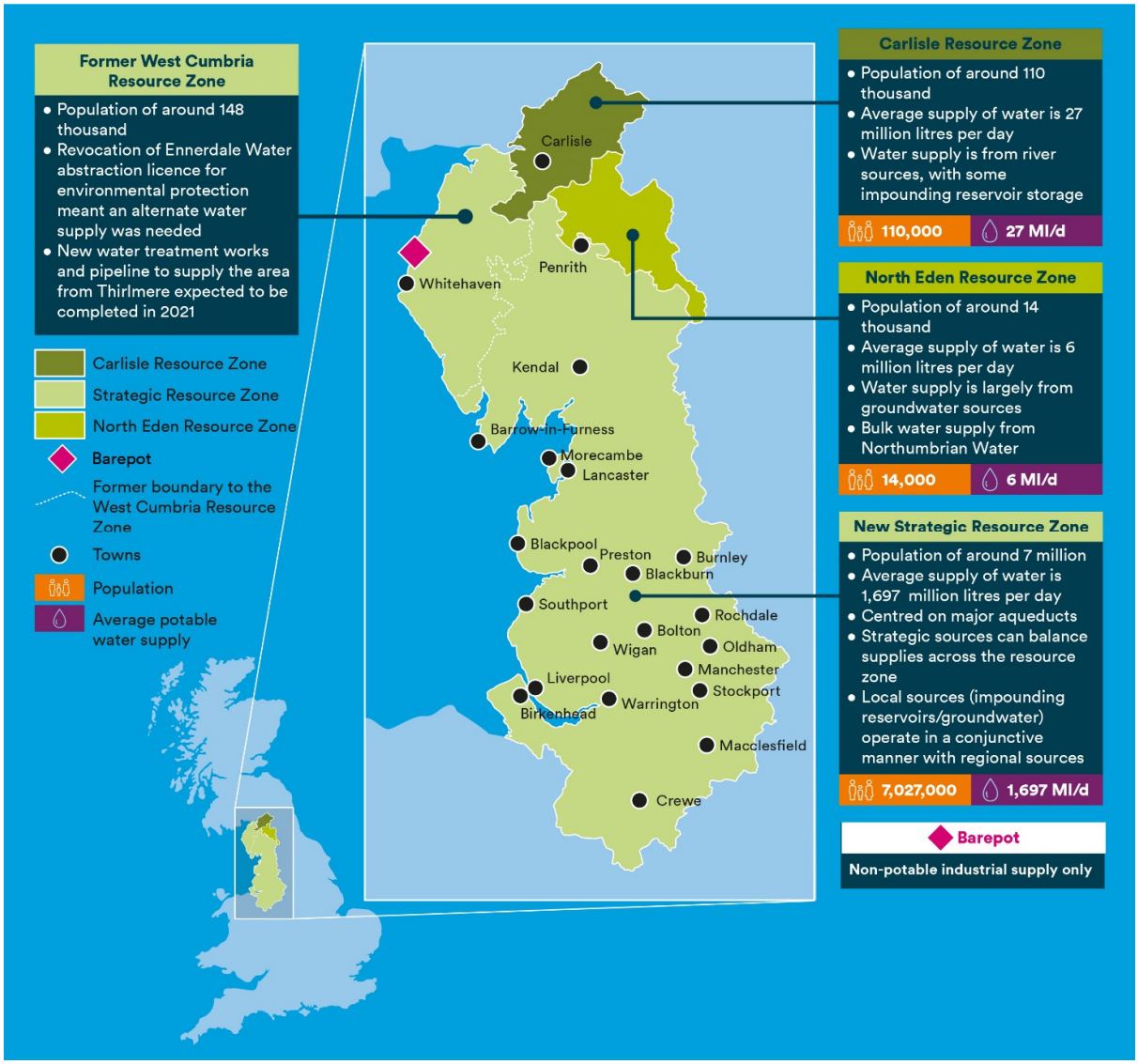
United Utilities supplies water to some 3 million households and 200,000 business customers in Cumbria, Lancashire, Greater Manchester, Merseyside, most of Cheshire and a small part of Derbyshire. More than 90% of the water supplied by United Utilities comes from rivers and reservoirs, with the remainder from groundwater.

WRMP19 will detail how United Utilities will maintain the balance between demand for water from its customers and the resources available to it over the next 25 years. The WRMP will present management options by water resource zone (WRZ). WRZs are defined in the Water Resources Planning Guideline as "*an area within which the abstraction and distribution of supply to meet demand is largely self-contained (with the exception of agreed bulk transfers)…Within a WRZ all parts of the supply system and demand centres (where water is needed) should be connected so that all customers in the WRZ should experience the same risk of supply failure and the same level of service for demand restrictions*".

United Utilities' region is currently split into four water resource zones (WRZs): the Integrated Water Resource Zone covering the major conurbations; North Eden; Carlisle; and West Cumbria. In the last WRMP published in 2015 (covering the period 2015-2040), United Utilities identified a future supply shortfall in the West Cumbria WRZ and the Thirlmere Transfer scheme was selected to meet this shortfall by using some of the spare water available in the neighbouring Integrated Resource Zone. United Utilities is in the process of building a new water treatment works and a pipeline from Thirlmere Reservoir into West Cumbria. Once completed (by 2021), West Cumbria will become part of the Integrated Resource Zone.

As a long-term 25-year strategic view, WRMP19 is being developed to reflect the merging of the West Cumbria and Integrated Resource Zones which together will form the Strategic Resource Zone. A new smaller resource zone, Barepot, has also been established to reflect supplies to commercial customers located in the West Cumbria area (these are not connected into the rest of the public water supply network). As a result, WRMP19 is being developed around the four WRZs that will exist from 2022, as shown in **Figure 1.2.** These are: the Strategic Resource Zone; the Carlisle Resource Zone; the North Eden Resource Zone; and Barepot non potable industrial supply zone.

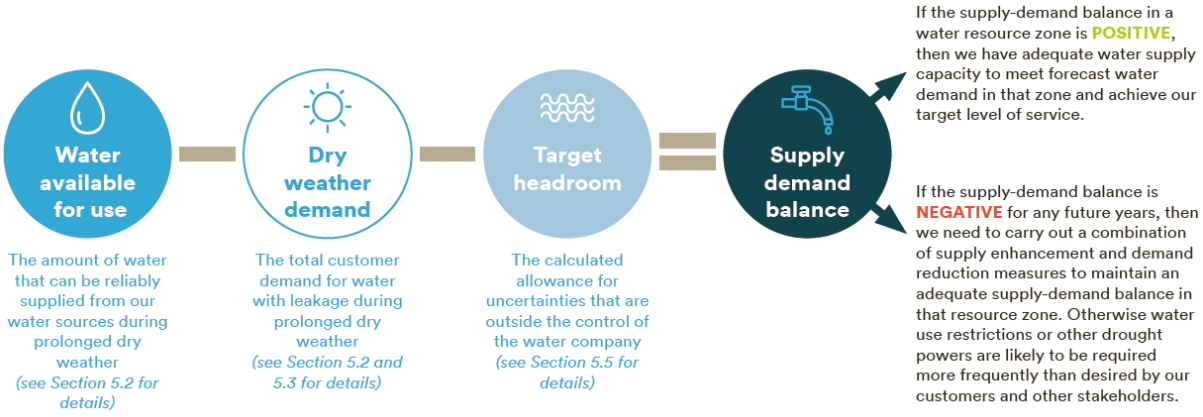
Figure 1.2 United Utilities' Resource Zones (from 2022 onwards)



Draft Water Resources Management Plan 2019

In preparing the Draft WRMP, United Utilities forecast the future demand for water and available supply (the supply-demand balance) for the 25 year period to 2045 following the approach illustrated in **Figure 1.3**. The baseline demand forecast was calculated using the latest data, tools and methods including the current population and local authority growth forecasts, and accounts for the potential impacts of climate change. Taking into account this baseline demand forecast, alongside water availability, dry weather demand and target headroom, United Utilities determined that there would be a surplus in all four of the company's WRZs in a dry year over the planning horizon of WRMP19.

Figure 1.3 The Supply-demand Balance Concept and Outcomes



Whilst at that time there was forecast to be enough water to meet demand over the period of WRMP19, following the Water Resources Planning Guidelines, consideration was given to using the forecast surplus, with possible new source or demand management investment, to explore strategic choices for the WRMP. The strategic choices considered by United Utilities in developing the Draft WRMP related to:

- enhanced leakage reduction;
- improved levels of service for drought permits and drought orders;
- increasing resilience to non-drought hazards, in particular asset failure; and
- exploring national water trading.

Using different combinations of these strategic choices, United Utilities identified four alternative plans for the WRMP, as follows:

- **Alternative Plan 1**: Continued demand management;
- **Alternative Plan 2**: Plan 1 plus enhanced leakage reduction and improved levels of service for drought permits and orders;
- **Alternative Plan 3**: Plan 2 plus resilience to other hazards;
- **Alternative Plan 4**: Plan 3 plus national water trading.

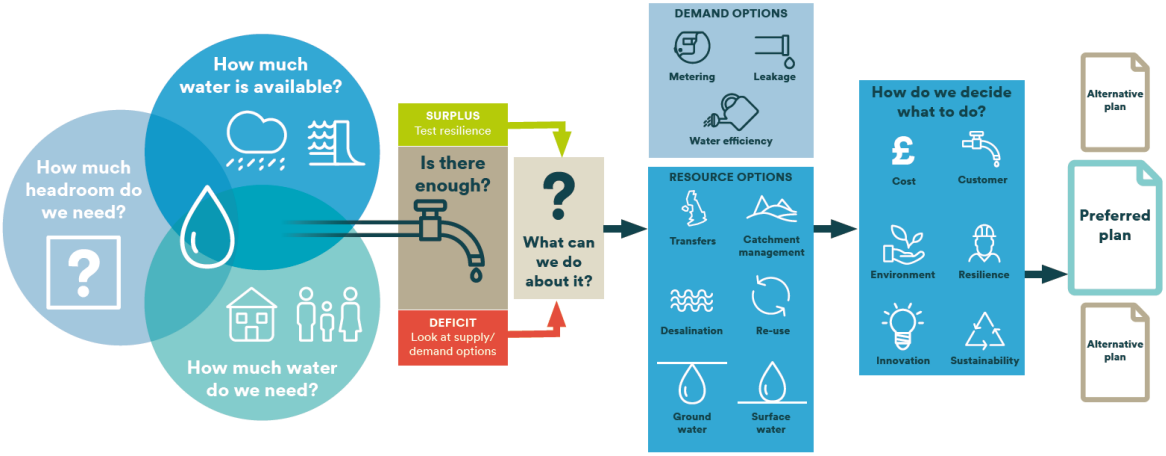
The four alternative plans were subject to a rigorous process of options appraisal which included the following techniques (see also **Figure 1.4**):

- Average Incremental Social Cost (AISC): this has ranked options according to their cost by unit volume (pence per cubic metre). AISC includes monetised environmental and social costs and can be used to apply options to a supply-demand deficit at a single point in time.
- Economics of Balancing Supply and Demand (EBSD): using AISC as an input, this modelling approach was used to apply options to a time varying (i.e. 2020-2045) supply-demand balance. It generated an optimised “lowest cost” portfolio of options to address any supply-demand deficit.
- Extended methods: this method represents a move away from the traditional supply-demand balance approach to explore wider aspects of water resources performance and answer a number of pertinent questions:
  - How does a portfolio of options perform under a wide range of future conditions such as extreme droughts or climate change?

- Can a portfolio be altered to increase its value under these conditions, as measured by a range of performance metrics which have been agreed with stakeholders?
- Are further or different options needed to protect customers and the environment from the wider impacts of water trading?

This options identification and appraisal process is described in detail in the Draft WRMP and its supporting technical documents[8,9].

Figure 1.4 Identification of the Alternative Plans



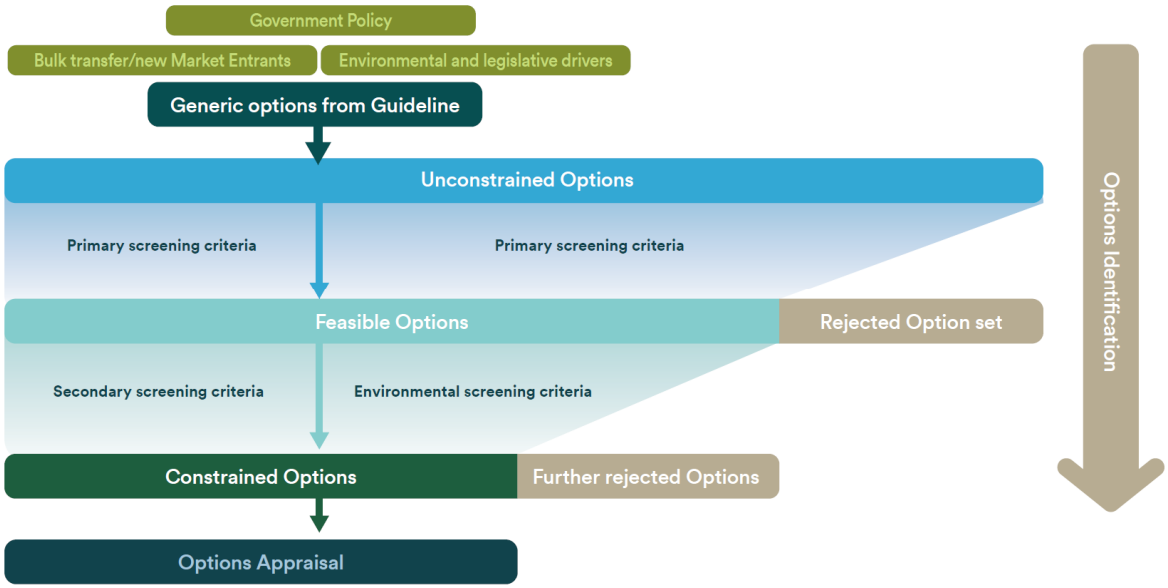
Taking into account the outcomes of the options appraisal process, United Utilities selected Alternative Plan 4 as its preferred option (the 'Preferred Plan') for WRMP19 in the Draft WRMP. This incorporated all four strategic choices, as follows:

- enhance leakage reduction by a total of 80 mega litres per day (Ml/d) over the planning period;
- improve levels of service for drought permits and orders from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual risk);
- increase resilience to other hazards, including through the Manchester and Pennine Resilience solution; and
- commit to continue to explore national water trading.

The Preferred Plan comprised a combination of preferred resource management and demand management (including leakage reduction and network metering) options designed to achieve the four strategic choices and maintain and enhance the supply-demand balance. The process adopted for identifying these options is shown in **Figure 1.5**.

[8] United Utilities (2017) *Draft Water Resources Management Plan 2019: Technical Report – Options Identification.*
[9] United Utilities (2017) *Draft Water Resources Management Plan 2019: Technical Report – Options Appraisal.*

Figure 1.5 The Options Identification Process



The Preferred Plan options were selected following a process of options identification and appraisal. This process initially reviewed as many potential solutions as possible (the 'unconstrained list' of options) to identify 'feasible' options. Following an initial round of screening (Primary Screening), the feasible options were then assessed in terms of their financial, environmental and social costs and ranked. Informed by this assessment, ongoing discussion with stakeholders, and the outcomes of the SEA, Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD) Assessment, plus some other assessments, this list was further refined through Secondary Screening to identify a list of constrained options, from which the Preferred Plan options were selected.

The options identification and appraisal process is described further in the Revised Draft WRMP and supporting documentation[10,11].

The Preferred Plan developed for the Draft WRMP included the strategic choice to enhance resilience to non-drought hazards; the largest resilience risk identified being that associated with the regional aqueduct system that supplies water from the Lake District to the Greater Manchester and Pennine areas including parts of Lancashire and south Cumbria. United Utilities identified that the aqueduct condition is deteriorating over time and presents a risk in terms of both water quality and water supply to Greater Manchester and areas of the Pennines. This risk could, in the future, result in a widespread water quality incident (for example, advice to boil water for drinking purposes for over a million properties) or loss of supply to many thousands of properties for an extended period. The development of solutions to address the risks of aqueduct deterioration (and its consequences) to the Strategic Resource Zone is collectively referred to as 'Manchester and Pennine Resilience'; at that stage, United Utilities' preferred Manchester and Pennine Resilience solution had not been determined.

Revised Draft Water Resources Management Plan 2019

Following consultation on the Draft WRMP, United Utilities has reviewed its Preferred Plan for WRMP19 and as a result, the Preferred Plan contained in the Draft WRMP has been modified. In particular, in response to consultation responses, additional customer research, further exploration of leakage options and innovations, and a tightening of the supply-demand balance (showing a very small deficit forecast in the Strategic Resource Zone at the end of the planning horizon (see **Figure 1.6**)), United Utilities has further enhanced its leakage reduction aspirations. Taking into account evidence from customer engagement,

[10] United Utilities (2018) *Revised Draft Water Resources Management Plan 2019: Technical Report – Options identification.*
[11] United Utilities (2018) *Revised Draft Water Resources Management Plan 2019: Technical Report – Options appraisal.*

consultation and economic and environmental appraisals as part of a multi-criteria analysis process (see **Figure 1.7**), United Utilities has also confirmed the proposed solution for Manchester and Pennine Resilience (Solution D).

Figure 1.6 Initial Supply-Demand Balance for the Strategic Resource Zone

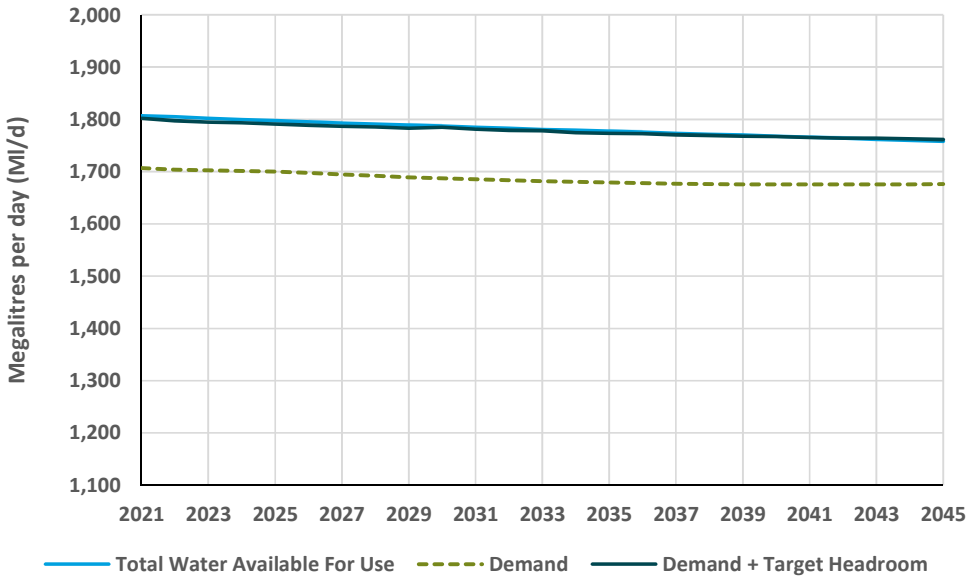
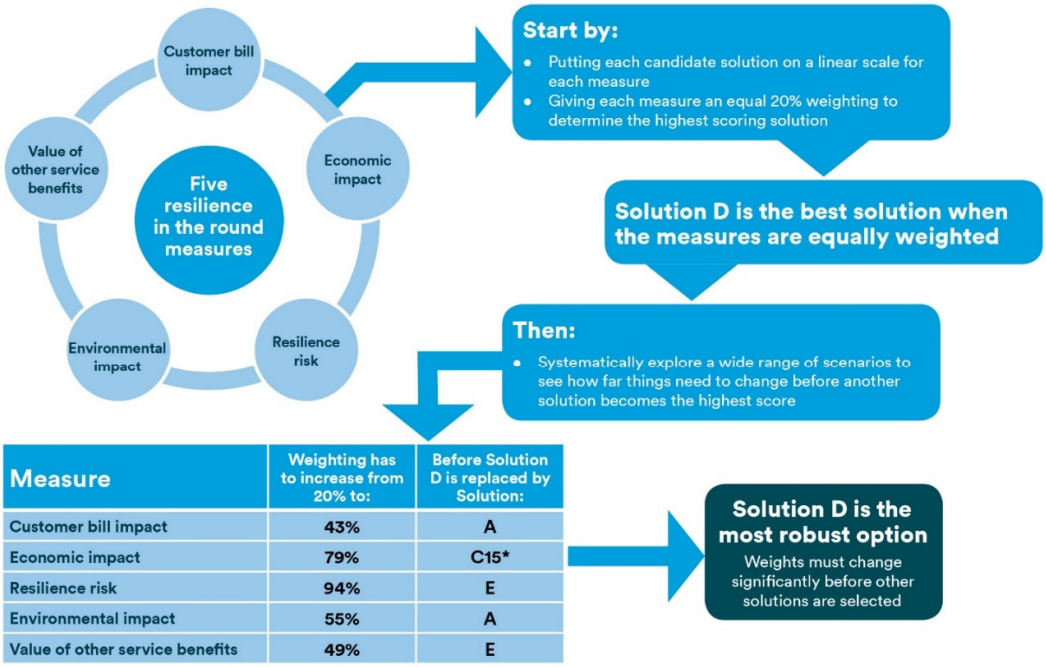


Figure 1.7 Manchester and Pennine Resilience Multi-criteria Analysis



Measure	Weighting has to increase from 20% to:	Before Solution D is replaced by Solution:
Customer bill impact	43%	A
Economic impact	79%	C15*
Resilience risk	94%	E
Environmental impact	55%	A
Value of other service benefits	49%	E

*Solution C15 is similar to Solution E, but includes more water resource options to enable long duration aqueduct outages so that the existing aqueduct can have a new concrete lining installed, rather than constructing new parallel tunnels. It does not perform well in other appraisals and was not considered suitable for inclusion in the short-list for consultation and customer research.

The revised Preferred Plan includes the following strategic choices:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25 UU plans to reduce leakage by at least 67 Ml/d, or 15%;
- Improve level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk);
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennine Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

The revised Preferred Plan encompasses a combination of preferred demand management measures and resilience options designed to achieve the three strategic choices outlined above which have been selected following the same options identification and appraisal process as for the Draft WRMP. **Table 1.1** lists the options that comprise the revised Preferred Plan together with their respective estimated total water saving (for demand management and leakage reduction measures).

It should be noted that the revised Preferred Plan does not include a water trading component. This is because a water trade from the North West is not included in the preferred plans of other water companies at this stage. However, water trading remains UU's preference and the company will continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round.

Table 1.1 Preferred Options

Ref	Preferred Option	Description	Saving (Ml/d)	Implementation (AMP)
Preferred Manchester and Pennine Resilience Solution D				
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	N/A	TBC
37-42	Manchester and Pennine Aqueduct sections T01 to T06	This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.	N/A	TBC
Preferred Demand Management Options – Leakage Reduction and Network Metering				
WR500a	Leakage reduction stage 1	Preferred options WR500a to WR500e would involve an increase in leakage detection and repair activity through the installation of pressure management valves (PMVs) over an 11 year period. Activities for Stage 1 to 5 would be as follows: • Stage 1: A total of 276 leakage surveys, 510 repairs and 10 PMV installations would be undertaken. • Stage 2: An additional 339 leakage surveys, 510 repairs and 13 PMV installations would be undertaken • Stage 3: An additional 332 leakage surveys, 408 repairs and 12 PMV installations would be undertaken. • Stage 4: An additional 520 leakage surveys, 510 repairs and 19 PMV installations would be undertaken.	10	AMP7
WR500b	Leakage reduction stage 2		20 (including Stage 1)	AMP7
WR500c	Leakage reduction stage 3		28 (including Stages 1 and 2)	AMP7
WR500d	Leakage reduction stage 4		38 (including	AMP10

Ref	Preferred Option	Description	Saving (Ml/d)	Implementation (AMP)
		• Stage 5: An additional 692 leakage surveys, 510 repairs and 26 PMV installations would be undertaken.	Stages 1 to 3)	
WR500e	Leakage reduction stage 5		48 (including Stages 1 to 4)	AMP10
WR500f	Leakage reduction stage 6	Preferred options WR500f to WR500k would involve additional leakage detection and repair activity (supplementary to that taken for Stages 1 – 5) through the installation of noise loggers over a six year period. Activities for Stages 6 – 11 would be as follows: • Stage 6: A total of 85 leakage surveys, 511 repairs and 4,424 noise logger installations would be undertaken. • Stage 7: An additional 104 leakage surveys, 625 repairs and 8,148 noise logger installations would be undertaken. • Stage 8: An additional 225 leakage surveys, 1,350 repairs and 20,083 noise logger installations would be undertaken. • Stage 9: An additional 231 leakage surveys, 1,388 repairs and 25,575 noise logger installations would be undertaken. • Stage 10: An additional 257 leakage surveys, 1,542 repairs and 29,235 noise logger installations would be undertaken. • Stage 11: An additional 112 leakage surveys, 671 repairs and 17,098 noise logger installations would be undertaken.	4.99	AMP7
WR500g	Leakage reduction stage 7		9.81 (including Stage 6)	AMP7
WR500h	Leakage reduction stage 8		19.81 (including Stages 6 to 7)	AMP7
WR500i	Leakage reduction stage 9		29.95 (including Stages 6 to 8)	AMP7
WR500j	Leakage reduction stage 10		39.90 (including Stages 6 to 9)	AMP7
WR500k	Leakage reduction stage 11		45.23 (including Stages 6 to 10)	AMP8
WR503	Monitoring of household meters to identify and fix supply pipe leaks	This preferred option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5 year period.	3.81	AMP8
WR514	Logging of large customers	This preferred option would involve the logging of large customers over a 5 year period (it is assumed that 10% of those temporarily logged would become permanent). This would require the installation of loggers to all customers identified as having high consumption (above 500 l/hr) in either District Metering Areas (DMAs) with poor operability or DMAs with good operability in order to assess which customers have the largest impact on the operability within DMAs. Logged customers would be setup in Netbase and their night use allowances would be updated to reflect the percentage of night use to daily consumption which should have a positive impact on operability and leakage.	1.07	AMP8
WR515	Splitting District Metering Areas	This preferred option includes a study of non-operable DMAs over a 5 year period to determine the reason(s) why a DMA is not currently operable, and subsequently, to carry out appropriate actions to remedy any identified issues and/or constraints. The option scope includes office design, hydraulic modelling and site investigation in addition to the construction of chambers, installation of meters and the repair of pipework and ancillary equipment.	2.15	AMP8
WR517	Upstream tiles enhancements	This preferred option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.	3.57 Ml/d	AMP8

Ref	Preferred Option	Description	Saving (Ml/d)	Implementation (AMP)
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	54.0	AMP10
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	2.12	AMP7
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP8
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP10
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	This option would involve the reduction of customer side leakage at non-household properties.	5.0	AMP8
WR914	Third Party - Cello 4S and Regulo	This preferred option would involve surveys and the installation of pressure management devices by a Third Party over a 5 year period together with ongoing maintenance to be undertaken by United Utilities.	4.0	AMP8

Further detail in respect of the Preferred Plan and in its component options is contained in **Section 6** of this report. Detailed information in relation to the development of the Preferred Plan is contained in the Revised Draft WRMP.

1.5 Strategic Environmental Assessment

Overview

SEA became a statutory requirement following the adoption of Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. This was transposed into legislation on 20 July 2004 as Statutory Instrument 2004 No.1633 - *The Environmental Assessment of Plans and Programmes Regulations 2004*.

The objective of the SEA Directive is *"to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view of contributing towards sustainable development"*.

Throughout the course of the development of the plan, policy or programme, the aim of SEA is to identify the potential impact of options proposed in the plan in terms of their environmental, economic and social effects. If any adverse effects are identified, these options can then be avoided or proposals modified to manage or mitigate adverse effects.

Applying SEA to Water Resources Management Planning

The SEA Directive requires "*an environmental assessment … of certain plans and programmes which are likely to have significant effects on the environment*" (Article 1). Plans and programmes are defined as those:

- *"which are subject to preparation and/or adoption by an authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government; and*
- *which are required by legislative, regulatory or administrative provisions"* (Article 2(a)).

Guidance produced by the European Commission (EC)[12] indicates that in preparing long-term plans for ensuring water resources, privatised utilities companies can be considered an authority because they are providing services that would be carried out by public authorities in a non-privatised regime. The preparation of a WRMP is a statutory requirement and therefore meets the requirements of Article 2(a) of the Directive.

Plans and programmes that may have significant effects on the environment are identified as those:

- *"which are prepared for… water management… and which set the framework for future development consent of projects listed in Annexes I and II to Directive 85/337/EEC [the Environmental Impact Assessment Directive]; or*
- *which, in view of the likely effect on sites, have been determined to require an assessment pursuant to Article 6 or 7 of Directive 92/43/ EEC [the Habitats Directive]"* (Article 3, paragraph 2(a)).

Broadly, this includes plans that may include development of infrastructure to source, store, or transfer water, or may affect sites that have European designations (Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and Ramsar sites and candidate sites).

Government[13], industry[14] and regulator[15] guidance set out that there is a requirement for water companies, as responsible authorities, to determine whether their WRMPs fall within the scope of the SEA Regulations and whether an SEA must be undertaken. United Utilities has determined that an SEA of WRMP19 is required based on the scope of the potential effects that could arise, particularly given the number and area covered by European designated conservation sites in the North West. In addition, it is noted that the Water Resources Planning Guideline states that "*SEA is mandatory if [the water company operates] wholly or mainly in Wales*".[15] Whilst United Utilities operates mainly in the North West of England, it does also operate in North Wales, and so undertaking an SEA is consistent with the intention of this guidance.

Stages of Strategic Environmental Assessment

SEA comprises five key stages:

- **Stage A:** Scoping;
- **Stage B:** Develop and Refine Alternatives and Assess Effects;
- **Stage C:** Prepare Environmental Report;
- **Stage D:** Consult on the Draft Plan and Environmental Report and Prepare the Post Adoption (SEA) Statement; and
- **Stage E:** Monitor Environmental Effects.

[12] EC (2003) *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment.*
[13] ODPM et al (2005) *A Practical Guide to the Strategic Environmental Assessment Directive.*
[14] UKWIR (2012) *Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7).*
[15] Environment Agency and Natural Resources Wales (2018) *Water Resources Planning Guideline.*

The processes and interrelationships between the key stages of SEA and development of WRMPs are shown in **Figure 1.8**.

The first stage of SEA **(Stage A)** is the production of a Scoping Report. This reviews plans and programmes that could affect the WRMP or be affected by it, outlines baseline information for the plan area and sets out the proposed framework for assessing potential environmental effects. The SEA Scoping Report[16] for WRMP19 was issued for consultation to the statutory consultation bodies (the Environment Agency, Natural England, Historic England, Natural Resources Wales, Cadw and the Welsh Government) for a five week period commencing 16th November 2016. Four responses to the consultation were received, which resulted in amendments to the baseline information and assessment framework that was used to assess the Draft WRMP (a schedule of consultation responses to the Scoping Report is contained at **Appendix F**).

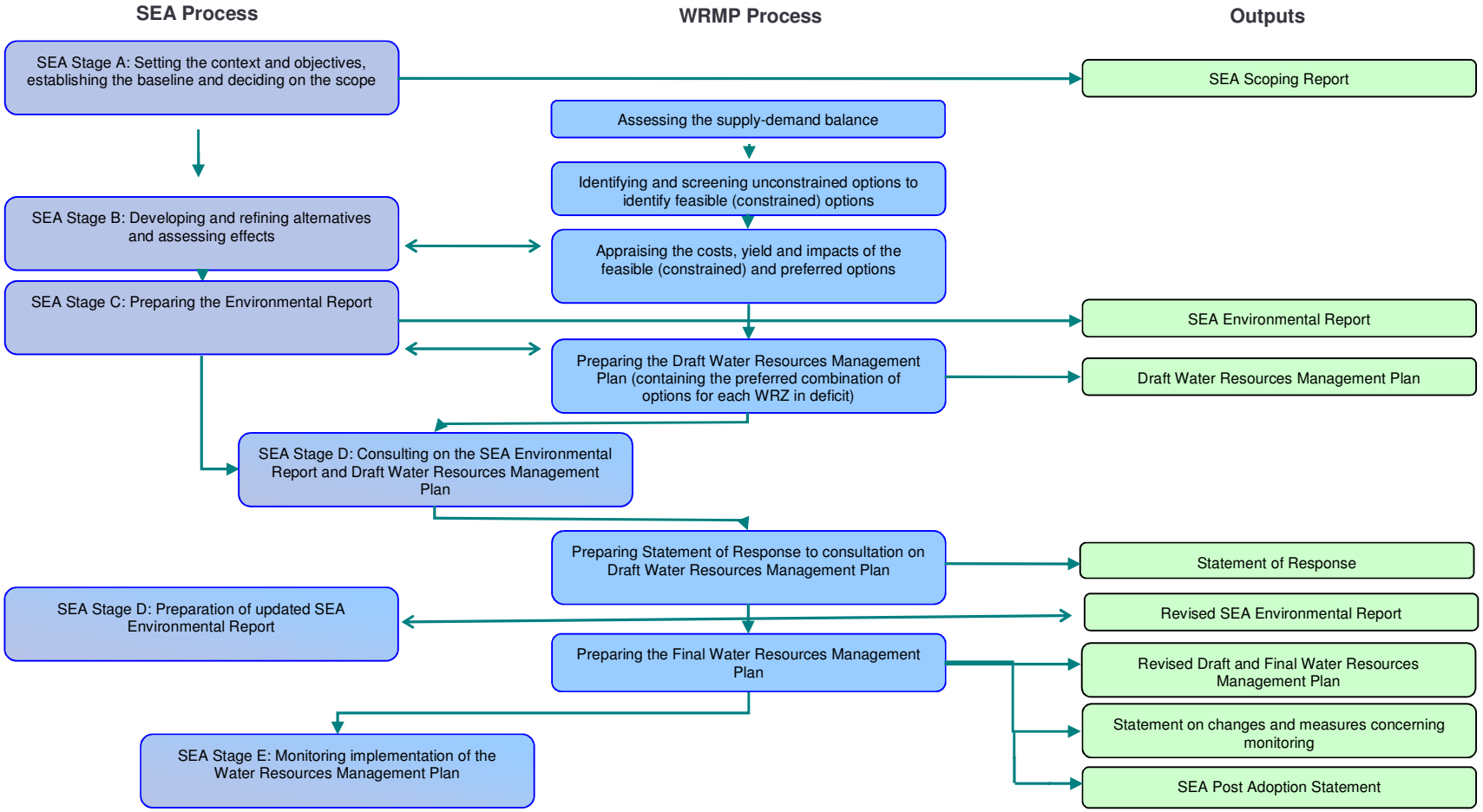
The Draft WRMP was subject to assessment using the amended assessment framework (**Stage B**). This comprised an initial high level assessment of all feasible (constrained) water management options as well as the four alternative plans detailed in **Section 1.4**. A more detailed assessment of the Preferred Plan including the constituent preferred options was then undertaken. The findings of the assessments were presented in the Draft WRMP Environmental Report (**Stage C**) that was published for consultation alongside the Draft WRMP itself (**Stage D**). In addition, an assessment of the Manchester and Pennine Resilience solutions identified by United Utilities was undertaken in a manner consistent with the assessment of the feasible water management options. This assessment was presented as supplementary information to the Environmental Report. A schedule of consultation responses received to these reports is contained in **Appendix F**.

As set out in **Section 1.4**, following consultation on the Draft WRMP, United Utilities has prepared the Revised Draft WRMP. To ensure that the SEA is thorough and complete, this report updates the Draft WRMP Environmental Report to take account of the changes made to United Utilities' Preferred Plan for WRMP19 alongside comments received during consultation on the Draft WRMP, ongoing engagement and new information provided by United Utilities. The Revised Draft WRMP and this Environmental Report are being submitted to the Secretary of State. Once directed to do so, United Utilities will publish and implement the WRMP accordingly. In conjunction with publishing the Final WRMP, United Utilities will also issue a Post Adoption Statement. This will set out the results of the consultation and SEA processes and the extent to which the findings of the SEA have been accommodated in the Final WRMP.

During the period of the WRMP, United Utilities will monitor the implementation and environmental effects of the plan (**Stage E**).

[16] Amec Foster Wheeler (2016) *Strategic Environmental Assessment of the Water Resources Management Plan 2019: Scoping Report*.

Figure 1.8 Linking the SEA and WRMP Development



1.6 Habitats Regulations Assessment and Water Framework Directive Assessment

Habitats Regulations Assessment

The Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations') requires that competent authorities assess the potential impacts of plans and programmes on the Natura 2000 network of European protected sites[17] to determine whether there will be any 'likely significant effects' on any European site as a result of the plan's implementation (either on its own or 'in combination' with other plans or projects); and, if so, whether these effects will result in any adverse effects on the site's integrity. The process by which the impacts of a plan or programme are assessed against the conservation objectives of a European site is known as Habitats Regulations Assessment (HRA)[18]. WRMPs are not explicitly included within this legislation, although Natural England has previously stated that this requirement should extend to plans such as WRMPs. The Habitats Regulations require every Competent Authority, in the exercise of any of its functions, to have regard to the requirements of the Habitats Directive. Water companies have a statutory duty to prepare WRMPs and are therefore the Competent Authority for HRA of WRMPs.

In accordance with the Habitats Regulations, what is commonly referred to as a HRA screening exercise was undertaken to identify whether United Utilities' WRMP will have any likely significant effects on any European sites (either alone or 'in combination' with other projects or plans). Where the possibility of significant effects could not be excluded, a more detailed Appropriate Assessment was carried out to determine whether these effects would adversely affect the site's integrity.

The HRA is undertaken and reported separately from the SEA. However, the conclusions of the HRA have helped to inform this assessment process, particularly in respect of the potential effects of the Revised Draft WRMP options on biodiversity.

Water Framework Directive Assessment

United Utilities has undertaken a separate Water Framework Directive (WFD) Assessment of the Revised Draft WRMP that seeks to ensure that the WRMP is compliant with the objectives of the WFD. This includes an assessment of existing abstractions, changes to abstractions (within licence limits) and proposed new abstractions (specifically, feasible (constrained) and preferred water resource management options). All construction and operational aspects of options in the WRMP have been considered in the WFD Assessment in order to determine whether there will be serious damage to, or deterioration of the status of, waterbodies under the WFD.

Similarly to the HRA, the WFD Assessment is reported separately from the SEA of the Revised Draft WRMP but informs the SEA Environmental Report as part of the assessment of feasible and preferred options, particularly in respect of the potential effects on water quality and also biodiversity.

[17] A European Site is any classified Special Protected Area (SPA) and any Special Area of Conservation (SAC) from the point where the Commission and the Government agree the site as a Site of Community Importance. SPAs and SACs have been created under the EC Birds Directive and Habitats Directive. In the UK they form part of a larger European network called Natura 2000. HRA is also required, as a matter of Government policy, for potential SPAs (pSPAs), possible SACs (pSACs) and listed Ramsar Sites for the purpose of considering development proposals affecting them (National Planning Policy Framework paragraph 118). As such, pSPAs, pSACs and Ramsar Sites must also be considered by any HRA. Within this report "European site" is used as a generic term for all of the above designated sites.

[18] 'Appropriate Assessment' has been historically used as an umbrella term to describe the process of assessment as a whole. The whole process is now more accurately termed 'Habitats Regulations Assessment' (HRA), and 'Appropriate Assessment' is used to indicate the specific stage of HRA.

1.7 Contribution of the Revised Draft WRMP to Wales' Well-being Goals and the Objective for the Sustainable Management of Natural Resources

The Well-being of Future Generations (Wales) Act 2015[19] places a duty on Welsh public bodies to carry out sustainable development aimed at achieving the seven well-being goals for Wales. The well-being goals established by the Act are as follows:

- A prosperous Wales;
- A resilient Wales;
- A healthier Wales;
- A more equal Wales;
- A Wales of cohesive communities;
- A Wales of vibrant culture and thriving Welsh language; and
- A globally responsible Wales.

The Environment (Wales) Act 2016[20], meanwhile, has established an objective for the sustainable management of natural resources (SMNR) "*to maintain and enhance the resilience of ecosystems and the benefits they provide and, in so doing—*

> *(a) meet the needs of present generations of people without compromising the ability of future generations to meet their needs, and*
>
> *(b) contribute to the achievement of the well-being goals in section 4 of the Well-being of Future Generations (Wales) Act 2015*".

United Utilities is not a Welsh public body; however, it does operate in Wales. Further, the Well-being of Future Generations (Wales) Act 2015 notes (in section 6(3)) that the provisions of the Act can apply to other parties '*who exercise functions of a public nature'* whilst the Environment (Wales) Act 2016 defines public authorities as including 'statutory undertakes'. It is also noted that for the purposes of SEA, as outlined in the EC guidance[21], United Utilities as a '*privatised utilities company can be considered an authority because they are providing services that would be carried out by public authorities in a non-privatised regime'*. In consequence, a high level analysis of the impact that the Revised Draft WRMP will have on the achievement of the well-being goals for Wales and the objective for SMNR has been completed and is presented in this report.

1.8 Environmental Report Structure

This Environmental Report is structured as follows:

- **Non-Technical Summary -** Provides a summary of the Environmental Report, including information on both the Revised Draft WRMP and the key findings of the assessment;
- **Section 1: Introduction -** Includes an overview of the Revised Draft WRMP, SEA and the Environmental Report contents;
- **Section 2: Review of Plans and Programmes** - Provides an overview of the review of those plans and programmes relevant to the WRMP which is contained at **Appendix B**;

[19] Available from http://www.legislation.gov.uk/anaw/2015/2/contents/enacted [Accessed January 2017].
[20] Available from http://www.legislation.gov.uk/anaw/2016/3/contents/enacted [Accessed January 2017].
[21] EC (2003) *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment*.

- **Section 3: Baseline Analysis** - Presents the baseline analysis of social, economic and environmental characteristics and identifies the key sustainability issues relevant to the WRMP and SEA;
- **Section 4: Approach to the Assessment** - Outlines the approach to the SEA of the Revised Draft WRMP including the assessment framework and the technical difficulties encountered in completing the assessment including assumptions and uncertainties;
- **Section 5: Assessment of Feasible Options and Manchester and Pennine Resilience Solutions** - Presents the findings of the assessment of the feasible options identified for the Draft and Revised Draft WRMP (detailed assessment matrices are contained at **Appendix D**);
- **Section 6: Assessment of Revised Draft WRMP and Alternatives** – Presents the findings of the assessment of the Revised Draft WRMP including United Utilities' Preferred Plan for WRMP19 (detailed assessment matrices for preferred options are contained at **Appendix E**) and the Alternatives (with additional information contained in **Appendix F**);
- **Section 7: Next Steps and Proposals for Monitoring** - Details the next steps in the SEA process and presents views on how the environmental effects of the WRMP will be monitored.

Compliance with the SEA Regulations

A Quality Assurance Checklist at **Appendix A** details how the requirements of the SEA Directive and its transposing regulations have been addressed in this Environmental Report. **Table 1.2** indicates the location in this report of the relevant information required under the SEA regulations.

Table 1.1 Information Provided in this Report to Meet the Requirements of the SEA Regulations

SEA Requirement	Section of this Report where Relevant Information is Presented
An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant plans and programmes.	1.4, 2, Appendix B
The relevant aspects of the current state of the environment and how it will change without implementation of the plan or programme.	3
The environmental characteristics of areas likely to be significantly affected.	3
Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds and the Habitats Directive.	3 (also see HRA report)
The environmental protection objectives, established at International, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation.	2, Appendix B
The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects, on issues such as biodiversity, population, human health, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the inter-relationship between these issues.	5, 6, Appendix D, Appendix E, Appendix F
The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme.	6.6, Appendix E

SEA Requirement	Section of this Report where Relevant Information is Presented
An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information.	1.6, 4.8
A description of the measures envisaged concerning monitoring.	7.3
A non-technical summary of the information provided.	Non-technical summary

2. Review of Plans and Programmes

2.1 Introduction

The SEA Regulations require a report containing "*an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes*" (Schedule 2(1)) as well as "*The environmental protection objectives, established at international (European) Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation*" (Schedule 2(5)).

One of the first steps in undertaking the SEA of WRMP19 is therefore to identify and review other relevant plans and programmes which could influence the plan. These may be plans and programmes at an international/European, national, regional or sub-regional level, commensurate with the scope of the WRMP. The review aims to identify the relationships between the WRMP and these other documents i.e. how the WRMP could be affected by the other plans' and programmes' aims, objectives and/or targets, or how it could contribute to the achievement of their environmental and sustainability objectives. It is also a valuable source of information to support the completion of the social, economic and environmental baseline analysis and to determine the key issues for the WRMP and SEA (see **Section 3**).

The completed review of plans and programmes is used to provide the policy context for the subsequent assessment process and helps to inform the development of objectives that comprise the assessment framework (see **Section 4**).

2.2 Review of Plans and Programmes

The SEA Scoping Report included a review of plans and programmes, consistent with the requirements of the SEA Directive. Consultation responses to the Scoping Report identified additional plans and programmes for consideration in the review which have been subsequently included in this Environmental Report.

Over 100 international/European, national, regional/sub-regional and local level plans and programmes have been reviewed in preparing this Environmental Report. These are listed in **Table 2.1,** with the results of the review provided in **Appendix B**.

Table 2.1 Plans and Programmes Reviewed for the SEA of the Draft WRMP

Plans and Programmes Reviewed for the SEA of the Draft WRMP
International/European Plans and Programmes
• Convention on the Conservation of Migratory Species of Wild Animals (1979) The Bonn Convention • Council of Europe (1992) European Convention on the Protection of the Archaeological Heritage • Council of Europe (2000) European Landscape Convention • European Commission (1982) The Bern Convention • European Commission (1991) The Nitrates Directive 91/676/EEC • European Commission (1991) The Urban Waste Water Directive 91/271/EEC • European Commission (1992) The Habitats Directive 92/43/EEC • European Commission (1998) The Drinking Water Directive 98/83/EC • European Commission (1999) Landfill Directive (1999/31/EC) • European Commission (2000) The Water Framework Directive 2000/60/EC • European Commission (2001) National Emissions Ceiling Directive 2001/81/EC • European Commission (2001) SEA Directive (2001/42/EC) • European Commission (2002) Environmental Noise Directive (END) (2002/49/EC) • European Commission (2006) European Thematic Strategy on Soil Protection • European Commission (2006) Mining Waste Directive (2006/21/EC) • European Commission (2006) The Bathing Waters Directive 2006/7/EC • European Commission (2006) Sustainable Development Strategy

Plans and Programmes Reviewed for the SEA of the Draft WRMP

- European Commission (2007) The Eel Directive 2007/1100/EC
- European Commission (2007) The Floods Directive 2007/60/EC
- European Commission (2008) Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC and Air Quality Framework Fourth Daughter Directive 2004/107/EC
- European Commission (2008) Waste Framework Directive 2008/98/EC
- European Commission (2008) Environmental Quality Standards Directive 2008/105/EC
- European Commission (2008) Marine Strategy Framework Directive 2008/56/EC
- European Commission (2009) The Birds Directive 2009/147/EC
- European Commission (2009) Renewable Energy Directive 2009/8/EC
- European Commission (2010) Industrial Emissions Directive (integrated pollution prevention and control) 2010/75/EU
- European Commission (2010) Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth
- European Commission (2010) Energy 2020 - A Strategy for Competitive, Sustainable and Secure Energy
- European Commission (2011) A Roadmap for Moving to a Competitive Low Carbon Economy in 2050
- European Commission (2011) EU Biodiversity Strategy to 2020
- European Commission (2012) Energy Efficiency Directive (2012/27/EU)
- European Commission (2013) Seventh Environmental Action Programme to 2020 'Living well, within the limits of our planet'
- European Commission (2013) Strategy on Adaptation to Climate Change
- European Commission (2013) Towards Social Investment for Growth and Cohesion 2014-2020
- European Commission (2014) 2030 Policy Framework for Climate and Energy
- European Union (2015) Invasive Alien Species Regulation (1143/2014/EU)
- UNEP (1973) Convention on International Trade in Endangered Species of Wild Fauna and Flora
- UNESCO (1971) The Ramsar Convention on Wetlands
- UNESCO (1972) Convention Concerning the Protection of the World Cultural and Natural Heritage
- UNESCO (2001) Convention on the Protection of Underwater Cultural Heritage
- United Nations (1992) The Rio Convention on Biodiversity
- United Nations (1997) Kyoto Protocol to the UN Framework Convention on Climate Change
- United Nations (2002) The World Summit on Sustainable Development
- United Nations (2015) Paris Agreement
- United Nations Economic Commission for Europe (1998) The Aarhus Convention
- World Health Organisation (2004) Children's Environment and Health Action Plan for Europe

National Plans and Programmes

- Department for Business, Energy and Industry Strategy (BEIS) (formerly DECC) (2011) Carbon Plan: Delivering our Low Carbon Future
- BEIS (2011) National Policy Statements for Energy Infrastructure
- BEIS (2011) UK Renewable Energy Roadmap
- Canal & River Trust (2015) Living Waterways Transform Places & Enrich Lives: Our 10 Year Strategy
- DCLG (2014) National Planning Policy for Waste
- Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework
- Department for Culture, Media & Sport (2007) Heritage Protection for the 21st Century
- Department for Culture, Media & Sport (2013) Scheduled Monuments & Nationally Important but Non-Scheduled Monuments
- Department for Culture, Media and Sport (2016) The Culture White Paper
- Department for Food and Rural Affairs (Defra) (2006) Shoreline Management Plan Guidance
- Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
- Defra (2010) Air Pollution: Action in a Changing Climate
- Defra (2011) Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services
- Defra (2011) Mainstreaming Sustainable Development
- Defra (2011) Marine Policy Statement
- Defra (2011) Natural Environment White Paper
- Defra (2012) National Policy Statement for Waste Water
- Defra (2012) UK post 2010 Biodiversity Framework
- Defra (2013) The National Adaptation Programme – Making the Country Resilient to a Changing Climate
- Defra (2013) Waste Management Plan for England
- Defra, Scottish Government, Welsh Government (2015) The Great Britain Invasive Non-native Species Strategy
- Defra (2016) Guiding Principles for Water Resources Planning
- Defra (2017) Air Quality Plan for Nitrogen Dioxide (NO2) in UK
- Environment Agency (2008) Better Sea Trout and Salmon Fisheries: Our Strategy for 2008-2021
- Environment Agency (2009) Water for People and the Environment: Water Resource Strategy for England and Wales
- Environment Agency (2011) National Flood and Coastal Erosion Risk Management Strategy for England
- Environment Agency (2013) Managing Water Extraction
- Environment Agency (2013) Areas of Water Stress: Final Classification
- Environment Agency (2015) Drought Response: Our Framework for England
- Environment Agency (2016) Creating a Better Place: Our Ambition to 2020
- Environment Agency and Natural Resources Wales (2018) Water Resources Planning Guideline
- Environment Agency (undated) Restoring Sustainable Abstraction Programme
- HM Government (1979) Ancient Monuments and Archaeological Areas Act

Plans and Programmes Reviewed for the SEA of the Draft WRMP

- HM Government (1981) Wildlife and Countryside Act
- HM Government (1990) Environmental Protection Act
- HM Government (1990) Planning (Listed Building and Conservation Areas) Act
- HM Government (1991) Water Industry Act 1991
- HM Government (1991) Water Resources Act 1991
- HM Government (1994) UK Biodiversity Action Plan
- HM Government (1995) Environment Act 1995
- HM Government (2000) Countryside Rights of Way Act 2000
- HM Government (2002) The National Heritage Act 2002
- HM Government (2003) Water Act 2003
- HM Government (2003) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003
- HM Government (2005) UK Sustainable Development Strategy
- HM Government (2006) Natural Environment and Rural Communities Act 2006
- HM Government (2007) Water Resources Management Plan Regulations 2007
- HM Government (2008) Climate Change Act 2008
- HM Government (2008) The Energy Act 2008
- HM Government (2008) Future Water: The Government's Water Strategy for England
- HM Government (2009) Marine and Coastal Access Act 2009
- HM Government (2009) The Eels (England and Wales) Regulations 2009
- HM Government (2009) The UK Renewable Energy Strategy
- HM Government (2010) Flood and Water Management Act 2010
- HM Government (2011) Water for Life: White Paper
- HM Government (2015) Infrastructure Act 2015
- HM Government (2015) Ozone-Depleting Substances Regulations 2015
- HM Government (2015) Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
- HM Government (2016) Environmental Permitting (England and Wales) Regulations 2016 SI 1154
- HM Government (2017) Conservation of Habitats & Species Regulations 2017
- HM Treasury (2016) National Infrastructure Delivery Plan
- National Assembly for Wales (2015) Well-being of Future Generations (Wales) Act 2015
- National Assembly for Wales (2016) Historic Environment (Wales) Act 2016
- National Assembly for Wales (2016) Environment (Wales) Act 2016
- Natural England (2011) UK Geodiversity Action Plan
- Ofwat (2008) Water Supply and Demand Policy
- Ofwat (2016) Water 2020
- Welsh Government (2004) Technical Advice Note 15: Development and Flood Risk
- Welsh Government (2006) Environment Strategy for Wales
- Welsh Government (2008) People, Places, Futures: The Wales Spatial Plan 2008 Update
- Welsh Government (2009) One Wales One Planet: The Sustainable Development Scheme for Wales
- Welsh Government (2009) Technical Advice Note 5: Nature Conservation and Planning
- Welsh Government (2010) Climate Change Strategy for Wales
- Welsh Government (2010) Towards Zero Waste
- Welsh Government (2011) National Strategy for Flood and Coastal Erosion Risk Management in Wales
- Welsh Government (2012) Energy Wales: A Low Carbon Transition
- Welsh Government (2013) The Historic Environment Strategy for Wales
- Welsh Government (2015) Water Strategy for Wales
- Welsh Government (2015) The Welsh National Marine Plan – Initial Draft
- Welsh Government (2016) Planning Policy Wales (Edition 9)
- Welsh Government (2016) The State of Natural Resources Report (SoNaRR)
- Welsh Government (2017) Natural Resources Policy

Regional Plans and Programmes

- Canal & River Trust (2015) North West Waterway Fisheries & Angling Action Plan
- Environment Agency (2011) North West of England and North Wales Shoreline Management Plan SMP2
- United Utilities (2015) Playing our part in the North West: Our revised business plan for 2015-2020
- Water Company (various) Drought Plans:
    - United Utilities Final Drought Plan 2018;
    - Dee Valley Drought Plan;
    - Welsh Water Drought Plan;
    - Severn Trent Drought Plan;
    - Yorkshire Water Drought Plan; and
    - Northumbrian Water Drought Plan.
- Water Company (various) Water Resources Management Plans (published and draft):
    - Dee Valley final Water Resources Management Plan;
    - Severn Trent final Water Resources Management Plan;
    - Yorkshire Water final Water Resources Management Plan;
    - Northumbrian Water final Water Resources Management Plan; and

Plans and Programmes Reviewed for the SEA of the Draft WRMP
○ Welsh Water final Water Resources Management Plan.
Sub-Regional/Local Plans and Programmes
• Area of Outstanding Natural Beauty (AONB) Management Units (various) AONB Management Plans • Defra (2010) Eel Management Plans (various) • Environment Agency (2013) Abstraction Licensing Strategies (CAMS process) • Environment Agency, Defra, Natural Resources Wales and Natural Scotland (2015) River Basin Management Plans (various) • Environment Agency, Natural Resources Wales and SEPA (2016) Flood Risk Management Plans (various) • Greater Manchester Combined Authority (emerging) Greater Manchester Spatial Framework • Local Biodiversity Action Plans (BAP) including Species and Habitats Action Plans (various) • Local Geodiversity Action Plans (LGAPs) • Local Planning Authority (various) Local Plans/Local Development Plans • National Park Management Plans (various) • Local Wildlife Trust Strategies (various)

2.3 Policy Objectives Relevant to the Water Resources Management Plan

The review of plans and programmes presented in **Appendix B** has identified a number of objectives and policy messages relevant to the WRMP. Reflecting the topics identified in Annex I of the SEA Directive and Schedule 2 of the SEA Regulations, these objectives and messages are set out for the following topic areas:

- Biodiversity;
- Geology and Soils;
- Water;
- Air Quality and Climate;
- Human Environment (including population and human health);
- Material Assets and Resource Use;
- Cultural Heritage; and
- Landscape.

The policy objectives and messages identified from the review of plans and programmes are summarised in **Table 2.2**. It is important that the assessment takes these into account as this helps to highlight any areas where the WRMP will help or hinder the achievement of the objectives of the other plans. Only the key sources are included; however, it is acknowledged that many other plans and programmes could also be included. The relevance of the key objectives and policy measures to the assessment of the Revised Draft WRMP is also indicated in **Table 2.2**.

Table 2.2 Key Policy Objectives Identified in Other Plans and Programmes relevant to the Assessment of the Revised Draft WRMP

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the Revised Draft WRMP?
Biodiversity		
Conservation and enhancement of the levels and variety of biodiversity, including designated sites, priority species and habitats	Rio Convention on Biodiversity; Bern Convention; Bonn Convention; Habitats Directive; Invasive Alien Species Regulation; Ramsar Convention on Wetlands; Birds Directive; EU Biodiversity Strategy to 2020; Marine Strategy Framework Directive; Biodiversity 2020; Natural Environment White Paper; UK post 2010 Biodiversity Framework; Better Sea Trout and Salmon Fisheries; Eel	Yes

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the Revised Draft WRMP?
	Regulations: Wildlife and Countryside Act; UK Biodiversity Action Plan; Marine and Coastal Access Act; Conservation of Habitats & Species Regulations; UK Marine Policy Statement; Countryside and Rights of Way Act; National Planning Policy Framework; Planning Policy Wales (Edition 9); Environment Strategy for Wales; TAN5: Nature Conservation and Planning; Environment (Wales) Act; Well-being of Future Generations (Wales) Act; Natural Resources Policy; Local Biodiversity Action Plans (BAP) including Species and Habitats Action Plans (various); Local Planning Authority Local Plans (various); AONB Management Plans; National Park Management Plans (various); Local Wildlife Trust Strategies (various).	
Geology and Soils		
Protection and enhancement of geology and soil quality	Thematic Strategy for Soil Protection; National Planning Policy Framework; Planning Policy Wales (Edition 9); TAN5: Nature Conservation and Planning; Natural Resources Policy; UK Geodiversity Action Plan; Local Planning Authority Local Plans (various); AONB Management Plans; National Park Management Plans (various); Local Geodiversity Action Plans (LGAPs).	Yes
Water		
Protection and enhancement of all water supplies and resources	Bathing Waters Directives; Drinking Water Directive; Nitrates Directive; Urban Waste Water Directive; Water Framework Directive; Water Framework Directive (Standards and Classification) Directions (England and Wales); Environmental Quality Standards Directive; Restoring Sustainable Abstraction Programme; Future Water; National Planning Policy Framework; Planning Policy Wales; Water Strategy for Wales; River Basin Management Plans (various); Water Company Drought Plans (various); Water Company Water Resource Management Plans (various); Abstraction Licensing Strategies (various); Local Planning Authority Local Plans (various).	Yes
Promoting the sustainable and efficient use of water	Water Framework Directive; Water for People and the Environment; Managing Water Extraction; Restoring Sustainable Abstraction Programme; Water Act; Water for Life: White Paper; Water Supply and Demand Policy; National Planning Policy Framework; Planning Policy Wales (Edition 9); Water Strategy for Wales; Natural Resources Policy; River Basin Management Plans (various); Water Company Drought Plans (various); Water Company Water Resource Management Plans (various); Abstraction Licensing Strategies (various); Local Planning Authority Local Plans (various).	Yes
Minimising flood risk and improving flood control infrastructure	Floods Directive; Water Framework Directive; Shoreline Management Plan Guidance; National Flood and Coastal Erosion Risk Management Strategy for England; Flood and Water Management Act; National Planning Policy Framework; Planning Policy Wales (Edition 9); TAN15: Development and Flood Risk; National Strategy for Flood and Coastal Erosion Risk Management in Wales; North West of England and North Wales Shoreline Management Plan SMP2; Flood Risk Management Plans (various); River Basin Management Plans (various); Local Planning Authority Local Plans (various).	Yes
Air Quality and Climate		
Ensuring air quality is maintained or enhanced and that emissions of air pollutants are kept to a minimum	Ambient Air Quality and Cleaner Air for Europe; National Emissions Ceiling Directive; Industrial Emissions Directive; Air Quality Strategy for England, Scotland, Wales and Northern Ireland; Air Pollution: Action in a Changing Climate; Air Quality Plans; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various)	Yes
Minimising the effects of climate change on natural resources, inhabitants and the economy	Strategy on Adaptation to Climate Change; National Adaptation Programme; Water for People and the Environment; UK Sustainable Development Strategy; National Flood and Coastal Erosion Risk Management Strategy for England; Adapting to Coastal Change; National Planning Policy Framework; People, Places, Futures: The Wales Spatial Plan 2008 Update; Planning Policy Wales (Edition 9); Environment Strategy for Wales; Climate Change Strategy for Wales; National Strategy for Flood and Coastal Erosion Risk Management in Wales; Natural Resources Policy; Water Resources Management Plans (various); River Basin Management Plans (various); North West of England and North Wales Shoreline Management Plan SMP2; Flood Risk Management Plans (various); Local Planning Authority Local Plans (various).	Yes

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the Revised Draft WRMP?
Minimising emissions of greenhouse gases that may cause climate change	Kyoto Protocol; Paris Agreement; Europe 2020; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; Climate Change Act; Renewable Energy Roadmap; National Planning Policy Framework; UK Sustainable Development Strategy; UK Renewable Energy Strategy; Environment Strategy for Wales; Climate Change Strategy for Wales; Environment (Wales) Act; Planning Policy Wales (Edition 9); Energy Wales; Local Planning Authority Local Plans (various).	Yes
Human Environment		
Addressing deprivation and reducing inequality	World Summit on Sustainable Development; Europe 2020; Sustainable Development Strategy; National Planning Policy Framework; People, Places, Futures: The Wales Spatial Plan 2008 Update; Energy Wales; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Promoting improvements to health and well-being	Aarhus Convention; Sustainable Development Strategy; World Summit on Sustainable Development; Seventh Environmental Action Programme to 2020; National Planning Policy Framework; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Providing high quality services, community facilities and social infrastructure that is accessible to all	National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Achieving sustainable economic growth and promoting key sectors in the local economy	World Summit on Sustainable Development; Europe 2020; UK Marine Policy Statement; Sustainable Development Strategy; National Planning Policy Framework; People, Places, Futures: The Wales Spatial Plan 2008 Update; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Improving and expanding the tourism economy	National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various); AONB Management Plans (various); National Park Management Plans (various).	No
Maximising job opportunities for all and enhancing the quality of employment opportunities	Europe 2020; National Planning Policy Framework; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Minimising noise pollution	Environment Noise Directive; Guidelines for Community Noise; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Promoting sustainable transport	Sustainable Development Strategy; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	No
Material Assets and Resource Use		
Minimising waste production, promoting re-use and recycling	Waste Framework Directive; Landfill of Waste Directive; Waste Management Plan for England; One Wales One Planet; Environment Strategy for Wales; National Planning Policy for Waste; Toward Zero Waste; Planning Policy Wales (Edition 9); Environment (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Promoting the most effective and efficient use of natural resources	World Summit on Sustainable Development; Seventh Environmental Action Programme to 2020; Energy 2020; Europe 2020; UK Sustainable Development Strategy; One Wales One Planet; National Planning Policy for Waste; Towards Zero Waste; Environment (Wales) Act; Natural Resources Policy; Local Planning Authority Local Plans (various).	Yes
Promoting the use of sustainable/renewable energy	Seventh Environmental Action Programme to 2020; Energy 2020; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; Renewable Energy Directive; Sustainable Development Strategy; Carbon Plan; Climate Change Act; UK Renewable Energy Strategy; UK Renewable Energy Roadmap; UK Sustainable Development Strategy; National Planning Policy Framework;	Yes

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the Revised Draft WRMP?
	Climate Change Strategy for Wales; Energy Wales; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	
Promoting the use of sustainable design and construction and encouraging energy efficiency	Energy 2020; Energy Efficiency Directive; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; Renewable Energy Directive; UK Sustainable Development Strategy; Energy Wales; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Cultural Heritage		
Protecting and enhancing cultural heritage and archaeological sites	World Heritage Convention; Heritage Protection for the 21st Century - White Paper; Ancient Monuments and Archaeological Areas Act; Planning (Listed Buildings and Conservation Areas) Act; National Planning Policy Framework; Planning Policy Wales (Edition 9); The National Heritage Act; Historic Environment (Wales) Act Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Landscape		
Protecting and enhancing the quality and distinctiveness of natural landscapes and environmental resources	European Landscape Convention; National Planning Policy Framework; Planning Policy Wales (Edition 9); Environment Strategy for Wales; AONB Management Plans (various); Local Planning Authority Local Plans (various); National Park Management Plans (various).	Yes

3. Baseline Analysis

3.1 Introduction

The SEA Regulations require a report containing *'The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme'* (Schedule 2(2)), *'The environmental characteristics of areas likely to be significantly affected'* (Schedule 2(3)), and *'Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds(1) and the Habitats Directive'* (Schedule 2(4)).

This section of the Environmental Report identifies and characterises current environmental baseline conditions, along with how these are likely to change in the future. Only with a knowledge of existing conditions, and a consideration of their likely evolution, can the effects of the WRMP be identified and appraised and its subsequent success or otherwise be monitored. This is also useful in determining the key issues for each topic that should be taken forward in the SEA, through the SEA objectives and guide questions. The analysis is presented for the following topics:

- Biodiversity;
- Geology and Soils;
- Water;
- Air Quality and Climate;
- Human Environment (including population and human health);
- Material Assets and Resource Use;
- Cultural Heritage; and
- Landscape.

The data has been drawn from a variety of sources, including a number of the plans and programmes reviewed as part of the SEA process (see **Section 2.2** and **Appendix B**). Where appropriate, figures are referenced in this overview. The key sustainability issues arising from the review of baseline conditions are summarised for each topic.

The baseline assessment has drawn on data for the North West, as this region is closely related to United Utilities' operating boundaries. The importance of the water supplies derived from North East Wales has also been acknowledged, and appropriate baseline information from this area has also been included.

3.2 Biodiversity

Baseline Characteristics

Biodiversity is defined as the variety of plants (flora) and animals (fauna) in an area, and their associated habitats. The importance of preserving biodiversity is recognised from an international to a local level. Biodiversity is important in its own right and has value in terms of quality of life and amenity.

Statutory Designated Sites

In the United Utilities supply area there are a large number of sites that are designated as internationally, nationally or locally important for biodiversity. These designated areas fall into three categories:

- designated areas that are established through International Agreements (including Ramsar sites, which are afforded the same degree of protection as European sites);

- designated areas that are established under European Union Directives of other European Initiatives (including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs)); and
- designated areas that are established under national legislation (Sites of Special Scientific Interest (SSSIs) and National Nature Reserves).

The distribution of designated sites across United Utilities' supply area (including North Wales) is shown in **Figures 3.1 to 3.4**. **Table 3.1** provides a breakdown.

Table 3.1 Nature Conservation Designations within the United Utilities Supply Area

Designated Site Classification	Area (hectares)	Description
Special Area of Conservation (SAC)	117,241	Including land in 41 SACs.
Site of Special Scientific Interest (SSSI)	160,086	Including land in 476 SSSIs.
Special Protection Areas (SPA)	79,136	Including land in 14 SPAs.
Ramsar	12,328	Including land in 14 Ramsar sites.
Marine Conservation Zones (MCZ)	70,593	4 zones in the inshore/offshore waters of the United Utilities supply area.

Sites of European importance (SPAs and SACs) are designated to conserve natural habitats and species of wildlife which are rare, endangered or vulnerable in the European Community. In the UK, these form part of the 'Natura 2000' network of sites protected under the EC Habitats Directive (1992). In the United Utilities supply area, there are 69 Natura 2000 sites including 41 SACs, 14 SPAs and 14 Ramsar Sites. Additionally, there are also four MCZs in the inshore/offshore waters of the United Utilities supply area, which protect a range of nationally important marine wildlife, habitats and geology.[22] There are also currently proposals to extend two SPAs in the area, which involve extending the existing Upper Solway Flats and Marshes SPA to create the Solway Firth SPA, and extending the Liverpool Bay / Bae Lerpwl SPA.

The United Utilities supply area has 160,086 hectares (ha) of land designated as SSSIs. The largest SSSIs cover intertidal or upland areas; elsewhere sites tend to be small and fragmented, particularly in the south of the region. At October 2017, 92.1% of the North West's SSSIs were in 'favourable' or 'unfavourable recovering' condition whilst 7.9% were classified as being in 'unfavourable no change' or 'unfavourable declining' condition.[23]

The North West has the greatest extent of designated rivers and open waters of all the English regions, and many of the major lakes are SSSIs. These habitats are important for protected and priority species such as otters, water voles and freshwater white-clawed crayfish.[24] A total of 43% of freshwater SSSIs in the region are in unfavourable condition (including declining or no change) mainly due to water quality, agriculture, invasive species, and inappropriate controls.

The region's coasts and estuaries are also internationally important for wildlife with over 80% of the coastline's length designated as SPA, SAC or Ramsar Site, including major estuaries (Dee, Mersey, Ribble and Alt, Morecambe Bay, Duddon and Solway Firth). Morecambe Bay is also a Marine SAC. These sites support internationally important populations of wildfowl and wading birds. The coast also contains a large

[22] JNCC (2016) *Marine Conservation Zones* [available at: http://jncc.defra.gov.uk/page-4525 (accessed October 2017)].
[23] Natural England (2017) *Condition of SSSI Units in Region: North West* [available at: https://designatedsites.naturalengland.org.uk/SearchRegion.aspx (accessed October 2017)].
[24] Environment Agency (2016) *North West river basin district: Flood Risk Management Plan 2015 to 2021- Part A – Background and river basin district wide information* [available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/507121/LIT_10209_NORTH_WEST_FRMP_PART_A.pdf (accessed October 2016)].

proportion of England's intertidal mudflats and saltmarsh. A total of 90% of coastal SSSIs are in favourable or recovering condition.

In the United Utilities supply area, there are 34 National Nature Reserves.

To the west of United Utilities' water supply area, the West Cheshire and North East Wales area contains some significant areas that are protected nationally or internationally, including SACs, SPAs and Ramsar Sites. This includes the Dee Estuary, which is of particular significance for its total populations of internationally important wintering waterfowl and waders, and the River Dee and Bala Lake SAC. There are also several designated sites in the vicinity of Lake Vyrnwy, including Berwyn SPA and SSSI, the Berwyn and South Clwyd Mountains SAC and Y Berwyn National Nature Reserve.

The State of Natural Resources Report (SoNaRR) for Wales published by Natural Resources Wales[25] highlights that as at 2013, the condition of SAC and SPA species features on sites in Wales remained mostly unfavourable (55%), with the exception of birds and mammals of which 86% and 68% were in favourable condition, respectively.

United Utilities owns some 57,000 ha of land, much of which is of high value in terms of nature conservation and recreational use. 30% of the land within United Utilities' ownership is designated as SSSIs, and United Utilities is helping to protect these sites as part of its obligation to conserve and enhance these areas. This has included working with partners such as the Royal Society for the Protection of Birds (RSPB), Natural England and the Forestry Commission on a Sustainable Catchment Management Programme (SCaMP) project, which began in 2005. This scheme has helped to:

- protect and improve water quality;
- reduce the rate of increase in raw water colour which will reduce future revenue costs;
- reduce or delay the need for future capital investment for additional water treatment;
- deliver government targets for SSSIs;
- ensure a sustainable future for the company's agricultural tenants;
- enhance and protect the natural environment;
- permit moorland habitat to become more resilient to long term climate change; and
- allow healthy upland peat moors to absorb significant volumes of carbon from the atmosphere.

SCaMP is now in its third stage and is being driven by drinking water safeguard zones i.e. drinking water catchments where water quality in rivers, reservoirs or groundwater is deteriorating and is becoming harder to treat, due to human activities on the land. United Utilities is investing in 29 projects under SCaMP 3 by 2020. The new Catchment Wise initiative has also been put in place to drive similar change around wastewater issues, in order to tackle pollution at source to improve the quality of water in lakes, rivers and the sea.[26]

[25] Natural Resources Wales (2016) *The State of Natural Resources Report (SoNaRR)* [available at https://naturalresources.wales/our-evidence-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en (accessed October 2016)].
[26] United Utilities (2017) *Catchment Management* [available at: https://www.unitedutilities.com/corporate/responsibility/environment/catchment-management/ (accessed October 2017)].

Figure 3.1 SACs in the United Utilities Supply Area and North Wales

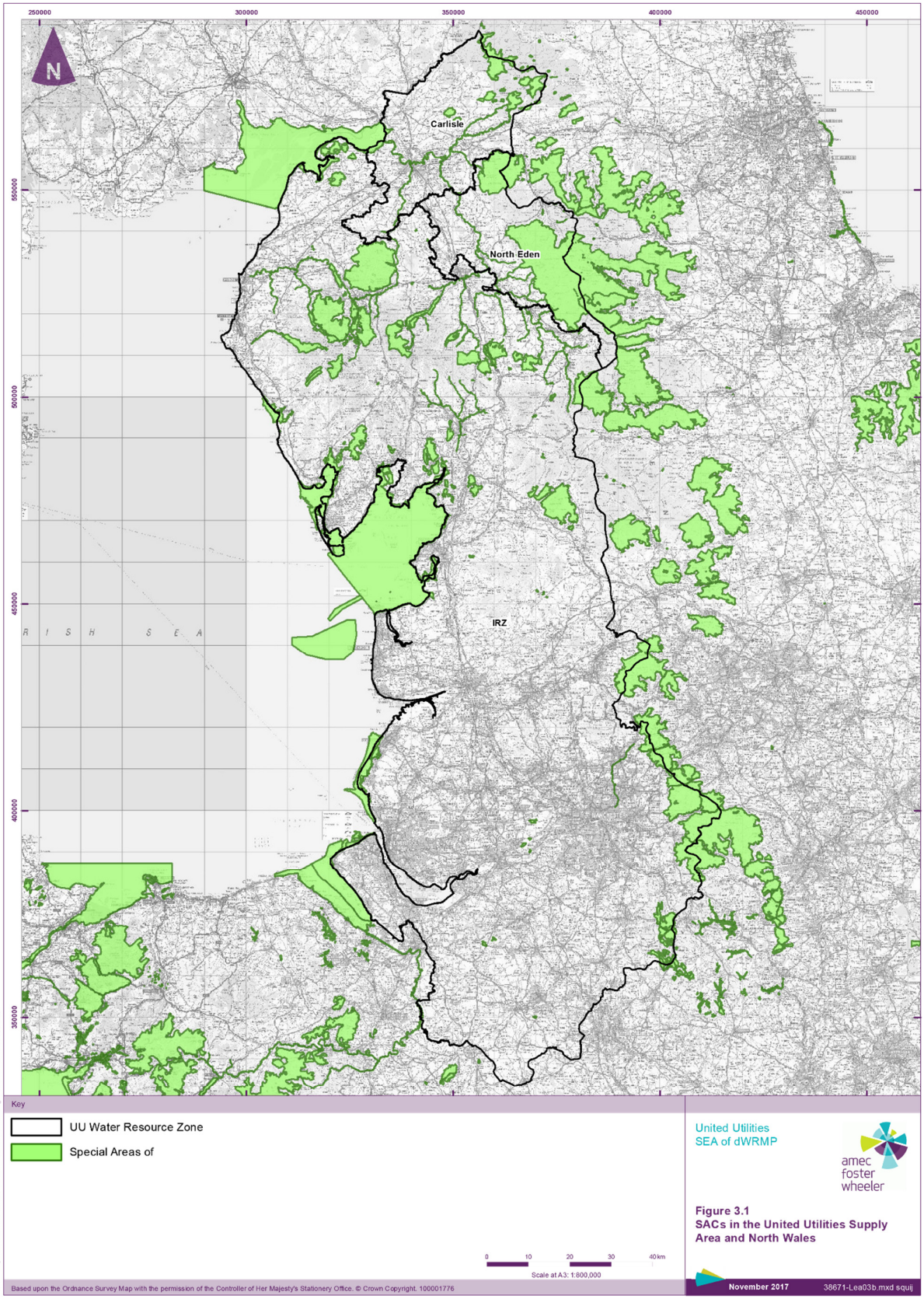


Figure 3.2 SPAs in the United Utilities Supply Area and North Wales

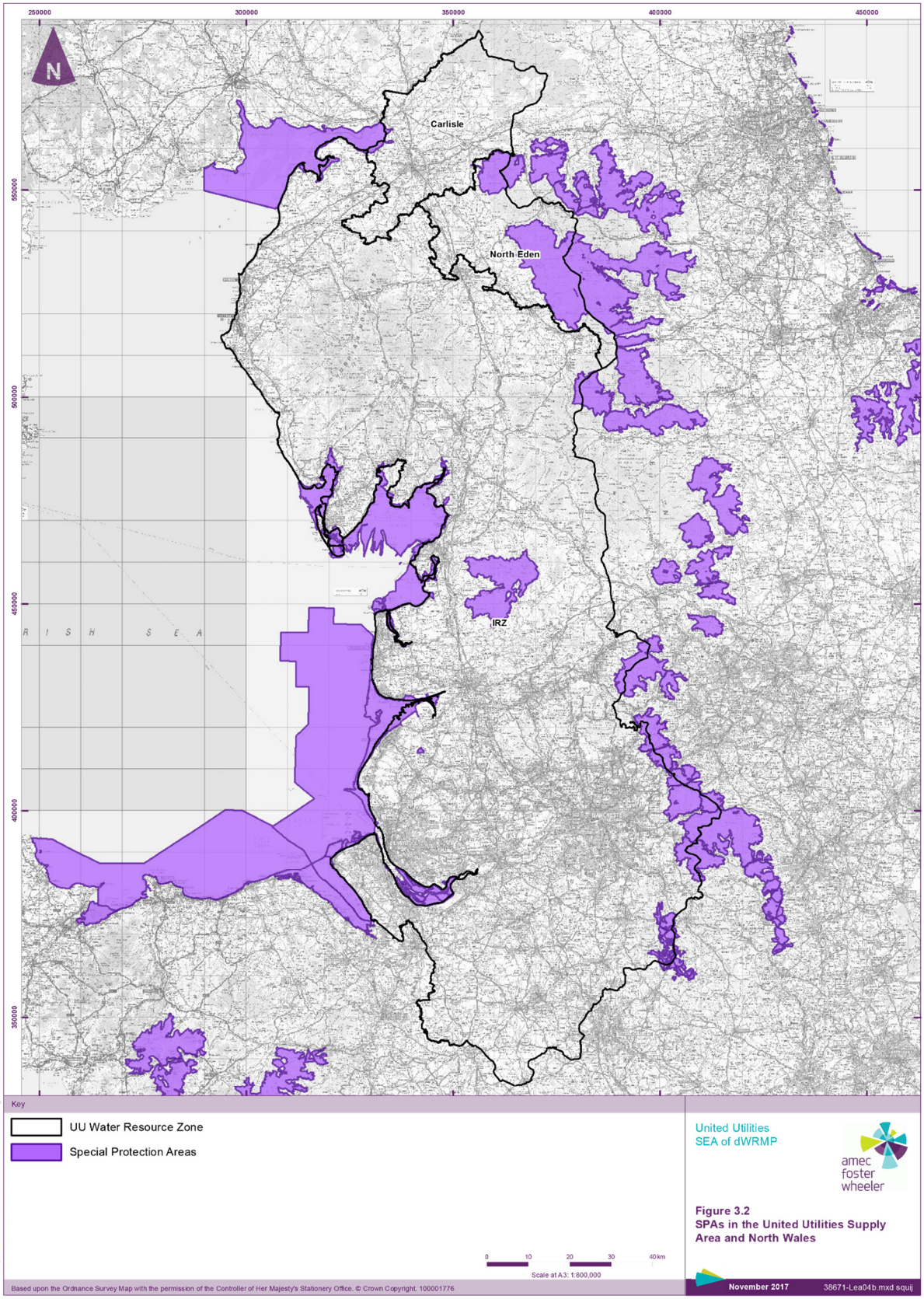


Figure 3.3 RAMSAR Sites in the United Utilities Supply Area and North Wales

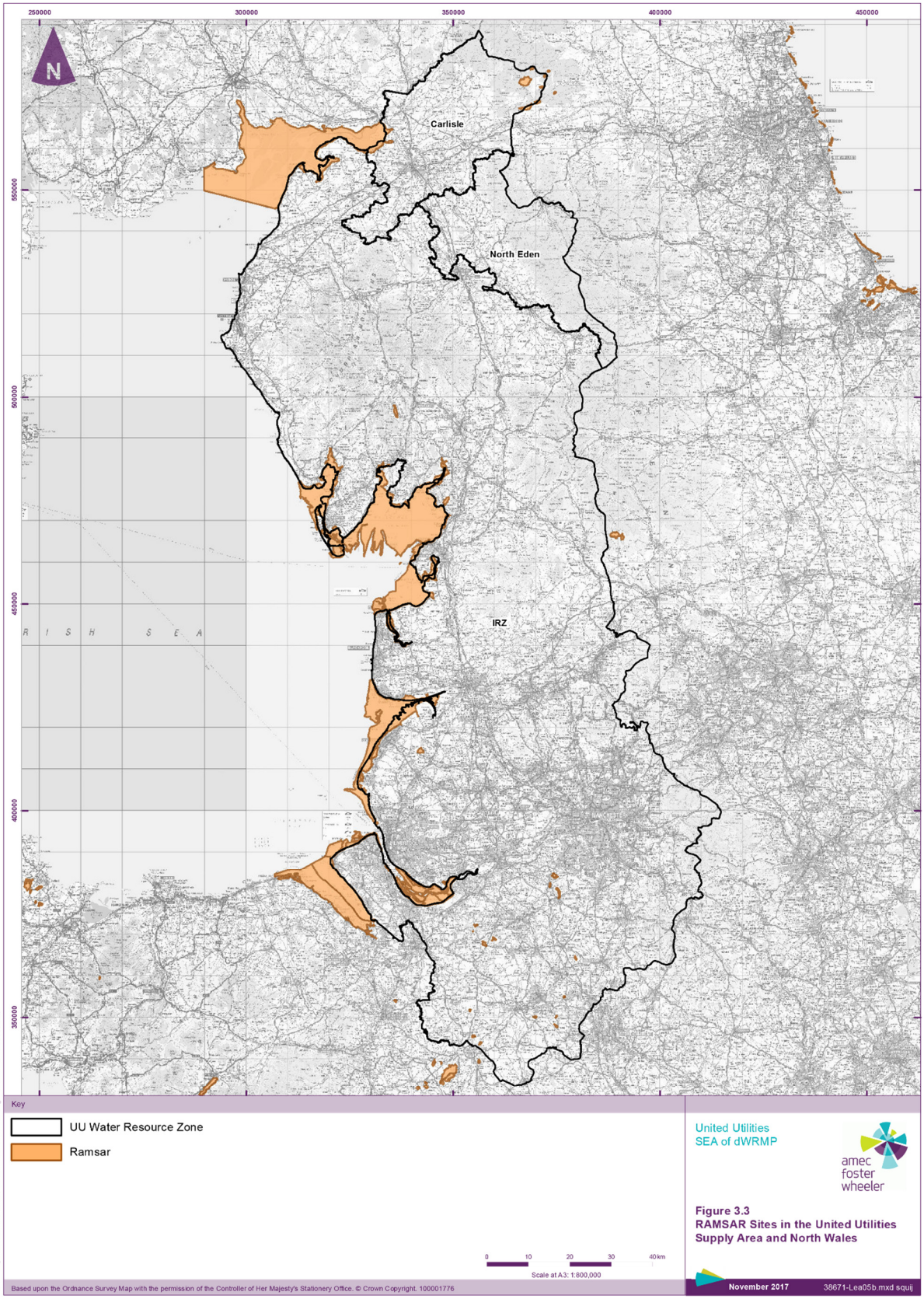
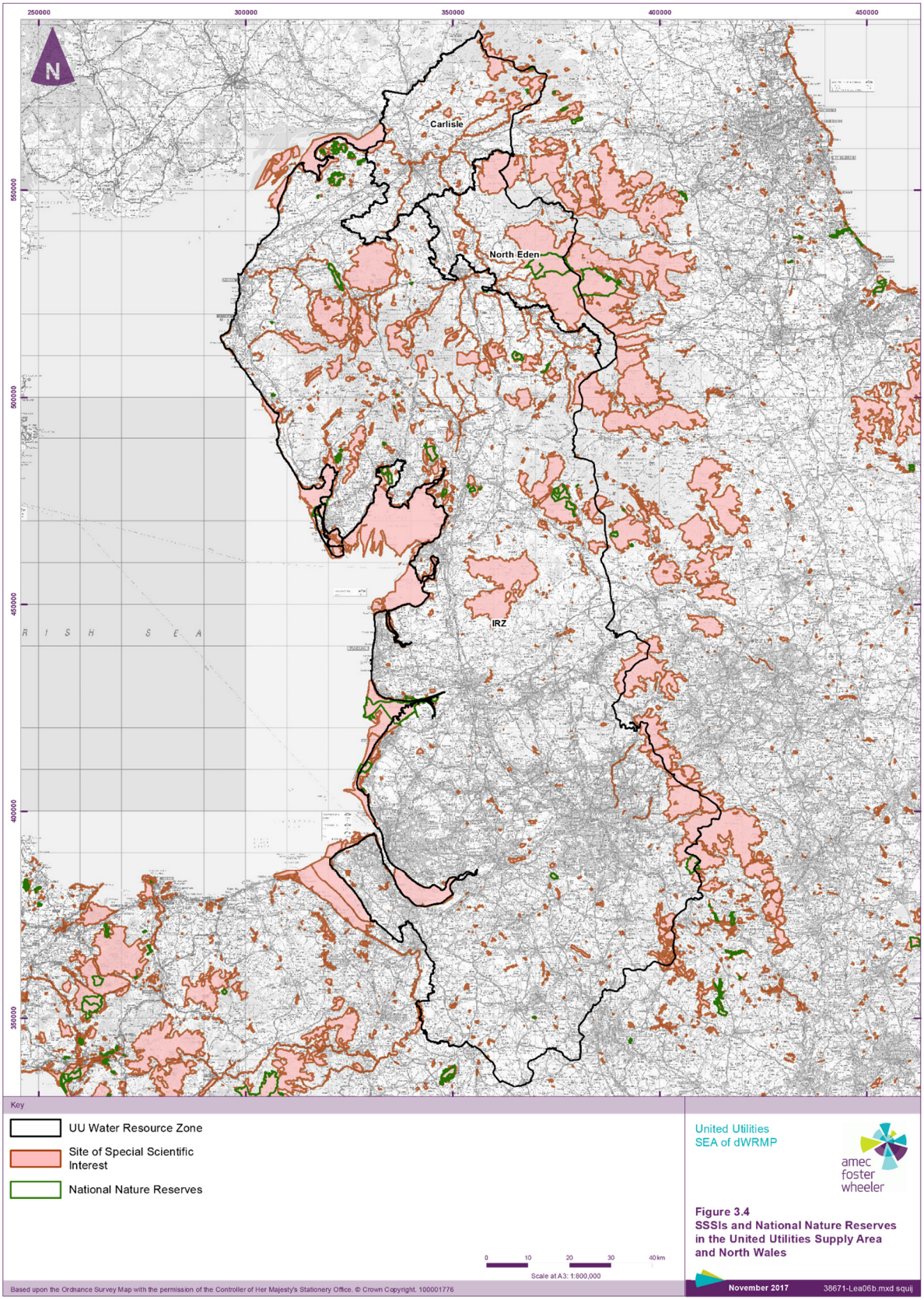


Figure 3.4 SSSIs and National Nature Reserves in the United Utilities Supply Area and North Wales



Non-statutory Protected Sites and Other Biodiversity

There are over 100 Local Nature Reserves across the North West region, in addition to numerous Local Wildlife Sites. Local Wildlife Sites include the following:

- **Cumbria:** over 1,600 County Wildlife Sites, including ancient woodland, species-rich grasslands, wetlands, roadside verges and hedgerows.[27]
- **Lancashire:** over 1,100 Biological Heritage Sites, covering 25,000 ha. This represents 8% of the county's area.
- **Greater Manchester:** more than 500 sites, which are known as Sites of Biological Importance.
- **Merseyside:** 161 Local Wildlife Sites in the area.[28]
- **Cheshire:** around 1,000 Local Wildlife Sites, covering over 15,000 ha and representing 5.75% of the total area of Cheshire.[29]
- **Derbyshire:** 1,144 Local Wildlife Sites covering 9,523 ha or 5.4% of Derbyshire (outside of the Peak District National Park).[30]

In Wales, 557 species are identified under Section 7 of the Environment (Wales) Act 2016, which specifies species of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales. This comprises:

- 188 invertebrates;
- 67 lichens;
- 77 vascular plants;
- 51 birds;
- 55 marine species;
- 52 mosses and liverworts;
- 27 fungi;
- 5 stoneworts;
- 17 mammals;
- 10 fish; and
- 8 amphibians and reptiles.[31]

Across the UK, 177 priority species (15%) are classified as internationally threatened whilst 324 priority species (28%) have suffered a marked decline in the UK.[32]

Likely Evolution of the Baseline without the WRMP

- Many designated nature conservation sites in the United Utilities supply area are in favourable / unfavourable recovering condition. However, key pressures and risks to biodiversity include:

[27] Cumbria Wildlife Trust, *County Wildlife Sites* [available at: http://www.cumbriawildlifetrust.org.uk/what-we-do/county-wildlife-sites (accessed October 2016)].
[28] Lancashire Wildlife Trust, *Local Wildlife Sites* [available at: http://www.lancswt.org.uk/nature-reserves/local-wildlife-sites (accessed October 2016)].
[29] Cheshire Wildlife Trust, *Local Wildlife Sites* (LWS) [available at: http://www.cheshirewildlifetrust.org.uk/localwildlifesites (accessed October 2016)].
[30] Derbyshire Wildlife Trust, *Local Wildlife Sites* [available at: http://www.derbyshirewildlifetrust.org.uk/what-we-do/policy-campaigns/local-wildlife-sites (accessed October 2016)].
[31] Wales Biodiversity Partnership (2016) *Section 7 lists: Section 7 Priority species* [available at: https://www.biodiversitywales.org.uk/Environment-Wales-Act (accessed October 2017)].
[32] JNCC (2010) *Priority Lists Spreadsheet* [available at: http://jncc.defra.gov.uk/page-5717 (accessed October 2016)].

- habitat loss and fragmentation;
- agricultural intensification;
- lack of sustainable management;
- water pollution;
- invasive and non-native species;
- climate change; and
- human disturbance.

- The fragmentation of biodiversity in the North West region's lowlands is an additional key threat. This is particularly pertinent in the south of the region where areas of biodiversity interest are frequently small and fragmented. Species in these areas are more vulnerable to damage from external influences such as climate change.
- United Utilities has a number of statutory duties towards biodiversity that would help to ensure the conservation and enhancement of biodiversity without the WRMP. These include duties under the following legislation:
  - International sites: Regulation 9(2) of the *Conservation of Habitats and Species Regulations 2017* ('Habitats Regulations') requires every competent authority, in the exercise of any of its functions, to have regard to the requirements of the Habitats Directive. The Regulations also include the requirement to secure compliance with the Directive in relation to the *Water Resources Act 1991*, amongst other legislation. As referred to in **Section 1.6** of this report, United Utilities is the competent authority for HRA.
  - SSSI: Section 28G of the *Wildlife and Countryside Act 1981*, as inserted by Section 75 of and Schedule 9 to the *Countryside and Rights of Way Act 2000*, places a duty on public authorities, including water companies, to take reasonable steps consistent with the proper exercise of their functions to further the conservation and enhancement of SSSIs.
  - Biodiversity and Protected Species: Under Section 40 of the *Natural Environment and Rural Communities Act 2006* every public authority, including statutory undertakers, must in the exercise of its functions have regard so far as is consistent with the proper exercise of those functions to the purpose of conserving biodiversity. Conserving biodiversity in this context includes restoring or enhancing a population or habitat.
- In this context, United Utilities understands the impacts that its operations can have on biodiversity and the company aims to manage its sites in a responsible manner with a policy that commits them to:
  - complying with all national and international natural environment legislation;
  - integrating the management of the natural environment into business as usual activities;
  - communicating, sharing and embedding best practice; and
  - working with external partners and stakeholders to actively inform and influence future developments affecting the natural environment and United Utilities, based on sound evidence.
- Actions taken by United Utilities to improve biodiversity on the company's sites include projects to restore blanket bogs, areas of exposed peat, hay meadows and heather moorland, which involve farm tenants, the RSPB, Natural England and the Forestry Commission.[26] Under the Final WRMP 2015, United Utilities is bringing forward the West Cumbria Water Supply Project (Thirlmere Transfer pipeline) in response to the need to cease abstraction from Ennerdale Water to relieve pressure on the River Ehen SAC. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents

programme due to the impact of abstraction on interest features in the SAC (primarily freshwater mussels). United Utilities has also agreed to surrender licences at Crummock, Dash Beck, Overwater and Chapel House as part of the River Ehen Compensatory Measures package. This will take place in 2022 when the West Cumbria Water Supply Project becomes operational.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA arising from the analysis of the biodiversity baseline are:

- the need to protect and enhance sites designated for nature conservation;
- the need to protect and enhance non-designated sites;
- the need to reverse the fragmentation of biodiversity in the North West region;
- the need to continue to increase and improve the condition of priority habitats and habitats of priority species, and restore populations of these species and other specially protected species;
- the need to prevent the spread/introduction of invasive non-native species;
- the need to maintain/enhance ecological connectivity; and
- the need to work within environmental limits and capacities.

3.3 Geology and Soils

Baseline Characteristics

Geology

There is a great diversity in the composition of geology across the North West region. The majority of the lowland Cheshire plains, Merseyside and western Lancashire are dominated largely by Triassic mudstone and sandstone. The uplands of Cumbria are partly made up of volcanic igneous rock from the Devonian period. Moving eastwards towards the Yorkshire Dales, the geology becomes dominated by distinctive carboniferous limestone, and south into Lancashire millstone grit and coal becomes abundant.

The majority of Wales is underlain by sedimentary rock beneath a suite of acid soils, characterised by a peaty surface horizon. As a broad overview, the following rock types exist in a progression from North West to South East (predominant rock types): Ordovician; Silurian; Devonian; and Carboniferous Peat (covers 3% to 4% of Wales and is predominantly acid blanket peat). There are small areas of raised bog scattered in lowland areas.[33] The Permo-Triassic sandstone forms an important groundwater resource in North Wales, whilst peat, sand and gravel deposits along river valleys support strategic local water supplies.

Within the North West region, there are 188 Geological Conservation Review (GCR) Sites, i.e. sites that are often SSSIs and selected on the basis of their national and international importance.[34] Information obtained from Natural England indicates that, UK-wide, 86% of SSSIs designated for one or more geodiversity features are in favourable or unfavourable recovering condition.[35] Within Wales there are 455 GCR Sites.[36]

[33] JNCC (2016) *Habitat Account - Raised Bogs and Mires and Fens* [available at: http://jncc.defra.gov.uk/protectedsites/sacselection/habitat.asp?FeatureIntCode=H7110 (accessed September 2016)].
[34] JNCC (2011) *Geological Conservation Review (Cheshire, East Cumbria, West Cumbria, Lancashire, Sefton, Greater Manchester North)* [available at: http://jncc.defra.gov.uk/default.aspx?page=4177&authority=UKD22,UKD12,UKD32,UKD43,UKD53,UKD11 (accessed September 2016)].
[35] Natural England (2015) *Natural England Access to Evidence Information Note EIN007: Summary of evidence: Geodiversity* [available at: http://publications.naturalengland.org.uk/publication/5005683512573952 (accessed October 2017)]
[36] JNCC (2011) *Geological Conservation Review (Wales)* [available at: *http://jncc.defra.gov.uk/default.aspx?page=4177&authority=UKL17,UKL22,UKL15,UKL13,UKL23,UKK13,UKL16,UKL12,UKG11,UKL11,UKL21,UKL24,UKL14,UKL18* (accessed September 2016)].

Soils

The variety of underlying geology in the North West region is reflected in its soils, the agricultural value of which varies (**Figure 3.5** highlights the extent of regional soil types). Rural land covers 80% of the region, with the majority of this managed for agriculture. Intensive arable and livestock farming are supported in lowland areas, while upland areas may be managed for grouse, forestry or farming.[24]

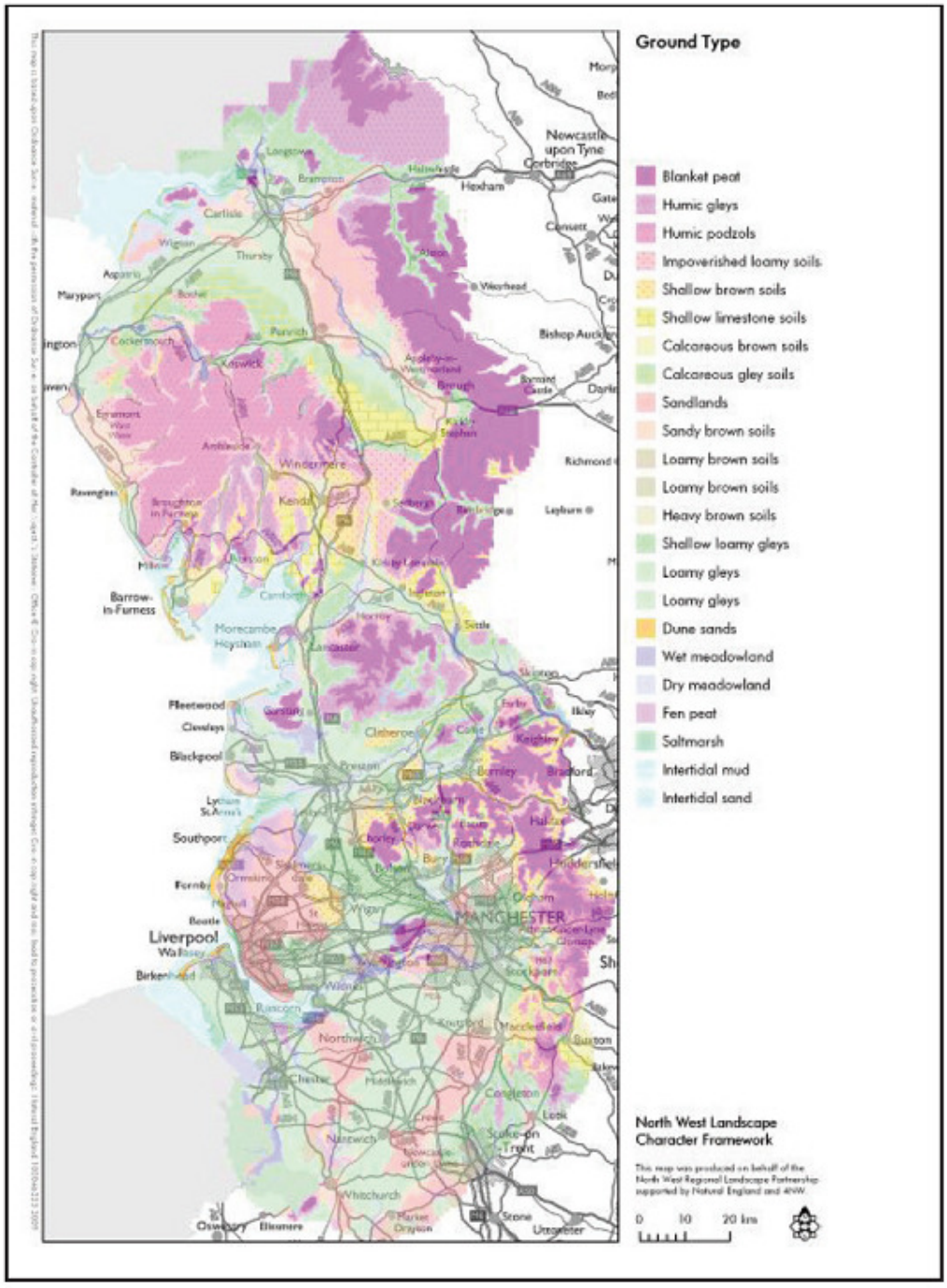
The Agricultural Land Classification System developed by Defra provides a method for assessing the quality of farmland, principally for use in land use planning. The system divides the quality of land into five categories, as well as non-agricultural and urban. The 'best and most versatile land' is generally defined as the agricultural land which falls into Grades 1, 2 and 3a.

Figure 3.6 shows agricultural land quality across United Utilities' supply area. The quality of agricultural land in the North West region is relatively poor, with large swathes of land classed as 'Poor' (Grade 4) or 'Very Poor' (Grade 5), which reflects the large proportion of upland area which generally has low agricultural quality due to exposure and poor soil cover. Areas to the north of Liverpool, west of Blackpool and across the southern part of the region include small areas of agricultural land of 'Excellent' (Grade 1) or 'Very Good' (Grade 2) quality. Large areas of 'Good to Moderate' (Grade 3) land are also present in the far north, far south and central parts of the region. Areas of urban land are focussed around Manchester and Liverpool. In Wales, 7% of the total land cover is classified as the 'best and most versatile land'.[37]

100% of sludge waste produced by United Utilities' wastewater treatment processes is diverted to beneficial use, including provision to local farmers to be used as high quality fertiliser.[38,39]

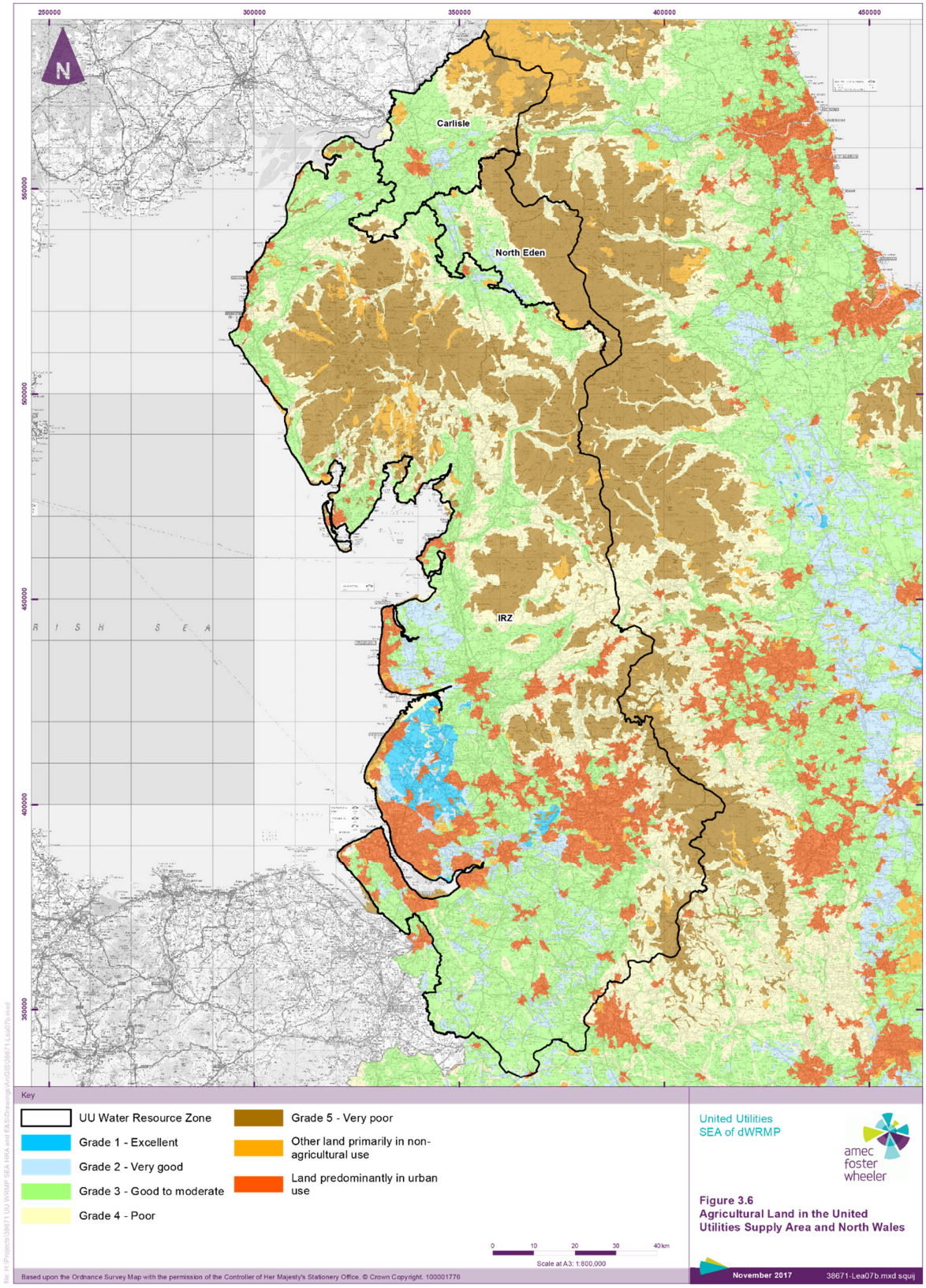
[37] Welsh Government (2016) *Agricultural Land Classification* [available at: http://gov.wales/topics/environmentcountryside/farmingandcountryside/agricultural-land-classification/?lang=en (accessed September 2016)].
[38] United Utilities (2017) *Resource Efficiency* [available at: http://www.unitedutilities.com/corporate/responsibility/environment/resource-efficiency/ (accessed October 2017)].
[39] United Utilities (2017) *Wastewater* [available at: https://www.unitedutilities.com/corporate/about-us/what-we-do/wastewater/ (accessed October 2017)].

Figure 3.5 Soil and Ground Types in the North West



Source: Countryscape (2009) *North West Landscape Character Framework Part 1: Using and Updating the Framework*

Figure 3.6 North West Region Agricultural Land Classification



Source: Natural England (2010) *Agricultural Land Classification map North West Region (ALC002)* [available at: http://publications.naturalengland.org.uk/publication/144015?category=23033 (accessed September 2017)].

Peat is of great importance in the North West region and nationally, providing a rich habitat, water quality improvements (through filtration of water), flood management and carbon storage. The UK's peatlands contain more carbon than all the forests in France and the UK combined. Half of England's blanket bog lies in the north Pennines in an area that straddles parts of Cumbria, and peat soils cover 40% of the Lake District National Park. There is pressure on peatland in England, with over 80% of UK peatland in a damaged state due to peat extraction, drainage for agriculture, overgrazing and pollution.[40,41] With regard to Wales, SoNaRR highlights that only 30% of the Welsh peat soil area is considered to be in 'good condition.[25]

Previously developed land (PDL) is defined as land that is or was occupied by a permanent structure (excluding agricultural or forestry buildings, landfills and parks) and associated fixed surface infrastructure. In 2012, the North West had a total of 7,220 ha of vacant or derelict PDL that was unused or may be available for redevelopment, which was the highest of all the English regions (see **Table 3.2**). Of this, almost 70% had some form of planning permission or was allocated for development in a local plan. Almost half (3,500 ha) of PDL in the North West region was considered to be suitable for housing, with capacity for 113,230 homes.[42]

Table 3.2 Previously Developed Land Available for Redevelopment, 2012

Region	All Vacant and Derelict PDL (ha)	Total Area Suitable for Housing (ha)
North West	**7,220**	**3,500**
South East	2,670	3,800
Yorkshire & the Humber	3,900	1,850
East of England	3,240	3,750
East Midlands	2,840	1,600
South West	2,360	1,800
West Midlands	3,000	1,910
North East	2,600	1,830
London	1,240	2,650
England	*45,120*	*22,681*

Source: University of the West of England, for the Campaign to Protect Rural England (2014) *From Wasted Space to Living Spaces: The Availability of Brownfield Land for Housing Development in England.*

Adopted and emerging local plans of the local planning authorities that comprise the region seek to utilise brownfield sites in addition to greenfield land where appropriate to meet housing and economic development needs.

United Utilities operates a large network of infrastructure assets including:

- 120,000 kilometres of water pipes and sewers;
- 168 reservoirs;

[40] IUCN National Committee United Kingdom (2016) *Peatland Programme: What's So Special about Peatlands?* [available at: http://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/160317%20Peatland_leaflet_WEB.pdf (accessed September 2016)].
[41] Lake District National Park Authority (2013) *Managing Land for Carbon* [available at: http://www.lakedistrict.gov.uk/__data/assets/pdf_file/0008/345482/Managing-land-for-carbon-booklet.pdf (accessed September 2016)]
[42] University of the West of England, for the Campaign to Protect Rural England (2014) *From Wasted Space to Living Spaces: The Availability of Brownfield Land for Housing Development in England* [available at: http://www.cpre.org.uk/resources/housing-and-planning/housing/item/3785-from-wasted-space-to-living-spaces (accessed October 2017)].

- 91 water treatment works; and
- 567 waste water treatment works.[43]

Likely Evolution of the Baseline

- Key threats to soils include draining soils, intensive agriculture, changes in land management, climate change, burning and extraction of peat, construction, and pollution.
- Loss of nitrate from agricultural soils can lead to failure of drinking water standards and contribute to eutrophication in estuaries and the sea. Eutrophication can also be caused by excess phosphate entering water bodies, usually via soil erosion.
- Soils and peatlands need to be safeguarded to protect their abilities to support plants and animals, store carbon, and provide other important ecosystem services.
- The need for greenfield land to accommodate housing and economic development may lead to a loss of greenspace and soils.
- It is expected that there will be increased opportunities to protect soils and improve water quality as agricultural practices and farm management are influenced by sustainable land management schemes such as United Utilities' SCaMP project.
- New development could increase pressure on geological assets.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the geology and soils baseline are:

- the need to maintain or improve the quality of soils/agricultural land;
- the need to protect and enhance sites designated for their geological interest;
- the need to protect peatlands in the North West;
- the need to make use of PDL, and to reduce the prevalence of derelict land; and
- the need to maintain soil function.

3.4 Water

Baseline Characteristics

The North West's exposure to westerly maritime air masses and extensive areas of high ground make the region one of the wettest in the UK. However, the large geographical differences across the region result in considerable variation in annual rainfall, for example higher parts of the Lake District receive 3,200mm of rain each year, while parts of the Eden Valley in Cumbria receive less than 800mm annually.[44] Rainfall patterns combined with sources of demand drive the nature of the water resource system operated by United Utilities.

The high proportion of upland landscape in the region means many of the rivers and streams in the North West are short and steep and often flow over impermeable rock and thin soils, which results in large variations in flow especially during periods of heavy rain.[24]

United Utilities supplies water to 3 million homes and 200,000 business customers in Cumbria, Lancashire, Greater Manchester, Merseyside, most of Cheshire and a small part of Derbyshire. More than 90% of the

[43] United Utilities (2017) *Our Water Cycle* [available at: https://www.unitedutilities.com/corporate/about-us/what-we-do/water-cycle/ (accessed October 2017)].
[44] Met Office (2016) *North West England & Isle of Man: Climate* [available at: http://www.metoffice.gov.uk/climate/uk/regional-climates/nw (accessed October 2017)].

water supplied by United Utilities comes from rivers and reservoirs, with the remainder from groundwater. In contrast, an average of 60% of water is supplied from rivers and reservoirs across the rest of England.[24]

United Utilities' region is currently split into four water resource zones (WRZs): the Integrated Water Resource Zone covering the major conurbations; North Eden; Carlisle and West Cumbria. In the last WRMP published in 2015 (covering the period 2015-2040), United Utilities identified a future supply shortfall in the West Cumbria WRZ and the Thirlmere Transfer scheme was selected to meet this shortfall by using some of the spare water available in the neighbouring Integrated Resource Zone. United Utilities is in the process of building a new water treatment works and a pipeline from Thirlmere Reservoir into West Cumbria. Once completed (by 2022), West Cumbria will become part of the Integrated Resource Zone.

United Utilities owns and operates over 100 water supply reservoirs, various river and stream intakes, as well as lake abstractions and numerous groundwater sources, and supplies around 1,730 million litres per day (Ml/d) of drinking water to approximately 3 million homes and 200,000 businesses in the North West in a normal year (although this would be higher in a dry year). Combined, the Integrated Zone and West Cumbria WRZ supply around 1,689Ml/d of drinking water, and have water sources in Wales, Cumbria and other parts of North West England. The remaining WRZs are served from sources in other parts of the region.[43,45]

[45] United Utilities (2017) *Draft Water Resources Management Plan*.

Water Availability

The Environment Agency and Natural Resources Wales have produced a series of Catchment Abstraction Management Strategies (CAMS) for the North West and other areas from which water is sourced to supply the United Utilities supply area (e.g. those sources in Wales). These CAMS set out how water resources will be managed in each catchment and provide information on how existing abstraction licences are managed and the availability of water for further abstraction. Within each CAMS, river flows and groundwater levels are monitored at Assessment Points (significant points on rivers) and assessed alongside the amount of water which has been abstracted on average over the previous six years and the situation if all abstraction licences were used to full capacity. This data is used to determine the water availability for each water body. Water availability falls into the following categories:

- Water available for licensing: There is more water than required to meet the needs of the environment. New licences can be considered depending on local and downstream impacts.
- Restricted water available for licensing: If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted and restrictions may be in place. Trading from an existing licence holder can occur.
- Water not available for licensing: Water body flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive). No further consumptive licences will be granted. Trading from an existing licence holder can occur.

The water availability assessments for the CAMS particularly relevant to the WRMP are summarised in **Table 3.3** below.

Table 3.3 Summary of CAMS Water Availability Assessments

Catchment Abstraction Management Strategy	Water Available	Restricted Water Available	Water Not Available	Total Number of Assessment Points
Derwent and West Cumbria	4	1	10	15
Eden and Esk	12	5	2	19
Lower Mersey and Alt	10	4	6	20
Lune & Wyre	4	11	8	23
Northern Manchester	0	11	2	13
Ribble, Douglas and Crossens	19	9	8	36
South Cumbria	11	14	1	26
Upper Mersey	1	12	4	17
Weaver and Dane	3	8	2	13
Severn Corridor	0	13	0	13
Tyne	7	0	0	7
Dee	0	0	8	8
Total	**71**	**88**	**51**	**210**

Source: Environment Agency (2013) and Natural Resources Wales (2015) *Abstraction Licensing Strategies.*

Sustainability Reductions - Review of Consents

Under the Habitats Directive, the Environment Agency is required to review all the consents (the RoC) that it regulates to ensure that there are no detrimental impacts on the conservation interests of designated sites including SPAs and SACs. Discharge consents and water abstraction licences are included within this review. Where the Environment Agency is unable to demonstrate that abstraction licences and discharge consents are not having an adverse impact on these designated sites, it has the power to enforce consent amendments.

Allowances for sustainability reductions totalling 42.5Ml/d were included in the Final WRMP 2015. The key driver for the majority of the reductions is the requirements of the Water Framework Directive (WFD). The greatest sustainability reductions are in the West Cumbria Resource Zone, which has a reduction of 37.5Ml/d and is primarily related to the Environment Agency's revocation of the Ennerdale abstraction licence. The River Ehen contains England's only viable population of the protected freshwater mussel, and new evidence identified that the abstraction licence did not allow for sufficient water flow for this species. This resulted in the licence being revoked in order to protect the mussel population. As noted in **Section 3.2**, United Utilities has also agreed to surrender licenses at Crummock Water, Dash Beck, Overwater and Chapel House as part of the River Ehen Compensatory Measures package. This will take place in 2022 when the West Cumbria Water Supply Project (Thirlmere Transfer pipeline) becomes operational.

Wastewater Treatment

Wastewater from 3 million homes and 200,000 businesses across the North West is treated by United Utilities every day. The wastewater is carried down drains, into the underground sewer network which comprises 72,000km of sewers, and transported to one of 567 wastewater treatment works (WwTW) where, once it is treated, is returned to rivers and to the sea.[39]

WwTW discharge consent standards are set to maintain good water quality. In 2016, United Utilities' WwTWs achieved 97.4% compliance with their environmental permit conditions, a slight improvement from 2015 (97.2%). However, this remains lower than the 2014 compliance of 98.3%, and also below the 2016 average across all water companies in England and Wales (98.6%). The Environment Agency gives water companies a star rating for their overall performance in protecting the environment (including during return of treated water to rivers and the sea). United Utilities have maintained the top four-star Environmental Performance Assessment (EPA) rating in 2015 and 2016.[46]

Water Quality

There are 1,266 surface water bodies covered by three River Basin Management Plans (RBMPs) that lie within the North West region (North West, Solway Tweed and Dee). Additionally, Lake Vyrnwy is a source to the United Utilities supply area which lies within the Severn RBMP district. All the water bodies in the region have been classified for their ecological status and have objectives set for 2021, 2027 and beyond.

Table 3.4 shows the percentage of water bodies in each River Basin District that are achieving good ecological status/potential or better, their target status by 2021 (based on data contained within the RBMPs prepared under the WFD) and a summary of the key water management issues that need to be dealt with in each district. Assessments in 2015 showed that around a third of surface water bodies across all districts had good ecological status/potential, with the Solway Tweed River Basin District having the greatest percentage of bodies at good or better status/potential (42%). Conversely, the Severn had the lowest proportion of bodies at good or better status/potential (20%). The percentage of bodies with this status is expected to increase to 2021. Out of the areas with groundwater bodies, the Dee had the greatest percentage at good or better status (100%). The Severn district, meanwhile, had the lowest proportion of groundwater bodies at good status (79%).

[46] Discover Water (2017) *Environmental Performance Assessment*. Available online at: http://www.discoverwater.co.uk/environmental-performance [accessed October 2017]

Table 3.4 Percentage of Water Bodies Achieving Good Ecological Status or Potential, 2015/2021

River Basin District	Surface Water (% of water bodies at good or better ecological status / potential)		Groundwater (% of water bodies at good or better quantitative status)		Significant Pressures
	2015	2021	2015	2021	
North West	22	25	89	94	• Physical modification; • Phosphate; • Pollution from waste water; • Pollution from rural areas; • Ammonia; • Pollution from towns, cities and transport; • Chemicals; and • Dissolved oxygen.
Solway Tweed	42	57 (surface and groundwater)	80	57 (surface and groundwater)	• Point source discharges; • Diffuse source pollution; • Water abstraction and flow regulation; • Modifications to physical condition; • Barriers to fish migration; and • Invasive non-native species.
Severn	20	27	79	81	• Phosphate; • Pollution from rural areas; • Pollution from waste water; • Physical modification; • Chemicals; • Pollution from towns, cities and transport; • Abstraction and flow; and • Changes to the natural flow and level of water.
Dee	29	71 (surface and groundwater)	100	71 (surface and groundwater)	• Physical modifications; • Pollution from waste water; • Pollution from rural areas; • Pollution from abandoned mines; • Pollution from towns, cities and transport; and • Changes to the natural flow and level of water.

Source: Environment Agency, Natural Resources Wales and Natural Scotland (2015) *River Basin Management Plans (North West, Solway Tweed, Severn, Dee).*

Bathing water in the region is generally of a high quality. Data from 2016 shows that 74% of the bathing waters in the North West achieved excellent or good standard under the EC Bathing Waters Directive (see **Table 3.5**). This is similar to 2015 (71%), but is a marked improved on 2014 when just over 45% of the bathing waters were at this standard.

Table 3.5 Bathing Water Quality in North West England, 2014-2015

Bathing Water	2014	2015	2016
West Kirby	Excellent	Excellent	Excellent
Meols	Excellent	Excellent	Excellent
Moreton	Excellent	Excellent	Excellent
Wallasey	Good	Good	Excellent
Formby	Excellent	Excellent	Excellent
Ainsdale	Sufficient	Good	Good

Bathing Water	2014	2015	2016
Southport	Good	Good	Good
St Annes	Good	Good	Good
St Annes North	Good	Excellent	Good
Blackpool South	Good	Excellent	Excellent
Blackpool Central	Poor	Sufficient	Good
Blackpool North	Poor	Good	Sufficient
Bispham	Sufficient	Sufficient	Good
Cleveleys	Poor	Poor	Good
Fleetwood	Poor	Excellent	Good
Morecambe South	Sufficient	Sufficient	Good
Morecambe North	Sufficient	Sufficient	Good
Walney Biggar Bank	Sufficient	Good	Sufficient
Walney Sandy Gap	Sufficient	Good	Sufficient
Walney West Shore	Sufficient	Good	Sufficient
Haverigg	Poor	Sufficient	Sufficient
Silecroft	Excellent	Excellent	Excellent
Seascale	Sufficient	Good	Good
St Bees	Good	Good	Excellent
Allonby South	Sufficient	Sufficient	Sufficient
Allonby	Poor	Poor	Sufficient
Silloth	Poor	Poor	Sufficient
Windermere Fellfoot	Good	Excellent	Excellent
Windermere Lakeside YMCA	Excellent	Excellent	Excellent
Windermere Millerground Landing	Excellent	Excellent	Excellent
Windermere, Rayrigg Meadow	No classification	Excellent	Excellent

Source: Environment Agency (2017) *Find a Bathing Water* [available at: http://environment.data.gov.uk/bwq/profiles (accessed October 2017).

There are 103 designated bathing waters along the Welsh coast which are tested for compliance with water quality standards under the EC Bathing Waters Directive. In 2016, 97 of the bathing waters had obtained excellent or good status, five were assessed as sufficient, and one was classified as poor.[47]

Across England and Wales, new drinking water standards came into force in 2016, *The Water Supply (Water Quality) (Amendment) Regulations 2016*. United Utilities' performance against the water quality tests (known

[47] Natural Resources Wales (2017) *Bathing Waters in Wales 2016* [available at: https://naturalresources.wales/media/681414/wales-bathing-water-report-2016.pdf (accessed October 2017)].

as Overall Mean Zonal Compliance) for 2016 was 99.96%, which meets the average standard for all water companies in England and Wales. This maintains 2015 performance, following a slight increase from 2014 levels (99.95%).[48]

Nitrate Zones

Nitrate Vulnerable Zones (NVZs) are areas of land that drain into surface or groundwater where nitrate levels are already high (greater than 50mg/l), or may have high levels of nitrate in the future. **Table 3.6** identifies the number of NVZs designated for high nitrate in surface water for each of the River Basin Districts in the United Utilities supply area. The Severn district has the highest number of NVZs designated for surface water nitrate levels, covering over half of the district. In contrast, the Solway Tweed NVZs cover only 1% of the district. In each district, there are also a smaller number of additional NVZs designated for groundwater nitrate levels or eutrophication.

Table 3.6 Nitrate Vulnerable Zones Designated for High Nitrate in Surface Water

River Basin District	Number of NVZs (high nitrate in surface water)	% of RBD covered by NVZ
North West	23	26
Solway Tweed	7	1
Severn	66	51
Dee	7	18

Source: Environment Agency, Natural Resources Wales and Natural Scotland (2015) *River Basin Management Plans (North West, Solway Tweed, Severn, Dee).*

The lower parts of the River Dee were designated as a Water Protection Zone (WPZ) in 1999. This is the only designated WPZ in the UK and was designated to protect public water supply sources from point source pollution on the river. This designation means that consent is required before substances including fuels, medicines and liquid foods can be used within the zone.

Flood Risk

Parts of the area supplied by United Utilities are prone to flooding. Much of the coastal area is at risk of tidal flooding, particularly low-lying land adjacent to the major estuaries in the region including the Solway Firth, the rivers entering Morecambe Bay, the Ribble, the Mersey and the Dee. Significant flooding occurred across the region in December 2015 as a result of record levels of rainfall, with the highest ever river flows registered in the Eden, Lune and Tyne catchments and many large rivers draining the Pennines.[49]

The 2016 Flood Risk Management Plans identify the number of people at high risk of flooding (more than a 1 in 30 chance of being flooded in any year (3.3%)) for each River Basin District. In the North West district, approximately 31,000 people are at high risk of flooding from rivers and the sea, and a further 32,600 people are at high risk living in the Severn district. Lower numbers of people are at high risk in the Dee and Solway Tweed river basin districts, with 3,000 people and 1,800 people respectively.[50] **Figure 3.8** shows the location of areas most at risk from flooding. Flood Zone 3 represents areas with a high probability of flooding, which could be flooded either from rivers or the sea if there were no flood defences. These areas could be affected by flooding from the sea that has a 0.5% (1 in 200) or greater chance of occurring each year, or flooding from rivers that has a 1% (1 in 100) or greater chance of occurring each year. Flood Zone 2

[48] Discover Water (2017) *Water quality results for all water companies*. Available online at: http://www.discoverwater.co.uk/quality [Accessed October 2017]
[49] Environment Agency (2016) *Flood Risk Management Plan: North West River Basin District Summary* [available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/507120/LIT_10208_NORTH_WEST_FRMP_SUMMARY_DOCUMENT.pdf (accessed September 2016)].
[50] Environment Agency, Natural Resources Wales, SEPA (2016) *Flood Risk Management Plans (North West, Solway Tweed, Severn, Dee)* [available at: https://www.gov.uk/government/collections/flood-risk-management-plans-frmps-2015-to-2021 (accessed September 2016)].

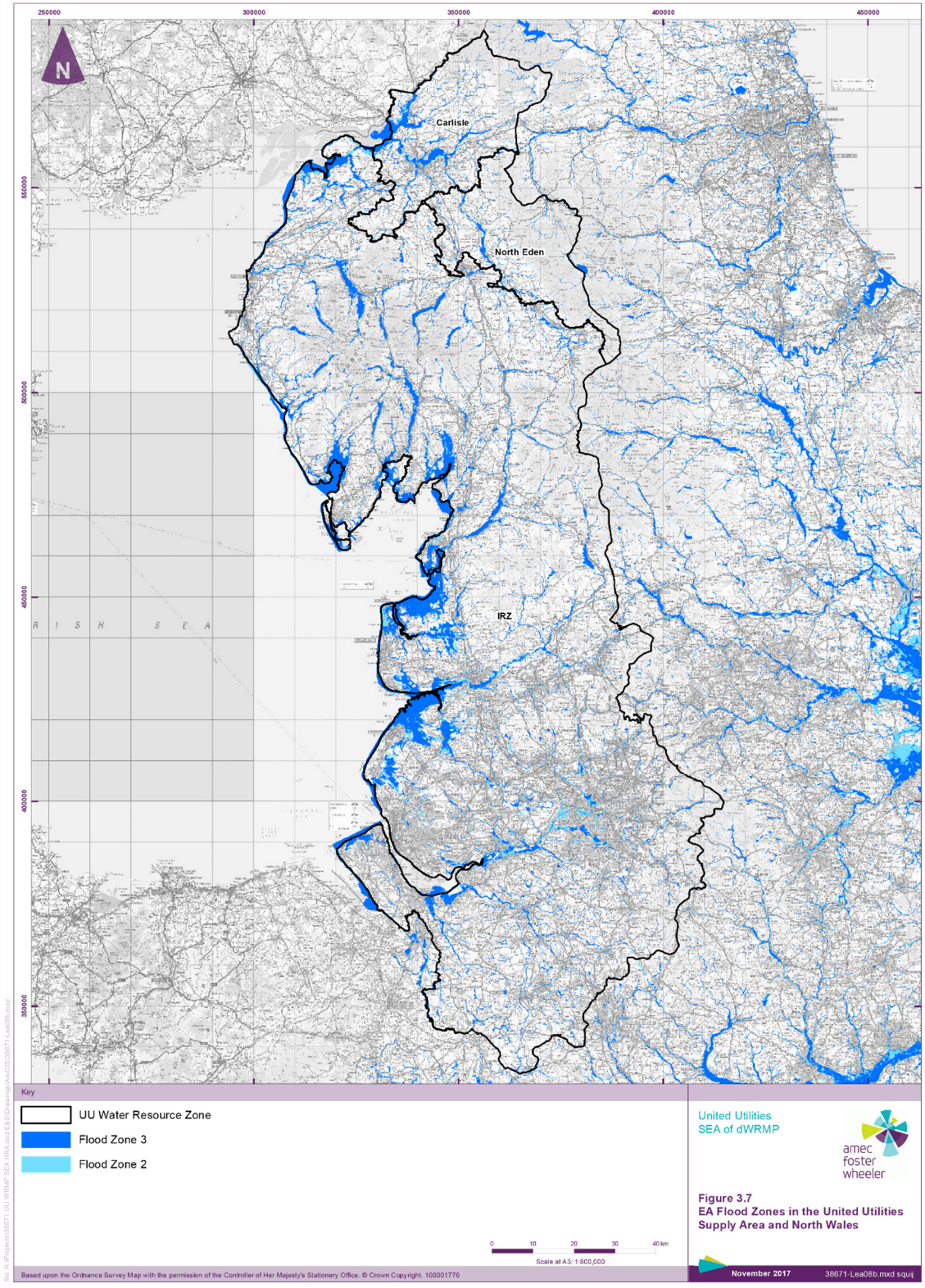
shows the additional extent of an extreme flood from rivers or the sea, with up to a 0.1% (1 in 1,000) chance of occurring each year.

Sewer flooding can result from blockages within sewers and from the capacity of sewers being exceeded due to intense or prolonged rainfall. United Utilities' 2016/17 target for sewer flooding was exceeded at 94.4 index points against a target of 83.9. Although the target was not met, partly due to becoming more stringent, this represents a reduction in the number of flooding incidents compared to 2015/6 which had a sewer flooding index of 100.8. The high rate of flooding in 2015/16 was likely to be due to the unusually high rainfall across the year and significant storm events in the winter of 2015. However, the 2016/17 sewer flooding index still remains higher than 2014/15, which had a sewer flooding index score of 82.5.[51]

Additionally, United Utilities' infrastructure may be at risk of flooding and flood events could lead to disruption to water supply and pollution incidents. This occurred during the December 2015 storms, when the Keswick treatment works and several other large wastewater treatment works were heavily flooded resulting in severe impacts on operations.

[51] United Utilities Water Limited (2017) *United Utilities 2016/17 Annual Performance Report* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/apr/uuw-2017-annual-performance-report.pdf (accessed October 2017)].

Figure 3.7 Areas at Risk of Flooding in North West England

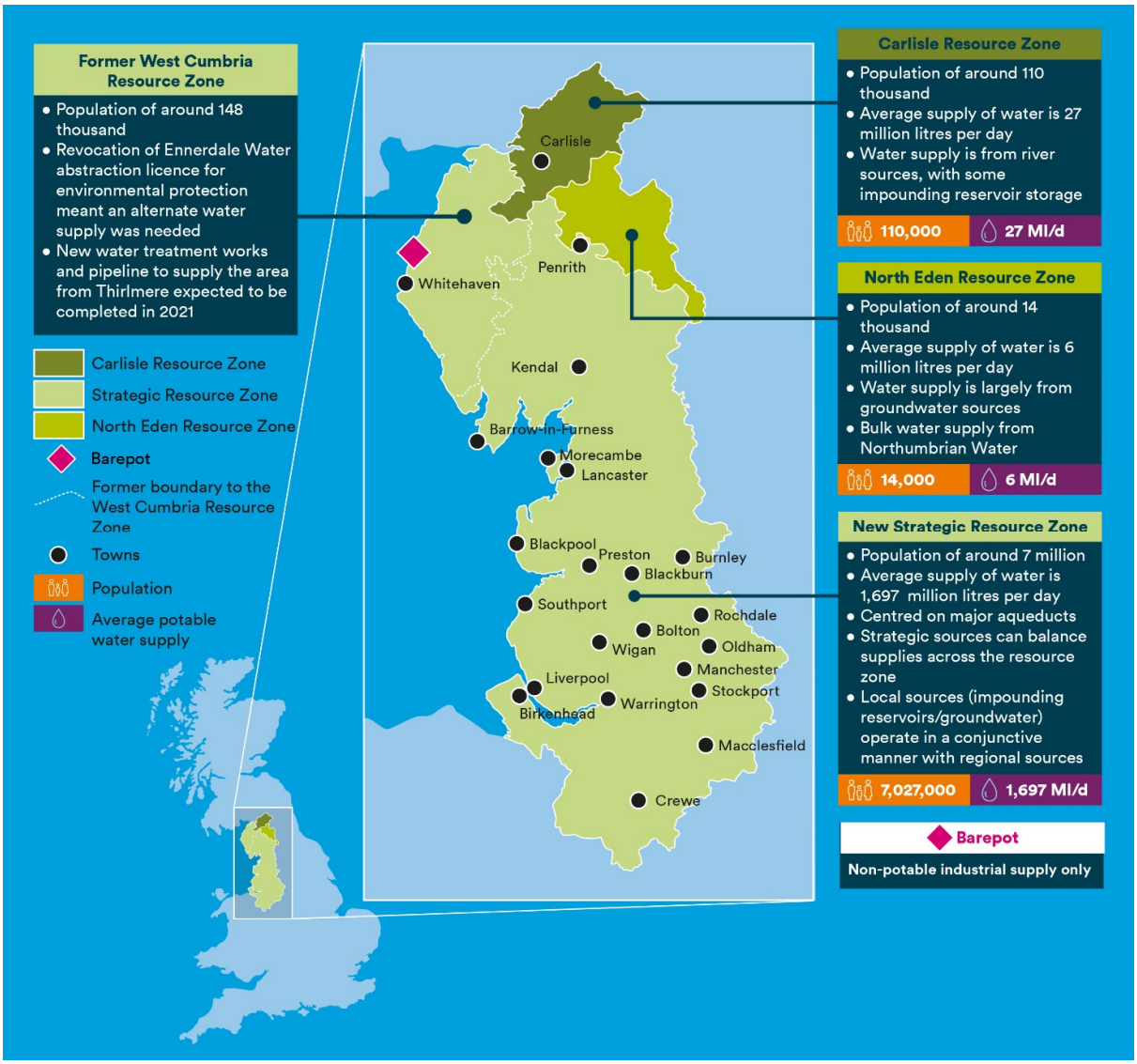


Source: Environment Agency (2017) *Flood Map for Planning* [available at: http://apps.environment-agency.gov.uk/wiyby/37837.aspx (accessed September 2017)].

Likely Evolution of the Baseline

- Under the Water Framework Directive, rivers in England and Wales were required to have achieved 'good ecological status by 2015. Where this was not possible and subject to criteria set out in the Directive, the aim is to achieve good status by 2021 or 2027. Only 20 – 42% of water bodies in the relevant River Basin Districts have so far met this target.
- Pressure to meet demand for public water supply in the area will increase as the population grows, despite efforts to manage demand through water efficiency and leakage reduction. Water is restricted for licencing in much of the North West. The West Cumbria Thirlmere Transfer Project is being brought forward in response to the need to cease abstraction from Ennerdale Water. In the interim, United Utilities has committed to revoking some licences in West Cumbria as compensation for the continued abstraction at Ennerdale until 2022. Further sustainability reductions may be required over the period of the WRMP, although this is to be confirmed by the Environment Agency.
- As a long-term 25-year strategic view, WRMP19 is being developed to reflect the merging of the West Cumbria and Integrated Resource Zones which together will form the Strategic Resource Zone. A new smaller resource zone, Barepot, has also been established to reflect supplies to commercial customers located in the West Cumbria area (these are not connected into the rest of the public water supply network). As a result, WRMP19 is being developed around the four WRZs that will exist from 2022, as shown in **Figure 3.8.** These are: the Strategic Resource Zone; the Carlisle Resource Zone; the North Eden Resource Zone; and Barepot.
- Priority water quality issues in the region include various pollution sources (including waste water, rural areas, diffuse and point source discharges), physical modifications and phosphate, which may put further pressure on water quality as well as habitats and species. With specific regard to Wales, SoNaRR[25] highlights a need to work within whole catchments to manage nutrients, and maintain, enhance and restore floodplains and hydrological systems.
- Climate change presents increased risk with respect to coastal flooding in the long term, while climate change combined with an increase in housing numbers or urban area presents an increased risk to fluvial and sewer flooding.
- The UK Climate Programme 2009 (UKCP09) projections for the North West for the medium emissions scenario central estimate (50% probability) that:
  - Winter mean precipitation will increase by 16% by the 2080s. It is very unlikely to increase by less than 3% and is very unlikely to increase by more than 34%.
  - Summer mean precipitation will reduce by 22% by the 2080s. It is very unlikely that summer mean precipitation will reduce by more than 43% and it is very unlikely that it will increase by more than 0%.
- SoNaRR[25] highlights that climate change may affect groundwater recharge in Wales and that by 2025, it is likely that groundwater recharge will decrease, resulting in decreased dry weather river flows and a general lowering of groundwater levels. This may have impacts on base-flow to rivers and wetlands in dry periods and affect small domestic and agricultural water supplies.

Figure 3.8 United Utilities' Resource Zones (from 2022 onwards)



Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the water baseline are:

- the need to maintain and improve water quality;
- the need to maintain seasonal flows in groundwater and surface water;
- the need to ensure the continued risk of flooding is mitigated effectively; and
- the need to prevent the deterioration of Water Framework Directive (WFD) waterbodies, achieve protected area objectives and achieve water body status objectives.

3.5 Air Quality and Climate

Baseline Characteristics

Air Quality

The emission of pollutants to air can pose a hazard to human health (e.g. respiratory illnesses and lung conditions) and can also have a negative impact on the environment (e.g. changes to ecosystems and damage to vegetation when present within the atmosphere in excess of certain concentrations). Such thresholds are set as objectives and include pollutants such as nitrogen dioxide (NO_2), sulphur dioxide (SO_2) volatile organic compounds (VOCs) and fine particles (known as 'particulates'). Air Quality Management Areas (AQMAs) are declared in specific locations where atmospheric concentrations of one or more pollutants are either close to or exceeding statutory objectives set out within the *Air Quality Strategy for England, Scotland, Wales and Northern Ireland*.[52]

A total of 36 local authorities across the North West have declared AQMAs for exceedance of NO_2 (within each local authority are there may be several AQMAs). One local authority has declared an AQMA for particulate matter. **Figure 3.9** below shows the location of AQMAs across the North West and surrounding area. In Wales, AQMAs for NO_2 have been declared in nine local authorities, predominantly across mid and south Wales, and there is a further particulate matter AQMA in Neath Port Talbot.

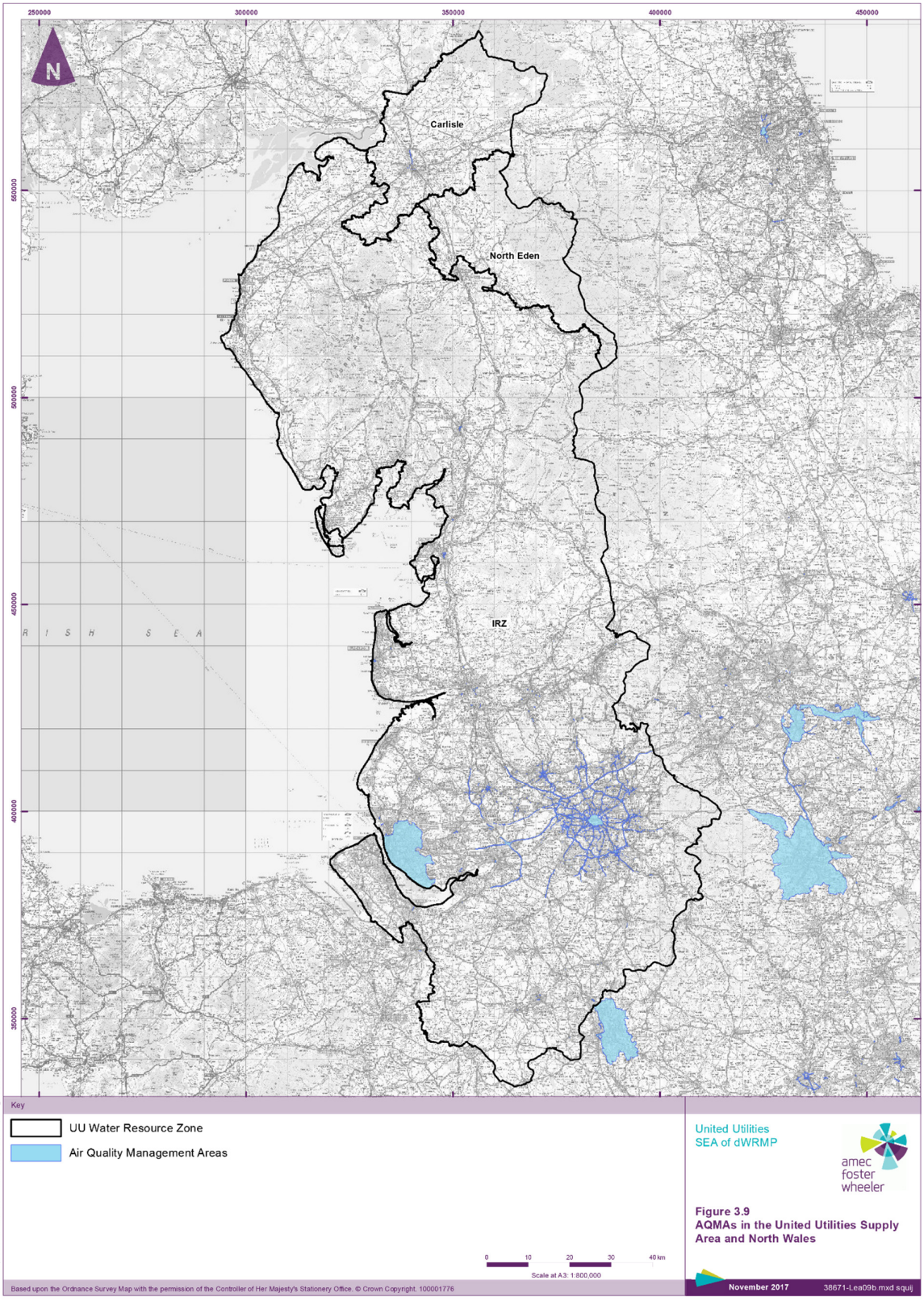
Air quality monitoring takes place across the UK to determine compliance with EU standards. With the exception of Blackpool and Preston, the rest of the North West region experienced exceedances of the annual mean NO_2 limit in 2016. None of the monitoring areas exceeded the 1-hour mean limit value for NO_2 in this period. In addition, the air quality in 2016 was within the particulate matter mean daily and annual limits. In Wales, the North Wales monitoring area exceeded the annual mean limit for NO_2, while South Wales exceeded both the annual and 1-hour mean limits. Both areas remained under the particulate matter limits in 2016.[53]

In recent years, several key air pollutants have shown major decreases in atmospheric concentrations across the UK, while others have remained constant:

- Atmospheric concentrations of SO_2 decreased across the UK due to reductions in the use of coal, gas and oil and reductions in the sulphur content of fuels.
- While overall emissions of NO_x have decreased over the last 25 years, the monitored atmospheric concentrations of urban traffic sites did not show such a consistent decrease, potentially due to the quantity and type of traffic on the adjacent road.
- Atmospheric concentrations of particulate matter (PM_{10} and $PM_{2.5}$) have steadily decreased since the early 1990s, but have remained relatively constant since 2009.
- Carbon monoxide (CO) concentrations have reduced as a result of reductions in emissions from road transport, iron and steel production and the domestic sector.[53]

[52] Defra (2007) *Air Quality Strategy for England, Scotland, Wales and Northern Ireland* [available at: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-2 (accessed September 2016)].
[53] Defra (2017) *Air Pollution in the UK 2016* [available at: https://uk-air.defra.gov.uk/library/annualreport/viewonline?year=2016_issue_1 (accessed October 2017)].

Figure 3.7 Air Quality Management Areas



Source: Defra (2017) *2017 AQMAs Dataset* [available at: https://uk-air.defra.gov.uk/aqma/maps (accessed September 2017)].

Climate

The effects of climate change are potentially some of the most significant environmental problems facing this area. These effects could include increased variability in precipitation and drought patterns, increased sea levels and a higher risk of flooding. By the 2080s, sea level increases of up to 63cm across most of the North West region are expected along with more frequent storm surges.[54]

Greenhouse gases including carbon dioxide (CO_2) emitted from human actions are a major contributor to climate change. North West England emitted 11% of the UK's greenhouse gas emissions in 2015. The amount of CO_2 emitted in the North West of England between 2011 and 2015 is shown in **Table 3.7** and highlights that emissions have reduced since 2011 by 15% to 40.7 million tonnes (Mt) CO_2 in 2015, principally because of declines in emissions from the industry and commercial and domestic sectors. Industry and commercial remained the largest source of CO_2 emissions in the region.[55]

Wales experienced a smaller decline in emissions across the same period, with the amount of CO_2 emitted reducing by 4% between 2011 and 2015. CO_2 emissions in 2015 were 26.9 $MtCO_2$. This was heavily dominated by the industrial and commercial sector, which fluctuated across the period but returned to 2011 levels of emissions during 2015.

On a local authority basis, Carlisle had the largest decreases in emissions in both the North West and across the UK, with a 38% reduction in emissions in 2015 compared to the previous year. This was primarily associated with changes in emissions from industry and commercial electricity. In contrast, Allerdale had the largest increase in greenhouse gas emissions in the North West from 2014 to 2015, with a 7% increase primarily due to industry and commercial gas emissions.

On a per capita basis, the North West emitted 5.7 tonnes (t) CO_2 per person in 2015. Across the UK as a whole, this ranged from 3.8 tCO_2 per person in London to 8.7 tCO_2 per person in Wales, the highest in the UK. This reflects the significant industrial base in Wales which resulted in a high contribution from industrial and commercial emissions.

Table 3.7 End User Estimates of Carbon Emissions ($MtCO_2$), North West England 2011-2015

End User	2011	2012	2013	2014	2015
Industrial and Commercial	20.8	22.4	20.4	17.4	15.6
Domestic	14.2	15.3	14.8	12.3	12.2
Transport	13.6	13.4	13.3	13.4	13.7
LULUCF	-0.6	-0.6	-0.6	-0.7	-0.7
Total	**48.0**	**50.6**	**47.9**	**42.4**	**40.7**
Per Capita Emissions (t)	*6.8*	*7.1*	*6.7*	*5.9*	*5.7*

NB: due to rounding totals may not sum exactly.

Source: BEIS (2017) *UK local authority and regional carbon dioxide emissions national statistics: 2005-2015*.

Increasing the amount of renewable energy generation is one response to the need to reduce CO_2 emissions, and the North West region has shown a steady year-on-year increase in renewable electricity generation from 2003 to 2015, with a slight drop in 2016. The renewable electricity capacity in the region continued to rise in 2016. The most recent data from the Department for Business, Energy & Industrial Strategy (BEIS) shows that in 2016, the North West generated 6,275 GWh electricity from renewable sources, an increase of 230% compared to 2010 (primarily due to increases in wind capacity). The North

[54] ClimateUK (2012) *A Summary of Climate Change Risks for North West England* [available at: http://climateuk.net/sites/default/files/NorthWest-NewText-1-A4.pdf (accessed August 2012)].
[55] BEIS (2017) *UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005-2015* [available at: https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics (accessed October 2017)].

West had 7% of the total renewable energy capacity of the UK (2,507 MWe), while Wales had 8% of the UK's capacity (2,711 MWe).[56,57]

In 2016/17 United Utilities' carbon footprint was 452 $ktCO_2e$, a reduction of 22% across the last 10 years. The company's renewable energy production in 2016/17 was 149 GWh, which represented 18% of the total electricity consumption in the year. This was predominantly from energy recovery, wind and solar photovoltaics. The proportion of renewable energy has risen over the last few years, up from 13% in 2012/13. In 2015, United Utilities installed one of Europe's largest floating solar array systems on Godley reservoir, which generates 35% of the water treatment works' total power.[58,59]

Actions associated with infrastructure work such as building water treatment works, renewing pipes and infrastructure can also require large quantities of materials which contain embodied carbon as a result of transport and manufacturing processes.

Likely Evolution of the Baseline

Air Quality

- With increasingly strong air quality legislation and de-industrialisation, levels of the majority of air pollutants will continue to decline.
- Pollutants associated with road transport such as nitrogen oxides and ozone will be harder to reduce particularly in hotspot areas of traffic congestion.

Climate Change

- The UK Climate Programme 2009 (UKCP09) provides climate information for different emissions scenarios (high, medium, low) and differing levels of uncertainty. For North West England (under medium emissions), by the 2080s the UKCP09 central estimate (50% probability) indicates that there will be:
  - An increase in winter mean temperature of 2.6ºC; it is very unlikely to be less than 1.4ºC and is very unlikely to be more than 4ºC.
  - An increase in summer mean temperature of 3.7ºC; it is very unlikely to be less than 2ºC and is very unlikely to be more than 5.9ºC.
  - A change in annual mean precipitation of 0%; it is very unlikely to be less than -8% and is very unlikely to be more than 8%.
  - A change in winter mean precipitation of 16%; it is very unlikely to be less than 3% and is very unlikely to be more than 34%.
  - A change in summer mean precipitation of -22%; it is very unlikely to be less than -43% and is very unlikely to be more than 0%.[60]
- For Wales, the central estimate (50% probability of occurring) indicates that there will be an increase in the amount of winter rainfall by around 19%, and an increase in average summer temperatures of 3.5ºC by 2080.[60] It is also projected that there will be an increase in the

[56] BEIS (2017) *Renewable Electricity in Scotland, Wales, Northern Ireland and the Regions of England in 2016* [available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/647344/Regional_renewable_electricity_2016.pdf (accessed October 2017)].
[57] BEIS (2017) *Regional Statistics 2003-2016: Generation & Installed Capacity* [available at: https://www.gov.uk/government/statistics/regional-renewable-statistics (accessed October 2017)].
[58] United Utilities Water Limited (2017) *Annual Report and Financial Statements for the year ended 31 March 2017* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/investor-pdfs/annual-reports/uuw_limited_mar_2017_v1.0.pdf (accessed October 2017)].
[59] United Utilities (2017) *Climate Change* [available at: https://www.unitedutilities.com/corporate/responsibility/environment/climate-change/ (accessed October 2017)].
[60] UK Climate Projections (2014) *Maps and Key Findings (UK Wide, North West, Wales)* [available at: http://ukclimateprojections.metoffice.gov.uk/21708?projections=23665 (accessed August 2012)].

number of dry periods exceeding 10 days during summers and the number of extreme hot days.

- The changes in average temperatures and rainfall as a result of climate change are likely to cause hotter, drier summers which will potentially result in:
  - increased maximum summer temperatures that are likely to lead to increased thermal discomfort in buildings;
  - increased health problems in the summer, including heat related deaths and those linked to high air pollution. Elevated summer temperatures cause health problems both directly and indirectly, via elevated levels of air pollutants;
  - increased summer water shortages as summer rainfall decreases;
  - growth in summer tourism; and
  - changes to the natural environment including impacts on habitats and species associated with changing temperatures and water availability (in both summer and winter).
- Milder winters are expected to result in:
  - a reduction in the number and severity of annual frosts and snowfall, caused by the likely increased temperatures during the winter months which could lead to longer growing seasons for suitable crops and grasslands;
  - less cold weather transport disruption;
  - reduced demand for winter heating;
  - less cold weather related illnesses;
  - increased river and urban flooding, due to the increased incidence and severity of extreme rainfall events; and
  - increased pressure on sewer systems with associated water quality impacts.
- A report by ClimateUK[54] highlights that climate change could see river flows in important regional rivers such as the Eden, Lune and Mersey (all of which have major water supply abstractions and wastewater discharges) reduce by as much as 80%, with impacts for households and businesses, especially during times of drought. The changes in climate are expected to result in an increase in the number of flash flooding events; place increased pressure on the capacity of the sewerage system; increase the frequency of summer water shortages and low flows in rivers; and result in the loss of habitats and species.
- The UK Climate Change Risk Assessment 2017[61] highlights that water supply deficits are projected to be widespread in the UK by the 2050s under a high population growth and a high climate change scenario, in the absence of additional adaptation interventions beyond those included in the current water company WRMPs. It highlights that the north-west of England and Yorkshire and Humber are projected to be highly susceptible, as well as London and the south-east.
- In response to the challenges posed by climate change, Water UK's 2016 'Water resources long term planning framework (2015-2065)'[62] recommends that demand management in conjunction with a combination of localised initiatives and strategic schemes/transfers should be adopted to provide future resilience. Reflecting the recommendations of this report, the

[61] Committee on Climate Change (2017) *UK Climate Change Risk Assessment 2017*. Available from https://www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/ [Accessed October 2017].
[62] Water UK (2016) *Water resources long term planning framework*. Available from https://dl.dropboxusercontent.com/u/299993612/Publications/Reports/Water%20resources/WaterUK%20WRLTPF_Final%20Report_FINAL%20PUBLISHED.pdf [Accessed August 2017].

Government[63] has confirmed that a 'twin track' approach to improving the resilience of water supplies is required, with investment in new supplies complementing measures to reduce the demand for water.

- The Kyoto Protocol's first commitment period ended in 2012, which had set a legally binding target for the UK to reduce its greenhouse gas emissions by 12.5% (compared to the 1990 base year) across 2008 to 2012. The 2015 United Nations Climate Change Conference (COP 21) negotiated the Paris Agreement, a global agreement to (*inter alia*) hold the increase in the global average temperature to well below 2 ℃ above pre-industrial levels and to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development.
- The UK Climate Change Act 2008 set legally binding targets for the UK to reduce greenhouse gas emissions by at least 80% by 2050, and CO_2 emissions by at least 26% by 2020, both set against a 1990 baseline. Under the requirements of the Act, the Government has set five year carbon budgets to set out a trajectory for emissions reductions to 2050. Budgets have been set covering the periods 2008-12, 2013-17, 2018-22, 2023-27 and 2028-32, equivalent to 22%, 28%, 34%, 50% and 57% reductions in carbon emissions compared to 1990 levels respectively.
- The UK Government has agreed to an EU-wide target of 20%renewable energy by 2020 – including a binding 10% target for the transport sector. The European Commission has proposed that the UK share of this target would be to achieve 15% of the UK's energy from renewables by 2020.
- There is a degree of conflict between increasing the level of treatment of waste water required to meet stricter environmental quality standards and the energy use and associated emissions that result from the improved treatment processes. However, United Utilities is committed to reducing its emissions by 50% by 2020 (against a 2005/06 baseline), and also plans to significantly increase renewable generation, with a target of generating 35% of its electricity consumption from renewable sources by 2020.[59]

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the air quality and climate baseline are:

- the need to minimise emissions of pollutant gases and particulates and enhance air quality;
- the need to reduce the need to travel and promote sustainable modes of transport;
- the need to reduce greenhouse gas emissions arising from implementation of the WRMP;
- the need to take into account, and where possible adapt to, the potential effects of climate change; and
- the need to increase environmental resilience to the effects of climate change.

[63] See Defra (2007) *The government's strategic priorities and objectives for Ofwat*. Available from https://consult.defra.gov.uk/water/consultation-on-a-new-sps/supporting_documents/Draft%20SPS%20for%20consultation%20%20FINAL.pdf [Accessed August 2017].

3.6 Human Environment

Baseline Characteristics

Community

As at the 2011 Census, the population of the North West was 7.1 million, an increase of 4% from 2001. The North West had the third largest population of any English region.[64] The population of the region in 2016 was estimated to be 7.22 million people, remaining the third highest of the UK regions.[65]

At the sub-regional level, a large proportion of the region's population is concentrated in Greater Manchester which had an estimated population of 2,782,100 people in 2016 (equating to 38.5% of the region's population). Eden, meanwhile, had the lowest population of all the local authorities in the region at 52,600 people, accounting for 0.7% of the region's total population.

The North West experienced a 2.3% rise in population from 2011 to 2016, but there was substantial local variation across the region. Manchester, Salford and Chorley had the greatest population rises in this period, ranging from 6.1 – 7.6%. Five local authorities experienced a decline in population over the same period, with Barrow-in-Furness having the greatest population decrease, at 2.6%.[66] **Table 3.8** shows population change across the local authorities in the North West region and Wales as a whole between 2015 and 2016.

Table 3.8 Population Change (2015-2016)

Name	Estimated Population mid-2015	Estimated Population mid-2016	Total Change	% Change
England	**54,786,327**	**55,268,067**	**481,740**	**0.88%**
North West	**7,173,835**	**7,219,623**	**45,788**	**0.64%**
Blackburn with Darwen	146,846	147,049	203	0.14%
Blackpool	139,578	139,195	-383	-0.27%
Cheshire East	375,392	376,695	1,303	0.35%
Cheshire West and Chester	333,917	335,680	1,763	0.53%
Halton	126,528	126,903	375	0.30%
Warrington	207,695	208,809	1,114	0.54%
Cumbria	497,996	497,906	-90	-0.02%
Allerdale	96,660	96,956	296	0.31%
Barrow-in-Furness	67,515	67,321	-194	-0.29%
Carlisle	108,155	108,409	254	0.23%
Copeland	69,647	69,307	-340	-0.49%
Eden	52,565	52,639	74	0.14%

[64] Office of National Statistics (2012) *Census result shows increase in population of the North West* [available at: http://www.ons.gov.uk/ons/rel/mro/news-release/census-result-shows-increase-in-population-of-the-north-west/censusnorthwestnr0712.html (accessed September 2016)].
[65] Nomis (2016) *Total Population - Area Comparison: All People Population (United Kingdom)* [available at: https://www.nomisweb.co.uk/reports/lmp/gor/2013265922/subreports/gor_pop_compared/report.aspx (accessed October 2017)].
[66] Nomis (2016) *Dataset Selection: Population Estimates* [available at: https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?opt=3&theme=&subgrp (accessed October 2017)]

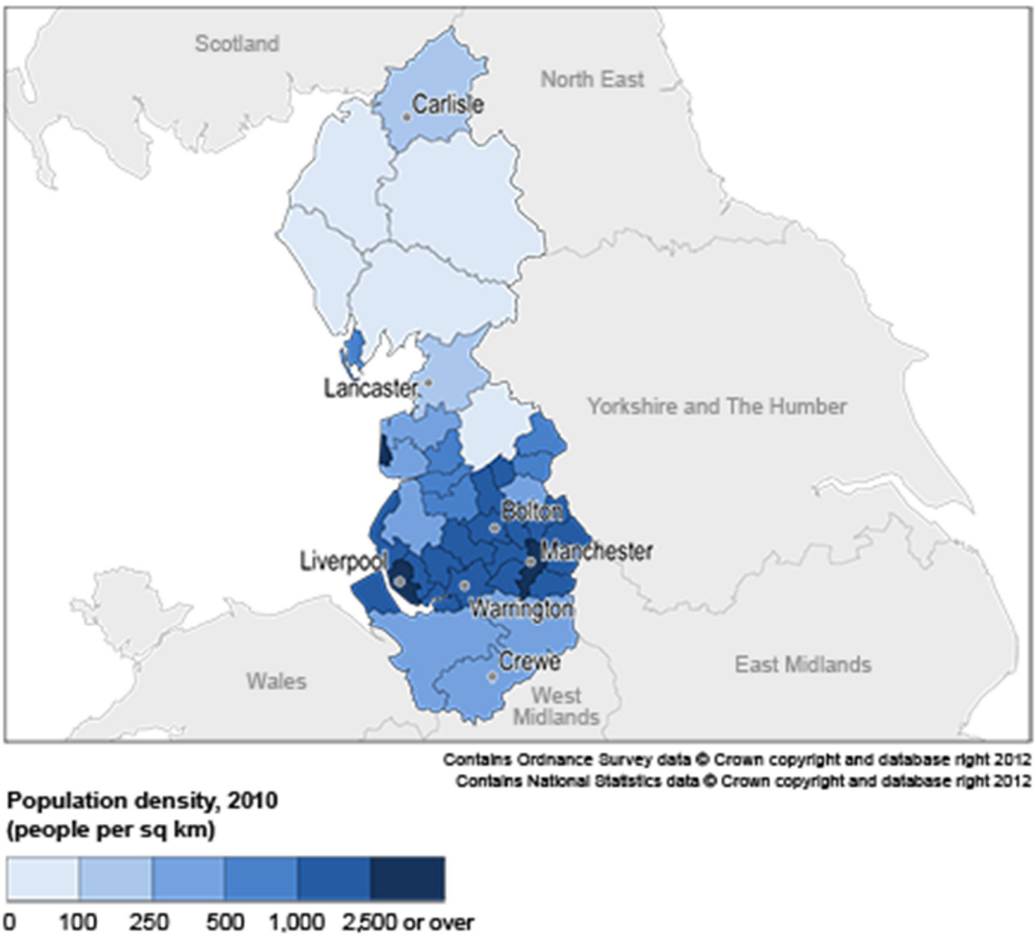
Name	Estimated Population mid-2015	Estimated Population mid-2016	Total Change	% Change
South Lakeland	103,454	103,274	-180	-0.17%
Greater Manchester (Met County)	2,756,162	2,782,141	25,979	0.94%
Bolton	281,619	283,115	1,496	0.53%
Bury	187,884	188,669	785	0.42%
Manchester	530,292	541,263	10,971	2.07%
Oldham	230,823	232,724	1,901	0.82%
Rochdale	214,195	216,165	1,970	0.92%
Salford	245,614	248,726	3,112	1.27%
Stockport	288,733	290,557	1,824	0.63%
Tameside	221,692	223,189	1,497	0.68%
Trafford	233,288	234,673	1,385	0.59%
Wigan	322,022	323,060	1,038	0.32%
Lancashire	1,191,691	1,198,798	7,107	0.60%
Burnley	87,371	87,522	151	0.17%
Chorley	112,969	114,351	1,382	1.22%
Fylde	77,322	77,990	668	0.86%
Hyndburn	80,228	80,537	309	0.39%
Lancaster	142,283	143,517	1,234	0.87%
Pendle	90,111	90,588	477	0.53%
Preston	141,302	141,801	499	0.35%
Ribble Valley	58,480	58,826	346	0.59%
Rossendale	69,487	69,886	399	0.57%
South Ribble	109,651	110,118	467	0.43%
West Lancashire	112,742	113,401	659	0.58%
Wyre	109,745	110,261	516	0.47%
Merseyside (Met County)	1,398,030	1,406,447	8,417	0.60%
Knowsley	147,231	147,915	684	0.46%
Liverpool	478,580	484,578	5,998	1.25%
Sefton	273,707	274,261	554	0.20%
St. Helens	177,612	178,455	843	0.47%
Wirral	320,900	321,238	338	0.11%
Wales	**3,099,086**	**3,113,150**	**14,064**	**0.45%**

Source: ONS (2017) *Population Estimates for UK, England and Wales, Scotland and Northern Ireland: mid-2016* [available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland (accessed October 2017)].

As at the 2011 Census, it is estimated that 89% of the population of the North West lived in urban areas, with a regional population density of 500 people per sq km.[67] Within the region, population density varies widely. In 2011, Manchester had 503,130 residents living in 120 km^2 (equivalent to 4,350 people per km^2). In comparison, Cumbria is largely rural with approximately 0.5 million residents living in 6,800 km^2 (equivalent to 70 people per km^2).[68] **Figure 3.10** illustrates the population density across the region.

[67] Nomis (2011) *Population Density* [available at: https://www.nomisweb.co.uk/census/2011/qs102ew (accessed September 2016)].
[68] Nomis (2011) *Dataset Selection: Census 2011, Quick Statistics, QS102EW - Population density* [available at: https://www.nomisweb.co.uk/query/select/getdatasetbytheme.asp?opt=3&theme=&subgrp (accessed September 2016)].

Figure 3.8 Population Density in the North West



Source: Office for National Statistics (2012) *Regional Profiles: Key Statistics - North West* [available at: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/regional-trends/region-and-country-profiles/key-statistics-and-profiles---august-2012/key-statistics---north-west--august-2012.html (accessed September 2016)].

The population of Wales stood at 3.1 million in 2011, with a population density of 150 people per sq km. 67% of the population lived in urban areas.[67]

Health

Life expectancy is used as a broad measure of the health of an area and where a person is born largely influences how long they will live. In the North West, the average life expectancy at birth for the period 2012-14 was 78.1 years for men and 81.9 years for women, compared to 79.5 and 83.2 years respectively for all of England. The region has one of the lowest life expectancies across all the English regions and one of the highest proportions of life spent with a persistent illness or disability. Compared with the rest of England, men in the North West can expect to live 1.4 years less on average whilst women can expect to live 1.3 years less.[69]

According to the 2011 Census, 20.3% of the North West's population was classified as having an activity limiting health problem or disability, 2.7 percentage points above the average for England of 17.6%. The only region in England with a greater proportion of people with an activity limiting problem is the North East

[69] Office for National Statistics (2016) *Disability-Free Life Expectancy (DFLE) and Life Expectancy (LE) at birth by Region, England* [available at: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/datasets/disabilityfreelifeexpectancydfleandlifeexpectancyleatbirthbyregionengland (accessed September 2016)].

(21.7%). Wales had a higher proportion than both the English average and the North West, with 22.7% of the Welsh population experiencing an activity limiting health problem or disability. Since 2001, both North West England and Wales had a small decrease in the proportion of the population with a disability. However, of the ten English local authorities with the highest prevalence of activity limiting health problems or disabilities, four of these are located in the North West.[70]

Economy

The proportion of economically active people during the period June to August 2017 was slightly lower in the North West and Wales than for the UK as a whole (see **Table 3.9**). Economically active in this context is defined as those persons of working age who are employed or looking to be employed. In the same period, the unemployment rate for the North West (4.4%) was marginally higher than the UK average whilst Wales was lower (4.0%).

Table 3.9 Economic Activity (June 2017 - August 2017)

	North West Levels	North West %	Wales Levels	Wales %	UK Levels	UK %
Economically Active	3,596,000	77.5	1,488,000	75.6	33,547,000	78.6
In Employment	3,438,000	74.1	1,428,000	72.3	32,105,000	75.1
Unemployed	158,000	4.4	60,000	4.0	1,443,000	4.3

Source: NOMIS (2017) *Labour Market Profile - Labour Supply (North West and Wales)* [available at: https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx (accessed October 2017)].

Table 3.10 lists jobs by industry sector and indicates that the largest proportion of jobs in the North West and Wales are within the wholesale and retail trade and human health and social work sectors, similar to UK trends. A total of 25,000 jobs in the North West (0.7%) are within the water supply, sewerage and waste management sector, similar to the proportion of jobs in this sector in Wales (0.8%) and for the UK as a whole (0.6%).

Table 3.10 Workforce Jobs by Industry Sector (June 2017)

Sector	North West Levels	North West %	Wales Levels	Wales %	UK Levels	UK %
A: Agriculture, forestry and fishing	22,000	0.6	60,000	4	402,000	1.2
B: Mining and quarrying	2,000	0.1	2,000	0.1	63,000	0.2
C: Manufacturing	319,000	8.8	158,000	10.5	2,666,000	7.6
D: Electricity, gas, steam and air conditioning	14,000	0.4	12,000	0.8	150,000	0.4
E: Water supply; sewerage, waste management	25,000	0.7	12,000	0.8	208,000	0.6
F: Construction	220,000	6.1	91,000	6	2,286,000	6.5
G: Wholesale and retail trade; repair of vehicles	575,000	15.9	207,000	13.8	5,112,000	14.6

[70] Office for National Statistics (2013) *Disability in England and Wales: 2011 and Comparison with 2001* [available at: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/disability/articles/disabilityinenglandandwales/2013-01-30 (accessed September 2016)].

Sector	North West Levels	North West %	Wales Levels	Wales %	UK Levels	UK %
H: Transportation and storage	187,000	5.2	50,000	3.3	1,748,000	5
I: Accommodation and food service activities	250,000	6.9	121,000	8	2,376,000	6.8
J: Information and communication	121,000	3.4	28,000	1.9	1,482,000	4.2
K: Financial and insurance activities	90,000	2.5	33,000	2.2	1,094,000	3.1
L: Real estate activities	64,000	1.8	24,000	1.6	550,000	1.6
M: Professional, scientific and technical activities	268,000	7.4	74,000	4.9	2,997,000	8.6
N: Administrative and support service activities	315,000	8.7	91,000	6	2,986,000	8.5
O: Public administration and defence	148,000	4.1	86,000	5.7	1,489,000	4.3
P: Education	298,000	8.3	139,000	9.2	2,980,000	8.5
Q: Human health and social work activities	474,000	13.1	229,000	15.2	4,382,000	12.5
R: Arts, entertainment and recreation	98,000	2.7	48,000	3.2	973,000	2.8
S: Other service activities	113,000	3.1	40,000	2.7	940,000	2.7
T: Activities of households as employers	4,000	0.1	1,000	0.1	66,000	0.2

Source: NOMIS (2017) *Labour Market Profile – Workforce jobs by industry section (SIC 2007) - seasonally adjusted (June 2017) (North West and Wales)* [available at: https://www.nomisweb.co.uk/reports/lmp/gor/contents.aspx (accessed October 2017)].

United Utilities currently employees over 5,000 people and plays a major role in the North West's economy. In addition, 10,000 people are engaged through the United Utilities supply chain, meaning that the company generates (either directly or indirectly) one in every 150 jobs in the region.[71] United Utilities also invested £3.6 million in the local community in 2016/17.[72]

Transport

The North West is easily accessible from the north and the south via the M6 and the West Coast mainline railway between London and Edinburgh; from east to west, the M62 connects Liverpool to Leeds. There are two major international airports in the region; in 2015, 23 million passengers used Manchester Airport and 4 million passengers used Liverpool John Lennon Airport.[73] The North West also has a major seaport, Liverpool which handled 6% of all UK sea freight in 2016 (31.9 million tonnes).[74]

[71] United Utilities (2017) *Employees* [available at: https://www.unitedutilities.com/corporate/responsibility/employees/ (accessed October 2017)].
[72] United Utilities (2017) *Community Investment* [available at: https://www.unitedutilities.com/corporate/responsibility/communities/community-investment/ (accessed October 2017)].
[73] Department for Transport (2016) *Air traffic by type of service, operator and airport: United Kingdom, 2005-2015 (Table AVI0102b)* [available at: https://www.gov.uk/government/statistical-data-sets/avi01-traffic-passenger-numbers-mode-of-travel-to-airport (accessed September 2016)].
[74] Department for Transport (2017) *UK major and minor ports, all freight traffic, by port and direction, from 1965 (Table PORT0101)* [available at: https://www.gov.uk/government/statistical-data-sets/port01-uk-ports-and-traffic (accessed October 2017)].

The North West region accounted for 11% of Great Britain's motor vehicle miles in 2016 with 35,478 million miles driven in the region. Vehicle miles driven has seen a steady increase since 2010. Prior to this, there had been a notable drop in annual motor vehicle miles, likely to be associated with the economic downturn.[75] In 2015/2016, the average resident of the North West made around 962 trips within England each year, slightly above the average for England (934 trips). Over the same time period, the average distance travelled per person per year in the North West by all modes of transport was 6,226 miles, slightly lower than the England average of 6,574 miles.[76]

In the North West, over 4,943 miles (79%) were undertaken as a car/van driver or passenger, similar to the England average of 78%. The proportion of adults in the North West that walked for at least 10 minutes or cycled each week in 2014/15 were 78.4% and 7.9% respectively. These proportions were lower than the averages for England (80.6% and 9.5%), and in each case were some of the lowest in the country.[77]

Although there were 17,400 road casualties in 2016, the North West's roads are safer than the average for England, and the number of casualties has broadly been reducing since 2012. Relative to the volume of traffic, the reported casualty rate was 302 per billion vehicle kilometres, compared with the average of 363 casualties per billion vehicle kilometres across England.[78]

Tourism

In 2016, 12.0 million UK domestic overnight trips were made to the North West, a 4% reduction on 2015 levels. This accounted for 12% of overnight trips in England.[79] In 2015, overnight trips to the area generated a total spend of £2.6 billion. In 2016/17, 9.6 million overnight trips were made to Wales from Great Britain generating £1.8 billion. North Wales was the most popular destination of the Welsh regions[80].

With specific regard to water resources, large seasonal fluxes in tourist numbers create additional demand on water resources in summer months when demand is already at its highest. United Utilities owns land and reservoirs in scenic areas of North West England which are publicly accessible for recreational activities. United Utilities' waste water management activities also influence the tourist industry due to the impacts on river and bathing water quality.

Deprivation

The English Index of Deprivation measures relative levels of deprivation in small areas of England called Lower Layer Super Output Areas (LSOA). The Indices of Deprivation is based on seven different domains[81] of deprivation:

- Income Deprivation;
- Employment Deprivation;

[75] Department for Transport (2017) *Motor vehicle traffic (vehicle miles) by local authority in Great Britain, annual from 1993 (Table TRA8901)* [available at: https://www.gov.uk/government/statistical-data-sets/tra89-traffic-by-local-authority (accessed October 2017)].
[76] Department for Transport (2017) *Average number of trips (trip rates) by main mode, region and Rural-Urban Classification: England, 2015/16 (Table NTS9903)* & *Average distance travelled by mode, region and Rural-Urban Classification: England, 2015/16 (Table NTS9904)* [available at: https://www.gov.uk/government/statistical-data-sets/nts99-travel-by-region-and-area-type-of-residence (accessed October 2017)].
[77] Department for Transport (2016) *Proportion of how often and how long adults walk for (at least 10 minutes) by local authority, 2014/15 (Table CW0105)* & *Proportion of how often and how long adults cycle for by local authority, 2014/15 (Table CW0104)* [available at: https://www.gov.uk/government/statistical-data-sets/how-often-and-time-spent-walking-and-cycling-at-local-authority-level-cw010 (accessed September 2016)].
[78] Department for Transport (2017) *Reported casualties by region and local authority, England, 2012 - 2016 and 2010-14 average (RAS30038)* & *Reported casualty rate per billion vehicle kilometres by local authority, England, 2012 - 2016 and 2010-14 average (RAS30040)* [available at: https://www.gov.uk/government/statistical-data-sets/ras30-reported-casualties-in-road-accidents (accessed October 2017)].
[79] Visit Britain (2017) *England - All Trip Purposes 2016* [available at: https://www.visitbritain.org/gb-tourism-survey-2016-overview (accessed October 2017)].
[80] Welsh Government (2017) Gre*at Britain Tourism Survey, July 2016 to June 2017* & *Great Britain Tourism Survey online viewer – Wales level data* [available at: http://gov.wales/statistics-and-research/great-britain-tourist-survey/?lang=en (accessed October 2017)].
[81] Each domain is based on a basket of indicators. As far as is possible, each indicator is based on data from the most recent time point available; in practice most indicators in the Indices of Deprivation 2015 relate to the tax year 2012/13. Combining information from the seven domains produces an overall relative measure of deprivation, the Index of Multiple Deprivation.

- Education, Skills and Training Deprivation;
- Health Deprivation and Disability;
- Crime;
- Barriers to Housing and Services; and
- Living Environment Deprivation.

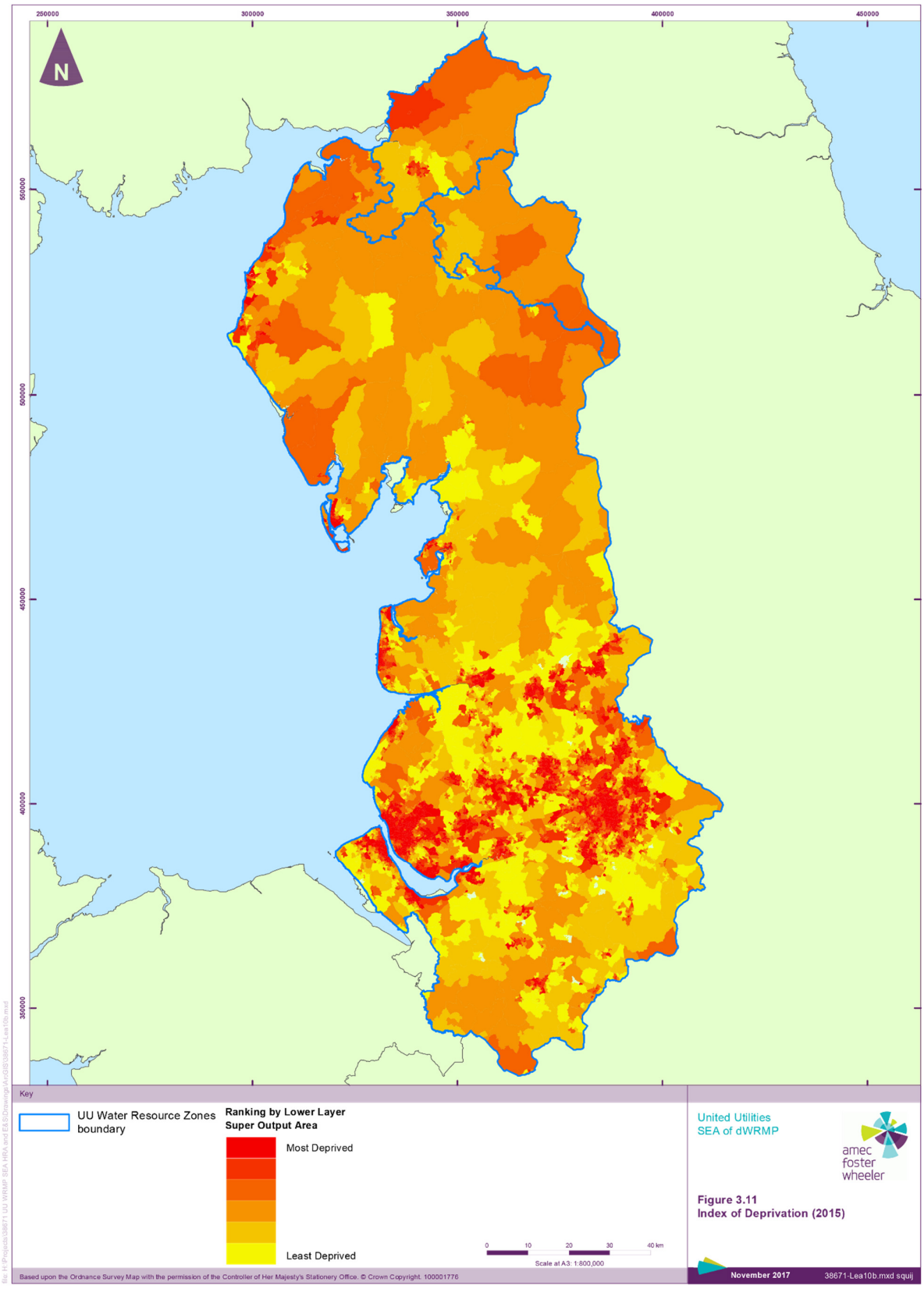
A map ranking each of the LSOAs within the United Utilities supply area is shown in **Figure 3.11**. A fifth (20.1%) of all LSOAs in the United Utilities supply area are in the 10% most deprived LSOAs nationally. 40.0% of the LSOAs, meanwhile, are in the 50% least deprived LSOAs across England.[82]

Severe deprivation is evident in most of the districts that comprise the supply area. Concentrations of LSOAs showing deprivation in the most deprived decile are found in the urban areas in and around Liverpool and Manchester. As with the previous (2010) Indices, the Merseyside districts of Liverpool, Sefton, Knowsley and St Helens, along with the area of Birkenhead on the Wirral, stand out as containing large concentrations of LSOAs with high levels of deprivation, as do many of the districts in Greater Manchester including Manchester, Wigan, Bolton, Salford and Oldham. Further concentrations of deprived areas can be seen in the coastal resort town of Blackpool and also in the series of towns running from the head of the Ribble Valley at Preston through Blackburn, Hyndburn, Burnley and Pendle.

Levels of deprivation, particularly income deprivation, affect the ability of customers to pay for water and may also impact on total water usage. United Utilities invests in programmes that support communities and those struggling to pay bills, and has various schemes to give financial support and reduce debts.[83] In 2016/17 United Utilities also invested £3.6 million in local communities.[84]

[82] DCLG (2015) *English indices of deprivation 2015: File 1: index of multiple deprivation* [available at: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015 (accessed September 2016)].
[83] United Utilities (2017) *Value for Money* [available at: https://www.unitedutilities.com/corporate/responsibility/customers/value-for-money/ (accessed October 2017)].
[84] United Utilities (2017) *Community Investment* [available at: https://www.unitedutilities.com/corporate/responsibility/communities/community-investment/ (accessed October 2017)].

Figure 3.9 Index of Deprivation (2015)



Housing

In 2016, there were 3.0 million households in the North West, approximately 13% of the English total. There were a further 1.3 million households in Wales.[85] As of the 2011 Census, 65% of the housing stock in the North West was owner (or shared ownership) occupied (very similar to the overall English proportion, 64%), 18% was rented from a social landlord, and 15% was privately rented.[86]

Likely Evolution of the Baseline

- The 2014 based sub-national population projections provide an indication of future population levels if current trends continue. The projections indicate that over the period 2014 to 2024, the population in the North West is expected to rise by 276,100 to reach 7,409,100 people. This equates to a 3.9% population increase across the 10 year period which is well below the projected increase for England (7.5%), and is the second smallest increase of any region in the country. Additionally, seven of the nine English local authorities which are projected to show a decrease in population in 2024 are located in the North West, with Barrow-in-Furness having the greatest projected population decrease in England (-4.3%).[87]
- Longer term, the population of the North West is expected to rise by 8.2% to 7,719,680 by 2039. If recently observed trends continue, the number of households is projected to increase more rapidly by 14.4% over the next 25 years, reaching 3.5 million by 2039.[88] An increase in households may place additional pressures on water resources.
- The population of Wales is projected to increase by 6.1% from 2014 to 3.3 million in 2039.[89] Household projections for Wales are projected to rise by 10.5% from 2014 to 2039, at a much higher rate than overall population growth.[90]
- Unemployment in the North West has fallen since 2012, to 4.4% from a peak of 9.4%. This is similar to national trends. Wales has also experienced a similar decline in unemployment. This trend may be expected to continue, however future growth and job creation remains uncertain in the current economic climate.
- Department for Transport (DfT) forecasts[91] indicate that vehicle miles travelled in the North West could increase by almost a third by 2040. This increase is likely to lead to impacts including increased congestion, driver delay and accidents as well as emissions to air.
- There is likely to be an increase in tourist numbers and popularity of water sports and other water based recreational activities.
- Ofwat has explored the many factors influencing water affordability in two recent reports.[92,93] Several initiatives are underway to improve the incentives for companies to better meet customers' need in the future. United Utilities introduced a social tariff in April 2015 for its most vulnerable customers, in addition to running several financial support schemes.

[85] ONS (2017) *Total number of households by region and country of the UK, 1996 to 2016* [available at: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/families/adhocs/005374totalnumberofhouseholdsbyregionandcountryoftheuk1996to2015 (accessed October 2017)]
[86] NOMIS (2011) *Tenure* [available at: https://www.nomisweb.co.uk/census/2011/ks402ew (accessed September 2016)].
[87] NOMIS (2014) *Population projections* [available at: https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=2006 (accessed October 2016)].
[88] Gov.uk (2016) *Live tables on household projections* [available at: https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections (accessed October 2016)].
[89] StatsWales (2015) *Population projections by year and gender* [available at: https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Projections/National/2014-Based/populationprojections-by-year-gender (accessed October 2017)].
[90] StatsWales (2017) *Household projections by household type and year* [available at: https://statswales.gov.wales/Catalogue/Housing/Households/Projections/National/2014-Based/householdprojections-by-householdtype-year (accessed October 2017)].
[91] DfT (2015) *Road Traffic Forecasts* 2015 [available at: https://www.gov.uk/government/publications/road-traffic-forecasts-2015 (accessed October 2016).
[92] Ofwat (2011) *Water today, water tomorrow: Affordable for all: How can we help those who struggle to pay their water bills?* [available at: http://www.ofwat.gov.uk/wp-content/uploads/2016/01/prs_inf_afford.pdf (accessed October 2016)].
[93] Ofwat (2015) *Affordability and debt – 2014-15* [available at: http://www.ofwat.gov.uk/wp-content/uploads/2015/12/prs_web20151201affordability.pdf (accessed October 2016)].

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA arising from the analysis of the human environment baseline are:

- the need to ensure that water resource requirements of people and visitors can be met at all times, in a sustainable way;
- the need to ensure that water resources remain affordable;
- the need to ensure that the WRMP measures do not adversely affect the health and well-being of any member of the community;
- the need to ensure that vulnerable people are not affected by implementation of the WRMP measures;
- the need to ensure that the WRMP measures do not have an adverse economic impact;
- the need to avoid disruption through effects on the transport network; and
- the need to ensure resilience of water supply/treatment infrastructure against climate change effects.

3.7 Material Assets and Resource Use

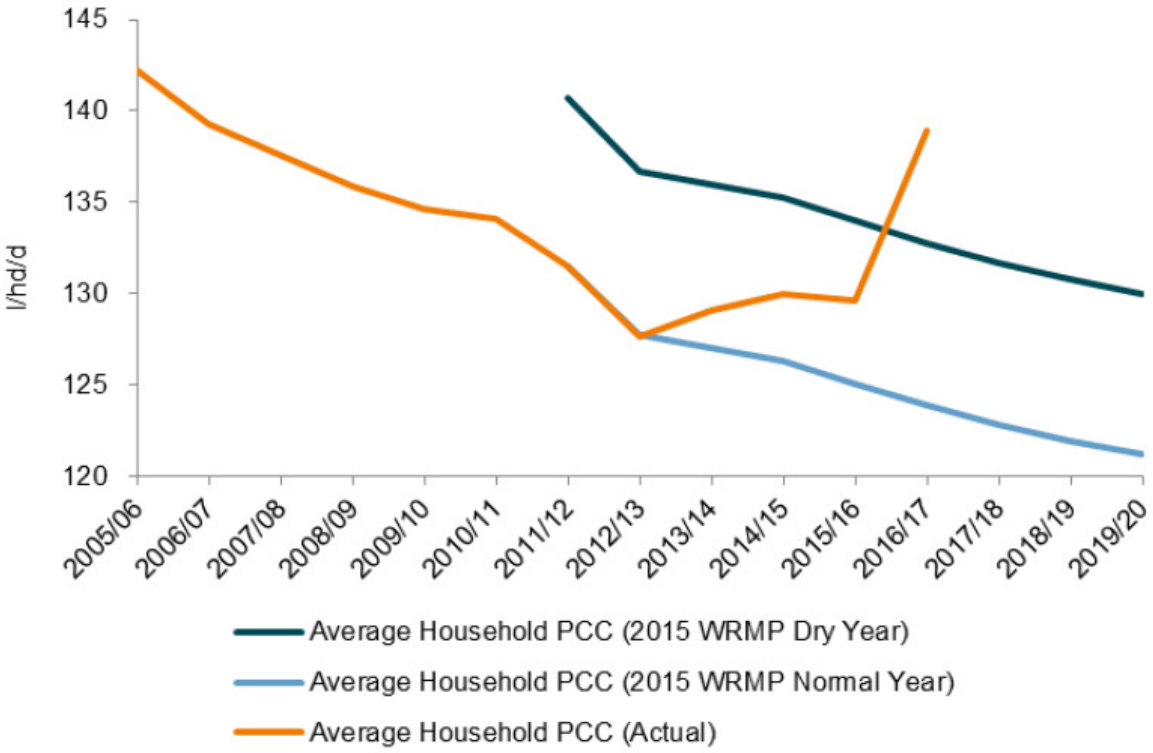
Baseline Characteristics

Water Demand

United Utilities currently distributes approximately 1,700 million litres of water every day to meet customer demand in the North West.[43] **Figure 3.12** shows that the average household per capita water consumption in the United Utilities supply area was 139 litres per head per day (l/hd/d) in 2016/17, which is an increase of 7% from the previous year. This increase is above the 2015 Water Resources Management Plan forecasts for normal and dry years, and was due to using updated occupancy rates in the per capita consumption calculations. There has been a general rise in consumption since 2012/13, following a period of steady decrease since 2005/06.[94] Consumption in the United Utilities area remains lower than the average for England and Wales of 141 l/hd/d.[95]

[94] United Utilities (2017) *Water Resources Review April 2016 – March 2017* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/annual-review---water-resource-management-plan-2016-17.pdf (accessed October 2017)].
[95] Discover Water (2017) *The Amount We Use* [available at: https://discoverwater.co.uk/amount-we-use (accessed October 2017)].

Figure 3.10 Average Household Per Capita Consumption since 2005/06



Source: United Utilities (2017) *Water Resources Review April 2016 – March 2017* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/annual-review---water-resource-management-plan-2016-17.pdf (accessed October 2017)].

As **Table 3.11** highlights, resource demand is heavily weighted to the Integrated Resource Zone, which is unsurprising given that it is by far the largest area of the four WRZs in the United Utilities supply area and contains the North West's main urban centres.

Table 3.11 Key WRZ Data for United Utilities 2016/17

	Carlisle Resource Zone	Integrated Resource Zone	North Eden Resource Zone	West Cumbria Resource Zone	Regional Total
Water available for use (own water sources) (Ml/d)	36	1,917	9	56	2,018
Total Population (000's)	110	6,879	14	148	7,150
Number of metered households (000's)	16	1,134	2	17	1,169
Water consumption by households (Ml/d)	14	849	2	20	884
Leakage (Ml/d)	5	415	3	16	439

Source: United Utilities (2017) *Water Resources Review April 2016 – March 2017* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/annual-review---water-resource-management-plan-2016-17.pdf (accessed October 2017)].

Leakage

Leakage levels are affected by a number of factors including the length, age and condition of the water mains network as well as weather conditions. Between 2015/16 and 2016/17, overall leakage in the United Utilities supply area reduced to its lowest ever level of 439 Ml/d. This is significantly below the annual target of 463 Ml/d. However, leakage varies between the WRZs reflecting the length of the network, age and condition of pipes, and the volume of water supplied through the network (see **Table 3.12**). In this regard, there was a slight increase in leakage in North Eden compared to the previous year, as the WRZ is very small, with few properties and a water balance across such an area is difficult to reconcile.

Table 3.12 United Utilities' Leakage Rates by WRZ

	Carlisle Resource Zone	Integrated Resource Zone	North Eden Resource Zone	West Cumbria Resource Zone	Regional Total
Total leakage 2015/16 (Ml/d)	5.9	427.4	2.6	16.1	451.9
Total leakage 2016/17 (Ml/d	5.3	414.9	3.1	16.1	439.2

Source: United Utilities (2017) *Water Resources Review April 2016 – March 2017* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/annual-review---water-resource-management-plan-2016-17.pdf (accessed October 2017)].

Water Efficiency

In 2016/17, United Utilities saved an estimated 4.4 Ml/d through water efficiency measures, exceeding Ofwat's target of 2.95 Ml/d.

Table 3.13 below summarises United Utilities' water efficiency programme in 2016/17.

Table 3.13 Summary of United Utilities' Water Efficiency Programme 2016/17

Water Efficiency Activity	Number	Estimated Water Saving (Ml/d)
Cisten devices distributed to customers	31,865	0.32
Water efficiency customer self-audits	123,103	1.06
Water butts distributed to customers	1,951	0.01
Water Efficiency Education Programme, pupils visited	7,486	0.39
Other promotional events	40	0.02
Crystal packs / water sticks distributed to customers*	1,465	0.00
Retrofit devices distributed to customers	70,600	1.09
Base Service Water Efficiency Programme – Total		***2.95***
Free meter options	32,447	1.10
West Cumbria Sustainable Level of Water Efficiency Programme	17,640	0.24
West Cumbria education programme	1,259	0.07
TOTAL SAVING		**4.36**

** Savings are greater than zero but do not show to two decimal places.*

Source: United Utilities (2017) *Water Resources Review April 2016 – March 2017* [available at: https://www.unitedutilities.com/globalassets/z_corporate-site/about-us-pdfs/water-resources/annual-review---water-resource-management-plan-2016-17.pdf (accessed October 2017)].

Water metering can help improve water efficiency within the home as households pay for the water that they use and as a result typically use less. Since 2001, United Utilities' customers have been entitled to trial water meters free of charge. In 2016/17, 32,500 households opted for a free meter although the number of requests per year varies due to a range of factors, but the expected trend is for more customers to have water meters installed over time (annual demand for meters is expected to decline as the proportion of households without meters decreases).[94]

Energy Use

provides a breakdown of total energy use in 2015 for the region for industry and commercial uses, domestic and road transport. It shows that for the North West, energy use by sector is broadly in line with the UK average, while for Wales, the proportion of energy use in the industrial and commercial sector is notably higher than the rest of the UK.

Table 3.14 Breakdown of Energy Consumption in North West England and Comparison with UK, 2015

Sector	North West Proportion of Total Regional Energy Use	Wales Proportion of Total Regional Energy Use	UK Proportional Energy Use
Industrial and Commercial	34.7	47.5	35.9
Domestic	32.0	23.9	30.7
Transport	29.5	23.8	30.2

Source: BEIS (2017) *Sub-National Total Final Energy Consumption Statistics: 2005-2015* [available at: https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level (accessed October 2017)].

Energy consumption by source in the North West is fairly representative of national trends, with most energy coming from petroleum (37.2%) and natural gas (36.9%). In 2016, 6,275 Gigawatt hours (GWh) of electricity was generated from renewable sources in North West England.[56]

Total energy consumption in Wales over the period 2005 to 2015 has reduced from 108,524 GWh to 93,456 GWh, a decrease of 14%. Petroleum (primarily associated with road transport) and natural gas are the most dominant energy sources in Wales, although manufactured fuels also make a notable contribution to the energy mix. In Wales, 5,139 GWh of electricity was generated from renewable sources in 2016.[56]

In 2016/17, United Utilities' electricity consumption was 812 GWh. Equivalent to 18% of this (149 GWh) was generated by renewable Third Parties at United Utilities' sites and the company plans to significantly increase renewables generation over the next few years. [59]

Material Use and Waste Generation

In 2015/16, 3.52 million tonnes of waste was collected by local authorities in the North West, which constitutes approximately 14% of England's total waste. As highlighted in

Table 3.15, annual household waste collected by local authorities in the region has reduced overall between 2006/07 and 2015/16 by approximately 692,000 tonnes, although there has been a slight rise in the last few years. Non-household waste arisings and recycling rates have also fluctuated slightly but reduced overall.

Table 3.15 Quantities of Waste (Thousands of tonnes) Produced in the North West from 2006/07 to 2015/16

Household Waste from:	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Regular household collection	2,021	1,828	1,702	1,608	1,593	1,479	1,383	1,312	1,295	1,296
Other household sources	177	186	156	171	157	139	149	158	161	169
Civic amenity sites	448	383	338	289	247	212	208	218	225	263
Household recycling	1,077	1,202	1,269	1,294	1,318	1,361	1,362	1,418	1,459	1,476
Total household	**3,723**	**3,599**	**3,465**	**3,362**	**3,315**	**3,191**	**3,102**	**3,106**	**3,139**	**3,204**
Non household sources (excl. recycling)	256	214	178	206	173	154	153	167	190	179
Non household recycling	236	239	209	123	148	141	132	153	137	140
Total LA collected waste	**4,215**	**4,052**	**3,852**	**3,692**	**3,636**	**3,486**	**3,387**	**3,426**	**3,466**	**3,523**

Source: Defra (2017) *Local authority collected waste generation from April 2000 to March 2016 (England and regions) and local authority data April 2015 to March 2016* [available at: https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables (accessed October 2017)].

Recycling rates across the region have risen significantly from 31% in 2006/07 to 46% in 2015/16 (which is above the England average of approximately 42%), whilst the volume of local authority collected waste sent to landfill has fallen from 66% to 24% over the same period (see **Table 3.16**), although volumes of waste sent to landfill remain higher than the national average (20%).

Table 3.16 Methods of Waste Disposal in the North West (percentages) from 2006/07 to 2015/16

Method	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Landfill	65.9%	62.2%	58.6%	59.2%	55.5%	51.7%	46.0%	40.3%	31.8%	24.1%
Incineration with EfW	2.9%	2.2%	2.8%	2.2%	1.9%	2.8%	5.5%	9.4%	17.3%	24.5%
Incineration without EfW	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	1.0%
Recycled/composted	31.1%	35.6%	38.3%	38.3%	40.2%	42.9%	43.7%	45.5%	45.9%	46.0%
Other	0.0%	0.0%	0.3%	0.2%	2.4%	2.6%	4.7%	4.7%	4.5%	4.5%

Source: Defra (2017) *Local authority collected waste generation from April 2000 to March 2016 (England and regions) and local authority data April 2015 to March 2016* [available at: https://www.gov.uk/government/statistical-data-sets/env18-local-authority-collected-waste-annual-results-tables (accessed October 2017)].

In 2015, households in Wales generated 1,278 thousand tonnes of waste. 56% of this waste was recycled, which represents an increase in recycling rates of 12 percentage points since 2010.[96]

In 2016/17, United Utilities produced 514,295 tonnes of waste which represents a decrease of approximately 30% on the amount of waste produced in 2015/16. The proportion of waste diverted from landfill has continued to increase, with 94.7% of the total waste produced being diverted to beneficial use, and only the remaining 5.3% taken to landfill. Wastewater sludge, which is produced as a direct result of the wastewater treatment processes, accounted for the greatest proportion of United Utilities' waste in 2016/17 (252,712 tonnes). Building water treatment works, renewing pipes and infrastructure requires large quantities of materials and generates a large amount of construction waste, and this was the second greatest source of waste in 2016/17 (133,011 tonnes).[97]

Likely Evolution of the Baseline without the WRMP

- United Utilities has more than halved leakage over the last 25 years and the company met its performance commitment for leakage for 2016/17, which was to maintain leakage below the target of 462.7 Ml/d.[94]
- Across the supply area as a whole, United Utilities forecast that water demand will generally reduce, despite the forecast growth in population and number of houses to be supplied with water. This is primarily due to the expected effects of:
  - reduced demand from businesses and industry (due to becoming less water intensive);
  - households becoming more water efficient;
  - water efficiency promotion;
  - pipe leak detection and repair; and
  - provision of water meters to customers free of charge.
- Notwithstanding the above, United Utilities' current 2015 WRMP identifies that there would be a supply-demand deficit in the West Cumbria Resource Zone over the lifetime of the plan due to the need to cease abstraction from Ennerdale Water. As set out in **Section 1.4**, the West Cumbria Thirlmere Transfer Project will address this deficit and connect West Cumbria to United Utilities' Integrated Resource Zone. The 2015 WRMP also sets out that United Utilities will continue to:
  - operate the most economically sustainable level of leakage;
  - encourage customers to take up a Free Meter Option; and
  - be leaders in the area of water efficiency.
- Installed renewable energy capacity is expected to continue to increase across North West England and Wales and in this context, the UK has agreed to an EU-wide target of 20% renewable energy by 2020. The European Commission has proposed that the UK share of this target would be to achieve 15% of the UK's energy from renewables by 2020. In this wider context, United Utilities plans to significantly increase its renewable generation, with a target of generating around 35% of its electricity consumption from renewable sources by 2020.[59]
- Future waste arisings in North West England and Wales are likely to remain relatively stable, as they have done for recent years. There may be a future decoupling between economic growth and waste growth due to regulatory and economic measures and cultural factors, and the likely further decline in the industrial/manufacturing sector in this region. United Utilities has a target to divert 95% of waste to beneficial use by 2020.[97]

[96] Defra (2017) *UK Statistics on Waste Data – December 2016 Update* [available at: https://www.gov.uk/government/statistical-data-sets/env23-uk-waste-data-and-management (accessed October 2017)].
[97] United Utilities (2017) *Resource Efficiency* [available at: http://www.unitedutilities.com/corporate/responsibility/environment/resource-efficiency/ (accessed October 2017)].

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the material assets and resource use baseline are:

- the need to promote water efficiency measures (including metering);
- the need to ensure that leakage is managed at a sustainable economic level;
- the need to maintain the balance between supply and demand for water;
- the need to reduce energy consumption;
- the need to ensure the sustainable and efficient use of resources such as construction materials; and
- the need to minimise waste arisings, promote reuse, recovery and recycling and minimise the impact of wastes on the environment and communities.

3.8 Cultural Heritage

Baseline Characteristics

The majority of the North West's ancient historical and archaeological heritage occurs in the more rural areas of the region, which contain important sites such as the St Bees Heritage Coastline and Hadrian's Wall, a World Heritage Site. The urban areas of the region also contain significant amounts of more recent historical heritage, particularly buildings dating from the Industrial Revolution. **Figure 3.13** highlights key cultural heritage designations within and around the United Utilities supply area.

There are three internationally recognised historic areas in the North West; the World Heritage Sites of the Frontiers of the Roman Empire (Hadrian's Wall); the English Lake District; and Liverpool Maritime Mercantile City. The United Utilities supply area also contains the following national and local designations:

- 1,525 scheduled monuments;
- 434 Grade I listed buildings;
- 1,483 Grade II* listed buildings;
- 23,906 Grade II listed buildings;
- 134 registered parks and gardens;
- 3 registered battlefields; and
- 876 conservation areas.

The 2017 Heritage at Risk Register[98] highlights that:

- 5.6% (89) of Grade I and Grade II* listed buildings are at risk in the region, compared to 3.8% nationally;
- 8.6% (114) of scheduled monuments are at risk, compared to 12.5% nationally;
- 5.2% (7) of the region's 135 registered parks and gardens are at risk, compared to 5.8% nationally;
- none of the regions' registered battlefields are at risk; and
- of the 867 conservation areas in the North West, 65 (8.0%) are at risk compared to 6.0% nationally.

[98] Historic England (2017) *Heritage at Risk*: *North West Register 2017* [available at: https://content.historicengland.org.uk/images-books/publications/har-2017-registers/nw-har-register2017.pdf/ (accessed October 2017)].

There are numerous historic sites and monuments across Wales including three World Heritage Sites, over 4,000 scheduled monuments, 30,000 listed buildings, over 500 conservation areas, 58 historic landscapes and nearly 400 historic parks and gardens.[99] North East Wales is noted for its Iron Age hill forts, particularly along the Clwydian Range.

The North West region and North East Wales contain a large number of undesignated cultural heritage assets, many of which may be of considerable significance (some of national quality, although not formally designated). Historic Environment Records (HERs) held by local authorities and Welsh Archaeological Trusts include both designated and undesignated assets.

Likely Evolution of the Baseline without the WRMP

- Development pressures, social pressures, natural and environmental threats including climate change, pressures from resource exploitation and infrastructure continue to threaten the condition of cultural heritage sites and monuments.[100]
- The protection, preservation and settings of cultural heritage assets needs to be considered when locating any new development including water resources management infrastructure.

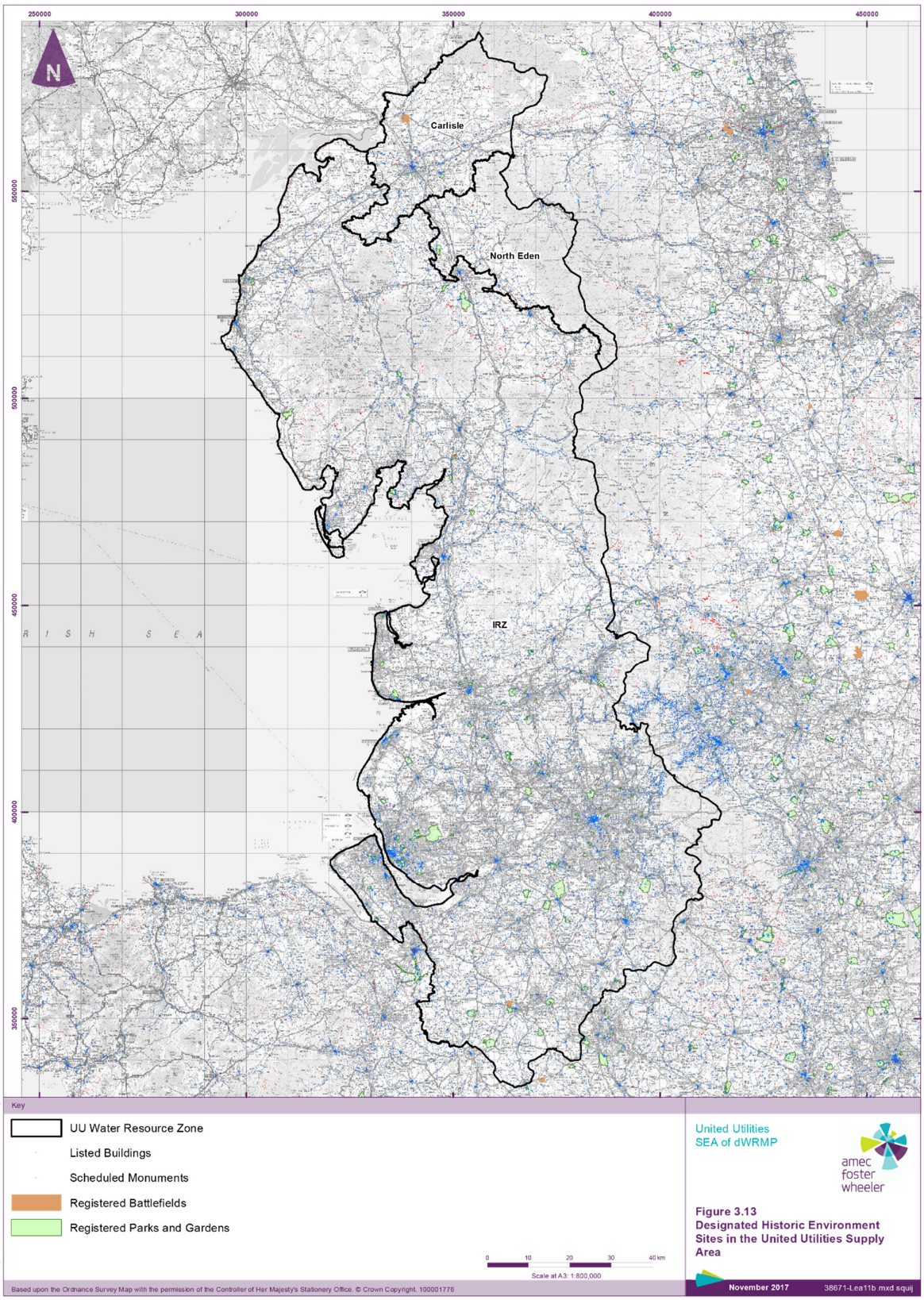
Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the cultural heritage baseline are:

- the need to conserve and enhance the historic significance of buildings, monuments, features, sites, places, areas and landscapes of archaeological and cultural heritage interest, and their settings;
- the need to avoid damage to important wetland areas with potential for palaeoenvironmental deposits.

[99] Cadw (2016) *Historic Environment: Protection* [available at: http://cadw.gov.wales/historicenvironment/protection/?lang=en (accessed September 2016)].
[100] Historic England (2015) *Facing the Future: Foresight and the Historic Environment* [available at: https://content.historicengland.org.uk/images-books/publications/facing-the-future/facing-the-future.pdf/ (accessed June 2016)].

Figure 3.11 Designated Historic Environment Sites in the United Utilities Supply Area and North Wales



3.9 Landscape

Baseline Characteristics

The landscape of the North West is some of the most diverse in the country, containing 29 National Character Areas and 32 distinct Landscape Character Types (see **Figure 3.14**) which have been defined by Natural England. [101] Although the region is generally low lying, it also contains some of the most striking upland landscapes in England, particularly within the Lake District National Park. The coastal landscape in the North West, meanwhile, contains remnants of the region's industrial history, in particular the Liverpool and Merseyside docklands, as well as defined areas of Heritage Coastline around St Bees Head. Across the North West and west Midlands, there are also almost 250,000 hectares of woodland present.[102]

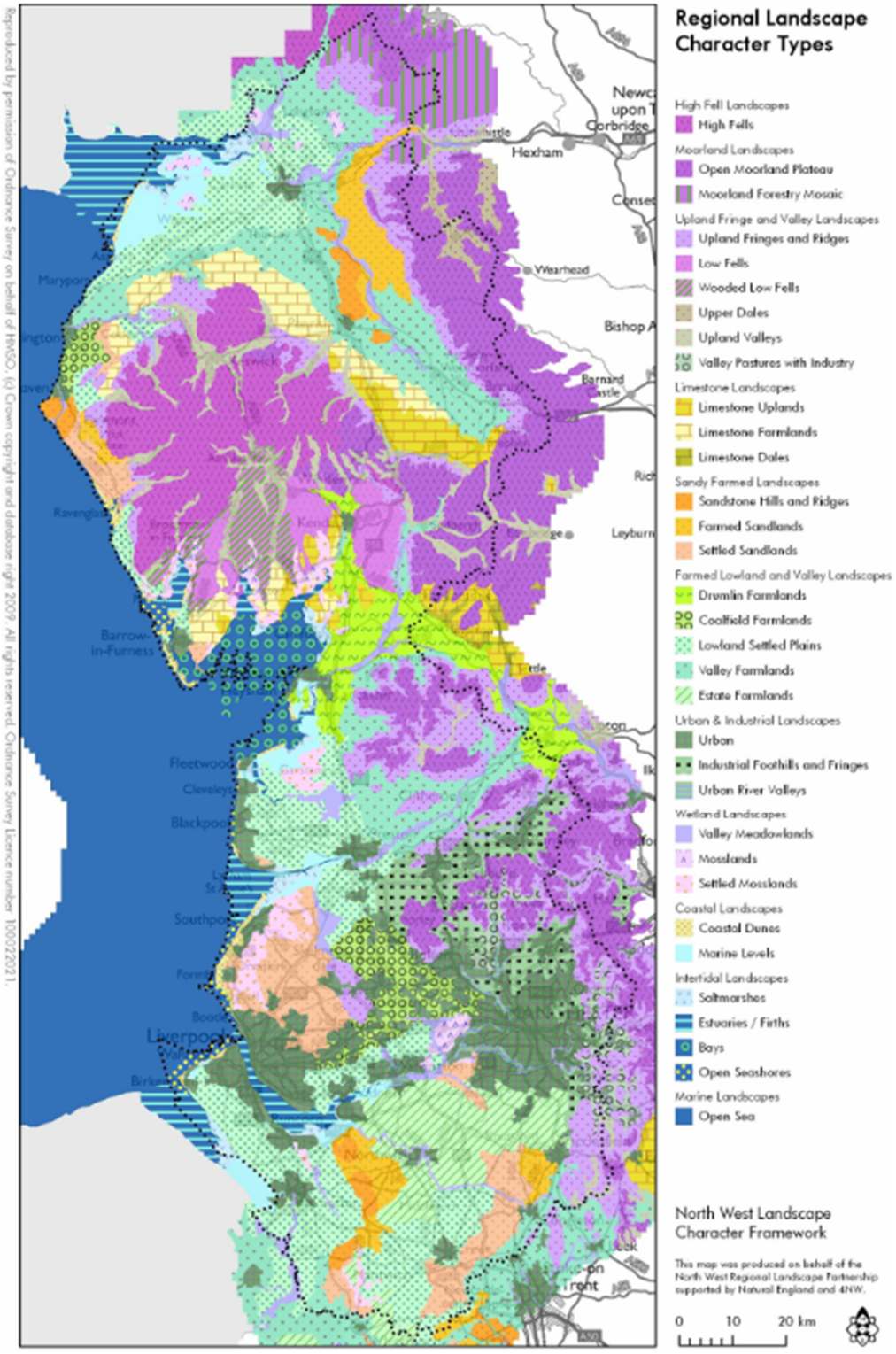
The Lake District National Park and World Heritage Sites in Cumbria covers an area of 2,362 km^2. The National Park boundary was extended by 3% towards the east in August 2016, up to the M6 and the newly extended Yorkshire Dales National Park. A population of 41,100 lives within its boundaries and it attracts 18.4 million visitors a year.[103] Two other National Parks also fall partly within the North West region; the Yorkshire Dales and the Peak District. In total, 18% of the North West is designated as National Parks.[24]

The North West has three AONBs which lie wholly or mainly in the region (Solway Coast, Arnside and Silverdale and Forest of Bowland). The North Pennines AONB also straddles Cumbria's eastern border. Snowdonia National Park and the Clwydian Range and Dee Valley AONB are the significant designated landscape sites within the region of Lake Vyrnwy and the River Dee. **Figure 3.15** shows those landscape designations in the United Utilities supply area and North Wales.

Nationally, land area designated as Green Belt, in which major developments will generally not be permitted apart from in very special circumstances in accordance with the National Planning Policy Framework (NPPF), has been gradually decreasing over the last five years. In 2015/16, several local authorities in the North West reduced the size of their Green Belt, including Blackburn with Darwen, Knowsley, Pendle and South Ribble.[104] There were no further Green Belt reductions in 2016/17 in the North West.

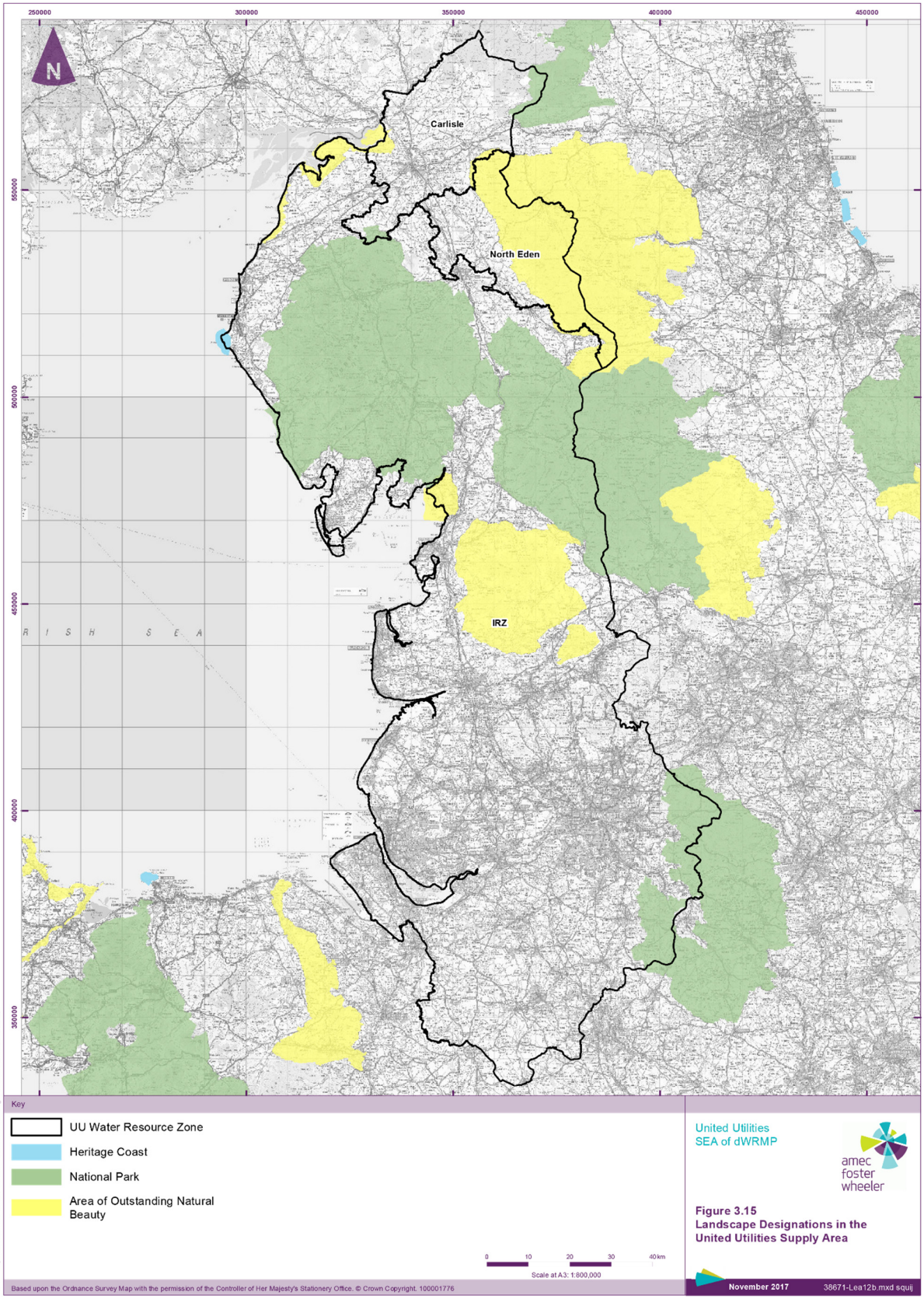
[101] Natural England (2014) *National Character Area Profiles* [available at: https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles#ncas-in-north-west-england (accessed September 2016)].
[102] Forestry Commission (2016) *North West & West Midlands Area* [available at: http://www.forestry.gov.uk/wmidlands (accessed October 2017)].
[103] LDNP Authority (2017) *Facts and Figures: Lake District National Park* [available at: http://www.lakedistrict.gov.uk/learning/factsandfigures (accessed October 2017)].
[104] DCLG (2016) *Local Planning Authority Green Belt: England 2015/16* [available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/551240/Green_Belt_Statistics_England_2015-16.pdf (accessed October 2016)]

Figure 3.12 Regional Character Types and Area



Source: Natural England (2009) *North West Landscape Character Framework* [available at: http://webarchive.nationalarchives.gov.uk/20140605090108/http://www.naturalengland.org.uk/Images/NWLCF-report2_tcm6-13277.pdf (accessed September 2016)].

Figure 3.13 Landscape Designations in the United Utilities Supply Area and North Wales



Likely Evolution of the Baseline without the WRMP

- There are threats to valuable landscapes from natural processes, climate change and human activities including development, agriculture and infrastructure.
- Green Belts in the region are at risk of continuing to reduce in size due to development pressures, which may affect local landscapes.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the landscape baseline are:

- the need to conserve the natural beauty of the area, especially within designated sites such as National Parks and AONBs;
- the need to conserve and enhance the landscape distinctiveness of the area.

3.10 Summary of Key Sustainability Issues

From the analysis of the baseline presented in the preceding sections, a number of key sustainability issues have been identified. These issues are summarised in **Table 3.17**.

Table 3.17 Key Sustainability Issues Relevant to the WRMP

Topic	Key Sustainability Issues to be Taken into Account when Assessing the WRMP
Biodiversity	• The need to protect and enhance sites designated for nature conservation. • The need to protect and enhance non-designated sites. • The need to reverse the fragmentation of biodiversity in the North West region. • The need to continue to increase and improve the condition of priority habitats and habitats of priority species, and restore populations of these species and other specially protected species. • The need to prevent the spread/introduction of invasive non-native species. • The need to maintain/enhance ecological connectivity. • The need to work within environmental limits and capacities.
Geology and Soils	• The need to maintain or improve the quality of soils/agricultural land. • The need to protect and enhance sites designated for their geological interest. • The need to protect peatlands in the North West. • The need to make use of previously developed land, and to reduce the prevalence of derelict land. • The need to maintain soil function.
Water	• The need to maintain and improve water quality. • The need to maintain seasonal flows in groundwater and surface water. • The need to ensure the continued risk of flooding is mitigated effectively. • The need to prevent the deterioration of Water Framework Directive (WFD) waterbodies, achieve protected area objectives and achieve water body status objectives.
Air Quality and Climate	• The need to minimise emissions of pollutant gases and particulates and enhance air quality. • The need to reduce the need to travel and promote sustainable modes of transport. • The need to reduce greenhouse gas emissions arising from implementation of the WRMP. • The need to take into account, and where possible adapt to, the potential effects of climate change. • The need to increase environmental resilience to the effects of climate change.
Human Environment	• The need to ensure that water resource requirements of people and visitors can be met at all times, in a sustainable way. • The need to ensure that water resources remain affordable. • The need to ensure that the WRMP measures do not adversely affect the health and well-being of any member of the community.

Topic	Key Sustainability Issues to be Taken into Account when Assessing the WRMP
	• The need to ensure that vulnerable people are not affected by implementation of the WRMP measures. • The need to ensure that the WRMP measures do not have an adverse economic impact. • The need to avoid disruption through effects on the transport network. • The need to ensure resilience of water supply/treatment infrastructure against climate change effects.
Material Assets and Resource Use	• The need to promote water efficiency measures (including metering). • The need to ensure that leakage is managed at a sustainable economic level. • The need to maintain the balance between supply and demand for water. • The need to reduce energy consumption. • The need to ensure the sustainable and efficient use of resources such as construction materials. • The need to minimise waste arisings, promote reuse, recovery and recycling and minimise the impact of wastes on the environment and communities.
Cultural Heritage	• The need to conserve and enhance the historic significance of buildings, monuments, features, sites, places, areas and landscapes of archaeological and cultural heritage interest, and their settings. • The need to avoid damage to important wetland areas with potential for palaeoenvironmental deposits.
Landscape	• The need to conserve the natural beauty of the area, especially within designated sites such as National Parks and Areas of Outstanding Natural Beauty. • The need to conserve and enhance the landscape distinctiveness of the area.

3.11 Limitations of the Data and Assumptions Made

The following data limitations have been encountered in preparing this Environmental Report:

- The data collated and presented for the baseline builds upon work undertaken for the previous Environmental Report[105] for the 2015 WRMP and has been updated where appropriate. However, in some cases no updated information is available and the original datasets have been re-presented.
- Although where possible the baseline data referred to in this report is based on the United Utilities supply area, many datasets were only available for the North West region and Wales as a whole. As such, this baseline information may not identify the more localised issues that may differ from the general trends described for the North West and Wales. This may include, for example, pockets of deprivation in relatively affluent areas or any localised differences in environmental quality.
- The information used has been sourced, so far as is possible, from the most recent datasets available utilising a wide range of authoritative and official sources. It is important to acknowledge that there are variable time lags between raw data collection and its publication. Consequently, at the time of this Environmental Report's publication, the baseline or predicted future trends may have varied from those described above.
- Data has generally been sourced from national and regional bodies where information is collected for the North West and other regions using consistent methods. While this allows for a more effective comparison between the region, other regions and UK averages, reliance on these datasets has in some cases meant that information is a number of years old.

[105] United Utilities (2013) *Strategic Environmental Assessment of Draft Water Resources Management Plan: Environmental Report*, Amec Foster Wheeler.

4. Approach to the Assessment

4.1 Introduction

This section describes the approach to the assessment of the Revised Draft WRMP. It draws on the information contained in Sections 2 and 3, as well as the responses received to consultation on the Scoping Report, to define the scope of the assessment (in terms of the environmental and socio-economic issues considered) and sets out the SEA objectives and guide questions that comprise the assessment framework. The section then outlines how this assessment framework has been used to appraise the feasible options, preferred options and alternative plans considered during the development of WRMP19 before highlighting the difficulties encountered during the assessment process. It should be noted that the approach to the assessment of the Revised Draft WRMP, including the Assessment Framework, is consistent with that adopted for the assessment of the Draft WRMP.

4.2 Scope of the Assessment

The aim of the SEA is to identify, describe and evaluate the likely significant effects of implementing the WRMP on the environment. Annex I of the SEA Directive and Schedule 2 of the SEA Regulations require that the assessment includes information on the "*likely significant effects on the environment, including on issues such as: biodiversity; population; human health; fauna; flora; soil; water; air; climatic factors; material assets; cultural heritage, including architectural and archaeological heritage; landscape; and the inter-relationship between the issues referred to*".

The key policy objectives identified from the review of other plans and programmes relevant to the assessment of the Revised Draft WRMP (**Section 2.3**) and the economic, social and environmental issues arising from the analysis of the baseline (**Section 3.10**), together with the characteristics of the potential water management options, have been used to define the scope of the assessment. In **Table 4.1**, each of the 12 SEA topic areas is considered in turn. In this instance, none of the topic areas have been scoped out of the assessment.

Table 4.1 Basis for Scoping Out Topic Areas from the SEA

SEA Topic Area	Included in Revised Draft WRMP SEA?	Justification for scoping the topic out of the SEA
Biodiversity	Yes	Included within SEA framework. .
Population	Yes	Included within SEA framework.
Human Health	Yes	Included within SEA framework.
Fauna	Yes	Included within SEA framework.
Flora	Yes	Included within SEA framework.
Soils	Yes	Included within SEA framework.
Water	Yes	Included within SEA framework.
Air	Yes	Included within SEA framework.
Climatic factors	Yes	Included within SEA framework.
Material assets	Yes	Included within SEA framework.
Cultural Heritage	Yes	Included within SEA framework.
Landscape	Yes	Included within SEA framework.

4.3 Assessment Framework

Establishing appropriate SEA objectives and guide questions is central to assessing the effects of the Revised Draft WRMP on the environment. Each option that makes up the Preferred Plan for the Revised Draft WRMP has been assessed against the SEA objectives to determine the scale and significance of the effect. By assessing each option against the objectives, it is more apparent where the Revised Draft WRMP will contribute to sustainability, where it might have a negative effect and where enhancements could be made. Guide questions focus the assessment on specific aspects of the objective that reflect issues identified from the review of baseline and contextual information relating to the United Utilities area.

The SEA objectives and guide questions used in the assessment of the Revised Draft WRMP reflect the topics contained in Annex I of the SEA Directive and have been informed by:

- the SEA objectives and guide questions developed as part of the SEA of the 2015 WRMP;
- the review of relevant plans and programmes and the associated key policy objectives and messages (**Section 2** and **Appendix B**);
- the baseline information and key sustainability issues contained in **Section 3**; and
- responses received to consultation on the SEA Scoping Report (see **Appendix F**).

The final assessment framework is presented in **Table 4.2**.

Table 4.2 Assessment Framework for the SEA of the Revised Draft WRMP

Topic Area	SEA Objective	Guide Questions
Biodiversity	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	*Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?*
		Will the option protect and enhance non-designated sites and local biodiversity?
		Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?
		Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?
		Will the option protect, and enhance where appropriate, coastal and marine habitats and species?
		Will the option prevent the spread/introduction of invasive non-native species?
Geology and Soils	2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	*Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?*
		Will the option utilise previously developed land?
		Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?
		Will the option minimise the loss of best and most versatile agricultural land?
		Will the option minimise conflict with existing land use patterns?
		Will the option minimise land contamination?
		Will the option affect geomorphology?

Topic Area	SEA Objective	Guide Questions
Water – Quantity and Quality	3. To protect and enhance the quantity and quality* of surface and groundwater resources and the ecological status of water bodies.	*Will the option minimise the demand for water resources?*
		Will the option protect and improve surface, groundwater, estuarine and coastal water quality?
		Will the option result in changes to river flows?
		Will the option result in changes to groundwater levels?
		Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?
		Will the option support the achievement of protected area objectives?
		Will the option support the achievement of environmental objectives set out in River Basin Management Plans?
		Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?
Water – Flood Risk	4. To reduce the risk of flooding.	*Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?*
		Will the option have the potential to help alleviate flooding in the catchment area now or in the future?
		Will the option be at risk of flooding now or in the future?
Air Quality	5. To minimise emissions of pollutant gases and particulates and enhance air quality.	*Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates?*
		Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)?
		Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?
		Will the option reduce the need to travel or encourage sustainable modes of transport?
Climate Change	6. To limit the causes and potential consequences of climate change.	*Will the option reduce or minimise greenhouse gas emissions?*
		Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?
		Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?
		Will the option increase environmental resilience to the effects of climate change?
Human Environment - Health	7. To ensure the protection and enhancement of human health.	*Will the option ensure the continuity of a safe and secure drinking water supply?*
		Will the option affect opportunities for recreation and physical activity?
		Will the option maintain surface water and bathing water quality within statutory standards?
		Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?
		Will the option ensure sufficient infrastructure is in place for predicted population increases?

Topic Area	SEA Objective	Guide Questions
Human Environment - Social and Economic Well-Being	8. To maintain and enhance the economic and social well-being of the local community.	*Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?*
		Will the option help to meet the employment needs of local people?
		Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?
		Will the option improve access to local services and facilities (e.g. sport and recreation)?
		Will the option contribute to sustaining and growing the local and regional economy?
		Will the option avoid disruption through effects on the transport network?
		Will the option be resilient to future changes in resources (both financial and human)?
Material Assets and Resource Use - Water Resources	9. To ensure the sustainable and efficient use of water resources.	*Will the option lead to reduced leakage from the supply network?*
		Will the option improve efficiency in water consumption?
Material Assets and Resource Use – Waste and Resource Use	10. To promote the efficient use of resources.	*Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials?*
		Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?
		Will the option encourage the use of sustainable design and materials?
		Will the option reduce or minimise energy use?
Cultural Heritage	11. To conserve and enhance cultural and historic assets.	*Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?*
		Will the option avoid or minimise damage to archaeologically important sites?
		Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits?
		Will the option affect public access to, or enjoyment of, features of cultural heritage?
Landscape	12. To conserve and enhance landscape character.	*Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?*
		Will the option protect and enhance landscape character, townscape and seascape?
		Will the option affect public access to existing landscape features?
		Will the option minimise adverse visual impacts?

*Please note that water quality in this context does not concern drinking water quality but instead the quality of waterbodies.

4.4 Assessment Methodology

The effects of the Revised Draft WRMP have been assessed in two stages, complementary to the development of the plan itself. The first stage (undertaken as part of the SEA of the Draft WRMP and updated in this Environmental Report to reflect additional information provided by United Utilities and the identification of further feasible options) comprised a high level assessment of all feasible (constrained)

options (including resource management and demand management options) against the 12 SEA assessment objectives outlined in **Table 4.2**. A more detailed assessment has then been undertaken of the options that comprise the Preferred Plan (the preferred options) for both the Draft WRMP and then the Revised Draft WRMP. Each stage is described in more detail below.

Feasible (Constrained) Options

Both the construction and operational effects of each feasible option were assessed against all of the SEA objectives that comprise the assessment framework. For those options that would not require construction works *per se* and may be ongoing in nature (for example, the installation of water efficient devices, audits and educational programmes), construction in the context of the SEA refers to any enabling/installation works or option implementation. This approach recognises that the environmental effects of the feasible options under consideration are likely to be different in nature in their construction (i.e. enabling/installation or implementation) and in their operational phases; it also ensures consistency across the assessment of resource management and demand management (including leakage reduction and network metering) options.

A matrix similar to that shown in **Table 4.3** was used to capture the assessment of each resource management option in a consistent manner; a key to the meaning of the symbols is presented in **Table 4.4**. The assessment matrices are contained in **Appendix D** and a summary of the findings of the assessment is provided in **Section 5**. As the environmental effects of the demand management (including leakage reduction and network metering) options are very similar and relatively minor in magnitude (when compared to effects associated with resource management options that may involve the development of new infrastructure), in order to ensure a proportionate and appropriate assessment and to minimise unnecessary duplication of reporting, individual assessment matrices were not produced for these feasible options (unlike the feasible resource management options). Instead, the effects are summarised in tables for the Carlisle, Strategic and North Eden WRZs in **Section 5**.

Table 4.3 Feasible (Constrained) Resource Management Options Assessment Matrix

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	Etc…
Option Name	Construction	-	-	0	
	Operation	+	0	++	

Construction

A description of the likely significant effects of the option under consideration on the SEA objectives during construction has been included here.

Operation

A description of the likely significant effects of the option under consideration on the SEA objectives during operation has been included here.

Table 4.4 Qualitative Scoring System

Score	Description	Symbol
Significant Positive Effect	Significant positive effect of the Water Resources Management Plan option on this objective	++
Minor Positive Effect	Positive effect of the Water Resources Management Plan option on this objective	+
Neutral	Overall neutral effect of the Water Resources Management Plan option on this objective	0
Minor Negative Effect	Negative effect of the Water Resources Management Plan option on this objective	-
Significant Negative Effect	Significant negative effect of the Water Resources Management Plan option on this objective	--
No Relationship	There is no clear relationship between the Water Resources Management Plan option and the achievement of the objective or the relationship is negligible.	~
Uncertain	The Water Resources Management Plan option has an uncertain relationship to the objective or the relationship is dependent on the way in which the aspect is managed. In addition, insufficient information may be available to enable an assessment to be made.	?
Mixed Effect	Mixed positive and negative effect of the Water Resources Management Plan option on this objective	+/-

The feasible options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where relevant, other information and assessments including the HRA and WFD Assessment have been referenced as appropriate.

To ensure a consistent approach to interpreting the significance of effects and to help the reader understand the decisions made by the assessment, a series of quantitative and semi-quantitative 'thresholds' have been defined (shown in **Appendix C**) to provide direction on what constitutes a significant effect.

Preferred Options

The feasible (constrained) options assessments have helped inform United Utilities' choice on which options to take forward as the preferred option(s) for WRMP19. The preferred options that comprise the Preferred Plan for both the Draft WRMP and then Revised Draft WRMP have been subject to more detailed assessment with the results recorded in a matrix similar to that shown in **Table 4.5**.

Table 4.5 Preferred Options Assessment Matrix

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	• Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? • Will the option protect and enhance non-designated sites and local biodiversity? • Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? • Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? • Will the option protect, and enhance where appropriate, coastal and marine habitats and species? • Will the option prevent the spread/introduction of invasive non-native species?	-	0	**Effects of Construction** *A description of the likely significant effects of the option on the SEA objective during construction has been included here.* **Effects of Operation** *A description of the likely significant effects of the option on the SEA objective during operation has been included here.* **Mitigation** *Mitigation and enhancement measures have been outlined here.* **Assumptions** *Any assumptions made in undertaking the assessment have been listed here.* **Uncertainties** *Any uncertainties encountered during the assessment have been listed here.*

The commentary section of the matrices provides justification for how the assessment was reached and includes consideration of the following:

- the nature of the potential effect (what is expected to happen);
- the timing and duration of the potential effect (e.g. short, medium or long term);
- the geographic scale of the potential effect (e.g. local, regional, national);
- the location of the potential effect (e.g. whether it affects rural or urban communities, or those in particular parts of the supply area);
- the potential effect on vulnerable communities or sensitive habitats;
- the reasons for whether the effect is considered significant;
- the reasons for any uncertainty, where this is identified; and
- the potential to avoid, minimise, reduce, mitigate or compensate for the identified effect(s) with evidence (where available).

Section 6.3 provides a summary of the findings of the assessment for the preferred options that comprise the Revised Draft WRMP Preferred Plan; detailed assessment matrices are contained in **Appendix E**. The

assessment of the preferred options identified for the Draft WRMP is contained in the Draft WRMP Environmental Report.

4.5 Assessment of Plan Alternatives

Article 5(1) of the SEA Directive requires the identification, description and evaluation of "*the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme*". The EC guidance[106] on the SEA Directive discusses possible interpretations of handling 'reasonable alternatives' as required by Article 5(1). It states that "*The alternatives chosen should be realistic. Part of the reason for studying alternatives is to find ways of reducing or avoiding the significant adverse effects of the proposed plan or programme*".

For the purposes of the SEA of WRMP19, the feasible options (including Manchester and Pennine Resilience solutions) have been assessed as reasonable alternatives to the preferred options that comprise the Preferred Plan. In addition, reasonable alternatives that operate at the plan level have also been considered, specifically the four alternative plans identified by United Utilities for WRMP19 as outlined in **Section 1.4** of this report as well as further alternative trading pathways identified in developing the Revised Draft WRMP. Each alternative has been assessed using the assessment framework with the findings presented in **Section 6.2** of this Environmental Report.

4.6 Assessment of Secondary, Cumulative and Synergistic Effects

The SEA Regulations require that the cumulative effects of the Revised Draft WRMP are assessed. This includes the cumulative effects of the individual preferred options and the effects of the Revised Draft WRMP in-combination with other plans and programmes.

The cumulative effects of the individual preferred options have been appraised through an assessment of the Preferred Plan (see **Section 6.3**). The cumulative effects of the Revised Draft WRMP in-combination with other plans and programmes, meanwhile, has considered:

- growth proposals and associated population change in the United Utilities region;
- National Policy Statements (NPS) and Nationally Significant Infrastructure Projects (NSIPs);
- United Utilities' Final Drought Plan 2018; and
- other water company WRMPs.

It should be noted that the cumulative effects of the Revised Draft WRMP are difficult to accurately assess given the inherent uncertainties concerning (inter alia): future changes to baseline environmental conditions; future population and economic growth; the deliverability of some NSIPs (and the potential for new NSIPs to be brought forward); and the proposals of emerging water company WRMPs.

The assessment of cumulative effects of the Revised Draft WRMP in-combination with other plans and programmes is presented in **Section 6.4**.

4.7 Contribution of the Revised Draft WRMP to Wales' Well-being Goals and the Objective for the Sustainable Management of Natural Resources

Section 6.5 provides a high level analysis of the impact that the Revised Draft WRMP will have on the achievement of the seven well-being goals for Wales and the objective for SMNR, given that United Utilities operates in Wales.

[106] EC (2003) *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment*.

4.8 Difficulties Encountered in Undertaking the Assessment

The SEA Directive requires the identification of any difficulties (such as technical deficiencies or lack of knowledge) encountered during the assessment process. The difficulties encountered in undertaking the SEA of the Revised Draft WRMP are summarised below:

- Due to the scope of the WRMP, and its nature in combining site-specific options into a plan for the whole of United Utilities' region, a balance needed to be struck between the information provided as an overview of the whole area and the detail of a specific location. Throughout the whole process, it was necessary to balance the need for enough information to undertake a robust assessment, while retaining its strategic focus.
- In undertaking the assessments of feasible and preferred options it has been necessary to make some assumptions. An example of this is the use of carbon estimates as a proxy for the amount of construction materials used in each option. Any assumptions made have been captured in the detailed preferred option assessments.
- Reflecting the strategic nature of the Revised Draft WRMP and SEA, for many resource management options exact site locations and pipeline routes are approximated at this stage whilst the final design of new infrastructure is unknown. However, the assessments of feasible and preferred options have been based on the best available information provided by United Utilities and any assumptions used in the assessment (e.g. in respect of pipeline routes) have been highlighted where appropriate. For some option types (e.g. leakage reduction options), the location of works are not known at this stage and would (if taken forward) be subject to more detailed analysis during the implementation of the WRMP. In consequence, effects on some objectives such as biodiversity are uncertain for these options. Where this is the case, the assessment has reflected this uncertainty.
- Whilst the assessment of the cumulative effects of the implementation of the Revised Draft WRMP and other plans and programmes has been based on the most up to date information available at the time of writing, in many cases there is a lack of detailed information at this stage to make robust conclusions. This is a typical issue encountered during the assessment of WRMPs.

5. Assessment of Feasible Options and Manchester and Pennine Resilience Solutions

5.1 Introduction

This section presents the findings of the assessment of the feasible options identified initially as part of the preparation of the Draft WRMP and considered as part of the supporting Environmental Report. Where appropriate, the assessments have been updated to take into account new information provided by United Utilities, the identification of additional feasible options, responses to consultation on the Draft WRMP Environmental Report and engagement with stakeholders.

The types of feasible options considered in the assessment can be broadly categorised as follows:

- resource management measures (e.g. increasing capacity at an existing groundwater source);
- demand management (e.g. water metering or household visits to install water efficiency measures); and
- demand management - leakage reduction and network metering measures (e.g. repairing pipes).

It should be noted that whilst leakage reduction and network metering options are a component of the suite of demand management options, for the purposes of this report, the effects of these options are summarised separately. This reflects the specific nature of the leakage reduction and network metering options and their likely effects which differ from those related to the water efficiency and metering options.

United Utilities identified three WRZs with potential baseline supply-demand balance deficits at the time of the feasible options assessment; Carlisle, Strategic and North Eden WRZs. A total of 81 feasible resource management options were assessed in this context, in addition to 27 demand management options and 32 leakage reduction and network metering options. In total, 140 feasible options were assessed. No feasible options were assessed for the Barepot WRZ.

Following consultation on the Draft WRMP, a further six feasible leakage reduction and network metering options were identified and assessed as part of the preparation of this report to accompany the Revised Draft WRMP.

All of the feasible options have been assessed using the framework and approach set out in **Section 4** to identify the likely environmental effects. Each feasible option was assessed against the SEA objectives to identify its potential effects in both the short term (during construction) and medium/long term (during operation). The feasible options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where quantified information was available for the feasible option from United Utilities, the assessment was also informed by reference to threshold values set out in the definitions of significance (see **Appendix C**).

The findings of the assessment are presented by each WRZ in-turn and option type in the sections that follow.

Additionally, this section presents the findings of the assessment of the five Manchester and Pennine Resilience solutions considered by United Utilities in preparing the Draft WRMP and Revised Draft WRMP. Each solution comprises a combination of different resilience options which include (inter alia) new abstractions, new WTWs, new pipelines, new tunnels and/or tunnel lining replacement; in some instances, an option appears in more than one solution.

5.2 Carlisle Resource Zone

Resource management options

A total of six feasible resource management options were assessed for the Carlisle WRZ; these are listed in **Table 5.1**. A summary of the assessment of these options is presented in **Table 5.2** with commentary on the likely significant construction and operational effects provided below.

Table 5.1 Resource Management Feasible Options: Carlisle WRZ

Ref	Option	Design Capacity (Ml/d)	Description
WR041	River Irthing to Cumwhinton Plus Castle Carrock Link	6.5	This option would involve the development of a new abstraction/intake point and pumping station on the River Irthing at Newby East in order to abstract and transfer 6.5 Ml/d of water to Cumwhinton water treatment works (WTW) via a new 9.6km raw water main. Modifications to Cumwhinton WTW may be necessary to accommodate the increased raw water input from the River Irthing. Treated output from Cumwhinton WTW would subsequently be transferred to treated water strorage via a new 10.1km treated water main and pumping station. Modifications to the treated water strorage facility (a secondary disinfection process at its outlet in order to maintain water quality compliance) would most likely be required.
WR095	Roughton Gill	1.5	This option would involve the reinstatement of the Roughton Gill mine abstraction source in order to abstract and transfer 1.5 Ml/d to a new WTW situated at a treated water storage site via the existing raw water main network (310m of new pipeline would additionally be required). Treated output would subsequently be transferred to the treated water storage site (on-site) and an additional treated water storage site via a new 4.5km treated water main.
WR128	Tarn Wood (North Eden to Carlisle)	4	This option would involve the installation of new borehole pumps at Tarn Wood WTW to augment the current maximum flow of 2.3 Ml/d to 4 Ml/d, an increase of 1.7 Ml/d. The scheme would require a new pumping station at Tarn Wood and a new circa 14km main to Cumwhinton WTW.
WR148	Cumwhinton Boreholes plus Castle Carrock Link	6.5	This option would involve the development of 2 new boreholes at Cumwhinton WTW in order to abstract a cumulative 6.5 Ml/d (3.25 Ml/d per borehole). Output from these boreholes would be transferred to Cumwhinton WTW via an existing raw water main. It should be noted that Cumwhinton WTW may need further modification to accommodate the increased raw water input from the new boreholes. Treated output from Cumwhinton WTW would subsequently be transferred to a treated water storage facility via a new 10.5km treated water main and pumping station. Modifications to the treated water storage facility (a secondary disinfection process at its outlet in order to maintain water quality compliance) would most likely be required.
WR150	Castle Carrock Dead Water Storage	6	This option would involve modification to the Castle Carrock impounding reservoir (IR) draw-off tower in order to abstract and transfer an additional 6 Ml/d to Castle Carrock WTW via a new dead water abstraction process and associated pipeline works.
WR824	Blenkinsopp Mine	2.2	This option would involve the new abstraction and transfer of 2.2 Ml/d of raw water from the Blenkinsopp Mine to the existing Castle Carrock WTW via a new pumping station and 21km raw water main. Treated output from Castle Carrock WTW would subsequently be transferred to an existing potable storage system.

Table 5.1 Resource Management Feasible Options Assessment Summary: Carlisle WRZ

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR041	River Irthing to Cumwhinton Plus Castle Carrock Link	C	-/?	-	0	-	-	--	-	++/-	0	--	-/?	-
		O	?	0	-/?	-	0	0	+/?	+	0	-	0	0
WR095	Roughton Gill	C	-	+	0	-	-	--	-	+/-	0	--	-	-
		O	?	0	0	0	0	0	+	+	0	-	0	-
WR128	Tarn Wood (North Eden to Carlisle)	C	-	+	0	0	-	--	0	+	0	--	-	-
		O	?	0	0	0	0	0	+	+	0	-	0	0
WR148	Cumwhinton Boreholes plus Castle Carrock Link	C	-	+	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	0	0	0	-	+	+	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR150	Castle Carrock Dead Water Storage	C	-	+	0	-	0	0	-	0	0	-	-	-
		O	0	0	0	0	0	0	+	+	0	-	0	-
WR824	Blenkinsopp Mine	C	--/?	0	0	-	-	--	0	+/-	0	--	-	--
		O	-/?	0	0	-	0	0	+	+	0	-	0	0

Construction Effects

With the exception of one feasible resource management option (Option WR150), all of the identified feasible options for the Carlisle WRZ were assessed as having a positive effect on wellbeing (SEA Objective 8) during the construction phase. This reflects the potential for capital investment to generate supply chain benefits and employment opportunities as well as increased spend in the local economy by contractors and construction workers. The anticipated scale of investment that may be generated by two options (Options WR041 and WR148) would be such that significant positive effects were identified in respect of this SEA objective. However, HGV movements and pipeline works associated with the majority of the options are considered to have the potential to cause traffic disruption, generating a minor negative effect on SEA Objective 8 and leading to the overall mixed scores against this objective.

No further significant positive effects were identified during the assessment. Options WR095, WR128, WR148 and WR150 were assessed as having a minor positive effect on geology and soils (SEA Objective 2) as new infrastructure and refurbishment/modification work associated with these options would be contained within existing sites.

All of the feasible options were assessed as having a negative effect on biodiversity (SEA Objective 1) during the construction phase. This reflects the potential for construction works to result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. Option WR824 was identified as having potentially significant negative effects on biodiversity as pipeline works would occur within Geltsdale and Glendue Fells SSSI (North Pennine Moors SAC), be in close proximity to several other internationally/nationally designated conservation sites and cross the River Gelt (a component of the River Eden and Tributaries SSSI/SAC) which could indirectly introduce pollution/debris and affect interest features. However, scheme design (for example, the re-routing of pipeline) and site level mitigation measures could help to ensure that significant adverse effects in this regard are avoided and therefore some uncertainty remains.

With the exception of Option WR150, all of the feasible options were assessed as having a significant negative effect on climate change (SEA Objective 6). This reflects the anticipated emissions of greenhouse gases from HGV movements, construction plant and the embodied carbon in raw materials. Material use, energy requirements and waste generation associated with these options would also have a significant negative effect on resource use (SEA Objective 10). Greenhouse gas emissions and resource use associated with Option WR150 would be more minor and in consequence, this option was assessed as having a neutral effect on SEA Objective 6 and minor negative effect on SEA Objective 10.

Option WR824 would require extensive pipeline works within and directly adjacent to the North Pennines AONB in addition to the construction of new abstraction infrastructure proximate to Northumberland National Park. In consequence, this option was assessed as having a significant negative effect on landscape (SEA Objective 12). The remaining options were assessed as having minor negative effects on this objective due to the potential for localised landscape/visual impacts associated with construction activity.

No further significant negative effects were identified during the assessment. Minor negative effects were identified in respect of geology and soils (SEA Objective 2), due to the loss of greenfield land (Option WR041 only), and flood risk (SEA Objective 4), given the location of development sites and pipeline works within Flood Zones 2 and 3. Emissions to air from vehicle movements and construction plant together with noise/vibration associated with the implementation of the majority of the feasible options may also have adverse impacts on air quality (SEA Objective 5) and human health (SEA Objective 7). All of the feasible options were also assessed as having a negative effect on cultural heritage (SEA Objective 11), given the potential for works to affect the settings of historic assets.

All options were assessed as having a neutral effect in respect of water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9) during the construction phase. Whilst a number of options would involve works in close proximity to/within watercourses, it is not expected that construction activity would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Operational Effects

No significant positive effects were identified with respect to the operation of the feasible resource management options. All of the feasible options were assessed as having a positive effect on health (SA Objective 7) and wellbeing (SA Objective 8) as their operation would help to ensure the continuity of a safe and secure drinking water supply which may in-turn support economic and population growth.

No significant negative operational effects were identified during the assessment. All of the feasible options were assessed as having a minor negative effect on resource use (SEA Objective 10) due to energy and chemical use associated with the treatment and pumping of water. Energy use and associated greenhouse gas emissions associated with Option WR148, meanwhile, was assessed as having a negative effect on climate change (SEA Objective 6) (emissions associated with the remaining options would be small and consistent with the definitions of significance contained in **Appendix C**, they were assessed as having a neutral effect on this objective).

Options WR148 and WR824 were assessed as having a negative effect on biodiversity (SEA Objective 1). With regard to Option WR148, the abstraction of groundwater could have adverse effects on conversation sites within the general area of the scheme including, for example, the River Eden SAC, Cotehill Pastures and Ponds SSSI and Eden Gorge Woodland SSSI and further analysis regarding any connectivity between the aquifer and these sites would therefore be required to clarify operational effects. The abstraction of groundwater from the Blenkinsopp Mine under Option WR824 could also have an adverse effect on nearby conservation sites as well as local ecosystems such as the former mine itself, although again uncertainty remains.

Increased abstraction associated with the operation of Option WR041 was assessed as having a minor negative effect on water quantity and quality (SEA Objective 3) due to restricted water availability in the River Irving, although uncertainty remains. The remaining options were assessed as having a neutral effect on this objective.

For some options, minor negative effects were identified in respect of flood risk (SEA Objective 4), given the location of development sites within Flood Zones 2 and 3 (Options WR041 and WR824), and landscape (SEA Objective 12), due to the development of small scale above ground infrastructure within the Lake District National Park and World Heritage Sites (Option WR095) and the North Pennines AONB (Option WR150).

Once construction activity is complete, it is not expected that any of the feasible options would have adverse effects on geology and soils (SEA Objective 2), air quality (SEA Objective 5), water resources (SEA Objective 9) or cultural heritage (SEA Objective 11).

Demand Management Options

A total of five demand management options were assessed for the Carlisle WRZ; these are listed in **Table 5.3** together with the related estimated total water saving. The results of the assessment of these options is presented in **Table 5.4** with commentary on the likely significant construction (i.e. enabling/installation/implementation) and operational effects identified provided below.

Table 5.3 Demand Management Options: Carlisle WRZ

Ref	Option Name	Description	Estimated Maximum Saving (Ml/d)
WR607b	Existing domestic water saving retrofit products - installation through smart home visits	Under this option, existing domestic customers would receive a water audit. Water-saving retrofit products such as shower heads, shower timers, save-a-flush etc. would subsequently be installed by a United Utilities representative (estimated 173 installations per year over a 10 year period).	0.07 Ml/d
WR612b	Partnership projects with public and third sector	This option would involve United Utilities partnering with public and third sector organisations to deliver an estimated 346 water efficiency projects	0.14 Ml/d

Ref	Option Name	Description	Estimated Maximum Saving (Ml/d)
	organisations, e.g. Housing Associations	per annum over a 10 year period. Projects would range from equipment retrofits to education and awareness campaigns.	
WR616b	Fixing leaking toilets	This option consists of United Utilities' customers receiving a water audit and toilet retrofit (estimated 41 per annum over a 10 year period).	0.09 Ml/d
WR621b	Provision of free water efficiency goods and advice to all newly metered customers	Under this option, newly metered customers would receive advice on increasing their water efficiency in addition to free water efficiency equipment (estimated 294 per annum over a 10 year period).	0.14 Ml/d
WR624b	Offering water efficiency home checks when installing a meter at a customer's property	Under this option, a United Utilities representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 294 audits per annum over a 10 year period.	0.12 Ml/d

Table 5.4 Assessment of Demand Management Feasible Options: Carlisle WRZ

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR607b	Existing domestic water saving retrofit products - installation through smart home visits	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR612b	Partnership projects with public and third sector organisations, e.g. Housing Associations	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR616b	Fixing leaking toilets	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR621b	Provision of free water efficiency goods and advice to all newly metered customers	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR624b	Offering water efficiency home checks when installing a meter at a customer's property	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**

Construction Effects

No significant positive or minor positive effects were identified during the assessment of the feasible demand management options identified for the Carlisle WRZ. Expenditure associated with the enabling works necessary for the demand management options would be relatively small and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any employment opportunities are likely to be very limited. In consequence, effects of the feasible options on wellbeing (SEA Objective 8) were assessed as neutral.

No significant negative effects were identified during the assessment. The demand management options would require different amounts of raw materials, energy and carbon; those options involving the installation of water efficiency devices would require a greater volume of resources and generate carbon emissions associated with both vehicle movements and the embodied carbon in new equipment. In this regard, Options WR607b, WR612b, WR621b and WR624b would produce carbon emissions exceeding 100 tonnes of carbon dioxide equivalent (tCO_2e) and consistent with the definitions of significance (see **Appendix C**), these options were assessed as having a minor negative effect on climate change (SEA Objective 6) and also resource use (SEA Objective 10). Resource use and emissions associated with the remaining options would be very small and they were therefore assessed as having a neutral effect on these objectives.

There would be increased vehicle movements during the enabling/installation/implementation period of the demand management options associated with the transportation of water efficiency devices and/or workers, the emissions from which could have adverse effects on air quality (SEA Objective 5). However, movements would be relatively low such that any effects on this objective would likely be negligible.

Environmental effects associated with the enabling/installation/implementation phase of the feasible demand management options on the remaining SEA objectives are likely to be very similar. None of the options identified would involve new development and where water efficiency devices are installed, this would take place within the curtilages of existing properties. In consequence, none of the options would be expected to have noticeable effects on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), health (SEA Objective 7), water resources (SEA Objective 9), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Operational Effects

No significant positive effects were identified during the assessment. Demand reductions through the operation of water efficient devices would have positive effects in respect of water quantity (SEA Objective 3) and water resources (SEA Objective 9).

Demand reductions may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. However, the estimated reductions in greenhouse gas emissions associated with the demand management options identified for the Carlisle WRZ would be very small (under 100 tCO_2e per year) and in consequence, the options were all assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The operation of the demand management options would be unlikely to significantly increase/ensure continuity of water supply or support population/economic growth (savings associated with the options would be below 1 Ml/d). Consistent with the definitions of significance, the options were therefore assessed as having neutral effects on health (SEA Objective 7) and wellbeing (SEA Objective 8).

Once installed, the feasible demand management options are considered unlikely to have any adverse environmental effects and no significant or minor negative effects were identified during the assessment.

Demand Management - Leakage Reduction and Network Metering Options

A total of five leakage reduction and network metering options were assessed for the Carlisle WRZ; these are listed in **Table 5.5** together with the related estimated total water saving. The results of the assessment

of these options is presented in **Table 5.6** with commentary on the likely significant construction and operational effects identified provided below.

Table 5.5 Leakage Reduction and Network Metering Options: Carlisle WRZ

Ref	Option Name	Description	Estimated Total Saving (Ml/d)
WR501a	Leakage reduction stage 1	Options WR501a to WR501c would involve an increase in leakage detection and repair activity over a 3 year period, as follows: • Stage 1: A total of 6 leakage surveys, 7 repairs and 3 pressure management valve (PMV) installations would be undertaken. • Stage 2: An additional 8 leakage surveys, 7 repairs, and 3 PMV installations would be undertaken. • Stage 3: An additional 9 leakage surveys, 7 repairs, and 5 PMV installations would be undertaken.	0.10 Ml/d
WR501b	Leakage reduction stage 2		0.20 Ml/d (including Stage 1)
WR501c	Leakage reduction stage 3		0.30 Ml/d (including Stages 1 and 2)
WR512	Network metering enhancements	This option would involve enhancing network metering including logger verification, meter verification and meter under/over registration over a 5 year period.	0.05 Ml/d
WR903b	Third Party Consulting - Proactive Leakage Reduction Service	Under this option, Third Party Consulting would provide a specialist proactive leakage detection service to reduce leakage over a 5 year period.	0.23 Ml/d

Table 5.6 Assessment of Leakage Reduction and Network Metering Options: Carlisle WRZ

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR501a	Leakage reduction stage 1	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**0**	**0**
WR501b	Leakage reduction stage 2	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**0**	**0**
WR501c	Leakage reduction stage 3	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**0**	**0**
WR512	Network metering enhancements	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	0	0	0	+	0	0	0
WR903b	Third Party Consulting - Proactive Leakage Reduction Service	C	-/?	0	0	0	-/?	0	-/?	0	0	0	0	-/?
		O	0	0	+	0	0	0	0	0	+	0	0	0

Construction Effects

No significant positive or minor positive effects were identified during the assessment of the feasible leakage reduction and network metering options identified for the Carlisle WRZ. Expenditure associated with the enabling works for these options would be relatively small and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any employment opportunities are likely to be very limited. Pipeline replacement/repair may take place within and/or utilise road networks which could result in increases in localised congestion and disruption/driver delay throughout the implementation phase, although any effects would be temporary and small in scale. Overall, the feasible leakage reduction and network metering options were assessed as having a neutral effect on wellbeing (SEA Objective 8).

No significant negative effects were identified during the assessment. Construction activity associated with the repair of leaks may impact on biodiversity (SEA Objective 1) including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through the options, may be subject to extensive excavation and disruption along the route of the affected water main. Works may also have adverse effects on air quality (SEA Objective 5) and health (SEA Objective 7), due to the potential for vehicle movements and the operation of plant to affect local air quality and generate noise/vibration disturbance, and landscape (SEA Objective 12), given the potential for works to have a temporary impact on landscape character and visual amenity. However, as the location of the works to be undertaken is unknown at this stage, some uncertainty remains with regard to the probability of adverse effects on these objectives occurring.

There would be a minor increase in resource use (for pipeline repair, meter enhancement etc.) and construction waste along with fuel usage for vehicles and plant. There would also be carbon emissions associated with leakage identification and reduction, arising from embodied carbon (in, for example, pipeline materials and equipment) in addition to plant operation and vehicle movements throughout the investigative and construction period. However, resource use and emissions across the leakage reduction and network metering options are expected to be negligible and therefore effects on climate change (SEA Objective 6) and resource use (SEA Objective 10) were assessed as neutral.

Environmental effects associated with the construction phase of the feasible leakage reduction and network metering options on the remaining SEA objectives are likely to be very similar with effects on geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11) expected to be negligible. This reflects the nature of works under these options and the likelihood that any potential adverse effects would be managed through site-specific mitigation and established best practice.

Operational Effects

No significant positive effects were identified during the assessment. The operation of leakage reduction and network metering options would result in less water being lost due to leakage and therefore lower demand for water abstraction. This would benefit the water environment and all of the options were therefore assessed as having a positive effect with respect to water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9).

Lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. The estimated reduction in greenhouse gas emissions associated with Options WR501a-c would be in excess of 100 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time) and for these options, positive effects were identified in respect of climate change (SEA Objective 6) and resource use (SEA Objective 10). The likely scale of emissions reductions associated with the remaining options would be very small and in consequence, they were assessed as having a neutral effect on these SEA objectives.

The level of leakage reduction associated with the feasible options in the Carlisle WRZ is unlikely to significantly increase continuity of water supply or support population and/or economic growth (savings associated with the options would be below 1 Ml/d). Consistent with the definitions of significance (see

Appendix C), the options were therefore assessed as having neutral effects on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No significant or minor negative effects were identified during the assessment. Once works have been completed, the feasible leakage reduction and network metering options are considered unlikely to have any adverse environmental effects.

5.3 Strategic Resource Zone

Resource Management Options

A total of 75 feasible resource management options were assessed for the Strategic Resource Zone; these are listed in **Table 5.7**. A summary of the assessment of these options is presented in **Table 5.8** with commentary on the likely significant construction and operational effects provided below. Detailed assessments are contained at **Appendix D**.

As highlighted in **Section 1.4**, the Draft WRMP included an option to trade with Thames Water during drought years; the works required to enable this trade were assessed as Option B2 in the Draft WRMP Environmental Report. For the purposes of preparing the Draft WRMP and undertaking the SEA at that time, United Utilities agreed with Thames Water that any environmental impacts downstream of Lake Vyrnwy in the Severn catchment, and in the Thames catchments associated with this transfer, would be assessed in the Thames Water WRMP. This was because the information necessary to assess this element of Option B2 was not publicly available. Following publication of the Thames Water Draft WRMP 2019, the assessment of Option B2 has been subsequently updated as part of the preparation of this report in order to take account of the downstream impacts of a transfer. This updated assessment is based on the findings of the Environmental Report[107] prepared in support of the Thames Water Draft WRMP (which includes an assessment of the downstream impacts of a transfer from Lake Vyrnwy (the Severn Thames Transfer).

In addition to the re-assessment of Option B2, the assessments of Options WR146, WR816 and WR820 have been reviewed to take into account updated design capacity information provided by United Utilities following publication of the Draft WRMP.

Table 5.7 Resource Management Feasible Options: Strategic Resource Zone

Ref	Option	Design Capacity (Ml/d)	Description
WR001	River Alt to Prescot WTW	13.5	This option comprises a new abstraction on the River Alt and the transfer of raw water to Prescot WTW for treatment and storage. The raw water transfer/treatment would utilise circa 18km of pipeline and a new WTW at Prescot, or alternatively, modifications to the existing Prescot WTW if new development is not seen as viable. There is no current abstraction licence associated with this option.
WR003	Fisher Tarn (Kendal) to Thirlmere Aqueduct and Lostock for Treatment	5	This option would involve the reinstatement of Fisher Tarn Reservoir in order to abstract and transfer a maximum of 5 Ml/d via a new 1.8km raw water main to the Mint South Well (Thirlmere Aqueduct) for treatment at Lostock WTW. Ancillary development may be required to facilitate the operation of this option such as a new pumping station and modification to the Mint South Well.
WR004	Longsleddale Reservoir	25	This option would involve the development of a new impounding reservoir across the River Spirit with a capacity of 1,897Ml. The proposed dam would be 370m long with a new access road 1.4km in length. Additionally, a new pumping station would be installed on an off-road site near Garnett Bridge. Raw water from the reservoir would be

[107] Ricardo (2017) *Draft Water Resources Management Plan 2019: Strategic Environmental Assessment Environmental Report*. Available from https://corporate.thameswater.co.uk/-/media/Site-Content/Your-water-future-2018/Appendices/dWRMP19-Appendix-B----Strategic-environmental-assessment---environmental-report-151217.pdf [Accessed August 2018].

Ref	Option	Design Capacity (Ml/d)	Description
			transferred to Watchgate WTW via a new raw water main (circa 10km in length).
WR006	Glaze Brook	15	This option would involve the provision of a new lowland river raw water abstraction on Glaze Brook and construction of a pumping station. A new circa11km raw water main to Lightshaw WTW would be required together with a new WTW process for river water. Treated water would be transferred to a treated water storage facility.
WR007	Sankey Brook	10	This option would involve the development of a new abstraction from Sankey Brook that would transfer 10 Ml/d of raw water to a new WTW at a treated water storage site via a new circa 5.5km main. Following water treatment, output from Hill Cliffe WTW would be transferred to the treated water storage facility.
WR009	River Rawthey to Watchgate	15	This option would involve the development of a new abstraction/intake point on the River Rawthey near Sedbergh in order to abstract and transfer an average of 15 Ml/d to Watchgate WTW via a new raw water main (circa15.5km in length). Ancillary infrastructure including two new pumping stations would also be delivered to facilitate the transfer of water to the Watchgate WTW. Modifications to the Watchgate WTW would be necessary to accommodate the increased raw water input from this option.
WR012	Borrow Beck Reservoir	60	This option would involve the development of a new impounding reservoir in Borrow Beck between Shooter Howe and Belt Howe. A new pumping station would be installed to facilitate the transfer of raw water to the inlet at Watchgate WTW via a new raw water main (circa 6.5km in length).
WR026a	River Ribble Support to Stocks Reservoir	6.67	This option would involve the development of a new abstraction/intake point on the River Ribble near Clitheroe in order to abstract and transfer an average of 6.67 Ml/d to Stocks IR via a new raw water main (circa 15km in length). Ancillary infrastructure would also be installed to facilitate the transfer of water to Stocks IR including a new pumping station and a new break pressure tank.
WR037a	Haweswater Reservoir (Raise Embankment Structure)	11.5	This option would involve the raising of Haweswater IR dam by 0.5m to increase water storage. Ancillary refurbishments and structural modifications would be required to accommodate the increased storage capacity of the reservoir including: raising of the reservoir's inlet tower and access bridge; installation of a new steelwork platform at the spillway; increase in the size of the existing stilling pools downstream of the dam; a new road bridge; minor perimeter works to the reservoir (7.5km); and remedial works to the proposed site compound.
WR037b	Haweswater Reservoir (Raise Embankment Structure)	23	This option would involve the raising of Haweswater IR dam by 1.0m to increase water storage. Ancillary refurbishments and structural modifications would be required to accommodate the increased storage capacity of the reservoir including: raising of the reservoir's inlet tower and access bridge; installation of a new steelwork platform at the spillway; increase in the size of the existing stilling pools downstream of the dam; a new road bridge; minor perimeter works to the reservoir (7.5km); and remedial works to the proposed site compound.
WR039a	River Eden (Temple Sowerby) to Watchgate	50	This option would involve the development of a new abstraction/intake point and pumping station on the River Eden within the vicinity of Temple Sowerby in order to abstract and transfer up to 50 Ml/d of water to a new upfront WTW situated on the existing Watchgate WTW site via a new 47km raw water main.
WR047a	Milwr Tunnel, Bagillt (Transfer to Huntington)	70	This option would involve the development of a new abstraction/intake point on the Milwr Tunnel at Bagillt in order to abstract and transfer 70 Ml/d for treatment at Huntington WTW via a new 31km raw water main and ancillary pumping stations. Huntington WTW would require

Ref	Option	Design Capacity (Ml/d)	Description
			modifications and structural enlargement in order to accommodate the increased raw water input.
WR049b	River Ribble (Transfer to Anglezarke IR)	40	This option would involve the provision of a new river intake, screen and pumping station on the River Ribble at Samlesbury. Subject to obtaining an abstraction licence, the scheme would abstract 30 - 40 Ml/d of raw water from the River Ribble to transfer to the Anglezarke IR for primary treatment at Rivington WTW via 15.5km of pipeline.
WR062a	Worthington WTW	12	This option would involve the recommissioning of the Worthington WTW in order to treat up to 12 Ml/d of raw water. The proposed scheme would utilise existing infrastructure and treatment processes to abstract and treat the raw water. Treated water output from the WTW would be transferred to a treated water storage facility via existing treated water mains.
WR062b	Worthington WTW (Rivington)	12	This option would utilise existing intake infrastructure to transfer up to 12 Ml/d of raw and/or partially treated water from Worthington IR to Rivington WTW via a new 6.5km water main.
WR074	River Darwen (Transfer to Fishmoor WTW)	10	This option would involve the development of a new abstraction/intake point on the River Darwen near Roach Bridge in order to abstract and transfer 10 Ml/d to Fishmoor IR via a new raw water main (14.7km in length). Ancillary infrastructure would also be installed to facilitate the operation of this option including a new pumping station and intake screens on the abstraction site.
WR076	River Bollin	25	This option would involve the provision of a new river abstraction and intake on the River Bollin in the vicinity of Lymm. In addition, a new WTW facility at the same location would be required together with a pumping station and treated water main (circa 6.5km in length) to transfer water to a treated water storage facility.
WR079b	Appleton Reservoir, Warrington	6	This option would involve the reinstatement of Appleton Reservoir comprising a new or refurbished abstraction point at the draw-off tower on its northern embankment and a new raw water pumping station. A new raw water main would be constructed to connect Appleton Reservoir to a new WTW at a treated water storage site.
WR079c	Appleton Reservoir, Warrington	9	This option would involve the reinstatement of Appleton Reservoir comprising a new or refurbished abstraction point at the draw-off tower on its northern embankment and a new raw water pumping station. A new raw water main would be constructed to connect Appleton Reservoir to a new WTW at a treated water storage site.
WR079d	Appleton Reservoir, Warrington	12.5	This option would involve the reinstatement of Appleton Reservoir comprising a new or refurbished abstraction point at the draw-off tower on its northern embankment and a new raw water pumping station. A new raw water main would be constructed to connect Appleton Reservoir to a new WTW at a treated water storage site.
WR099a	Worsthorne Borehole (Compensation)	4	This option comprises the recommissioning and refurbishment of Worsthorne borehole providing a yield of up to 4 Ml/d. Refurbishments would include a new pump, new/improved headworks, and the construction of a new 400m extension of the existing raw water main to divert flow into the River Brun as a compensation flow.
WR099b	Worsthorne Borehole (Hurstwood IR)	4	This option comprises the recommissioning and refurbishment of Worsthorne borehole in order to abstract a maximum capacity of 4 Ml/d. Refurbishments would include a new pump, new/improved headworks and mechanical and electrical systems (M & E) together with the construction of a new 1.1km main to transfer water to Hurstwood IR.
WR099c	Worsthorne Borehole (Worsthorne WTW)	4	This option comprises the recommissioning and refurbishment of Worsthorne borehole. Refurbishments would include a new pump, new/improved headworks and M & E. The option would utilise the

Ref	Option	Design Capacity (Ml/d)	Description
			existing raw water mains to Worsthorne WTW where treatment processes would be modified to accommodate up to 4 Ml/d of water from the borehole.
WR100	Thorncliffe Road Borehole, Barrow-in-Furness	4.5	This option would involve the development of a new duplicate borehole at the Thorncliffe Road WTW site in addition to a new WTW. A new inlet to a treated water storage facility would be developed to facilitate the transfer of a cumulative 9 Ml/d of treated water from the new and existing boreholes. Once operational, the new borehole/WTW would abstract, treat, and transfer 4.5 Ml/d to a treated water storage facility via a new 92m treated water main. In conjunction with this scheme, abstraction from the Schneider Road boreholes would be reduced in order to ensure no deterioration in WFD objectives for the Furness aquifer.
WR101	Franklaw Z Site Plus Increased Franklaw WTW Treatment Capacity	30	This option would involve the reinstatement and refurbishment of two existing boreholes at the Franklaw Z site in order to abstract and transfer a maximum of 18 Ml/d of raw groundwater to the existing Franklaw WTW via an existing raw water pipeline. Additionally, new borehole pumps would be installed at 10 other existing/utilised Franklaw/Broughton boreholes in order to abstract an additional 12 Ml/d and the capacity of Franklaw WTW would be increased.
WR102a	Widnes Boreholes to Prescot WTW	52.3	This option comprises the refurbishment of Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites, which are currently out of service. Additional refurbishment at Pex Hill would introduce a new break tank and pumping station, refurbishment of Cronton Booster pumping station to permit required flow transfer to Pex Hill, and two new water mains: one pipeline connecting Pex Hill to Prescot WTW (7.2km) and the other from Pex Hill to District Metered Area (DMA) 127-1 (6.1km). New WTW plant at Prescot would be developed to treat the blended water from the open reservoirs and boreholes.
WR102ai	Widnes Boreholes to Prescot WTW	52.3	This option comprises the refurbishment of Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites, which are currently out of service. Additional refurbishment at Pex Hill would introduce a new break tank and pumping station, refurbishment of Cronton Booster pumping station to permit required flow transfer to Pex Hill, and two new water mains: one pipeline connecting Pex Hill to the Prescot WTW (7.2km) and the other from Pex Hill to DMA 127-1 (6.1km). New WTW plant at Prescot would be developed to treat the blended water from the open reservoirs and boreholes.
WR102b	Widnes Boreholes to Liverpool and Warrington DMZs	55.3	This option comprises the refurbishment of Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites. Development within the Liverpool District Metred Zone (DMZ) would include an upgrade to Netherley WTW in order to treat the combined raw water transfer from Belle Vale, Netherley, Water Lane, and Greensbridge Lane, a new pumping station at Netherley, and new treated water mains between Netherley WTW and two treated water storage sites (approx. 4.4km) and Pex Hill to DMA 127-1 (6.1km). Development within the Warrington DMZ would include the refurbishment of Stockswell WTW, a new WTW at Pex Hill, slip lining of the existing treated water main between the Stockswell WTW and Pex Hill, and the abandonment of the Cronton Booster pumping station.
WR102c	Widnes Boreholes to Runcorn and Warrington DMZs	55	This option would involve the recommissioning and refurbishment of the existing Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell, and Pex Hill boreholes. Development within the Runcorn DMZ would consist of installing a new raw water main connecting Belle Vale, Netherley, Water Lane, and Stockswell boreholes to the Greensbridge Lane borehole site to facilitate the transfer of 30 Ml/d – 48 Ml/d of raw water to a new WTW at Hale Bank. Output from the Hale Bank WTW would subsequently be transferred to a treated water storage facility via a new pumping station and treated water main for

Ref	Option	Design Capacity (Ml/d)	Description
			distribution as required by demand. Development within the Warrington DMZ would consist of a new WTW situated within the existing treated water storage site to treat and transfer 5.8Ml/d – 9.1 Ml/d to customers within DMA 127-1 via a new treated water. Because the cumulative abstraction amount of 57.1 Ml/d is greater than the existing conjunctive licence of 55 Ml/d, maximum capacities of the two treated water storage sites would be reduced to 47 Ml/d and 8 Ml/d, respectively, to maintain a total scheme capacity of 55 Ml/d.
WR102d	Eccleston Hill Borehole to Prescot WTW	5	This option comprises the refurbishment of Eccleston Hill boreholes and the construction of a new 1.5km raw water main to the Prescot open reservoirs.
WR102e	Bold Heath Boreholes to Prescot WTW	9	This option comprises the recommissioning of Bold Heath boreholes and the construction of a new 9km raw water main to Prescot WTW.
WR105a	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook)	9.1	This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes. Utilising existing raw water mains and pumping infrastructure, the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at Sow Brook. Output from the new WTW would be pumped into an existing treated water main and transferred to the Manchester DMZ.
WR105ai	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook)	9.1	This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes. Utilising existing raw water mains and pumping infrastructure, the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at Sow Brook. Output from the new WTW would be pumped into an existing treated water main and transferred to the Manchester DMZ. This option would include water softening within the treatment process.
WR105b	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Hill Cliffe)	9.1	This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes. Utilising a new pumping main (8.4km), the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at a treated water storage site.
WR105bi	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Hill Cliffe)	9.1	This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes. Utilising a new pumping main (8.4km), the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at a treated water storage site. It should be noted that this option includes water softening within the treatment process.
WR106	Walton and Daresbury Boreholes	8.45	This option would involve the reinstatement and refurbishment of existing boreholes at Walton and Daresbury. A new raw water main (approximately 3.6km in length) would be constructed between the Walton and Daresbury borehole sites as well as a new 500m main between a treated water storage facility and a new WTW at Hill Cliffe.
WR107a	Aughton Park Moss End Boreholes	10	This option would involve fully commissioning two existing boreholes located at Aughton Park and Moss End. A new raw water main would transfer water from the two sites to the existing Royal Oak WTW which would be modified to allow the additional water to be treated.
WR107ai	Aughton Park Moss End Boreholes	10	This option would involve fully commissioning two existing boreholes located at Aughton Park and Moss End. A new raw water main would transfer water from the two sites to the existing Royal Oak WTW which would be modified to allow the additional water to be treated. It should be noted that water softening (ion exchange) is included within the treatment process.
WR107b	Randles Bridge, Knowsley, Primrose Hill	12	This option would involve the recommissioning of the Randles Bridge boreholes, Knowsley boreholes, and the Primrose Hill borehole. A cumulative 12 Ml/d of raw water would be abstracted and transferred to Royal Oak WTW via new raw water mains: Randles Bridge/Knowsley

Ref	Option	Design Capacity (Ml/d)	Description
			main (14.2km) and Primrose Hill main (8.9km). Royal Oak WTW's treatment processes would be modified to accommodate the increased 12 Ml/d input (54 Ml/d to 65 Ml/d). Additional modifications to Royal Oak WTW's output and distribution network would occur as appropriate to permit the WTW's increased capacity to function within the Southport and Liverpool DMZs.
WR109	Swineshaw Boreholes (Buckton Castle WTW)	4	This option involves the recommissioning and refurbishment of three existing boreholes located on the Swineshaw Brook catchment and the transfer of up to 4 Ml/d (1.33 Ml/d per borehole) of raw water to Buckton Castle WTW via existing raw water transfer infrastructure.
WR110	Rushton Spencer Boreholes	2	This option would involve increasing the licenced abstraction rate of the two existing Rushton Spencer boreholes in order to abstract and transfer an additional 2 Ml/d to Hug Bridge WTW via an existing raw water main. Neither the Rushton Spencer boreholes nor Hug Bridge WTW are expected to require any modifications to accommodate the increased abstraction, transference, and treatment of raw water.
WR111	Woodford Borehole	12	This option would involve increasing the capacity of Woodford borehole from 9 Ml/d to 12 Ml/d. The option would also require a new WTW at a treated water storage site and (potentially) circa 7.8km of upgraded pipeline.
WR112	Bramhall Borehole	5	This option would involve the development of a new borehole and pumping stations within the Bramhall area in order to abstract an average of 5 Ml/d. A new 5.3km raw water main, partially following the existing main, would transfer raw water from the Bramhall borehole to a new WTW adjacent to a treated water storage facility.
WR113	Tytherington Boreholes	6.4	This option would involve the replacement of an existing treated water main between Tytherington WTW and a treated water storage facility to permit an additional 3 Ml/d treated water transfer to existing storage. It would also comprise the replacement of existing borehole pumps at Tytherington and modifications to the WTW.
WR114	Python Mill Borehole	3	This option comprises the reinstatement and refurbishment of Python Mill borehole and the transfer of raw water to Rochdale Canal, offsetting compensation from the Chelburn system. It would also require 3km of new transfer pipeline along a road from Python Mill to Rochdale Canal. A new discharge scour into the canal and new sewer connection at Python Mill would also be required.
WR119a	Egremont Boreholes (Existing)	11	This option would involve the continued use of the South Egremont boreholes (Merry Hill, Kellhead, Gulley Flatts, and Black Ling) and associated pipeline network to abstract and transfer 11 Ml/d to Ennerdale WTW and a treated water storage facility. This option proposes a new WTW at Nannycatch and a new treated water main between the Nannycatch WTW and treated water storage site.
WR119b	Egremont Boreholes (New)	21	This option would involve the continued use of the South Egremont boreholes (Merry Hill, Kellhead, Gulley Flatts, and Black Ling) as well as the development of three new boreholes located at Sandwith, Rottington and Moor Platts. The Catgill borehole would also be refurbished. A new raw water main would transfer water from the new and refurbished boreholes to the Catgill site, and then subsequently to a treated water storage facility. A new WTW at Nannycatch and a new treated water main between the Nannycatch WTW and the treated water storage site would be developed to treat and transfer a combined 21 Ml/d from the new and existing boreholes.
WR120	Cross Hill Boreholes, Wirral	15	This option would involve the construction of three new boreholes and a new WTW at a treated water storage site, in order to abstract/transfer 15 Ml/d. Additionally, the revocation of existing abstraction licences at Hooton, Gorston, and Springhill would be included within the abstraction licence proposal.

Ref	Option	Design Capacity (Ml/d)	Description
WR120i	Cross Hill Boreholes, Wirral	15	This option would involve the construction of three new boreholes and a new WTW at a treated water storage site, located at Thingwall on the Wirral, in order to abstract/transfer 15 Ml/d. Additionally, the revocation of existing abstraction licences at Hooton, Gorston, and Springhill would be included within the abstraction licence proposal. It should be noted that water softening (ion exchange) is included within the treatment process for this option.
WR121a	Eaton Boreholes (Hollins Hill)	6.7	This option would involve the reinstatement and refurbishment of the two Eaton boreholes and development of a new WTW at the site. Once operational, up to 6.7 Ml/d of treated water would be transferred to a treated water storage facility via an existing main, sections of which may need to be replaced.
WR121b	Eaton Boreholes (Mid Cheshire Main)	6.7	This option would involve the reinstatement and refurbishment of the two Eaton boreholes and development of a new WTW at the site. Once operational, up to 6.7 Ml/d of treated water would be transferred to the Mid Cheshire Main via an existing main, sections of which may need to be replaced.
WR122	Newton Hollows Boreholes	9	This option would involve reinstating and refurbishing three boreholes at Newton Hollows. A new WTW within the existing WTW site would be required together with three new borehole pumps, rising main and headworks on the new boreholes. An existing main between the WTW and treated water storage facility would be recommissioned as part of the scheme.
WR125	Bearstone Boreholes	6.36	This option would involve the reinstatement and refurbishment of two of the three Bearstone boreholes. Bearstone WTW's treatment processes would be modified to accommodate the increased abstraction output. The cumulative output from Bearstone WTW would be transferred to a treated water storage facility via an existing 3.4km treated main though pipeline modification may be required. Similarly, a new outlet booster pumping station may be included within the scheme if required.
WR129	North Cumbria Boreholes	10	This option would involve the continued abstraction and transfer of 6 Ml/d from the three Scales boreholes to Quarry Hill WTW. Additionally, new boreholes would be developed at Waverton and Thursby with each borehole producing 2 Ml/d. New raw water mains (15.8km combined) would transfer water from both boreholes to a new blending tank and then to Quarry Hill WTW which would be refurbished to treat the combined 10 Ml/d from all five boreholes. Treated water would then be transferred to a treated water storage facility via a new treated water main (9.8km).
WR140	Horwich WwTW – Final Effluent Reuse	5	This option would involve the development of a new abstraction/intake point on Pearl Brook/the River Douglas in order to abstract and transfer final effluent from Horwich WwTW to Rivington WTW via a new 2m raw water main and pumping station. Rivington WTW would be modified in order to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water (5 Ml/d) would then be transferred into an existing distribution system from Rivington WTW.
WR141	Rossendale WwTW – Final Effluent Reuse	10	This option would involve the development of a new abstraction/intake point on the River Irwell in order to abstract and transfer final effluent from Rossendale WwTW to Townsend Fold WTW via a new 2.2km raw water main and pumping station. Townsend Fold WTW would be modified in order to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water would then be transferred into an existing distribution system.
WR142	Hyndburn WwTW – Final Effluent Reuse	10	This option would involve the development of a new abstraction/intake point on the River Calder in order to abstract and transfer final effluent from Hyndburn WwTW to Martholme WTW via a new 2.1km raw water main and pumping station. Martholme WTW would be modified in order

Ref	Option	Design Capacity (Ml/d)	Description
			to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water would then be transferred into the existing distribution system.
WR144	Saddleworth and Mossley Top – Final Effluent Reuse	5	This option would involve the development of a new abstraction/intake point on the River Tame in order to abstract and transfer final effluent from Mossley Top WwTW and Saddleworth WwTW to Buckton Castle WTW via a new 2.9km raw water main and pumping station. Buckton Castle WTW would be modified in order to accommodate the increased raw water input as well as to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water would then be transferred into the existing distribution system from Buckton Castle WTW.
WR146	Davyhulme – Final Effluent Reuse	100	This option would involve the development of a new storage tank and pumping station within the vicinity of the Davyhulme WwTW facility in order to abstract and transfer 159 Ml of final effluent to a new WTW and treated water storage (on-site) via a new 400m raw water main. The new WTW would be required to treat final effluent to potable water quality standards. Treated water would then be transferred into an existing treated water network for Manchester.
WR153	Simmonds Hill – Increased WTW Capacity	11	This option would involve the reinstatement and refurbishment of the Helsby boreholes in order to abstract and transfer 3 Ml/d to the Foxhill WTW via a new 1.6km raw main between a treated water storage site and the Foxhill facility. Foxhill borehole would also be reinstated. Foxhill WTW's disinfection process would be modified with water transferred from the WTW to Simmonds Hill WTW via an existing treated water main. Additionally, Mouldsworth, Manley Common, Manley Quarry, and Five Crosses boreholes would be refurbished to abstract an additional 5 Ml/d of water which would also be transferred to Simmonds Hill WTW via existing water infrastructure. Simmonds Hill WTW would be modified to increase its existing capacity.
WR154	Sandiford – Increased WTW Capacity	10	This option would involve the refurbishment of the existing Organsdale, Delamere, Delamere, Eddisbury, Cotebrook, Cotebrook, and Sandiford boreholes in order to increase raw water production (within existing licence constraints). Delamere WTW and Sandiford WTW would require modification to increase treatment capacity. Output from Sandiford WTW would be transferred to a treated water storage facility for wider distribution.
WR159	Group 1 - Improved Reservoir Compensation Release Control	13.2	This option would involve the construction of new automated penstock arrangements at 76 reservoirs (Group 1) in order to provide compensation control in line with licence requirements. The proposed development scope would also include a new kiosk at each targeted reservoir.
WR160	Group 2 – Improved Reservoir Compensation Release Control	8.8	This option would involve the construction of new automated penstock arrangements at four reservoirs (Group 2: Lake Vyrnwy, Rivington, Thirlmere and Haweswater) in order to provide compensation control in line with licence requirements. The proposed development scope would also include a new kiosk at each targeted reservoir.
WR800	River Bela to Thirlmere Aqueduct	4.5	This option would involve an abstraction trade from an existing non-water industry abstraction licence holder abstracting from the River Bela. It would require the development of a new abstraction/intake point on the River Bela at Bela Mill in order to abstract and transfer 4.5 Ml/d of water to Thirlmere Aqueduct (Lupton North Well) via a new pumping station and 8.5km raw water main.
WR810	Cow Green IR to Haweswater via Heltondale Aqueduct (Northumbrian Water)	40	This option would involve the development of new abstraction infrastructure and screens at Cow Green Reservoir in order to abstract and transfer 40 Ml/d to the Heltondale Aqueduct via a new pumping station at Cow Green, a new 44.6km raw water main, and 8 new break pressure tanks situated along the route. Abstracted water would then

Ref	Option	Design Capacity (Ml/d)	Description
			be discharged from the Heltondale Aqueduct into the Haweswater Reservoir.
WR812	Transfer of raw water from Kielder Water IR (Northumbrian Water) to the SRZ	100	This option comprises the transfer of water from Kielder Water in the Northumbrian Water supply region to the United Utilities supply region. Under this option, a new intake structure and screening equipment would be constructed at Kielder Water. A new 40km raw water main with three pumping stations would be constructed from Kielder to transfer water into Heltondale Aqueduct.
WR813	Scammonden IR to Buckton Castle via Huddersfield Narrows Canal	5	This option would involve the development of a new abstraction point and pumping station at Scammonden IR in order to abstract and transfer 5 Ml/d to Huddersfield Narrow Canal via a new 4.23km raw water main and break pressure tank. A second new abstraction point and pumping station would be installed on the Huddersfield Narrow Canal near Mossley in order to abstract and transfer 5 Ml/d to Buckton Castle WTW via a new 700m raw water main for treatment and distribution.
WR814a	Increased abstraction capacity at Heronbridge	24	This option would involve a reduction in industrial supply from Heronbridge pumping station on the River Dee, releasing additional capacity for abstraction and treatment at Huntington WTW. The option would require modifications to/expansion of Huntington WTW.
WR814b	Increased abstraction capacity at Heronbridge	24	This option would involve a reduction in industrial supply from Heronbridge pumping station on the River Dee, releasing additional capacity for abstraction and treatment at Hurleston WTW via Llangollen Canal. Treated output would be transferred to the Mid-Cheshire Main located near Nanney's Bridge via existing infrastructure. The option would require modifications to/expansion of Hurleston WTW.
WR814c	Increased abstraction capacity at Heronbridge	24	This option would involve a reduction in industrial supply from Heronbridge pumping station on the River Dee, releasing additional capacity for abstraction and treatment at Hurleston WTW. Water would be abstracted from the Dee/Llangollen Canal confluence and transferred via a new circa 44km raw water main to the WTW. Treated output would then be transferred to the Mid-Cheshire Main located near Nanney's Bridge via existing infrastructure. The option would require modifications to/expansion of Hurleston WTW and new pumping infrastructure.
WR816	Manchester Bolton Bury Canal to Integrated Zone	6.5	This option would involve the development of a new abstraction/intake point and pumping station at Elton Reservoir in order to abstract and transfer 6.5 Ml/d from Manchester, Bolton and Bury Canal to a new WTW on-site via a new 300m raw water main. Treated output from the new WTW would then be transferred to a treated water storage facility via a new 4.8km treated water main.
WR817	Carr Mill Dam to Integrated Resource Zone	23	This option would involve the development of a new abstraction/intake point and pumping station on Carr Mill dam in order to abstract and transfer 23 Ml/d of water from St. Helens Canal to a new WTW via a new 900m raw water main. Treated output from the new WTW would then be transferred to a treated water storage facility via a new 1km treated water main.
WR820	Shropshire Union Canal to Integrated Resource Zone	15	This option would involve increased abstraction from the Shropshire Union Canal for treatment to potable standards at Hurleston WTW and transfer to the Mid-Cheshire Main located near Nanney's Bridge. It would require additional abstraction infrastructure, a new/expanded WTW at Hurleston and a 6.9km treated water main.
WR821	Shropshire Union Canal	30	This option would involve increased abstraction from the Shropshire Union Canal for treatment to potable standards at Hurleston WTW and transfer to the Mid-Cheshire Main located near Nanney's Bridge. It would require additional abstraction infrastructure, a new/expanded WTW at Hurleston and a 6.9km treated water main.

Ref	Option	Design Capacity (Ml/d)	Description
B2	Thames Water Trading Enabling Works including Severn Thames Transfer (United Utilities works)	180	In order to maintain supplies to United Utilities' own customers when exporting water from Lake Vyrnwy to the Thames Water region, Dee Aqueduct water would be diverted into the Vyrnwy Aqueduct using existing aqueduct connections and would then be pumped up Line 3 of the Vyrnwy Aqueduct for additional treatment at Oswestry. The option would require modifications to Oswestry WTW, 4 booster stations and pipeline replacement.
B2 (Thames Water works)	Thames Water Trading Enabling Works including Severn Thames Transfer (Thames Water works) – included for completeness	180	The following information is provided for completeness, and relates to Thames Water enabling works undertaken downstream of Lake Vyrnwy to facilitate the trading option. It has been taken from information in the Thames Water Draft WRMP 2019. The water released from Lake Vyrnwy would be re-abstracted from the Severn at Deerhurst (for subsequent transfer into the River Thames to supply Thames Water). According to Thames Water modelling work, the need for transfers of water from the River Severn into the Thames Water area would occur, on average, 9% of the time. Mythe WTW would provide support to the River Severn to River Thames Transfer by using the 15 Ml/d of the unused part of the existing Severn Trent Water (STW) abstraction licence at its intake - the spare licensed volume would be left in the River Severn for abstraction downstream at Deerhurst by Thames Water. The Mythe intake is located on the River Severn near Tewkesbury, 5km northeast of Deerhurst. STW has advised Thames Water that only minor works would be required at Mythe and elsewhere to release the spare licence volume for abstraction by Thames Water at Deerhurst. The transfer of water would be through a supported conveyance pipeline option that would abstract the water from Deerhurst on the River Severn to the outfall at Culham on the River Thames with a 300 Ml/d capacity and a total length of 88km. As well as the pipeline route, associated works required to transfer the flow to the River Thames would include: • A river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station; • A raw water low lift pump station and a twin pipeline to the water treatment works; • Treatment works; • A treated water high lift pump station; • A rising main; • A break pressure tank at the high point; • A gravity main to discharge; • An outfall at Culham with an actuated valve and an aeration cascade; • Washouts along the route provided with permanent discharge pipework to adjacent watercourses; • A tee off the main pipeline for Swindon and Oxfordshire supply.

Table 5.8 Resource Management Feasible Options Assessment Summary: Strategic Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR001	River Alt to Prescot WTW	C	-	0	0	0	-	--	0	++/-	0	--	-	-
		O	?	0	-/?	0	0	-	++/?	++/?	0	-	0	0
WR003	Fisher Tarn (Kendal) to Thirlmere Aqueduct and Lostock for Treatment	C	-	-	0	0	-	--	-	0	0	--	-	-
		O	0	0	0	0	0	0	+/-	+	0	-	0	0
WR004	Longsleddale Reservoir	C	--/?	-	0	--	-	--	-	++/-	0	--	-	--
		O	--/?	0	--	0	0	-	++/?	++	0	-	0	--
WR006	Glaze Brook	C	--/?	-	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	-/?	-	0	0	++	++	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR007	Sankey Brook	C	-	-	0	0	-	--	-	++/-	0	--	-	-
		O	-/?	0	-/?	0	0	0	+	+	0	-	0	0
WR009	River Rawthey to Watchgate	C	-	-	0	-	-	--	0	++/-	0	--	-	-
		O	-/?	0	-/?	0	0	-	++/?	++/?	0	-	0	-
WR012	Borrow Beck Reservoir	C	--/?	--	0	--	-	--	-	++/-	0	--	--	--
		O	--	0	--	-	0	-	++	++	0	-	0	--
WR026a	River Ribble Support to Stocks Reservoir	C	--	-	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	-/?	-	0	-	+/?	+	0	-	0	-
WR037a	Haweswater Reservoir (Raise Embankment Structure)	C	--/?	+	0	--	-	-	-	++/-	0	-	-	--

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	--	0	0	0	0	-/?	++	++	0	-/?	0	-
WR037b	Haweswater Reservoir (Raise Embankment Structure)	C	--/?	+	0	--	-	-	-	++/-	0	-	-	--
		O	--	0	0	0	0	-/?	++	++	0	-/?	0	-
WR039a	River Eden (Temple Sowerby) to Watchgate	C	--/?	0	0	-	--	--	-	++/--	0	--	-	-
		O	--/?	0	--	-	0	-	++/?	++	0	-	0	-
WR047a	Milwr Tunnel, Bagillt (Transfer to Huntington)	C	-	+	0	-	-	--	-	++/-	0	--	-	-
		O	?	0	-/?	-	0	-	++	++	0	-	0	0
WR049b	River Ribble (Transfer to Anglezarke IR)	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	-/?	-	0	-	++	++	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR062a	Worthington WTW	C	**0**	**+**	**0**	**-**	**-**	**--**	**-**	**++**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**0**	**-**	**0**	**0**	**++**	**++**	**0**	**-**	**0**	**0**
WR062b	Worthington WTW (Rivington)	C	**-**	**0**	**0**	**-**	**-**	**--**	**-**	**++/-**	**0**	**--**	**-**	**0**
		O	**-**	**0**	**0**	**0**	**0**	**0**	**++/?**	**++**	**0**	**-**	**0**	**0**
WR074	River Darwen (Transfer to Fishmoor WTW	C	**-**	**-**	**0**	**-**	**-**	**--**	**-**	**++/-**	**0**	**--**	**-**	**-**
		O	**-/?**	**?**	**-/?**	**0**	**0**	**-**	**+**	**+**	**0**	**-**	**0**	**0**
WR076	River Bollin	C	**-**	**-**	**0**	**--**	**-**	**--**	**-**	**++/-**	**0**	**--**	**-**	**-**
		O	**-/?**	**0**	**-/?**	**--**	**0**	**-**	**++**	**++**	**0**	**-**	**-**	**-**
WR079b	Appleton Reservoir, Warrington	C	**-**	**0**	**0**	**-**	**-**	**--**	**-**	**++**	**0**	**--**	**-**	**-**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	?	0	-/?	0	0	0	+/?	+	0	-	0	-
WR079c	Appleton Reservoir, Warrington	C	-	0	0	-	-	--	-	++	0	--	-	-
		O	?	0	-/?	0	0	0	+/?	+	0	-	0	-
WR079d	Appleton Reservoir, Warrington	C	-	0	0	-	-	--	-	++	0	--	-	-
		O	?	0	-/?	0	0	0	++/?	++	0	-	0	-
WR099a	Worsthorne Borehole (Compensation)	C	0	+	0	0	0	-	0	0	0	-	0	0
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR099b	Worsthorne Borehole (Hurstwood IR)	C	-	+	0	0	0	-	0	0	0	-	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR099c	Worsthorne Borehole (Worsthorne WTW)	C	0	+	0	0	0	-	0	0	0	-	0	0
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR100	Thorncliffe Road Borehole, Barrow-in-Furness	C	-	+	0	0	-	--	-	+	0	--	0	0
		O	0	0	+/?	0	0	0	+	+	0	-	0	0
WR101	Franklaw Z Site Plus Increased Franklaw WTW Treatment Capacity	C	0	+	0	-	-	--	-	++/-	0	--	0	0
		O	0	0	-/?	-	0	-	++	++	0	-	0	0
WR102a	Widnes Boreholes to Prescot WTW	C	-	+	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	-	0	-	++	++	0	-	0	-
WR102ai		C	-	+	0	-	-	--	-	++/-	0	--	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Widnes Boreholes to Prescot WTW	O	0	0	0	-	0	--	++	++	0	--	0	-
WR102b	Widnes Boreholes to Liverpool and Warrington DMZs	C	-	+	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	-	0	--	++	++	0	--	0	-
WR102c	Widnes Boreholes to Runcorn and Warrington DMZs	C	-	-	0	-	--	--	-	++/--	0	--	-	-
		O	0	0	0	-	0	--	++	++	0	--	0	-
WR102d	Eccleston Hill Borehole to Prescot WTW	C	-	+	0	0	-	--	0	0	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR102e		C	-	+	0	0	-	--	-	+/-	0	--	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Bold Heath Boreholes to Prescot WTW	O	0	0	0	0	0	-	+	+	0	-	0	0
WR105a	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	-
WR105ai	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	-
WR105b	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Hill Cliffe)	C	-	+	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	0	+	+	0	-	0	-
WR105bi		C	-	+	0	-	-	--	-	++/-	0	--	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Hill Cliffe)	O	0	0	0	0	0	-	+	+	0	-	0	-
WR106	Walton and Daresbury Boreholes	C	-	+	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	-	+	+	0	-	0	-
WR107a	Aughton Park Moss End Boreholes	C	-	+	0	0	-	--	0	++/-	0	--	0	-
		O	0	0	-/?	0	0	-	+	+	0	-	0	0
WR107ai	Aughton Park Moss End Boreholes	C	-	+	0	0	-	--	0	++/-	0	--	0	-
		O	0	0	-/?	0	0	-	+	+	0	-	0	0
WR107b		C	-	-	0	-	-	--	-	++/-	0	--	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Randles Bridge, Knowsley, Primrose Hill	O	0	0	-/?	-	0	-	++	++	0	-	0	0
WR109	Swineshaw Boreholes (Buckton Castle WTW)	C	0	+	0	0	0	-	0	0	0	-	0	0
		O	--/?	0	0	0	0	0	+	+	0	-	0	0
WR110	Rushton Spencer Boreholes	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	-/?	0	0	0	+	+	0	-	0	0
WR111	Woodford Borehole	C	-	-	0	0	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	0	+	+	0	-	0	-
WR112	Bramhall Borehole	C	-	-	0	0	-	--	-	++/-	0	--	-	-
		O	0	0	-/?	0	0	-	+	+	0	-	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR113	Tytherington Boreholes	C	0	+	0	0	-	--	-	0	0	--	-	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR114	Python Mill Borehole	C	-	+	0	-	-	--	-	0/-	0	--	-	-
		O	?	0	-/?	-	0	0	+	+	0	-	0	0
WR119a	Egremont Boreholes (Existing)	C	-	+	0	-	-	--	-	++/-	0	--	0	-
		O	0	0	0	0	0	-	++	++	0	-	0	-
WR119b	Egremont Boreholes (New)	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	?	0	--/?	0	0	-	++	++	0	-	-	-
WR120	Cross Hill Boreholes, Wirral	C	-	+	0	0	-	--	-	++/-	0	--	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	?	0	-/?	0	0	-	++	++	0	-	0	-
WR120i	Cross Hill Boreholes, Wirral	C	-	+	0	0	-	--	-	++/-	0	--	0	-
		O	?	0	-/?	0	0	-	++	++	0	-	0	-
WR121a	Eaton Boreholes (Hollins Hill)	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	-	+	+	0	-	0	-
WR121b	Eaton Boreholes (Mid Cheshire Main)	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	-	+	+	0	-	0	-
WR122	Newton Hollows Boreholes	C	-	+	0	0	-	--	-	++	0	--	0	0
		O	0	0	-/?	0	0	0	+	+	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR125	Bearstone Boreholes	C	0/?	+/-	0	-	-	--	-	++	0	--	-	-
		O	0	0	-/?	-	0	-	+	+	0	-	0	0
WR129	North Cumbria Boreholes	C	-	-	0	-	-	--	-	++/-	0	--	-/?	-
		O	?	0	0	0	0	-	+	+	0	-	0	-
WR140	Horwich WwTW – Final Effluent Reuse	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	-/?	-	0	0	+	+	+	-	0	0
WR141	Rossendale WwTW – Final Effluent Reuse	C	-	0	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	-/?	-	0	0	+/?	+	++	-	0	0
WR142		C	-	0	0	-	-	--	0	++/-	0	--	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Hyndburn WwTW – Final Effluent Reuse	O	-/?	0	-/?	-	0	0	+/?	+	++	-	0	0
WR144	Saddleworth and Mossley Top – Final Effluent Reuse	C	-	0	0	-	-	--	-	+	0	--	-	-
		O	0	0	0	-	0	0	+	+	+	-	0	0
WR146	Davyhulme – Final Effluent Reuse	C	0	+	0	-	-	--	0	++/-	0	--	0	-
		O	?	0	-/?	-	0	--	++	++	++	--	0	0
WR153	Simmonds Hill – Increased WTW Capacity	C	-	+	0	0	-	--	-	++/-	0	--	-	-
		O	?	0	-/?	0	0	0	++	++	0	-	0	0
WR154		C	-	+	0	-	0	-	-	+	0	-	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Sandiford – Increased WTW Capacity	O	0	0	-/?	-	0	-	+	+	0	-	0	0
WR159	Group 1 - Improved Reservoir Compensation Release Control	C	-	+	0	-	0	-	-	0	0	-	-	-
		O	0/?	0	0	0/?	0	+	++	++	++	0	0	0
WR160	Group 2 – Improved Reservoir Compensation Release Control	C	-	+	0	-	0	-	-	0	0	-	-	-
		O	0/?	0	0	0/?	0	+	+	+	++	0	0	0
WR800	River Bela to Thirlmere Aqueduct	C	-	+	0	-	-	--	-	+/-	0	--	-	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR810	Cow Green IR to Haweswater via Heltondale Aqueduct (Northumbrian Water)	C	--	0	0	-	--	--	-	++/--	0	--	-	--
		O	--/?	0	0	-	0	-	++/?	++	0	-	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR812	Transfer of raw water from Kielder Water IR (Northumbrian Water) to the IRZ	C	--/?	-	0	-	--	--	-	++/--	0	--	-/?	--
		O	--/?	0	?	0	0	--	++/?	++	0	--	0	-
WR813	Scammonden IR to Buckton Castle via Huddersfield Narrows Canal	C	-	0	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	0	-	0	0	+	+	0	-	0	0
WR814a	Increased abstraction capacity at Heronbridge	C	-	-	0	0	-	--	-	++/-	0	--	-	-
		O	0/?	0	+/?	0	0	-	++	++	0	-	-	-
WR814b	Increased abstraction capacity at Heronbridge	C	-	-	0	0	-	--	-	++/-	0	--	-	-
		O	?	0	-/?	0	0	0	++/?	++	0	-	-	-
WR814c		C	-	-	0	-	--	--	-	++/--	0	--	--	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Increased abstraction capacity at Heronbridge	O	-/?	0	-/?	0	0	0	++/?	++	0	-	0	-
WR816	Manchester Bolton Bury Canal to Integrated Zone	C	-	0	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	0	0	0	0	+/?	+	0	-	0	-
WR817	Carr Mill Dam to Integrated Resource Zone	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	-/?	0	0	-	0	-	++/?	++	0	-	0	-
WR820	Shropshire Union Canal to Integrated Resource Zone	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	0	++	++	0	-	-	-
WR821	Shropshire Union Canal	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	0	++	++	0	-	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
B2	Thames Water Trading Enabling Works including Severn Thames Transfer (Cumulative assessment)	C	**-/?**	**+/-**	**0**	**-**	**-**	**--**	**-**	**++/-**	**0**	**--**	**--**	**--**
		O	**-**	**0**	**-**	**0**	**0**	**+/--**	**++**	**++**	**0**	**--**	**0**	**-**

Construction Effects

Construction of the majority of the identified feasible resource management options for the Strategic Resource Zone would require a large capital investment (in excess of £10 million) that would be likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. Where this is the case, the options were assessed as having a significant positive effect on wellbeing (SEA Objective 8). For a total of five options (Options WR100, WR102e, WR144, WR154 and WR800), investments would be less (i.e. below £10 million but greater than £5 million) and therefore positive effects on this objective were assessed as minor (a total of 11 options were assessed as having neutral effects in this regard as the level of investment associated with their implementation would be below £5 million). HGV movements and large scale pipeline works associated with many of the options are considered to have the potential to cause traffic disruption, generating a minor negative effect on SEA Objective 8 and leading to an overall mixed score against the objective. In the case of five options (Options WR039a, WR102c, WR810, WR812 and WR814c), significant negative effects were identified in this regard given the extent of pipeline works, volume of associated vehicle movements and requirements for major road crossings.

No further significant positive effects were identified during the assessment. A total of 32 options were assessed as having a minor positive effect on geology and soils (SEA Objective 2) as new infrastructure associated with these schemes would be located at existing sites, making best use of existing sites and not requiring new land. A further two options (Options WR125 and B2) were assessed as having a mixed minor positive and negative effect on this objective as works would involve the use of existing sites but would also result in the loss of greenfield land.

The majority of the feasible options were assessed as having a negative effect on biodiversity (SEA Objective 1) during the construction phase. This reflects the potential for construction works associated with the option to result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. Two options were assessed as having a significant negative effect on this objective (Option WR026a and Option WR810). Option WR026a would involve excavation directly through Bell Sykes Meadows SSSI with no obvious alternative route to mitigate/prevent any potential effects on this conservation area. Option WR810, meanwhile, would require the laying of circa 13km of pipeline directly within Moors House-Upper Teesdale National Nature Reserve (NNR)/SAC, Upper Teesdale SSSI, Appleby Fells SSSI and the North Pennine Moors SPA. These overlapping conservation areas constitute an extensive upland area within the North Pennines containing a number of nationally rare habitat types as well as a variety of representative habitats and associated plant and animal communities which are unlikely to be fully mitigated against risks resulting from excavation. A further seven options (Options WR004, WR006, WR012, WR037a/b, WR039a and WR812) were assessed as having a *potentially* significant negative effect on biodiversity due to possible effects on a range of European designated sites including (inter alia): River Kent and Tributaries SAC (SSSI); Manchester Mosses SAC (Holcroft Moss SSSI); Lake District High Fells SAC (Shap Fells SSSI); the Asby Complex SAC (Crosby-Ravensworth Fell SSSI); North Pennine Dale Meadows SAC; Naddle Forest SAC (SSSI); Moors House-Upper Teesdale SAC (NNR); North Pennine Moors SPA; and Border Mires, Kielder – Butterburn SAC. However, in these cases HRA Screening has identified that potential effects on these sites could be avoided or mitigated by utilising scheme specific mitigation in conjunction with best practice. Furthermore, it would be anticipated that scheme level investigations and appropriate assessment would be undertaken at the project stage should these options be taken forward.

A total of 30 feasible options were assessed as having a negative effect on geology and soils (SEA Objective 2) which principally reflects the loss of greenfield land including that which is 'best and most versatile' (land classified as 'best and most versatile land' is generally defined as agricultural land which falls into Grades 1, 2 and 3a). Option WR012 was assessed as having a significant negative effect on SEA Objective 2. This option would involve the development of a new impounding reservoir in Borrow Beck between Shooter Howe and Belt Howe. The construction of this option would involve the permanent loss of a significant area of greenfield land (although this would be of relatively poor (Grade 5) agricultural land quality) as well as an existing farm.

Construction activity associated with the majority of the feasible options would take place within or proximate to a Flood Zones 2/3 and works may therefore be vulnerable to flooding (depending on timing). A total of five options (Options WR004, WR012, WR037a/b and WR076) were considered to be particularly vulnerable

to flood risk given the scale of works that would take place in Flood Zone 3; in these cases, negative effects on flood risk (SEA Objective 4) were assessed as significant.

Construction activity would generate emissions to air associated with the use of plant and machinery as well as vehicle movements. The majority of the feasible options were therefore assessed as having negative effects on air quality (SEA Objective 5). Reflecting the likely volume of vehicle movements and potential for works to lead to traffic congestion, Options WR039a, WR102c, WR810, WR812 and WR814c were assessed as having a significant negative effect on this objective.

Given the scale of construction activity associated with the construction of the feasible options, most were assessed as having a significant negative effect on climate change (SEA Objective 6). This reflects the anticipated emissions of greenhouse gases from vehicle movements, construction plant and the embodied carbon in raw materials. Material use, energy requirements and waste generation would also be substantial and therefore these options were also assessed as having a significant negative effect on resource use (SEA Objective 10).

Options WR012 and WR814c were assessed as having significant negative effects on cultural heritage (SEA Objective 11). The implementation of Option WR012 would result in the loss of Low Borrowdale Farm House Grade II Listed Building whereas pipeline works required for Option WR814c would be directly routed through Offa's Dyke and Wat's Dyke Scheduled Monuments and Pontcysyllte Aqueduct and Canal World Heritage Site. Additionally, Option B2 was assessed as having a significant negative effect on this objective, reflecting the findings of the Environmental Report prepared in support of the Thames Water Draft WRMP 2019. This was due to the large number of designated assets in proximity to the construction areas associated with the scheme. Due to potential impacts on the settings of cultural heritage assets such as listed buildings and scheduled monuments, a further 51 feasible options were assessed as having a minor negative effect on SEA Objective 11 during construction.

The development of water resources infrastructure including pipeline works has the potential to temporarily affect landscape character and/or visual amenity. The majority of feasible options were therefore assessed as having a negative effect on landscape (SEA Objective 12). Those options involving more substantial development (for example, modifications to existing/development of new reservoirs, extensive pipeline works and new water treatment works) within the Lake District National Park and World Heritage Site were assessed as having a significant negative effect on this objective during the construction phase. These options include Options WR004, WR012, WR037a/b, WR810, and WR812. Pipeline works associated with Option WR810 may also adversely affect the North Pennines AONB and Yorkshire Dales National Park whilst Option WR812 would require new pipelines and a pumping station in Northumberland National Park. Option B2, meanwhile, would require significant pipeline works within the Cotswolds AONB and in consequence, this option was also assessed as having a significant negative effect on landscape within the Thames Water Draft WRMP Environmental Report.

No further significant negative effects were identified during the assessment. The majority of feasible options were assessed as having a negative effect on human health (SEA Objective 7) due to the potential for emissions to air from HGV movements and construction plant together with noise/vibration from construction activity to affect residential and other receptors such as users of open space in close proximity to development sites and along transport routes. However, any impacts would be temporary and are likely to be managed through the adoption of good construction practice.

All options were assessed as having a neutral effect in respect of water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9) during the construction phase. Whilst a number of options would involve works in close proximity to/within watercourses, it is not expected that construction activity would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Operational Effects

All of the feasible resource management options were assessed as having a positive effect on health (SA Objective 7) and wellbeing (SA Objective 8) as their operation would help to ensure the continuity of a safe and secure drinking water supply which may in-turn support economic and population growth. In the case of 36 options, effects on these SEA objectives were assessed as significant which reflects their larger design capacities.

Those options that would involve either the reuse of final effluent or improved management of compensations flows would deliver a yield benefit/improved resilience without the need for additional abstraction of water and were assessed as having a positive effect on water resources (SEA Objective 9). The yield benefit associated with Options WR141, WR142, WR146, WR159 and WR160 would be greater than 5 Ml/d and consistent with the definitions of significance contained in **Appendix C**, they were assessed as having a significant positive effect on water resources (SEA Objective 9).

No further significant positive operational effects were identified during the assessment. Options WR100 and WR814a were assessed as having a positive effect on water quantity and quality (SEA Objective 3) as they would support an overall reduction in abstraction quantity which may benefit the hydrological regime, although uncertainty remains in this regard. Options WR159, WR160 and B2, meanwhile, were assessed as having minor positive effects in respect of climate change (SEA Objective 6) as they would support improved climate change resilience/adaptation.

The operation of 33 feasible options was assessed as having a potentially negative effect on biodiversity (SEA Objective 1) (although in most cases uncertainty remains). This principally reflects the potential for abstraction to affect aquatic habitats and species. In this context, Options WR012, WR037a and WR037b were assessed as having a significant negative effect on biodiversity due to the potential for impacts on designated European sites such as the River Eden SAC and the Naddle Forest SAC (under Options WR037a/b) and significant long term and unavoidable effects to local habitats and ecological features (Option WR012). Significant negative effects were also identified in respect of Options WR004, WR039a, WR109, WR810 and WR812, though with a higher degree of uncertainty, due to potential impacts on European designated sites such as the River Kent and Tributaries SAC and River Eden SAC. Four options (Options WR004, WR012, WR039a and WR119b) were also considered likely to have significant negative effects on water quantity and quality (SEA Objective 3) due to associated reductions in surface and groundwater levels and potential impacts on the WFD status of waterbodies. A total of 32 options were assessed as having minor negative effects on this objective. For both significant and minor effects identified, uncertainty remains with respect to the likelihood of adverse effects occurring and this would require further investigation at the project stage with appropriate mitigation implemented where possible informed by scheme level assessments.

Option WR076 would involve the development of abstraction infrastructure and a WTW within Flood Zone 3 and in consequence, it was assessed as having a significant negative effect on flood risk (SEA Objective 4) whilst a number of other options (23) were assessed as having a minor negative effect on this objective. It should be noted, however, that it is not expected that operation of the feasible options would cause or exacerbate flood risk elsewhere.

The operation of the feasible options would require energy and generate greenhouse gas emissions associated with the treatment and pumping of water. Emissions associated with over half (40) of the feasible options would be greater than 100 tCO_2e and consistent with the definitions of significance contained in **Appendix C**, they were assessed as having a negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10). A total of six of these options (Options WR102ai, WR102b, WR102c, WR146, WR812 and B2) would generate in excess of 1,000 tCO_2e during operation and in consequence, these options were assessed as having a significant negative effect on SEA Objectives 6 and 10.

The operation of new above ground infrastructure may have adverse landscape and visual amenity impacts, particularly where located on greenfield sites in rural settings or where development is adjacent to sensitive receptors. Options WR004 and WR012 would involve the development and operation of new reservoirs within the Lake District National Park and World Heritage Site which would be expected to have substantial impacts on the special qualities of the Park as well as on the visual amenity of recreational receptors. In consequence, these options were assessed as having a significant negative effect on landscape (SEA Objective 12). A large proportion of the remaining options (37) were assessed as having a minor negative effect on this objective.

No further significant negative effects associated with the operation of the feasible options were identified during the assessment. A small number of options (Options WR076, WR119b, WR814a, WR814b, WR820 and WR821) were assessed as having minor negative effects on cultural heritage (SEA Objective 11) due to potential impacts on the settings of proximate heritage assets associated with new above ground infrastructure.

Once construction activity is complete, it is not expected that any of the feasible options would have adverse air quality impacts. Effects on SEA Objective 5 were therefore assessed as neutral. Operational effects on geology and soils (SEA Objective 2) were also assessed as neutral; the one exception to this is Option WR074 which was assessed as having an uncertain effect on this objective as abstraction from the River Darwen under this option could affect the Darwen River Section SSSI, a significant site for geological study.

Demand Management Options

A total of 15 demand management (including water efficiency and metering) options were assessed for the Strategic Resource Zone; these are listed in **Table 5.9** together with the related estimated total water saving. The results of the assessment of these options is presented in **Table 5.10** with commentary on the likely significant construction (i.e. enabling/installation/implementation) and operational effects identified provided below.

Table 5.9 Demand Management Options: Strategic Resource Zone

Ref	Option Name	Description	Estimated Maximum Saving (Ml/d)
WR606a	Existing domestic water saving retrofit products - installation through smart home visits	Under this option, existing domestic customers would receive a water audit. Water-saving retrofit products including shower heads, shower timers, save-a-flush etc. would subsequently be installed by a United Utilities representative (estimated 9,816 installations per year over a 5 year period).	2.04 Ml/d
WR606b		Under this option, existing domestic customers would receive a water audit. Water-saving retrofit products including shower heads, shower timers, save-a-flush etc. would subsequently be installed by a United Utilities representative (estimated 9,814 installations per year over a 10 year period).	4.08 Ml/d
WR610a	Education programme	This option would involve United Utilities developing and delivering a water efficiency educational programme for roll-out to Key Stage (KS) 2 students over a 5 year period.	1.41 Ml/d
WR610b		This option would involve United Utilities developing and delivering a water efficiency educational programme for roll-out to KS2 students over a 10 year period.	2.83 Ml/d
WR611a	Partnership projects with public and third sector organisations, e.g. Housing Associations	This option would involve United Utilities partnering with public and third sector organisations to deliver an estimated 19,631 water efficiency projects per annum over a 5 year period. Projects would range from equipment retrofits to education and awareness campaigns.	4.05 Ml/d
WR611b		This option would involve United Utilities partnering with public and third sector organisations to deliver an estimated 19,628 water efficiency projects per annum over a 10 year period. Projects would range from equipment retrofits to education and awareness campaigns.	8.09 Ml/d
WR615a	Fixing leaking toilets	This option consists of United Utilities' customers receiving a water audit and toilet retrofit (estimated 2,454 per annum over a 5 year period).	2.60 Ml/d
WR615b		This option consists of United Utilities' customers receiving a water audit and toilet retrofit (estimated 2,454 per annum over a 10 year period).	5.20 Ml/d

Ref	Option Name	Description	Estimated Maximum Saving (Ml/d)
WR620a	Provision of free water efficiency goods and advice to all newly metered customers	Under this option, newly metered customers would receive advice on increasing their water efficiency in addition to free water efficiency equipment (estimated 35,653 per annum over a 5 year period).	8.34 Ml/d
WR620b		Under this option, newly metered customers would receive advice on increasing their water efficiency in addition to free water efficiency equipment (estimated 34,153 per annum over a 10 year period).	15.99 Ml/d
WR623a	Offering water efficiency home checks when installing a meter at a customer's property	Under this option, a United Utilities representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 35,653 audits per annum over a 5 year period.	7.41 Ml/d
WR623b		Under this option, a United Utilities representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 34,153 audits per annum over a 10 year period.	14.20 Ml/d
WR716a	Promote to customers who had service renewal - 5 years	This option would involve a promotional campaign for metering that would target customers who recently had a service renewal with United Utilities. It is anticipated that an average of 337 meters would be installed per annum over a 5 year period.	0.05 Ml/d
WR716b	Promote to customers who had service renewal - 10 years	This option would involve a promotional campaign for metering which would target customers who recently had a service renewal with United Utilities. It is anticipated that an average of 451 meters would be installed per annum over a 10 year period.	0.13 Ml/d
WR905	Third Party - Customer awareness and smart metering [reduce demand - increase metering]	This option would involve water efficiency awareness raising and targeted installation of smart meters by a Third Party over a 7 year period.	1.34 Ml/d

Table 5.10 Assessment of Demand Management Feasible Options: Strategic Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR606a	Existing domestic water saving retrofit products - installation through smart home visits	C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**0**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**+**	**+**	**+**	**++**	**0**	**0**
WR606b	Existing domestic water saving retrofit products - installation through smart home visits	C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**+**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**+**	**+**	**+**	**++**	**0**	**0**
WR610a	Education programme	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR610b	Education programme	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR611a	Partnership projects with public and third sector organisations, e.g. Housing Associations	C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**+**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**+**	**+**	**+**	**++**	**0**	**0**
WR611b	Partnership projects with public and third sector organisations, e.g. Housing Associations	C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**++**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**+**	**+**	**++**	**++**	**0**	**0**
WR615a	Fixing leaking toilets	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR615b	Fixing leaking toilets	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**+**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**++**	**0**	**0**	**0**
WR620a		C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**0**	**0**	**--**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Provision of free water efficiency goods and advice to all newly metered customers	O	0	0	+	0	0	++	+	+	++	++	0	0
WR620b	Provision of free water efficiency goods and advice to all newly metered customers	C	0	0	0	0	-/?	--	0	0	0	--	0	0
		O	0	0	+	0	0	++	++	++	++	++	0	0
WR623a	Offering water efficiency home checks when installing a meter at a customer's property	C	0	0	0	0	-/?	--	0	0	0	--	0	0
		O	0	0	+	0	0	++	+	+	++	++	0	0
WR623b	Offering water efficiency home checks when installing a meter at a customer's property	C	0	0	0	0	-/?	--	0	0	0	--	0	0
		O	0	0	+	0	0	++	++	++	++	++	0	0
WR716a	Promote to customers who had service renewal - 5 years	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR716b	Promote to customers who had service renewal - 10 years	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR905	Third Party - Customer awareness and smart metering [reduce demand - increase metering]	C	**0**	**0**	**0**	**0**	**0**	**--**	**0**	**0**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**+**	**+**	**0**	**0**

Construction Effects

Expenditure associated with the enabling works necessary for the demand management options would be relatively small and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that employment opportunities are likely to be limited. In consequence, the feasible demand management options identified for the Strategic Resource Zone were assessed as having either neutral or minor positive effects on wellbeing (SEA Objective 8). However, expenditure related to Option WR611b could be of a scale that may generate significant positive effects on this objective.

Apart from Option WR611b, no further significant positive effects were identified during the assessment of the enabling/installation and implementation works associated with the demand management options.

Implementation of the demand management options would require different amounts of raw materials, energy and carbon. As the majority of options would require engineers and/or United Utilities representatives to conduct audits, participate in partnerships or educational programmes, and/or retrofit premises with water efficient equipment and metres, there would also be emissions related to vehicle movements. Emissions associated with nine of the feasible demand management options would exceed 1,000 tCO_2e and consistent with the definitions of significance (see **Appendix C**), they were assessed as having a significant negative effect on climate change (SEA Objective 6) as well as resource use (SEA Objective 10). Option WR615b, meanwhile, would produce emissions up to 349 tCO_2e and this option was assessed as having a minor negative effect on climate change. Emissions/resource use associated with the remaining demand management options would be very small and these options were therefore assessed as having a neutral effect on these SEA objectives.

No further significant negative effects were identified during the assessment. As noted above, there would be increased vehicle movements during the implementation period of the demand management options, the emissions from which could have adverse effects on air quality (SEA Objective 5). Options WR611a/b, WR620a/b and WR623a/b would generate in excess of 80,000 vehicle movements per annum whilst movements associated with Options WR606a/b would be 15,105 and 31,405 respectively. This scale of vehicle movements is not considered likely to cause significant effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if such a scale of vehicle movements were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and may be considered significant. Movements associated with the remaining options would be small such that it is expected that they would have a negligible effect on SEA Objective 5.

Environmental effects associated with the implementation phase of the feasible demand management options on the remaining SEA objectives are likely to be very similar. None of the options identified would involve new development and where water efficiency devices are installed, this would take place within the curtilages of existing properties. In consequence, none of the options would be expected to have noticeable effects on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), health (SEA Objective 7), water resources (SEA Objective 9), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Operational Effects

Demand reductions associated with the operation of water efficient devices and metering as well as increased water efficiency as a result of educational programmes in the Strategic Resource Zone would generate savings of between 0.05 Ml/d and 15.99 Ml/d. For all options, this was assessed as having a positive effect in respect of water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9). Options WR611b, WR615b, WR620a/b and WR623a/b would generate savings in excess of 5 Ml/d and consistent with the definitions of significance (see **Appendix C**), these options were assessed as having a significant positive effect on SEA Objective 9.

Demand reductions may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. Energy savings and emission reductions associated with Options WR606a/b, WR611a/b, WR620a/b and WR623a/b would be in excess of 1,000 tCO_2e per annum (on average over the first ten years of operation, although savings would gradually decline over time) and for these options, significant positive effects were identified in respect of climate change (SEA Objective 6) and resource use (SEA Objective 10). A further five options were assessed as having a positive effect on these objectives.

Savings associated with the water efficiency options would help ensure a continual supply of clean drinking water and may support economic/population growth; these options were therefore assessed as having a positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8). For Options WR620b and WR623b, savings would be 15.99 Ml/d and 14.20 Ml/d respectively and consistent with the definitions of significance, both options were assessed as having a significant positive effect on SEA Objectives 7 and 8. Savings associated with the metering options (Options WR716a/b) would be relatively small (0.05 Ml/d and 0.13 M/d respectively) and these options were therefore assessed as having a neutral effect on SEA Objectives 7 and 8.

No further significant positive effects were identified during the assessment.

Once installed, the feasible demand management options are considered unlikely to have any adverse environmental effects and no significant or minor negative effects were identified during the assessment.

Demand Management - Leakage Reduction and Network Metering Options

A total of 30 leakage reduction and network metering options were assessed for the Strategic Resource Zone, including an additional six options identified by United Utilities following consultation on the Draft WRMP (Options 500f-k); these are listed in **Table 5.11** together with the related estimated total water saving. The results of the assessment of these options is presented in **Table 5.12** with commentary on the likely significant construction and operational effects identified provided below.

Table 5.11 Leakage Reduction Options: Strategic Resource Zone

Ref	Option Name	Description	Estimated Total Saving (Ml/d)
WR500a	Leakage reduction stage 1	Options WR500a to WR500e would involve an increase in leakage detection and repair activity through the installation of PMVs over an 11 year period. Activities for Stages 1 to 5, would be as follows: • Stage 1: A total of 276 leakage surveys, 510 repairs and 10 PMV installations would be undertaken. • Stage 2: An additional 339 leakage surveys, 510 repairs and 13 PMV installations would be undertaken • Stage 3: An additional 332 leakage surveys, 408 repairs and 12 PMV installations would be undertaken. • Stage 4: An additional 520 leakage surveys, 510 repairs and 19 PMV installations would be undertaken. • Stage 5: An additional 692 leakage surveys, 510 repairs and 26 PMV installations would be undertaken.	10 Ml/d
WR500b	Leakage reduction stage 2		20 Ml/d (including Stage 1)
WR500c	Leakage reduction stage 3		28 Ml/d (including Stages 1 and 2)
WR500d	Leakage reduction stage 4		38 Ml/d (including Stages 1, 2 and 3)
WR500e	Leakage reduction stage 5		48 Ml/d (Including Stages 1, 2 3 and 4)
WR500f	Leakage reduction stage 6	Options WR500f to WR500k would involve additional leakage detection and repair activity (to that already set out for Stages 1 – 5) through the installation of noise loggers over a six year period. Activities for Stages 6 -11 would be as follows:	4.99 Ml/d
WR500g	Leakage reduction stage 7		9.81 Ml/d (including Stage 6)

Ref	Option Name	Description	Estimated Total Saving (Ml/d)
WR500h	Leakage reduction stage 8	• Stage 6: A total of 85 leakage surveys, 511 repairs and 4,424 noise logger installations would be undertaken. • Stage 7: An additional 104 leakage surveys, 625 repairs and 8,148 noise logger installations would be undertaken. • Stage 8: An additional 225 leakage surveys, 1,350 repairs and 20,083 noise logger installations would be undertaken. • Stage 9: An additional 231 leakage surveys, 1,388 repairs and 25,575 noise logger installations would be undertaken. • Stage 10: An additional 257 leakage surveys, 1,542 repairs and 29,235 noise logger installations would be undertaken. • Stage 11: An additional 112 leakage surveys, 671 repairs and 17,098 noise logger installations would be undertaken.	19.81 Ml/d (including Stages 6 to 7)
WR500i	Leakage reduction stage 9		29.95 Ml/d (including Stages 6 to 8)
WR500j	Leakage reduction stage 10		39.90 Ml/d (including Stages 6 to 9)
WR500k	Leakage reduction stage 11		45.23 Ml/d (including Stages 6 to 10)
WR503	Monitoring of household meters to identify and fix supply pipe leaks	This option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5 year period.	3.81 Ml/d
WR506	Free supply pipe leak repair to non-household customers	Under this option, United Utilities would provide free repair to all private non-household supply pipe leaks over a 5 year period.	0.50 Ml/d
WR511	Network metering enhancements	This option would involve enhancing network metering including logger verification, meter verification and meter under/over registration over a 5 year period.	8.22 Ml/d
WR514	Logging of large customers	This option would involve the logging of large customers over a 5 year period (it is assumed that 10% of those temporarily logged would become permanent). This would require the installation of loggers to all customers identified as having high consumption (above 500 l/hr) in either District Metering Areas (DMAs) with poor operability or DMAs with good operability in order to assess which customers have the largest impact on the operability within DMAs. Logged customers would be setup in Netbase and their night use allowances would be updated to reflect the percentage of night use to daily consumption which should have a positive impact on operability and leakage.	1.07 Ml/d
WR515	Splitting District Metering Areas	This option includes a study of non-operable DMAs over a 5 year period to determine the reason(s) why a DMA is not currently operable, and subsequently, to carry out appropriate actions to remedy any identified issues and/or constraints. The option scope includes office design, hydraulic modelling and site investigation in addition to the construction of chambers, installation of meters and the repair of pipework and ancillary equipment.	2.15 Ml/d
WR517	Upstream tiles enhancements	This option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.	3.57 Ml/d
WR520	Set up hydraulic water supply zones for analysis and reporting	Under this option, desk top exercises would establish new hydraulic areas in Netbase in order to set up new hydraulic water supply zones for analysis and reporting.	0.48 Ml/d

Ref	Option Name	Description	Estimated Total Saving (Ml/d)
WR903a	Third Party Consulting - Proactive Leakage Reduction Service	Under this option, Third Party Consulting would provide a specialist proactive leakage detection service to reduce leakage over a 5 year period.	24.7 Ml/d
WR907a	Third Party - Scenario 1 - Stop.Watch Full - Targeted at 100% of Properties	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 10 year period.	108 Ml/d
WR907b	Third Party - Scenario 2 - Stop.Watch Full - Targeted at 20% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	43.20 Ml/d
WR907c	Third Party - Scenario 3 - Stop.Watch Light - Targeted at 100% of Properties	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 10 year period.	108 Ml/d
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	54.0 Ml/d
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	2.12 Ml/d
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	10.53 Ml/d
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	10.53 Ml/d
WR911a	Third Party 1 - Proposal to reduce unaccounted-for water for UU by 5 Ml/day across AMP - unbilled consumption scenario	This option would involve the reduction of unaccounted for water at non-household properties. If water is unaccounted for it has to be reported as leakage. By identifying and accounting for this water, reported leakage is reduced.	5.0 Ml/d
WR911b	Third Party 1 - Proposal to reduce unaccounted-for water for UU by 5 Ml/day across AMP - unbilled + excessive consumption scenario	This option would involve the reduction of unaccounted for water at non-household properties. If water is unaccounted for it has to be reported as leakage. By identifying and accounting for this water, reported leakage is reduced.	5.0 Ml/d
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	This option would involve the reduction of customer side leakage at non-household properties.	5.0 Ml/d
WR914	Third Party - Cello 4S and Regulo	This option would involve surveys and the installation of pressure management devices by a Third Party over a 5 year period together with ongoing maintenance to be undertaken by United Utilities.	4.0 Ml/d

Table 5.12 Assessment of Leakage Reduction and Network Metering Options: Strategic Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR500a	Leakage reduction stage 1	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**++**	**+**	**0**	**0**
WR500b	Leakage reduction stage 2	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**+**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500c	Leakage reduction stage 3	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**+**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500d	Leakage reduction stage 4	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**++**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR500e	Leakage reduction stage 5	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**++**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500f	Leakage reduction stage 6	C	**-/?**	**0**	**0**	**0**	**-/?**	**-**	**-/?**	**0**	**0**	**-**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**+**	**+**	**0**	**0**
WR500g	Leakage reduction stage 7	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**0**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**++**	**+**	**0**	**0**
WR500h	Leakage reduction stage 8	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500i	Leakage reduction stage 9	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500j	Leakage reduction stage 10	C	-/?	0	0	0	-/?	--	-/?	++	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500k	Leakage reduction stage 11	C	-/?	0	0	0	-/?	--	-/?	++	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR503	Monitoring of household meters to identify and fix supply pipe leaks	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR506	Free supply pipe leak repair to non-household customers	C	0	0	0	0	-/?	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR511	Network metering enhancements	C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**0**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**++**	**+**	**0**	**0**
WR514	Logging of large customers	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR515	Splitting District Metering Areas	C	**-/?**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**+**	**+**	**0**	**0**
WR517	Upstream tiles enhancements	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR520	Set up hydraulic water supply zones for analysis and reporting	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR903a	Third Party Consulting - Proactive Leakage Reduction Service	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**+**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR907a	Third Party - Scenario 1 - Stop.Watch Full - Targeted at 100% of Properties	C	**0**	**0**	**0**	**0**	**-/?**	**-**	**0**	**++**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**++**	**++**	**++**	**++**	**0**	**0**
WR907b	Third Party - Scenario 2 - Stop.Watch Full - Targeted at 20% Highest Leakage	C	**0**	**0**	**0**	**0**	**-/?**	**-**	**0**	**++**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR907c	Third Party - Scenario 3 - Stop.Watch Light - Targeted at 100% of Properties	C	**0**	**0**	**0**	**0**	**-/?**	**-**	**0**	**++**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**++**	**++**	**++**	**++**	**0**	**0**
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**+**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**+**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR907g		C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	O	0	0	+	0	0	+	++	++	++	+	0	0
WR911a	Third Party 1 - Proposal to reduce unaccounted-for water for UU by 5 Ml/day across AMP - unbilled consumption scenario	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR911b	Third Party 1 - Proposal to reduce unaccounted-for water for UU by 5 Ml/day across AMP - unbilled + excessive consumption scenario	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR914	Third Party - Cello 4S and Regulo	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0

Construction Effects

Employment opportunities and supply chain benefits may be generated during the implementation of leakage reduction and network metering options in the Strategic Resource Zone. The assessment highlighted that the scale of investment that may potentially be generated by Options WR500d/e/j/k and WR907a-c (which would involve larger scale leakage reduction activity) could potentially be substantial and for these options, positive effects on wellbeing (SEA Objective 8) were assessed as significant. Pipeline repair may take place within and/or utilise road networks which could result in increases in localised congestion and disruption/driver delay throughout the implementation phase of the options, although any effects would be temporary and small in scale.

No further significant positive effects were identified during the assessment.

For the majority of the feasible leakage reduction and network metering options there would be carbon emissions arising from embodied carbon (in, for example, materials for pipeline repair, PMVs, noise loggers and meters/probes) in addition to plant and vehicle movements throughout the investigative and construction period. There would also be an increase in resource use for pipeline repair and construction waste along with fuel usage for vehicles and plant. Embodied carbon and carbon emissions associated with the implementation of Options 500g-k and Option WR511 would be in excess of 1,000 tCO_2e and consistent with the definitions of significance (see **Appendix C**), these option were assessed as having a significant negative effect on climate change (SEA Objective 6) as well as on resource use (SEA Objective 10). The implementation of a further 10 options would produce over 100 tCO_2e and for these options, minor negative effects were identified in respect of SEA Objectives 6 and 10. Carbon emissions associated with the remaining options would not be expected to exceed a maximum of 100 tCO_2 such that effects on climate change (and resource use) would be negligible.

No further significant negative effects were identified during the assessment. Construction activity associated with leakage repair and the installation of equipment may impact on biodiversity (SEA Objective 1) including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through these options, may be subject to extensive excavation and disruption along the route of the affected water main. Works may also have adverse effects on air quality (SEA Objective 5) and health (SEA Objective 7), due to the potential for vehicle movements and the operation of plant to affect local air quality and generate noise/vibration disturbance, and landscape (SEA Objective 12), given the potential for works to have a temporary impact on landscape character and visual amenity. However, as the location of the works to be undertaken is unknown at this stage, some uncertainty remains with regard to the probability of adverse effects on these objectives occurring.

Environmental effects associated with the construction phase of the feasible leakage reduction and network metering options on the remaining SEA objectives are likely to be very similar with effects on geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11) expected to be negligible. This reflects the nature of works under these options and the likelihood that any potential adverse effects would be managed through site-specific mitigation and established best practice.

Operational Effects

The operation of leakage reduction and network metering options would result in less water being lost due to leakage and therefore lower demand for water abstraction. This would benefit the water environment and all of the feasible options were therefore assessed as having a positive effect with respect to water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9). The potential volume of leakage reduction associated with 17 options would be of a magnitude (i.e. above 5 Ml/d) such that effects on SEA Objective 9 could be significant. Fifteen of these options were also assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8) given the potential for water savings to help ensure continuity of water supply and support population and economic growth (a further 13 options were assessed as having a potentially positive effect on these objectives).

Lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. The estimated reduction in greenhouse gas emissions associated with

Options WR907a/c would be in excess of 1,000 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time) and consistent with the definitions of significance (see **Appendix C**), they were assessed as having a significant positive effect on climate change (SEA Objective 6) and resource use (SEA Objective 10). A further 18 feasible options were assessed as having a positive effect on these objectives; the likely scale of emissions reductions associated with the remaining options would be very small and in consequence, they were assessed as having a neutral effect.

No further significant positive effects were identified during the assessment.

No significant or minor negative effects were identified during the assessment. Once works have been completed, the feasible leakage reduction and network metering options are considered unlikely to have any adverse environmental effects.

5.4 North Eden Resource Zone

Resource Management Options

No feasible resource management options were assessed for the North Eden WRZ.

Demand Management Options

A total of seven demand management options were assessed for the North Eden WRZ; these are listed in **Table 5.13** together with the related estimated total water saving. The results of the assessment of these options is presented in **Table 5.14** with commentary on the likely significant construction (i.e. enabling/installation/implementation) and operational effects identified provided below.

Table 5.13 Demand Management Options: North Eden WRZ

Ref	Option Name	Description	Estimated Maximum Saving (Ml/d)
WR608b	Existing domestic water saving retrofit products - installation through smart home visits	Under this option, existing domestic customers would receive a water audit. Water-saving retrofit products including shower heads, shower timers, save-a-flush etc. would subsequently be installed by a United Utilities representative (estimated 20 installations per year over a 10 year period).	0.01 Ml/d
WR613b	Partnership projects with public and third sector organisations, e.g. Housing Associations	This option would involve United Utilities partnering with public and third sector organisations to deliver an estimated 40 water efficiency projects per annum over a 10 year period. Projects would range from equipment retrofits to education and awareness campaigns.	0.02 Ml/d
WR617a	Fixing leaking toilets	This option consists of United Utilities' customers receiving a water audit and toilet retrofit (estimated 5 per annum over a 5 year period).	0.01 Ml/d
WR617b		This option consists of United Utilities' customers receiving a water audit and toilet retrofit (estimated 5 per annum over a 10 year period).	0.01 Ml/d
WR622b	Provision of free water efficiency goods and advice to all newly metered customers	Under this option, newly metered customers would receive advice on increasing their water efficiency in addition to free water efficiency equipment (estimated 24 per annum over a 10 year period).	0.01 Ml/d
WR625a	Offering water efficiency home checks when installing a meter at a customer's property	Under this option, a United Utilities representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 24 audits per annum over a 5 year period.	0.01 Ml/d

Ref	Option Name	Description	Estimated Maximum Saving (Ml/d)
WR625b		Under this option, a United Utilities representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 24 audits per annum over a 10 year period.	0.01 Ml/d

Table 5.14 Assessment of Demand Management Feasible Options: North Eden WRZ

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR608b	Existing domestic water saving retrofit products - installation through smart home visits	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR613b	Partnership projects with public and third sector organisations, e.g. - Housing Associations	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR617a	Fixing leaking toilets	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR617b	Fixing leaking toilets	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR622b	Provision of free water efficiency goods and advice to all newly metered customers	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR625a	Offering water efficiency home checks when installing a meter at a customer's property	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR625b	Offering water efficiency home checks when installing a meter at a customer's property	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**

Construction Effects

The type and range of effects on the SEA objectives due to the enabling/installation/implementation works associated with the demand management options in the North Eden WRZ would be similar to those identified in respect of the Carlisle and Strategic Resource Zones; however, the overall magnitude of effects on the SEA objectives would be reduced commensurate with the relatively small number of customers that would be targeted in this zone.

No significant positive or minor positive effects were identified during the assessment. Expenditure associated with the implementation of the demand management options would be very small and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any employment opportunities are likely to be very limited. In consequence, effects of the feasible options on wellbeing (SEA Objective 8) were assessed as neutral.

No significant negative effects were identified during the assessment. There would be increased vehicle movements during the implementation period associated with the transportation of water efficiency devices and/or workers, the emissions from which could have adverse effects on air quality (SEA Objective 5). However, the number of vehicle movements associated with the implementation of the demand management options in the North Eden WRZ would be very small and therefore any effects on this objective are likely to be negligible.

The demand management options would require different amounts of raw materials, energy and carbon. However, resource use and emissions associated with the feasible options in the North Eden WRZ would be very small and as a result, effects on climate change (SEA Objective 6) and resource use (SEA Objective 10) were assessed as neutral.

Environmental effects associated with the implementation phase of the feasible demand management options on the remaining SEA objectives are likely to be very similar. None of the options identified would involve new development and where water efficiency devices are installed, this would take place within the curtilages of existing properties. In consequence, none of the options would be expected to have noticeable effects on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), health (SEA Objective 7), water resources (SEA Objective 9), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Operational Effects

No significant positive effects were identified during the assessment. Demand reductions through the operation of water efficient devices would have positive effects in respect of water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9).

Demand reductions would reduce greenhouse gas emissions and energy use; however, the estimated decreases in greenhouse gas emissions would be extremely small and in consequence, the feasible options for the North Eden WRZ were all assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The operation of the demand management options would be unlikely to significantly increase/ensure continuity of water supply or support population/economic growth (savings associated with the options would be below 1 Ml/d). Consistent with the definitions of significance (see **Appendix C**), the options were therefore assessed as having neutral effects on health (SEA Objective 7) and wellbeing (SEA Objective 8).

Once installed, the feasible demand management options are considered unlikely to have any adverse environmental effects and no significant or minor negative effects were identified during the assessment.

Demand Management - Leakage Reduction and Network Metering Options

Three leakage reduction and network metering options were identified for the North Eden WRZ; these are listed in **Table 5.15** together with the related estimated total water saving. The results of the assessment of these options is presented in **Table 5.16** with commentary on the likely significant construction and operational effects identified provided below.

Table 5.15 Leakage Reduction Options: North Eden WRZ

Ref	Option Name	Description	Estimated Total Saving (Ml/d)
WR513	Network metering enhancements	This option would involve enhancing network metering including logger verification, meter verification and meter under/over registration over a 5 year period.	0.02 Ml/d
WR519	Upstream tiles enhancements	This option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.	0.01 Ml/d
WR903c	Third Party Consulting - Proactive Leakage Reduction Service	Under this option, Third Party Consulting would provide a specialist proactive leakage detection service to reduce leakage over a 5 year period.	0.07 Ml/d

Table 5.16 Assessment of Leakage Reduction and Network Metering Options: North Eden WRZ

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR513	Network metering enhancements	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR519	Upstream tiles enhancements	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**
WR903c	Third Party Consulting - Proactive Leakage Reduction Service	C	**-/?**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**

Construction Effects

The type and range of effects on the SEA objectives associated with the implementation of leakage reduction and network metering options in the North Eden WRZ would be similar to those identified in respect of the Carlisle and Strategic Resource Zones; however, the overall magnitude of effects would likely be less reflecting the relatively small scale of works/activity in this zone.

No significant positive or minor positive effects were identified during the assessment. Expenditure associated with the implementation of the leakage reduction and network metering options would be relatively small and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any employment opportunities are likely to be very limited. Pipeline repair may take place within and/or utilise road networks which could result in increases in localised congestion and disruption/driver delay throughout the implementation phase of the options, although any effects in this regard would be temporary and small in scale. Overall, the feasible leakage reduction and network metering options were assessed as having a neutral effect on wellbeing (SEA Objective 8).

No significant negative effects were identified during the assessment. Pipeline works associated with Option WR903c may impact on biodiversity (SEA Objective 1) including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through the option, may be subject to excavation and disruption along the route of the affected water main. There may also be adverse effects on landscape (SEA Objective 12), given the potential for works to have a temporary impact on landscape character and visual amenity. However, as the location of the works to be undertaken is unknown at this stage, some uncertainty remains.

Pipeline works under Option WR903c and vehicle movements associated with all of the feasible options may have adverse effects on air quality (SEA Objective 5) and health (SEA Objective 7). However, the number of vehicle movements associated with the feasible leakage reduction and network metering options in the North Eden WRZ would be very small such that any effects on these objectives are likely to be negligible.

There would be a very small increase in resource use for pipeline repair and new equipment together with fuel usage for vehicles and plant, although any effects on SEA Objective 10 are likely to be negligible. There would also be carbon emissions as a result of the implementation of the feasible leakage reduction and network metering options. However, emissions across the options are not expected to exceed a maximum of 100 tCO_2e such that effects on climate change (SEA Objective 6) were assessed as neutral.

Environmental effects associated with the construction phase of the feasible leakage reduction and network metering options on the remaining SEA objectives are likely to be very similar with effects on geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), flood risk (SEA Objective 4), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11) expected to be negligible. This reflects the nature of works under these options and the likelihood that any potential adverse effects would be managed through site-specific mitigation and established best practice.

Operational Effects

No significant positive effects were identified during the assessment. The operation of the feasible options would result in less water being lost due to leakage and therefore lower demand for water abstraction. Whilst the volume of savings associated with the implementation of options in the North Eden WRZ would be very small, consistent with the definitions of significance (see **Appendix C**), all of the options were assessed as having a positive effect with respect to water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9).

Lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, emissions reductions related to the feasible options in the North Eden WRZ would be very small and in consequence, they were assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The level of leakage reduction associated with the feasible options in the North Eden WRZ would be unlikely to significantly increase/ensure continuity of water supply or support population/economic growth (savings

associated with the options would be below 1 Ml/d). Consistent with the definitions of significance, the options were therefore assessed as having neutral effects on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No significant or minor negative effects were identified during the assessment. Once works have been completed, the feasible leakage reduction and network metering options are considered unlikely to have any adverse environmental effects.

5.5 Manchester and Pennine Resilience Solutions

Resilience Solutions

As set out in **Section 5.1**, five potential Manchester and Pennine Resilience solutions were identified by United Utilities as part of the preparation of the Draft WRMP. These solutions are listed below:

- **Solution A (FM20-SO4):** New sources and targeted repair of Tunnel 5 and Tunnel 6 (T05 and T06) of the existing aqueduct, supported by uprating the West East Link Main (WELM) and construction of a new associated break tank near Bolton in conjunction with a new abstraction from the River Irwell and an associated new water treatment works (WTW) (similar to water resources Option WR141).
- **Solution B (C29):** New tunnel sections T05 and T06 and partial UV and metals treatment at existing United Utilities facilities along the length of the existing Manchester and Pennine Aqueduct.
- **Solution C (FM15-SO4b):** Convert the Manchester and Pennine Aqueduct to raw water supply and build new WTWs at Bury and in the Ribble Valley.
- **Solution D (C11):** New tunnel sections T01, T02, T03, T04, T05 and T06.
- **Solution E (C17):** New tunnel sections as for Solution D, plus use of new and existing sources requiring WTW and associated pipelines varying in length from 100 m to over 8 km. The new sources are similar to water resources Options WR049a/b and WR141.

To support United Utilities' decision making, and to ensure consistency between the assessment of the Manchester and Pennine Resilience solutions and the feasible options contained in the Draft WRMP, the component options that make up each solution as well as the solutions themselves were assessed and the findings used to inform the selection of the preferred Manchester and Pennine Resilience solution.

Resilience Options

Following initial screening in two distinct stages and ranking of over 300 options (consistent with the approach adopted to the identification of feasible (constrained) options for the Draft WRMP), United Utilities identified a total of 34 resilience options, different combinations of which formed the five potential Manchester and Pennine Resilience solutions. These options are listed and described in **Table 5.17** together with the respective solution(s) to which they relate.

Table 5.17 Resilience Options

Ref	Option	Description	Solution(s)
3	Manchester and Pennine Aqueduct to Raw: 2 Stage filtration (Bury)	This option would involve the development of a new 2 stage filtration Water Treatment Works (WTW) at an existing site in the Bury area in order to provide increased resilience. In conjunction with Options 212, 213, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.	• Solution C

Ref	Option	Description	Solution(s)
		In addition to the new WTW, the scheme would require new abstraction/ pumping from a Bulk Supply Point (BSP) to the new WTW, pumping from the new WTW to existing treated water storage, and the demolition of the existing connection mains.	
37-38	Manchester and Pennine Aqueduct section T05 to T06	This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 19.3km, and new connection chambers and isolating penstocks.	• Solution B
37-42	Manchester and Pennine Aqueduct sections T01 to T06	This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.	• Solution D • Solution E
46	WELM Uprate to 150Ml/day	This option would provide additional connectivity for treated water. It would involve the construction of a 3.1Ml break tank and intermediate pumping facilities to enable the transfer of 150 Ml/d.	• Solution A • Solution E
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	This option would involve implementing Manchester and Pennine Aqueduct outage for a period of 4 weeks to facilitate the installation of connections. There would be no new development associated with this option.	• Solution B • Solution D
212	Manchester and Pennine Aqueduct to Raw (Newton-in-Bowland)	Under this option, raw water would be taken directly from the Manchester and Pennine Aqueduct (without treatment) for treatment at a new WTW in the Newton-in-Bowland area. In conjunction with Options 3, 213, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would involve the construction of a new 2 stage filtration WTW together with a new connection from the Aqueduct to the WTW and pumped supply to an existing aqueduct. The new WTW is expected to treat an average of 41 Ml/d, with a maximum treatment capacity of 60 Ml/d.	• Solution C
213	Manchester and Pennine Aqueduct to Raw (Clayton-le-Moors)	Under this option, raw water would be taken directly from the Manchester and Pennine Aqueduct (without treatment) for treatment at a new WTW in the Clayton-le-Moors area. In conjunction with Options 3, 212, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would involve the construction of a new 2 stage filtration WTW together with a new connection from the Manchester and Pennine Aqueduct to the WTW inlet, a pumping station and circa 2.8km pipeline from the WTW to two BSPs.	• Solution C
214	Manchester and Pennine Aqueduct to Raw (Haslingden)	Under this option, raw water would be taken directly from the Manchester and Pennine Aqueduct (without treatment) for treatment at a new WTW in the Haslingden area. In conjunction with Options 3, 212, 213, 301, 303, 306 and 382, it would form part of the overall solution which covers the	• Solution C

Ref	Option	Description	Solution(s)
		requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would involve the construction of a new 2 stage filtration WTW together with new connections from the Manchester and Pennine Aqueduct to the WTW inlet and from the WTW to an existing pumping station.	
215	Alternative Supply: Raw water transfer and WTW (Clayton-le-Moors)	This option would provide additional raw water from the River Ribble (under a new abstraction licence) and additional water treatment capacity in the Clayton-le-Moors area. The option, in conjunction with Options 216, 217 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a new abstraction point, circa 9.1km of 800m main to a new 3 stage WTW and a pumping station.	• Solution E
216	Alternative Supply: Raw water abstraction and WTW (Haslingden)	This option would provide additional raw water from the River Irwell (under a new abstraction licence) and additional water treatment capacity in the Haslingden area. The option, in conjunction with Options 215, 217 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a new abstraction point and pumping station, circa 1.0km of 450mm main to a new 3 stage WTW and a new connection from the WTW to an existing BSP.	• Solution A • Solution E
217	Alternative Supply: Raw water transfer and WTW (Newton-in-Bowland)	This option would provide additional raw water from an aqueduct and additional water treatment capacity in the Newton-in-Bowland area. The option, in conjunction with Options 215, 216 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a new connection to the raw water aqueduct, circa 5.3km of 700mm diameter pipeline to transfer water from the connection point and a new 3 stage WTW and pumping station.	• Solution E
218	Alternative Supply: Raw water transfer and WTW (Preston)	This option would redirect raw water from the River Wyre to additional water treatment capacity in the Preston area. The option, in conjunction with Options 215, 216 and 217, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a connection to the raw water feed from the River Wyre and pumping from the connection point via circa 8.5km of 800mm main to a new 3 stage WTW. A new pumping station would also be constructed at the WTW site to feed water from the WTW into an existing aqueduct via circa 4.4km of 700mm pipeline.	• Solution E
238	Metals & UV treatment of BSPs: Bury	This option seeks to provide treatment of metals, cryptosporidium and/or E.Coli to the treated water which is being siphoned off the Manchester and Pennine Aqueduct. The option would require the construction of a new 2 stage WTW in the Bury area.	• Solution B
260	Ribblesdale South Well Isolation	This option would enable the isolation of the downstream section T05 for rehabilitation. It would require a new valve chamber constructed around existing siphon pipes in the Clitheroe area and a new valve house over the chamber. The option would also require a new access road.	• Solution A
261	Haslingden Well Isolation	This option would enable the isolation of the downstream section T06 for rehabilitation. It would require a new 12.5mID shaft on an existing 2.59mID conduit in the Haslingden area with two isolating penstocks and provision for downstream	• Solution A

Ref	Option	Description	Solution(s)
		tunnel access. The option would also require a new control kiosk and access road.	
296	T05 targeted repair 2025	This option would target section T05 for remedial works (tunnel lining) in order to provide greater structural support to the wider water distribution network. Under the option, approximately 100m of section T05 would undergo tunnel lining which would involve the installation of steel liner. The installation of two new access shafts (5m diameter/110m deep) would be required to facilitate the proposed works. It should be noted that the installation of tunnel liners would subsequently decrease the diameter of the Manchester and Pennine Aqueduct, e.g. reduced water flow, thus further hydraulic analysis is required to confirm the minimum acceptable diameter to support/maintain present operation.	• Solution A
297	T06 targeted repair 2025	This option would target section T06 for remedial works (tunnel lining and conduit lining) in order to provide greater structural support to the wider water distribution network. It is proposed that an approximate 200m of section T06 would undergo conduit lining which would involve the installation of steel reinforcement cages sprayed with concrete lining whilst 200m of the tunnel would receive tunnel lining. The installation of four new access shaft/chambers (5m diameter/110m deep) would be required. Additionally, there is a risk that it may be necessary to rebuild a cracked conduit bridge (approx 30m) in addition to implementing a new settled conduit configuration as additional ancillary works. It should be noted that the installation of conduit/tunnel liners would subsequently decrease the diameter of the Manchester and Pennine Aqueduct, e.g. reduced water flow, thus further hydraulic analysis is required to confirm the minimum acceptable diameter to support/maintain present operation.	• Solution A
301	Lunesdale Siphon BSPs North	This option seeks to provide additional connectivity for treated water via existing pipework to a treated water storage facility in the Kendal area and onwards to the north end of the Lunesdale Siphon where it would be intercepted by a proposed new pipeline connecting to existing BSPs. In conjunction with Options 3, 212, 213, 214, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would require pipelines from the treated water storage facility to the Manchester and Pennine Aqueduct in the vicinity of the BSPs in the Kirkby Lonsdale area in addition to increased storage provision at the existing treated water storage facility (from 0.75Ml to 9.0Ml).	• Solution C
303	Lunesdale Siphon BSPs South	This option would increase connectivity for treated water through Manchester and Pennine Aqueduct outage on a permanent basis. In conjunction with Options 3, 212, 213, 214, 301, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The options would require new sections of pipeline between BSPs in the Bentham area. The option would also require: a new pumping station in the Bentham area; additional 9Ml storage at an existing treated water storage facility near Lancaster; modification to a pumping station in the Morecambe area to accommodate permanent usage; and the abandonment of existing facilities.	• Solution C
306	Ribblesdale Siphon BSPs North	This option would adapt the connectivity of the treated water network with BSPs in the Clitheroe area being permanently	• Solution C

Ref	Option	Description	Solution(s)
		supplied via an existing aqueduct and pumping stations using existing network infrastructure. In conjunction with Options 3, 212, 213, 214, 301, 303 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would require a new circa 2.9km reinforcing pipe (250mm diameter) to support the new configuration between the BSPs and the aqueduct. Some existing pipelines would be abandoned.	
348	Metals & UV Treatment of BSPs: Lunesdale Siphon (1)	This option would involve the construction of a new WTW with second stage rapid gravity filters (RGF) for metals removal and UV treatment in the Kirkby Lonsdale area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 2.48 Ml/d.	• Solution B
349	Metals & UV Treatment of BSPs: Lunesdale Siphon (2)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Kirkby Lonsdale area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 2.9 Ml/d.	• Solution B
350	Metals & UV Treatment of BSPs: Lunesdale Siphon (3)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Kirkby Lonsdale area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 0.36 Ml/d, with a maximum treatment capacity of 0.57 Ml/d.	• Solution B
351	Metals & UV Treatment of BSPs: Lunesdale Siphon (4)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Wrayton area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 5.59 Ml/d, with a maximum treatment capacity of 6.04 Ml/d.	• Solution B
352	Metals & UV Treatment of BSPs: Lunesdale Siphon (5)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Bentham area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 0.01 Ml/d.	• Solution B
353	Metals & UV Treatment of BSPs: Lunesdale Siphon (6)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Bentham area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 0.01 Ml/d.	• Solution B
354	Metals & UV Treatment of BSPs: Hodder Siphon	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Newton-in-Bowland area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is	• Solution B

Ref	Option	Description	Solution(s)
		expected to treat an average of 40.86 Ml/d, with a maximum treatment capacity of 45.28 Ml/d.	
355	Metals & UV Treatment of BSPs: Ribblesdale Siphon (1)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clitheroe area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 0.02 Ml/d, with a maximum treatment capacity of 0.03 Ml/d.	• Solution B
356	Metals & UV Treatment of BSPs: Ribblesdale Siphon (2)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clitheroe area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 4.09 Ml/d, with a maximum treatment capacity of 5.05 Ml/d.	• Solution B
357	Metals & UV Treatment of BSPs: Ribblesdale Siphon (3)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clitheroe area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 2.10 Ml/d, with a maximum treatment capacity of 2.17 Ml/d.	• Solution B
358	Metals & UV Treatment of BSPs: Ribblesdale Siphon (4)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clayton-le-Moors area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 33.51 Ml/d, with a maximum treatment capacity of 43.05 Ml/d.	• Solution B
359	Metals & UV Treatment of BSPs: Ribblesdale Siphon (5)	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Accrington area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 5.23 Ml/d, with a maximum treatment capacity of 6.83 Ml/d.	• Solution B
360	Metals & UV Treatment of BSPs: Haslingden	This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Haslingden area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 8.97 Ml/d, with a maximum treatment capacity of 9.96 Ml/d.	• Solution B
382	Manchester and Pennine Aqueduct to Raw: WTW reduced flow	This option would reduce the flow of a WTW in the Kendal area from 570 Ml/d to 80 Ml/d whilst continuing to provide treated water to existing BSPs. In conjunction with Options 3, 212, 213, 214, 301, 303 and 306, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would require: modifications and refurbishment of the existing WTW to maintain the existing process but at a reduced flow of 80 Ml/d; new connections to a new inlet tank (total length circa 8km); new UV disinfection process; new final	• Solution C

Ref	Option	Description	Solution(s)
		water chemical dosing and storage in bunded area – replaced existing due to new outlet position; sodium bisulphite dosing and storage for de-chlorination of start up to waste line and pre UV disinfection (prevention of fouling); dual process streaming of works to minimise plant shut-downs and ensure 50% of max flow can be maintained at all times; and a new valve chamber and new twin outlet pipelines from the WTW to supply existing BSPs.	

To provide a detailed and comparable understanding of the likely significant environmental effects, each resilience option was assessed individually (the detailed findings are reproduced in **Appendix D** to this report). The assessments of the individual options were then aggregated to provide an assessment of the predicted cumulative effects on the environment from each potential Manchester and Pennine Resilience solution. All of the resilience options were assessed using the SEA framework and approach set out in **Section 4**.

The findings of the assessment of the Manchester and Pennine Resilience solutions and composite options were summarised in a supplementary report; this summary is reproduced in the subsections below.

Solution A

Solution A comprises of six resilience options. A summary of the assessment of these options and the cumulative effects for Solution A is presented in **Table 5.18**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 5.18 Resilience Options Assessment Summary: Solution A

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
46	WELM Uprate to 150Ml/day	C	0	0	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	0
216	Alternative Supply: Raw water abstraction and WTW (Haslingden)	C	0	0	0	0	-	--	-	++	0	--	-	-
		O	0/?	0	0/?	0	0	0	+	+	0	0	0	-
260	Ribblesdale South Well Isolation	C	-	-	0	0	0	--	-	0	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	0
261	Haslingden Well Isolation	C	-	-	0	0	0	--	-	0	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	0
296	T05 targeted repair 2025	C	0	0	-/?	0	-	--	0	++/-	0	--	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	0	0	0	0	+	+	0	0	0	0
297	T06 targeted repair 2025	C	0	0	-/?	0	-	--	0	++/-	0	--	0	0
		O	0	0	0	0	0	0	+	+	0	0	0	0
Cumulative Effects of Solution A		C	-	-	-/?	0	-	--	-	++/-	0	--	-	-
		O	0/?	0	0/?	0	0	0	++	++	0	0	0	-

Construction Effects

Construction activity associated with the implementation of those resilience options that comprise Solution A would represent a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits. In combination, the scale of investment would likely be substantial and in consequence, this solution has been assessed as having a significant positive effect on wellbeing (SEA Objective 8). Vehicle movements during the construction of two of the resilience options (Options 296 and 297) may result in traffic disruption, although any effects in this regard would be temporary and short-term only. This has been assessed as having a (mixed) minor negative effect on this SEA Objective 8.

No further significant positive effects from construction have been identified during the assessment of Solution A.

The use of plant on-site and transportation of equipment and materials by road would result in increased emissions of greenhouse gases, whilst the materials used for construction would contain embodied carbon. Taken together, the options under Solution A would generate an estimated 70,000 tCO_2e during construction which has been assessed as having a significant negative effect on climate change (SEA Objective 6). Raw materials and energy required during construction of the resilience options, and waste generation, have also been assessed as having an overall significant negative effect on resource use (SEA Objective 10).

No further significant negative effects have been identified during the assessment of Solution A.

The assessment has highlighted that development associated with two of the resilience options (Options 260 and 261) may result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. Due to the distance between the option locations it is unlikely, however, that there would be in-combination effects arising from the concurrent implementation of the options on ecological receptors. Further, any disturbance to habitats and species is likely to be minor and short-term, and overall Solution A has therefore been assessed as having a minor negative effect on biodiversity (SEA Objective 1). Options 260 and 261 have also been assessed as having a minor negative effect on geology and soils (SEA Objective 2) due to the loss of greenfield land associated with these options.

A minor negative effect with some uncertainty has been identified with respect to water quantity and quality (SEA Objective 3). This relates to the potential for effects on groundwater levels and flows associated with the construction of access shafts and tunnel repair under Options 296 and 297.

The operation of plant and machinery as well as vehicle movements associated with several of the resilience options would result in emissions to air which could affect air quality. However, the differing locations of individual resilience options and timing of implementation means that in-combination effects are not expected to arise, and overall Solution A is assessed as having a minor negative effect on air quality (SEA Objective 5). Local air quality impacts alongside noise/vibration disturbance during construction may cause temporary adverse effects on nearby residential receptors and recreational areas. However, any adverse impacts in this regard would be temporary and are likely to be managed through the implementation of best practice construction methods. Overall, a minor negative effect on health (SEA Objective 7) has been identified for this solution.

Construction activity associated with Solution A could have a minor negative effect on cultural heritage (SEA Objective 11). This is principally due to the potential for works related to Option 216 to affect the settings of heritage assets (listed buildings) in close proximity to the scheme. Option 216, together with Options 46, 260 and 261, may also have minor adverse impacts on landscape character and visual amenity during the construction period. In consequence, Solution A has been assessed as having an overall minor negative effect on landscape (SEA Objective 12).

No effects on flood risk (SEA Objective 4) or water resources (SEA Objective 9) are anticipated during construction.

Operational Effects

Targeted repair of the Manchester and Pennine Aqueduct and the establishment of new sources would reduce the risk of aqueduct deterioration and failure and provide alternative supplies to customers both during and following the completion of the repair works. Together, this would increase the resilience of

supply to over two million customers, helping to ensure continuity of a clean and safe water supply and supporting regional economic and population growth. In consequence, Solution A has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No further significant positive effects from operation have been identified during the assessment of Solution A.

No significant negative operational effects have been identified during the assessment of Solution A. Option 216 would require new aboveground infrastructure which is anticipated to have a minor adverse impact on local landscape character, depending on final design and location of the scheme and any mitigation implemented at the project stage. As a result, Solution A has been assessed as having a minor negative effect on landscape (SEA Objective 12). Option 216 would also involve a new surface water abstraction from the River Irwell which could affect this waterbody and the ecology it supports. However, water in the Irwell has been assessed as being available at all flows and overall, Solution A has therefore been assessed as having a neutral effect on biodiversity (SEA Objective 1) and water quantity and quality (SEA Objective 3), although some uncertainty remains.

Once construction activity is complete, no effects on geology and soils (SEA Objective 2), flood risk (SEA Objective 4), air quality (SEA Objective 5), climate change (SEA Objective 6), water resources (SEA Objective 9), resource use (SEA Objective 10) and cultural heritage (SEA Objective 11) are anticipated.

Solution B

Solution B comprises of 16 resilience options. A summary of the assessment of these options and the cumulative effects for Solution B is presented in **Table 5.19**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 5.19 Resilience Options Assessment Summary: Solution B

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7., Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
37-38	Manchester and Pennine Aqueduct section T05 to T06	C	-	0	-/?	-	--	--	-	++/-	0	--	0	0
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0
238	Metals & UV treatment of BSPs: Bury	C	0	-/?	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	-	-	+	+	0	-	0	-
348	Metals & UV Treatment of BSPs: Lunesdale Siphon (1)	C	-	-	0	0	-	--	0	+	0	--	0	--
		O	0	0	0	0	0	0	+	+	0	0	0	--
349	Metals & UV Treatment of BSPs: Lunesdale Siphon (2)	C	-	-	0	0	-	--	0	+	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7., Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
350	Metals & UV Treatment of BSPs: Lunesdale Siphon (3)	C	-	-	0	0	0	--	0	+	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	-
351	Metals & UV Treatment of BSPs: Lunesdale Siphon (4)	C	-	-	0	0	-	--	-	++	0	--	0	--
		O	0	0	0	0	0	0	+	+	0	0	0	--
352	Metals & UV Treatment of BSPs: Lunesdale Siphon (5)	C	-	-	0	0	0	--	0	0	0	--	0	--
		O	0	0	0	0	0	0	+	+	0	0	0	--
353	Metals & UV Treatment of BSPs: Lunesdale Siphon (6)	C	-	-	0	0	0	--	0	0	0	--	-	--
		O	0	0	0	0	0	0	+	+	0	0	-	--
354	Metals & UV Treatment of BSPs: Hodder Siphon	C	-	-	0	0/?	-	--	0	++	0	--	0	--
		O	0	0	0	0/?	0	-	++	++	0	-	0	--
355		C	-	-	0	0	0	--	0	0	0	--	0	--

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7., Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Metals & UV Treatment of BSPs: Ribblesdale Siphon (1)	O	0	0	0	0	0	0	+	+	0	0	0	--
356	Metals & UV Treatment of BSPs: Ribblesdale Siphon (2)	C	-	-	0	0	-	--	0	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	-
357	Metals & UV Treatment of BSPs: Ribblesdale Siphon (3)	C	-	-	0	0	0/-	--	0	+	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	-
358	Metals & UV Treatment of BSPs: Ribblesdale Siphon (4)	C	-	+/-/?	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	++	++	0	0	0	-
359	Metals & UV Treatment of BSPs: Ribblesdale Siphon (5)	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	-
360	Metals & UV Treatment of BSPs: Haslingden	C	0	+	0	0	-	--	-	+	0	--	0	0
		O	0	0	0	0	0	0	+	+	0	0	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7., Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
Cumulative Effects of Solution B		C	-	+/-	-/?	-	--	--	-	++/-	0	--	-	--
		O	0	0	-/?	0/?	-	--	++	++	0	--	-	--

Construction Effects

Capital investment associated with Solution B is expected to generate significant employment opportunities and supply chain benefits. The scale of investment would be substantial and the solution has therefore been assessed as having a significant positive effect on wellbeing (SEA Objective 8). However, vehicle movements and the requirement for road crossings related to the construction of Option 37-38 may result in traffic disruption (although any effects would be temporary and short-term only), generating a (mixed) minor negative effect on this objective.

No further significant positive effects from construction have been identified during the assessment of Solution B.

The operation of plant and machinery and vehicle movements during the construction phase of several of the resilience options that comprise Solution B would generate emissions to air which could affect air quality. Option 37-38 in particular would generate a very large number of vehicle movements and in consequence, this solution has been assessed as having a significant negative effect on air quality (SEA Objective 5). The use of plant on-site and transportation of equipment and materials by road would also result in increased energy/resource use and associated emissions of greenhouse gases, whilst the materials used for construction would contain embodied carbon. In this regard, it is estimated that Solution B would generate in the region of 260,000 tCO_2e during construction which has been assessed as having a significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

Six of the resilience options would involve construction work within either the Yorkshire Dales National Park or Forest of Bowland Area of Outstanding Natural Beauty (AONB) which could have a temporary but significant adverse effect on these designated landscapes. A further seven options would result in minor adverse effects on landscape and visual amenity. Overall, Solution B has therefore been assessed as having a significant negative effect on landscape (SEA Objective 12).

No further significant negative effects have been identified during the assessment of Solution B.

Development associated with 13 of the resilience options that make up Solution B may result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. Due to the distance between the option locations, however, it is unlikely that there would be in-combination effects arising from the concurrent implementation of the options on ecological receptors. Further, any disturbance to habitats and species is likely to be minor and short-term, and the solution has therefore been assessed as having a minor negative effect on biodiversity (SEA Objective 1).

The assessment has identified that there is potential from dewatering arising from the construction of the tunnel and shafts under Option 37-38 which may affect groundwater levels and flows and could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) protect surface water bodies from impacts arising from changes in the groundwater regime. Overall, Solution B has been assessed as having a negative effect on water quantity and quality (SEA Objective 3) at this stage, although some uncertainty remains.

Option 37-38 would involve waterbody crossings and works would take place in Flood Zones 2 and 3. In consequence, construction activity may be liable to flooding (depending on the timing of works); however, this scheme is not expected to cause or exacerbate flooding elsewhere. Overall, Solution B has been assessed as having a minor negative effect on flood risk (SEA Objective 4).

There may be temporary noise/vibration disturbance and air quality impacts associated with construction and excavation works which could affect residential receptors, although any adverse impacts in this regard would be temporary and are likely to be managed through the implementation of best practice construction methods and techniques at the project stage. Option 37-38 specifically also has the potential to disrupt recreational users of the River Irwell. Overall, Solution B has been assessed as having a minor negative effect on human health (SEA Objective 7).

Solution B has been assessed as having a minor negative effect in respect of cultural heritage (SEA Objective 11). This reflects the potential for construction activity associated with Option 353 in particular to temporarily affect the setting of an adjacent listed building, although direct effects on this asset are not expected assuming appropriate mitigation is in place.

The majority of the resilience options under Solution B would result in the loss of small areas of greenfield land, while two options would involve the utilisation of existing sites. As a result, this solution would be expected to have a mixed minor positive and negative effect on geology and soils (SEA Objective 2).

A neutral effect has been determined for water resources (SEA Objective 9).

Operational Effects

Solution B would involve the replacement of those sections of the Manchester and Pennine Aqueduct in poorest condition whilst providing targeted treatment to maintain water quality. This would enhance the resilience of supply to over two million customers, ensuring continuity of a clean and safe water supply and supporting regional economic and population growth. In consequence, the solution has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No further significant positive effects from operation have been identified during the assessment of Solution B.

The additional treatment of water associated with Solution B would generate operational greenhouse gas emissions of approximately 1,500 tCO_2e per annum. Consistent with the definitions of significance contained at **Appendix C**, this has been assessed as having a significant negative effect on climate change (SEA Objective 6). The ongoing energy and resource use has also been assessed as having a significant negative effect SEA Objective 10.

This solution would require new aboveground infrastructure which may affect landscape character and/or visual amenity. For six of the resilience options, development would be located in the Yorkshire Dales National Park or Forest of Bowland AONB and, overall, Solution B has therefore been assessed as having a significant negative effect landscape (SEA Objective 12).

No further significant negative effects have been identified during the assessment of Solution B.

Under Option 37-38, the tunnel would be constructed within the saturated zone of the aquifer and the presence of a low permeability linear structure may alter groundwater flows and levels (particularly where the tunnel is shallower and within the zone of active groundwater flow) and affect surface water. However, as noted above (for construction), a detailed study of the geology of the tunnel route has not been undertaken at this time and good connections between the groundwater and surface water environment have been assumed. Overall, Solution B has been assessed as having a negative effect on water quantity and quality (SEA Objective 3) at this stage, although some uncertainty remains.

Under this solution, there would be a relatively large number of ongoing vehicle movements during operation which could have localised air quality impacts. In consequence, the solution has been assessed as having a minor negative effect on air quality (SEA Objective 5). New above ground infrastructure associated with Option 353 may affect the setting of an adjacent listed building. The solution has therefore also been assessed as having a minor negative effect on cultural heritage (SEA Objective 11).

The final extent of the infrastructure required for Option 354 has not yet been determined and development may extend into Flood Zones 2 and 3. Overall, the solution has been assessed as having a neutral effect on SEA Objective 4 at this stage, with some uncertainty depending on final infrastructure location. Neutral effects have also been identified in respect of biodiversity (SEA Objective 1), geology and soils (SEA Objective 2) and water resources (SEA Objective 9).

Solution C

Solution C comprises of eight resilience options. A summary of the assessment of these options and the cumulative effects for Solution C is presented in **Table 5.20**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 5.20 Resilience Options Assessment Summary: Solution C

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
3	Manchester and Pennine Aqueduct to Raw: 2 Stage filtration (Bury)	C	-	-	0	0	--	--	--	++/-	0	--	0	-
		O	0	0	0	0	-	-	++	++	0	-	0	-
212	Manchester and Pennine Aqueduct to Raw (Newton-in-Bowland)	C	-	-	0	0/?	-	--	0	++	0	--	0	--
		O	0	0	0	0/?	-	-	++	++	0	-	0	--
213	Manchester and Pennine Aqueduct to Raw (Clayton-le-Moors)	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	-	++	++	0	-	0	-
214	Manchester and Pennine Aqueduct to Raw (Haslingden)	C	-	-	0	0/?	-	--	-	++	0	--	0	-
		O	0	0	0	0/?	0	0	++	++	0	0	0	-
301	Lunesdale Siphon BSPs North	C	-	0	0	-	-	--	-	+	0	--	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	0	0	0	0	+	+	0	0	0	0
303	Lunesdale Siphon BSPs South	C	-	0	0	-	-	--	0	+	0	--	-	-
		O	0	0	0	-	0	0	++	++	0	0	0	0
306	Ribblesdale Siphon BSPs North	C	0	0	0	0	0	0	-	0	0	0	-	0
		O	0	0	0	0	0	0	+	+	0	0	0	0
382	Manchester and Pennine Aqueduct to Raw: WTW reduced flow	C	-	-	0	-	-	--	-	++/-	0	--	0	-
		O	0	0	0	0	0	-	+	+	0	-	0	-
Cumulative Effects of Solution C		C	-	-	0	-	--	--	--	++/-	0	--	-	--
		O	0	0	0	-	-	--	++	++	0	--	0	--

Construction Effects

Construction activity associated with the implementation of those resilience options that comprise Solution C would represent a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits. In combination, the scale of investment would likely be substantial and in consequence, the solution has been assessed as having a significant positive effect on wellbeing (SEA Objective 8). Vehicle movements associated with construction for two of the resilience options (Options 3 and 382) may result in traffic disruption, although any effects would be temporary and short-term only; Solution C has therefore also been assessed as having a (mixed) minor negative effect on SEA Objective 8.

No further significant positive effects from construction have been identified during the assessment of Solution C.

The operation of plant and machinery and vehicle movements during the construction phase of the majority of the resilience options that comprise Solution C would generate emissions to air which could affect air quality. The assessment has highlighted that Option 3 in particular would generate a very large number of vehicle movements and that this scheme would be in close proximity to an Air Quality Management Area (AQMA). In consequence, Solution C has been assessed as having a significant negative effect on air quality (SEA Objective 5). Option 3, and therefore Solution C, have also been assessed as having a significant negative effect on health (SEA Objective 7) at this stage due to the potential impacts on air quality and also noise and vibration effects during construction which may affect residential receptors in close proximity to the scheme (the majority of the remaining resilience options have been assessed as having a minor negative effect on this objective). However, adverse impacts in this regard would be temporary and are likely to be managed through the implementation of best practice construction methods.

The use of plant on-site and transportation of equipment and materials by road would result in increased emissions of greenhouse gases, whilst the materials used for construction would contain embodied carbon. Taken together, emissions associated with this solution would be an estimated 90,000 tCO_2e during construction and this has been assessed as having a significant negative effect on climate change (SEA Objective 6). Raw materials and energy use required during the construction phase of the resilience options that comprise Solution C, and waste generation (including excavation debris and infrastructure waste), have also been assessed as having an overall significant negative effect on resource use (SEA Objective 10).

The proposed development site under Option 212 is located within the Forest of Bowland AONB and construction could therefore have a temporary but significant adverse effect on this designated landscape. Six further options, meanwhile, have been identified as having a potentially minor adverse effect on local landscape character and visual amenity. Overall, Solution C has therefore been assessed as having a significant negative effect on landscape (SEA Objective 12) at this stage.

No further significant negative effects have been identified during the assessment of Solution C.

With the exception of Option 306, development associated with the resilience options that make up Solution C may result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. Due to the distance between the option locations, however, it is unlikely that there would be in-combination effects arising from the concurrent implementation of the options on ecological receptors. Further, any disturbance to habitats and species is likely to be minor and short-term, and the solution has therefore been assessed as having a minor negative effect on biodiversity (SEA Objective 1). Land take and the loss of greenfield land associated with five of the resilience options means that Solution C has also been assessed as having a minor negative effect on geology and soils (SEA Objective 2).

The assessment has identified the potential for this solution to have a minor negative effect on flood risk (SEA Objective 7). This is because pipeline works associated with Options 301, 303 and 382 would be located in Flood Zones 2 and 3 and therefore construction activity may be liable to flooding (depending on the timing of the works). For two further options (Options 212 and 214), the final extent of infrastructure is not yet certain and construction activity may take place in Flood Zones 2 and 3. For these options, effects on SEA Objective 7 have been assessed as neutral at this stage, although some uncertainty remains.

Historic assets in close proximity to works associated with three of the resilience options (Options 301, 303 and 306) may experience minor adverse impacts on their settings as a result of construction activity. Solution C has therefore been assessed as having a minor negative effect on cultural heritage (SEA Objective 11).

Neutral effects have been identified in respect of water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9).

Operational Effects

Solution C would involve the conversion of the Manchester and Pennine Aqueduct from a treated water aqueduct to a raw water aqueduct when the integrity of the tunnel is compromised. This would enable the treatment of any impurities that could enter the water supply via the aqueduct, enhancing the resilience of supply to over two million customers and supporting regional economic and population growth. In consequence, Solution C has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No further significant positive effects from operation have been identified during the assessment of Solution C.

Additional treatment and the pumping of water associated with Solution C would generate greenhouse gas emissions of approximately 1,600 tCO_2e per annum. Consistent with the definitions of significance contained at **Appendix C**, this has been assessed as having a significant negative effect on climate change (SEA Objective 6). The ongoing energy and resource use has also been assessed as having a significant negative effect SEA Objective 10.

As noted above (under construction), Option 212 would result in the development of new aboveground infrastructure in the Forest of Bowland AONB which could have a significant adverse effect on this designated landscape. Four further options have been identified as having a minor adverse effect on local landscape character and visual amenity and overall, Solution C has been assessed as having a significant negative effect on SEA Objective 12.

No further significant negative effects have been identified during the assessment of Solution C.

New aboveground infrastructure under Option 303 would be situated within Flood Zones 2 and 3 and may therefore be liable to flooding during operation. For two further options (Options 212 and 214), the final extent of infrastructure is not yet certain and this could be located within Flood Zones 2 and 3. Overall, Solution C has been assessed as having a minor negative effect on flood risk (SEA Objective 4) at this stage.

Due to the ongoing volume of vehicle movements associated with the operation of Options 3 and 212, operational emissions to air have been assessed as having a minor negative effect on air quality (SEA Objective 5).

Once construction activity is complete, Solution C is not expected to have effects on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity and quality (SEA Objective 3), water resources (SEA Objective 9) or cultural heritage (SEA Objective 11).

Solution D

Solution D comprises of Options 37-42 and 112. A summary of the assessment of these options and the cumulative effects for Solution D is presented in **Table 5.21**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 5.21 Resilience Options Assessment Summary: Solution D

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
37-42	Manchester and Pennine Aqueduct sections T01 to T06	C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0
Cumulative Effects of Solution D		C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	-	++	++	0	-	0	0

Construction Effects

Option 112 would involve implementing Manchester and Pennine Aqueduct outage for a period of four weeks to facilitate the installation of connections. There would be no new development associated with this option and therefore no construction-related effects on the SEA objectives are expected. In consequence, effects during construction associated with Solution D would be those arising from the implementation of Option 37-42 only, which would involve the construction of new tunnels.

Capital investment associated with Solution D is expected to be substantial and would be likely to generate employment opportunities and supply chain benefits; the scale of investment has been assessed as having a significant positive effect on wellbeing (SEA Objective 8). Utilisation of the local road network as a transportation corridor for vehicle movements during the implementation period in addition to road crossings/works within roads may, however, result in congestion and localised travel disruption. This has been assessed as having a (mixed) minor negative effect on SEA Objective 8, although any effects in this regard would be temporary and are likely to be lessened by the adoption of mitigation measures at the project stage.

No further significant positive effects from construction have been identified during the assessment of Solution D.

Solution D has been assessed as having a significant negative effect on air quality (SEA Objective 5). This reflects the scale of vehicle movements associated with the works required under Option 37-42 which, together with emissions to air from plant and machinery, may have adverse effects on local air quality. The use of plant on-site and transportation of equipment and materials by road would also result in increased emissions of greenhouse gases, whilst the materials used for the construction of the tunnels would contain high levels of embodied carbon. In this regard, Solution D would generate an estimated 960,000 tCO_2e during construction which has been assessed as having a significant negative effect on climate change (SEA Objective 6). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements as well as waste arisings are also considered likely to be substantial and a significant negative effect has therefore been identified in respect of resource use (SEA Objective 10).

No further significant negative effects have been identified during the assessment of Solution D.

The proposed route for the six tunnels under Option 37-42 would cross the Bowland Fells Special Protection Area (SPA)/Site of Special Scientific Interest (SSSI) for a distance of approximately 7km. However, it is understood that this section would be completed with non-invasive tunnelling or drilling techniques, with any receptor pits (etc.) sited outside the SPA/SSSI boundary such that effects on this site as a result of construction are unlikely (assuming all normal best-practice). The HRA highlights that there is a theoretical risk of groundwater bodies being affected by the pipeline, which may then have indirect effects on any groundwater dependent ecosystems associated with European sites. Provisional geological investigations have indicated that this risk is minimal due to the dominance of low-permeability geological formations and the depth of the pipeline. In addition, any potential effects can be avoided through pipeline design to prevent water ingress. The River Kent SAC is also within close proximity of the proposed works, although the HRA notes that effects on the SAC are likely to be avoidable with normal best-practice. More generally, works would be likely to result in localised disturbance to habitats and species, although any such disturbance would be minor and temporary. Overall, Solution D has been assessed as having a minor negative effect on biodiversity (SEA Objective 1).

Whilst this solution would not require permanent land take (excavated land would be reinstated following the construction phase), the proposed overall tunnel length is substantial and in consequence, the solution has been assessed as having a minor negative effect on geology and soils (SEA Objective 2).

There is potential for dewatering arising from the construction of the tunnels and shafts under Option 37-42 to affect groundwater levels and flows, which could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, a detailed study of the geology of the tunnel route has not been undertaken at this time and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) protect surface water bodies from impacts arising

from any changes in the groundwater regime. Overall, Solution D has been assessed as having a negative effect on water quantity and quality (SEA Objective 3) at this stage, although some uncertainty remains.

Works associated with this solution would involve waterbody crossings and take place within Flood Zones 2/3. In consequence, construction activity may be liable to flooding (depending on the timing of the works); however, the solution is not expected to cause or exacerbate flooding elsewhere and Solution D has therefore been assessed as having a negative effect on flood risk (SEA Objective 4).

There may be temporary noise/vibration disturbance and air quality impacts associated with construction activity under this solution which could affect residential receptors and cause disruption to recreational users of the River Irwell. Notwithstanding this, works would be temporary and dispersed over a large area and associated effects are expected to be felt in the short term only. Further, it is likely that impacts would managed/mitigated where possible using best practice. Overall, Solution D has been assessed as having a minor negative effect on human health (SEA Objective 7).

The assessment has highlighted that the proposed route of the tunnels would traverse the Yorkshire Dales National Park (for approximately 1km) and the Forest of Bowland AONB. However, as such works would be largely at depth, the associated landscape and visual impacts would be minor and temporary and Solution D has therefore been assessed as having a minor negative effect on landscape (SEA Objective 12).

Neutral effects have been identified in respect of water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

Operational Effects

The development of new tunnel sections would address water supply and water quality risks associated with a failure of the Manchester and Pennine Aqueduct. This would significantly enhance the resilience of supply to over two million customers, ensuring continuity of a clean and safe water supply and supporting regional economic and population growth. In consequence, Solution D has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No further significant positive effects from operation have been identified during the assessment of Solution D.

Once construction activity associated with Solution D is complete, there are likely to be very few adverse environmental impacts and no significant negative operational effects have been identified. As the tunnels would be constructed within the saturated zone of the aquifer, the presence of a low permeability linear structure may alter groundwater flows and levels (particularly where the tunnels are shallower and within the zone of active groundwater flow) and affect surface water. However, as noted above, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Solution D has therefore been assessed as having a negative effect on water quantity and quality (SEA Objective 3) at this stage, although some uncertainty remains

During aqueduct outage (to facilitate the construction of new connections), there would be an overall net increase in energy and resource use required to treat water. This has been assessed as having a minor negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

No operational effects are expected on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), flood risk (SEA Objective 4), air quality (SEA Objective 5), water resources (SEA Objective 9), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Solution E

Solution E comprises of six resilience options. A summary of the assessment of these options and the cumulative effects for Solution E is presented in **Table 5.22**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 5.22 Resilience Options Assessment Summary: Solution E

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
37-42	Manchester and Pennine Aqueduct sections T01 to T06	C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
46	WELM Uprate to 150Ml/day	C	0	0	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	0	0	0
215	Alternative Supply: Raw water transfer and WTW (Clayton-le-Moors)	C	0	-	0	-	-	--	-	++/-	0	--	-	-
		O	0/?	0	-	0	0	-	++/-	++	0	-	0	-
216	Alternative Supply: Raw water abstraction and WTW (Haslingden)	C	0	0	0	0	-	--	-	++	0	--	-	-
		O	0/?	0	0/?	0	0	0	+	+	0	0	0	-
217	Alternative Supply: Raw water transfer and WTW (Newton-in-Bowland)	C	-	0	0	-	-	--	-	++/-	0	--	-	--
		O	0	0	0	0	0	0	+	+	0	0	0	--

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
218	Alternative Supply: Raw water transfer and WTW (Preston)	C	0	-/?	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	-	+	+	0	-	0	0
Cumulative Effects of Solution E		C	-	-	-/?	-	--	--	-	++/-	0	--	-	--
		O	0/?	0	-/?	0	0	-	++/-	++	0	-	0	--

Construction Effects

Construction activity associated with the implementation of those resilience options that comprise Solution E would represent a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits. In combination, the scale of investment would likely be substantial and in consequence, the solution has been assessed as having a significant positive effect on wellbeing (SEA Objective 8). However, vehicle movements associated with construction for the majority of the resilience options that comprise this solution, in addition to works within roads, may result in traffic disruption (although any effects would be temporary and short-term only). This has been assessed as having a (mixed) minor negative effect on this objective.

No further significant positive effects from construction have been identified during the assessment of Solution E.

The operation of plant and machinery and vehicle movements during the construction phase would generate emissions to air which could affect air quality. Option 37-42 in particular would generate a very large number of vehicle movements and in consequence, Solution E has been assessed as having a significant negative effect on air quality (SEA Objective 5). The use of plant on-site and transportation of equipment and materials by road would also result in increased emissions of greenhouse gases, whilst the materials used for construction would contain embodied carbon. Taken together, the resilience options that comprise Solution E would generate over 1,000,000 tCO_2e during construction which has been assessed as having a significant negative effect on climate change (SEA Objective 6). The implementation of Solution E would also require raw materials, fuel for vehicles and plant and generate waste which has been assessed as having a significant negative effect on resource use (SEA Objective 10).

Option 217 would involve the construction of a new WTW on a greenfield site within the Forest of Bowland AONB which may give rise to substantial landscape impacts. Construction activity associated with the other resilience options of this solution, meanwhile, are expected to have minor adverse effects on landscape and visual amenity. The assessment has highlighted that the proposed route of the tunnels would traverse the Yorkshire Dales National Park and the Forest of Bowland AONB. However, as such works would be largely at depth, the associated landscape and visual impacts would be minor and temporary. Overall, Solution E has been assessed as having a significant negative effect on landscape (SEA Objective 12).

No further significant negative effects have been identified during the assessment of Solution E.

Works associated with the implementation of Options 37-42 and 217 may result in the localised loss of/disturbance to habitats and species and in consequence, Solution E has been assessed as having a minor negative effect on biodiversity (SEA Objective 1). The assessment has highlighted that the proposed route for the six tunnels under Option 37-42 would cross the Bowland Fells SPA/SSSI, although it is understood that this section would be completed with non-invasive tunnelling or drilling techniques, with any receptor pits (etc.) sited outside the SPA/SSSI boundary such that effects on this site are unlikely (assuming all normal best-practice). The HRA highlights that there is a theoretical risk of groundwater bodies being affected by the pipeline, which may then have indirect effects on any groundwater dependent ecosystems associated with European sites. Provisional geological investigations have indicated that this risk is minimal due to the dominance of low-permeability geological formations and the depth of the pipeline. In addition, any potential effects can be avoided through pipeline design to prevent water ingress. The River Kent SAC is also within close proximity of the proposed works, although the HRA notes that effects on the SAC are likely to be avoidable with normal best-practice.

This solution has been assessed as having a minor negative effect on geology and soils (SEA Objective 2) due to the loss of greenfield land associated with the implementation of several resilience options. Whilst Option 37-42 would not require permanent land take (with excavated land being reinstated following the construction phase), the proposed overall tunnel length is substantial and in consequence, adverse effects on this objective have also been identified in respect of this resilience option.

There is potential for dewatering arising from the construction of the tunnels and shafts under Option 37-42 to affect groundwater levels and flows, which could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and

surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) could protect surface water bodies from impacts arising from changes in the groundwater regime. Overall, Solution E has been assessed as having a negative effect on water quantity and quality (SEA Objective 3) at this stage, although some uncertainty remains.

Works associated with this solution would involve waterbody crossings and take place within Flood Zones 2/3. In consequence, construction activity may be liable to flooding (depending on the timing of the works); however, the solution is not expected to cause or exacerbate flooding elsewhere and Solution E has therefore been assessed as having a negative effect on (SEA Objective 4).

There may be temporary noise/vibration disturbance and air quality impacts associated with construction activity which could affect residential receptors, in addition to disruption of use or loss of amenity for footpaths and bridleways crossed by tunnels/pipelines. Option 37-42 also has the potential to disrupt recreational users of the River Irwell. Overall, Solution E has been assessed as having a minor negative effect on human health (SEA Objective 7). A minor negative effect on cultural heritage (SEA Objective 11) has also been identified reflecting the proximity of heritage assets to four of the resilience options and the potential for effects on the settings of these features.

No effects are anticipated with respect to water resources (SEA Objective 9).

Operational Effects

The development of new tunnel sections would address water supply and water quality risks associated with a failure of the Manchester and Pennine Aqueduct. Additionally, this solution would enable future tunnel maintenance by providing alternative water supplies whilst associated works are being carried out. This would significantly enhance the resilience of supply to over two million customers, ensuring continuity of a clean and safe water supply and supporting regional economic and population growth. In consequence, Solution E has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8). The assessment has identified that abstraction of the scale proposed from the River Ribble under Option 215 could affect recreational fishing with consequential impacts on the health and wellbeing of associated receptors. Solution E has therefore also been assessed as having a (mixed) minor negative effect on SEA Objective 7 during operation.

No further significant positive effects from operation have been identified during the assessment of Solution E.

As noted above, Option 217 would involve the development of new aboveground infrastructure within the Forest of Bowland AONB which has the potential to adversely affect this designated landscape. Two further options would also result in new aboveground infrastructure in non-designated areas. Overall, Solution E has been assessed as having a significant negative effect on landscape (SEA Objective 12) at this stage.

No further significant negative effects have been identified during the assessment of Solution E.

The tunnels associated with Option 37-42 would be constructed within the saturated zone of the aquifer and the presence of a low permeability linear structure may alter groundwater flows and levels (particularly where the tunnels are shallower and within the zone of active groundwater flow) and affect surface water. However, as noted above, a detailed study of the geology of the tunnel route has not been undertaken at this time and good connections between the groundwater and surface water environment have been assumed. Solution E has therefore been assessed as having a negative effect on water quantity and quality (SEA Objective 3) at this stage, although some uncertainty remains.

The treatment and pumping of water under this solution would generate circa 400 tCO_2e per annum. This has been assessed as having a minor negative effect on climate change (SEA Objective 6). The ongoing energy and resource use associated with Solution E has also been assessed as having a minor negative effect on SEA Objective 10.

Once construction activity is complete, no effects on biodiversity (SEA Objective 1) are expected, although some uncertainty remains with regard to the potential ecological impacts of new abstractions from the River Ribble under Options 215 and 216.

Neutral effects have been identified in respect of geology and soils (SEA Objective 2), flood risk (SEA Objective 4), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

6. Assessment of the Revised Draft WRMP and Alternatives

6.1 Introduction

This section of the Environmental Report presents the findings of the assessment of the preferred programme of options contained in the Revised Draft WRMP (and reasonable alternatives) which has been undertaken in accordance with the methodology described in **Section 4**. It begins by presenting the high level assessment of alternative plans that were identified and considered by United Utilities in developing the Draft WRMP (**Section 6.2**) before assessing in detail United Utilities' Preferred Plan as contained in the Revised Draft WRMP (**Section 6.3**). The cumulative, synergistic and secondary effects of the Revised Draft WRMP are considered in **Section 6.4** and commentary is then provided on the performance of the plan against the well-being goals of the Well-being of Future Generations (Wales) Act 2015 and the objective for the sustainable management of natural resources (SMNR) established in the Environment (Wales) Act 2016 (**Section 6.5)**. An overview of the mitigation and enhancement measures identified during the assessment is set out in **Section 6.6** before the section concludes by identifying the reasons for selection of the Preferred Plan and for the rejection of the reasonable alternative considered in preparing the Revised Draft WRMP (**Section 6.7**).

6.2 Assessment of Draft WRMP Plan Alternatives

In developing the Draft WRMP United Utilities forecast the future demand for water and available supply for the 25 year period to 2045. At that time, the initial analysis of the supply-demand balance demonstrated that the United Utilities region would be unlikely to experience a supply-demand deficit in any of its WRZs over the planning horizon of the WRMP. Notwithstanding this, in developing the Draft WRMP, United Utilities identified a number of 'strategic choices' in order to help protect and, where possible, benefit customers and the environment. The strategic choices considered in developing the Draft WRMP related to:

- enhanced leakage reduction;
- improved levels of service for drought permits and drought orders;
- increasing resilience to non-drought hazards, in particular asset failure; and
- exploring national water trading.

Using different combinations of these strategic choices, United Utilities identified four alternative plans for the Draft WRMP, as follows:

- **Alternative Plan 1**: Continued demand management;
- **Alternative Plan 2**: Plan 1 plus enhanced leakage reduction and improved levels of service for drought permits and orders;
- **Alternative Plan 3**: Plan 2 plus resilience to other hazards;
- **Alternative Plan 4**: Plan 3 plus national water trading (United Utilities' Draft WRMP Preferred Plan).

The Draft WRMP Environmental Report included a high level of assessment of these four alternative plans against the 12 SEA objectives that comprise the assessment framework, commensurate with the level of information and detail contained in the Draft WRMP at that time. This high level assessment is reproduced below.

Alternative Plan 1: Continued Demand Management

Plan Overview

Alternative Plan 1 would seek to maintain the baseline supply-demand balance position and there would be no further investment over the planning horizon of the WRMP. However, a range of demand management activities would be required in order to maintain the supply-demand balance and which form part of the baseline for WRMP19, including:

- maintaining leakage levels at 448.2 Ml/d based on a three year average from 2014/15 to 2016/17;
- water efficiency activities achieving, as a minimum, an annual saving of 1 litre per property per day for the remainder of the period to 2020; and
- installing a total of around 180,000 water meters between 2020 and 2045.

Strictly, the range of effects described are contained in the evolution of the baseline (as they would happen without the implementation of the Draft WRMP); however, for completeness are described below.

Likely Significant Effects

Alternative Plan 1 would not involve additional investment in resource management or demand management measures beyond that which forms part of the baseline for the WRMP. In consequence, this plan alternative was considered unlikely to have any significant effects on the SEA objectives (above the baseline changes).

Whilst no significant adverse effects were identified, maintaining levels of leakage and implementing demand management measures including metering would help support future population growth, ensure a continuity of supply of clean drinking water and promote the sustainable use of water resources with associated benefits for the environment. In this context, Alternative Plan 1 was assessed as likely to have minor positive effects on water quantity and quality (SEA Objective 3), health (SEA Objective 7), wellbeing (SEA Objective 8) and water resources (SEA Objective 9). Demand/leakage reduction may also reduce greenhouse gas emissions associated with pumping and treatment of water and lower energy use from heating water in the home. This was assessed as having a positive effect on climate change (SEA Objective 6) and resource use (SEA Objective 10). However, there would be resource use, carbon emissions and waste arisings associated with the continued installation of water efficiency devices and pipeline works and in consequence, minor negative effects were anticipated in respect of SEA Objective 6 and 10.

Should pipeline works be located in environmentally sensitive areas such as designated nature conservation sites or landscapes, the potential for construction activity to have adverse effects on (inter alia) biodiversity (SEA Objective 1) and landscape (SEA Objective 12) was identified, although effects in this regard could be minimised through the implementation of established best practice construction techniques and methods at the project stage.

Alternative Plan 2: Plan 1 plus Enhanced Leakage Reduction and Improved Levels of Service for Drought Permits and Orders

Plan Overview

The Draft WRMP highlighted that, if leakage is maintained at existing levels, United Utilities would be operating well below the sustainable economic level of leakage. Further, as noted above, no supply-demand deficit was identified at the time of publication of the Draft WRMP. Notwithstanding this baseline position, United Utilities conducted a wide range of specific customer research on leakage which demonstrated very strong support for leakage reduction but that there are also limits and any willingness to pay for leakage reduction is finely balanced with the corresponding costs.

In this context, in addition to continued demand management (as per Alternative Plan 1), Alternative Plan 2 would involve the implementation of a programme of leakage reduction designed to deliver an 80 Ml/d level in accordance with profile outlined in **Table 6.1**.

Table 6.1 Draft WRMP Leakage Reduction Profile

Year	2020-25	2025-30	2030-35	2035-40	2040-45
Baseline position (Ml/d)			448.2		
Further leakage reduction (Ml/d)	-30.0	-20.0	-10.0	-10.0	-10.0
Proposed leakage level (Ml/d)	418.2	398.2	388.2	378.2	368.2

The Draft WRMP leakage reduction programme comprised three distinct phases:

- 2020-2025: there would be a large dependency on the leakage options that United Utilities is confident can be delivered, with only a small reliance on innovative approaches;
- 2025-2030: there would be an even balance of reliable and innovative solutions;
- Beyond 2030: there would be a focus on low cost and innovative solutions.

As highlighted above, improved levels of service for drought permits and drought orders were identified by United Utilities as a strategic choice for the Draft WRMP. The definition of this strategic choice was to reduce the stated frequency of drought permits and orders from 1 in 20 years on average to 1 in 40 years on average (from 5% to 2.5% risk of happening in any given year). Rather than invest directly in new options to facilitate this strategic choice, United Utilities would link it to enhanced leakage reduction, as a supplementary benefit of these activities on the basis that there is a supply-demand benefit of 30 Ml/d from leakage reduction by 2025, which exceeds the requirement to move to a 1 in 40 year frequency for drought permits and orders.

Likely Significant Effects

Employment opportunities and supply chain benefits are likely to be generated during the implementation of the leakage reduction programme and Alternative Plan 2 was assessed as having a significant positive effect on wellbeing (SEA Objective 8), although it is recognised that a large proportion of additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any new employment opportunities may be limited. Pipeline repair may take place within and/or utilise road networks which could result in increases in localised congestion and disruption/driver delay throughout the implementation phases, although any effects would be temporary and small in scale.

There would be carbon emissions arising from embodied carbon (in, for example, materials for pipeline repair, PMVs and meters/probes) in addition to plant and vehicle movements throughout the investigative and construction period. There would also be an increase in resource use for pipeline repair and construction waste along with fuel usage for vehicles and plant. Taken together, total emissions associated with the leakage reduction programme would be likely to be substantial. However, once construction work is complete, lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Further, the implementation of the leakage reduction programme would reduce the frequency of drought permits and orders from 1 in 20 years on average to 1 in 40 years on average; this would be likely to improve the resilience of the water supply to the impacts of climate change. Overall, Alternative Plan 2 was assessed as having a mixed significant positive and significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The leakage reduction programme, in addition to continued demand management, would result in less water being lost due to leakage, promote the efficient use of water resources and lower demand for water abstraction. The reduction in the frequency of drought permits and orders would also help to conserve water quantity and quality by limiting the requirement to take water from the environment at times of drought with beneficial effects on habitats and species (from reductions in stresses arising from drought). This was assessed as having an overall significant positive effect on water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9) with a minor positive effect on biodiversity (SEA Objective 1). Given the potential for water savings and the reduction in the frequency of drought permits and orders to help ensure

continuity of water supply and support population and economic growth, Alternative Plan 2 was also assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No further likely significant effects were identified. Construction activity associated with leakage repair could impact on biodiversity (SEA Objective 1), air quality (SEA Objective 5), health (SEA Objective 7) and landscape (SEA Objective 12). However, as the location of the works to be undertaken is unknown at this stage, some uncertainty remains with regard to the probability of adverse effects on these objectives occurring. Notwithstanding this, adverse effects could be minimised through the implementation of established best practice construction techniques and methods at the project stage.

Alternative Plan 3: Plan 2 plus Resilience to Other Hazards

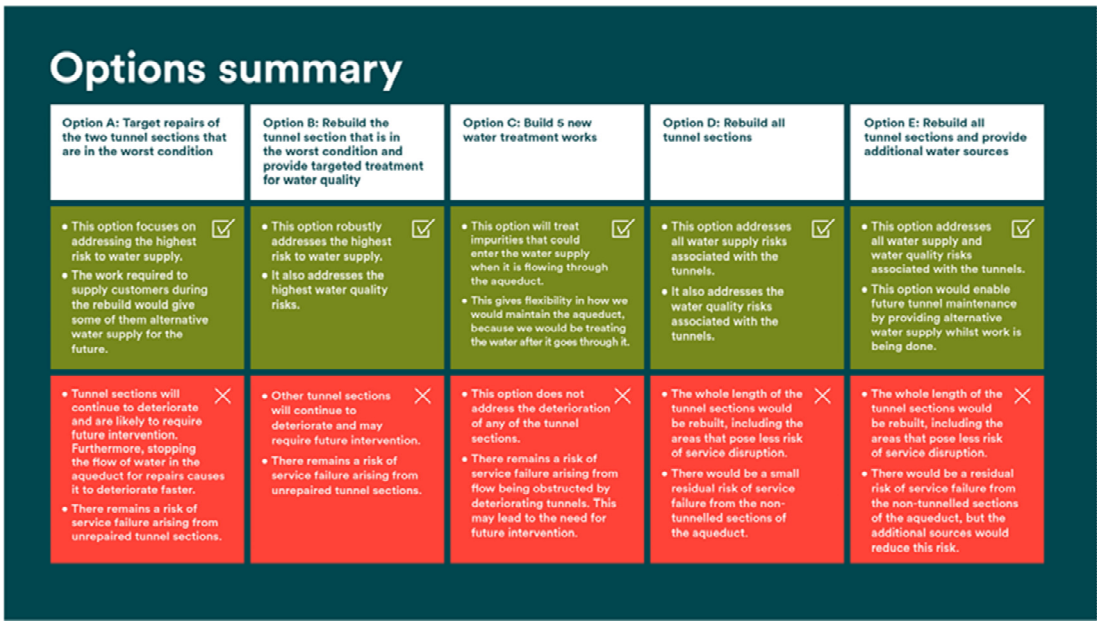
Plan Overview

Under this alternative, continued demand management (Alternative Plan 1) and a programme of leakage reduction (Alternative Plan 2) would be implemented. Additionally, United Utilities would seek to enhance resilience to non-drought hazards; the largest resilience risk identified being that associated with the regional aqueduct system which supplies water from the Lake District to the Manchester and Pennine areas. United Utilities identified that aqueduct condition is deteriorating over time and that the greatest risk in terms of both water quality and water supply relates to the aqueduct serving Greater Manchester and areas of the Pennines. This risk could, in the future, result in a widespread water quality incident (for example, advice to boil water for drinking purposes for over a million properties) or loss of supply to many thousands of properties for an extended period. United Utilities identified three indicative events to represent the overall baseline system risk over a future 10 year period:

- 65% probability that 1.2 million properties could be affected by water quality problems for 1 week;
- 35% probability that 120,000 properties could be affected by supply interruptions for up to 3 months;
- 20% probability that 240,000 properties could be affected by supply interruptions for up to 2 weeks.

The development of solutions to address the risks of aqueduct deterioration (and its consequences) to the Strategic Resource Zone was collectively referred to as ‘Manchester and Pennine Resilience’. The Draft WRMP identified for consultation five potential Manchester and Pennine Resilience solutions and these are shown in **Figure 6.1**.

Figure 6.1 Alternative Solutions to Reduce Resilience Risk



At the Draft WRMP stage, United Utilities' preferred Manchester and Pennine Resilience solution had not been determined and in consequence, the assessment of this component of Alternative Plan 3 (and Alternative Plan 4) contained in the Draft WRMP Environmental Report was necessarily undertaken at a high level, commensurate with the level of information/detail available at that time.

Likely Significant Effects

The implementation of the Manchester and Pennine Resilience solution (once confirmed) would be likely to generate substantial employment opportunities and supply chain benefits. The level of investment (and, therefore, magnitude of beneficial economic effects) would be significant but would be dependent on a number of factors including, in particular, the solution ultimately adopted. However, works associated with Alternative Plan 3 would be likely to generate substantial vehicle movements resulting in increases in congestion and disruption/driver delay throughout the implementation phase. Overall, Alternative Plan 3 was assessed as having a mixed significant positive and minor negative effect on wellbeing (SEA Objective 8).

There would be carbon emissions and resource use associated with the construction phase of the Manchester and Pennine Resilience solution, continued demand management and implementation of the leakage reduction programme. The exact volume of emissions and resource use would be dependent on the resilience solution adopted; however, this would likely be significant. Where solutions would involve new treatment or supplies, there would also be operational emissions and resource use. However, lower levels of leakage associated with the leakage reduction programme may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and improve climate change resilience. Further, the Manchester and Pennine Resilience solution would be expected to help further reduce leakage from the network (with associated reductions in carbon emissions) and may contribute towards improved resilience to drought (by helping to maintain continuity of water supplies). On balance, Alternative Plan 3 was assessed as having a mixed significant positive and significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The Manchester and Pennine Resilience solution would help to address the risks of aqueduct deterioration and potential failure (and its consequences). Alongside benefits associated with the implementation of the leakage reduction programme (as described under Alternative Plan 2), this was assessed as having an overall significant positive effect on water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9), although should the solution ultimately taken forward include alternative supplies then there would be the potential for associated abstractions to have an adverse effect on SEA Objective 3 and in consequence, some residual uncertainty was identified. Given the potential for this alternative plan to help ensure continuity of a clean and safe water supply and support population and economic growth, it was also

been assessed as having an overall significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No further likely significant effects were identified. Construction activity could impact on biodiversity (SEA Objective 1) due the loss of/disturbance to habitats and species. Subject to the Manchester and Pennine Resilience solution adopted and the requirement or not for new resource management options, associated water abstraction during the operation of the scheme could also adversely affect water dependent habitats and species. Where these impacts affect ecologically sensitive areas, effects could be significant and in this regard, it is noted that the regional aqueduct system crosses under/is within close proximity to a large number of internationally and nationally designated nature conservation sites. However, the exact type/nature and location of the solution to be taken forward was not defined at the Draft WRMP stage and in consequence, some residual uncertainty was also identified in the assessment. Notwithstanding this, adverse effects could be minimised through, for example, the implementation of established best practice construction techniques and methods at the project stage and the re-routing of pipelines to avoid sensitive areas.

Construction activity associated with Alternative Plan 3 would be likely to have some adverse impacts on air quality (SEA Objective 5) and health (SEA Objective 7) due to the potential for vehicle movements and the operation of plant to affect local air quality and generate noise/vibration disturbance, particularly where works would be in close proximity to large numbers of residential receptors (the regional aqueduct system is within proximity to/crosses under a number urban centres including the Greater Manchester conurbation). There was also the potential for negative effects on geology and soils (SEA Objective 2), due to the loss of greenfield land to accommodate new development/potential impacts on designated geological sites, and flood risk (SEA Objective 4), should construction activity and/or new development be located in areas at risk of flooding.

Construction activity and the presence of new above ground infrastructure (if required) could affect cultural heritage (SEA Objective 11) and landscape (SEA Objective 12). These effects could be significant where works affect designated historic assets and landscapes and/or large numbers of sensitive visual receptors. In this regard, it is noted that the regional aqueduct system crosses under nationally designated landscapes (including the Lake District National Park and World Heritage Site and Forest of Bowland AONB), is in close proximity to a range of heritage assets and crosses under major urban centres. However, the likelihood of adverse effects occurring and their magnitude would be dependent on the exact type/scale of development and the sensitivity of the receiving environment. Notwithstanding this, adverse effects could be minimised through the implementation of appropriate mitigation such as sensitive design and screening at the project stage.

Alternative Plan 4: Plan 3 plus National Water Trading

Overview

Alternative Plan 4 would comprise all of the components of Alternative Plans 1, 2 and 3 described above (including continued demand management, leakage reduction and Manchester and Pennine Resilience). In line with the planning guidelines[108], the UK Government's Guiding Principles for Water Resources Planning[109] and the Water Resources Long Term Planning Framework (2015-2065)[110], this alternative would also involve national water trading. Specifically, the Draft WRMP identified that up to 180 Ml/d of water would be made available for transfer from Lake Vyrnwy to Thames Water via the River Severn during periods of drought (when dry weather means there is a need for the water in the Thames catchment).

In order to maintain supplies to the company's own customers when exporting from Lake Vyrnwy, enabling works to large diameter trunk mains to allow the pumping of water from the River Dee normally used to

[108] Environment Agency and Natural Resources Wales (2018) *Water Resources Planning Guideline*. Available at: https://cdn.naturalresources.wales/media/686174/interim-wrpg-update-july18-final-changes-highlighted.pdf [Accessed August 2018].
[109] Defra (2016) *Guiding Principles for Water Resources Planning*.
[110] Water UK (2016) *Water resources long term planning framework*. Available from https://www.dropbox.com/s/o5iydhdczz7sir8/WaterUK%20WRLTPF_Final%20Report_FINAL%20PUBLISHED.pdf?dl=0 [Accessed November 2017].

supply Liverpool to customers in Cheshire currently supplied from Lake Vyrnwy would be required. Additionally, trading dry year proposals included:

- a new water resource from a third party supplier via the Shropshire Union Canal in Cheshire;
- enhancements to groundwater sources across the region;
- improvements to resource efficiency by adding automated controls to reservoir releases; and
- promoting water efficiency to metered customers.

Alternative Plan 4 was selected as the Preferred Plan for the Draft WRMP.

Likely Significant Effects

The type and range of effects associated with the implementation of Alternative Plan 4 were identified as being likely to be similar to those described in respect of Alternative Plans 1 to 3 above and to avoid duplication, this is not repeated here.

Under this alternative, water would be exported from Lake Vyrnwy to the Thames Water region, helping to ensure the continuity of water supply to Thames Water customers during periods of drought. This would generate additional benefits in terms of health (SEA Objective 7) and wellbeing (SEA Objective 8) as well as climate change resilience (SEA Objective 6) beyond those identified in respect of Alternative Plans 1 to 3. However, enabling works required to facilitate the export of water and the construction/operation of measures designed to maintain supplies to United Utilities customers would be likely to generate additional negative environmental effects across several of the SEA objectives.

Summary

The high level assessment of the four plan alternative identified by United Utilities for the Draft WRMP found that the type, range and magnitude of both positive and negative environmental effects would be likely to increase commensurate with the level of intervention proposed.

The assessment highlighted that Alternative Plan 1 would not involve additional investment in resource management or demand management measures beyond that which forms part of the baseline for WRMP19. In consequence, any effects associated with this alternative are likely to be very minor.

The programme of leakage reduction under Alternative Plan 2 would be likely to generate significant positive effects on health (SEA Objective 7) and wellbeing (SEA Objective 8), associated with increased investment and continuity of water supply, and water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9), as less water would be lost due to leakage, lowering demand for water abstraction. Mixed significant positive and significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10) were also identified reflecting carbon emissions arising from pipeline repair but also the expectation that lower levels of leakage (and improved water efficiency) would reduce greenhouse gas emissions and energy use. Reflecting the scale of intervention associated with this alternative plan, no further significant effects were identified.

Through the implementation of the Manchester and Pennine Resilience solution, the high level assessment found that Alternative Plans 3 and 4 would be expected to deliver the most benefits in terms of both levels of investment and continuity of water supply. Additionally, Alternative Plan 4 would provide national benefits through export to Thames Water, helping to address risks associated with drought beyond the United Utilities region. However, reflecting the increased scale of construction activity and potential operational impacts associated with the abstraction of water, the assessment highlighted that potential adverse environmental effects associated with these alternatives are more likely.

The Draft WRMP Preferred Plan

For the Draft WRMP, United Utilities selected Alternative Plan 4 as its Preferred Plan. This Preferred Plan comprised a combination of preferred resource management and demand management (including leakage reduction and network metering) measures designed to achieve the four strategic choices outlined above

and was subject to further assessment as part of the Draft WRMP Environmental Report (see Section 6.3 of the previous report).

The assessment highlighted that the Draft WRMP Preferred Plan would be likely to generate significant positive effects across several of the SEA objectives including water quality and quantity (SEA Objective 3), climate change (SEA Objective 6), health (SEA Objective 7), wellbeing (SEA Objective 8), water resources (SEA Objective 9) and resource use (SEA Objective 10). This reflected the operational benefits of the plan including increased water supply resilience, climate change adaptation and mitigation, reduced demand for water and, in terms of construction, capital investment.

Where negative effects had been identified, these were expected to be minor only. The assessment noted that adverse effects associated with the construction/implementation of water management measures would be short term and temporary and that best practice construction techniques and methods could be implemented at the project stage to help reduce the likelihood of such effects occurring and their magnitude. Similarly, the assessment highlighted that negative operational effects could be managed to an acceptable level at the project stage, with appropriate mitigation identified through further detailed assessment of environmental impacts. The exception to this was in respect of climate change (SEA Objective 6) and resource use (SEA Objective 10) where significant negative effects were identified during construction (although it was noted that these effects reflected the energy and resource use associated with the implementation of the water management measures which is to a large extent unavoidable and may be reduced at the project stage through, for example, the use of renewable energy and sustainably sourced construction materials).

The Draft WRMP Preferred Plan was selected by United Utilities as it contained all of the strategic choices proposed by United Utilities to address customer and stakeholder views (the reasons for the selection of the Preferred Plan and rejection of the alternative plans considered in preparing the Draft WRMP were detailed in Section 6.7 of the Environmental Report for the Draft WRMP).

Following consultation on the Draft WRMP, United Utilities has reviewed its Preferred Plan for WRMP19 and as a result, the Preferred Plan contained in the Draft WRMP has been modified. In particular, in response to consultation responses, additional customer research, further exploration of leakage options and innovations, and a tightening of the supply-demand balance (showing a very small deficit forecast in the Strategic Resource Zone at the end of the planning horizon), United Utilities has further enhanced its leakage reduction aspirations. Taking into account evidence from customer engagement, consultation and economic and environmental appraisals as part of a multi-criteria analysis process, United Utilities has also confirmed the proposed solution for Manchester and Pennine Resilience (Solution D). Additionally, the revised Preferred Plan does not now include a water trading component such that Alternative Plan 3 is the approach being taken forward. This is because a water trade from the North West is not included in the preferred plans of other water companies at this stage. However, water trading remains UU's preference and the company will continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round.

6.3 Detailed Assessment of the Revised Draft WRMP Preferred Plan

Overview

The Revised Draft WRMP Preferred Plan includes the following strategic choices:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25, United Utilities plans to reduce leakage by at least 67 Ml/d, or 15%;
- Improve the level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk);
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennine Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

The Preferred Plan encompasses a combination of preferred demand management measures and resilience options designed to achieve the three strategic choices outlined above. **Table 6.2** lists the options that comprise the Preferred Plan together with their respective estimated total water saving (for demand management and leakage reduction measures).

Table 6.2 Preferred Options

Ref	Preferred Option	Description	Saving (Ml/d)	Implementation (AMP)
Preferred Manchester and Pennine Resilience Solution D				
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	N/A	TBC
37-42	Manchester and Pennine Aqueduct sections T01 to T06	This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.	N/A	TBC
Preferred Demand Management Options – Leakage Reduction and Network Metering				
WR500a	Leakage reduction stage 1	Preferred options WR500a to WR500e would involve an increase in leakage detection and repair activity through the installation of PMVs over an 11 year period. Activities for Stages 1 to 5 would be as follows: • Stage 1: A total of 276 leakage surveys, 510 repairs and 10 PMV installations would be undertaken. • Stage 2: An additional 339 leakage surveys, 510 repairs and 13 PMV installations would be undertaken • Stage 3: An additional 332 leakage surveys, 408 repairs and 12 PMV installations would be undertaken. • Stage 4: An additional 520 leakage surveys, 510 repairs and 19 PMV installations would be undertaken. • Stage 5: An additional 692 leakage surveys, 510 repairs and 26 PMV installations would be undertaken.	10	AMP7
WR500b	Leakage reduction stage 2		20 (including Stage 1)	AMP7
WR500c	Leakage reduction stage 3		28 (including Stages 1 and 2)	AMP7
WR500d	Leakage reduction stage 4		38 (including Stages 1 to 3)	AMP10
WR500e	Leakage reduction stage 5		48 (including Stages 1 to 4)	AMP10
WR500f	Leakage reduction stage 6	Preferred options WR500f to WR500k would involve additional leakage detection and repair activity (to that already set out for Stages 1 – 5) through the installation of noise loggers over a six year period. Activities for Stages 6 to11 would be as follows: • Stage 6: A total of 85 leakage surveys, 511 repairs and 4,424 noise logger installations would be undertaken. • Stage 7: An additional 104 leakage surveys, 625 repairs and 8,148 noise logger installations would be undertaken. • Stage 8: An additional 225 leakage surveys, 1,350 repairs and 20,083 noise logger installations would be undertaken. • Stage 9: An additional 231 leakage surveys, 1,388 repairs and 25,575 noise logger installations would be undertaken. • Stage 10: An additional 257 leakage surveys, 1,542 repairs and 29,235 noise logger installations would be undertaken.	4.99	AMP7
WR500g	Leakage reduction stage 7		9.81 (including Stage 6)	AMP7
WR500h	Leakage reduction stage 8		19.81 (including Stages 6 to 7)	AMP7
WR500i	Leakage reduction stage 9		29.95 (including Stages 6 to 8)	AMP7

Ref	Preferred Option	Description	Saving (Ml/d)	Implementation (AMP)
WR500j	Leakage reduction stage 10	• Stage 11: An additional 112 leakage surveys, 671 repairs and 17,098 noise logger installations would be undertaken.	39.90 (including Stages 6 to 9)	AMP7
WR500k	Leakage reduction stage 11		45.23 (including Stages 6 to 10)	AMP8
WR503	Monitoring of household meters to identify and fix supply pipe leaks	This preferred option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5 year period.	3.81	AMP8
WR514	Logging of large customers	This preferred option would involve the logging of large customers over a 5 year period (it is assumed that 10% of those temporarily logged would become permanent). This would require the installation of loggers to all customers identified as having high consumption (above 500 l/hr) in either District Metering Areas (DMAs) with poor operability or DMAs with good operability in order to assess which customers have the largest impact on the operability within DMAs. Logged customers would be setup in Netbase and their night use allowances would be updated to reflect the percentage of night use to daily consumption which should have a positive impact on operability and leakage.	1.07	AMP8
WR515	Splitting District Metering Areas	This preferred option includes a study of non-operable DMAs over a 5 year period to determine the reason(s) why a DMA is not currently operable, and subsequently, to carry out appropriate actions to remedy any identified issues and/or constraints. The option scope includes office design, hydraulic modelling and site investigation in addition to the construction of chambers, installation of meters and the repair of pipework and ancillary equipment.	2.15	AMP8
WR517	Upstream tiles enhancements	This preferred option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.	3.57 Ml/d	AMP8
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	54.0	AMP10
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	2.12	AMP7
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP8
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP10
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	This option would involve the reduction of customer side leakage at non-household properties.	5.0	AMP8

Ref	Preferred Option	Description	Saving (Ml/d)	Implementation (AMP)
WR914	Third Party - Cello 4S and Regulo	This preferred option would involve surveys and the installation of pressure management devices by a Third Party over a 5 year period together with ongoing maintenance to be undertaken by United Utilities.	4.0	AMP8

Likely Significant Effects

In accordance with the approach detailed in **Section 4**, the preferred options listed in **Table 6.2** above have been subject to detailed assessment. The findings of the assessment are presented in the matrices contained in **Appendix E** and summarised in **Table 6.3** together with the predicted overall cumulative effect of implementing all of the preferred options that comprise the Revised Draft WRMP Preferred Plan.

Table 6.3 Assessment of the Preferred Plan

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
37-42	Manchester and Pennine Aqueduct sections T01 to T06	C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0
WR500a	Leakage reduction stage 1	C	-/?	0	0	0	-/?	0	-/?	0	0	0	0	-/?
		O	0	0	+	0	0	+	+	+	++	+	0	0
WR500b	Leakage reduction stage 2	C	-/?	0	0	0	-/?	0	-/?	+	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500c	Leakage reduction stage 3	C	-/?	0	0	0	-/?	0	-/?	+	0	0	0	-/?

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500d	Leakage reduction stage 4	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500e	Leakage reduction stage 5	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500f	Leakage reduction stage 6	C	-/?	0	0	0	-/?	-	-/?	0	0	-	0	-/?
		O	0	0	+	0	0	+	+	+	+	+	0	0
WR500g	Leakage reduction stage 7	C	-/?	0	0	0	-/?	--	-/?	0	0	--	0	-/?
		O	0	0	+	0	0	+	+	+	++	+	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR500h	Leakage reduction stage 8	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500i	Leakage reduction stage 9	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500j	Leakage reduction stage 10	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**++**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500k	Leakage reduction stage 11	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**++**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR503		C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Monitoring of household meters to identify and fix supply pipe leaks	O	0	0	+	0	0	0	+	+	+	0	0	0
WR514	Logging of large customers	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR515	Splitting District Metering Areas	C	-/?	0	0	0	0	0	0	0	0	0	0	-/?
		O	0	0	+	0	0	+	+	+	+	+	0	0
WR517	Upstream tiles enhancements	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	C	0	0	0	0	0	-	0	+	0	-	0	0
		O	0	0	+	0	0	+	++	++	++	+	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	0	0	0	0	0	-	0	+	0	-	0	0
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	0	0	0	0	0	0	0	+	0	0	0	0
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR914	Third Party - Cello 4S and Regulo	C	0	0	0	0	0	0	0	0	0	0	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	0	+	+	+	0	0	0
Cumulative Effects of the Preferred Plan		C	-/?	-	-/?	-	--	--	-	++/-	0	--	0	-/?
		O	0	0	+/-/?	0	0	++/-	++	++	++	++/-	0	0

The subsections that follow provide commentary on the likely significant construction and operational effects of the Preferred Plan, taking into account the findings of the detailed assessment of the preferred options summarised in **Table 6.3** above.

Construction Effects

Capital investment associated with the Preferred Plan would generate supply chain benefits, employment opportunities and increased spend in the local economy by contractors and construction workers. In combination, the scale of investment associated with the preferred options would be substantial and in consequence, the Preferred Plan has been assessed as having an overall significant positive effect on wellbeing (SEA Objective 8). However, HGV movements and pipeline works during construction would be likely to cause some traffic disruption, generating a (mixed) minor negative effect on this objective.

No further significant positive effects from construction have been identified during the assessment of the Preferred Plan.

The operation of plant and machinery and vehicle movements during the construction phase of Manchester and Pennine Resilience Solution D and the leakage reduction and network metering options would generate emissions to air which could affect air quality. There would also be emissions to air related to the transportation of water efficiency devices and/or workers associated with the preferred demand management options. Reflecting the number of vehicle movements likely to be associated with Solution D in particular, the Preferred Plan has been assessed as having a significant negative effect on air quality (SEA Objective 5). Emissions to air, alongside noise and vibration disturbance, during construction may also have minor adverse effects on residential and other sensitive receptors in close proximity to construction sites and along transport routes whilst pipeline works may cause some temporary disturbance to users of local footpaths, open space and other recreational facilities. However, any adverse impacts in this regard would be temporary and are likely to be managed through the implementation of best practice construction methods. A minor negative effect has therefore been identified in respect of health (SEA Objective 7).

For the majority of options that comprise the Preferred Plan there would be carbon emissions arising from embodied carbon (in, for example, construction materials and equipment such as PMVs and noise loggers) in addition to plant operation and vehicle movements. In particular, Manchester and Pennine Resilience Solution D would generate a high volume of greenhouse gas emissions associated with the construction of tunnels and alongside the demand management options, total emissions associated with the Preferred Plan would be in excess of 1,000,000 tCO_2e. In consequence, the Preferred Plan has been assessed as having an overall significant negative effect on climate change (SEA Objective 6). Implementation of the Preferred Plan would also require raw materials, fuel for vehicles and plant and generate waste which has been assessed as having a significant negative effect on resource use (SEA Objective 10).

No further significant negative effects have been identified during the assessment of the Preferred Plan.

Development associated with the Preferred Plan may result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. The proposed route for the six tunnels under Option 37-42 would cross the Bowland Fells SPA/ SSSI for a distance of approximately 7km. However, effects on this site as a result of construction-related disturbance are unlikely (assuming all normal best-practice). The HRA highlights that there is a theoretical risk of groundwater bodies beneath the SPA being affected by the aqueduct, which may then have indirect effects on any groundwater dependent ecosystems within the European sites that have hydrological connectivity. This could, in theory, result affect the integrity of the SPA by affecting the habitats that support the interest features. However, this risk is considered to be negligible due to:

- the dominance of low-permeability geological formations;
- the nature of the upland habitats (predominantly ombrotrophic mires (etc.) maintained by rainfall and shallow subsurface flows rather than deep groundwater) and the absence of any evidence of significant connectivity with groundwater;
- the depth of the pipeline (at least 50m below the surface at the boundary of the SPA, and more typically in excess of 200m below the surface);

- the absence of any evidence that the existing aqueduct, which also runs beneath the fells, is having any effect on surface habitats.

The River Kent SAC is also within close proximity of the tunnel works whilst short sections of open-cut pipeline either cross, or are within the catchment of, minor tributaries of Morecambe Bay (and hence its associated European sites). However, the effects on the River Kent SAC and Morecambe Bay suite of sites are likely to be avoidable with normal best-practice. The potential likelihood of adverse effects on biodiversity occurring due to the implementation of the leakage reduction and network metering options are uncertain at this stage; this is because the locations of the pipelines requiring repair and the scale of the proposed works are currently unknown (although it is expected that works are likely to focus on areas where the distribution network is most dense which, alongside the implementation of standard mitigation, should limit impact pathways to sensitive ecological receptors). Overall, the Preferred Plan has been assessed as having a minor negative effect on biodiversity (SEA Objective 1), although some uncertainty remains.

Solution D (and therefore the Preferred Plan) has also been assessed as having a negative but uncertain effects on water quantity and quality (SEA Objective 3). There is potential for dewatering arising from the construction of the tunnels and shafts under Option 37-42 to affect groundwater levels and flows, which could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, a detailed study of the geology of the tunnel route has not been undertaken at this time and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) protect surface water bodies from impacts arising from changes in the groundwater regime.

Whilst Solution D would not require permanent land take (excavated land would be reinstated following the construction phase), the proposed overall tunnel length is substantial and in consequence, the Preferred Plan has been assessed as having an overall minor negative effect on geology and soils (SEA Objective 2). A minor negative effect has also been identified in respect of flood risk (SEA Objective 4) as works associated with Solution D would involve waterbody crossings and take place within Flood Zones 2/3 such that construction activity may be liable to flooding (depending on the timing of the works).

Construction activity associated with preferred Manchester and Pennine Resilience solution may have adverse impacts on landscape character and visual amenity, although effects are not expected to be significant. Those preferred leakage reduction and network metering options involving pipeline repair may also have temporary impacts in this regard, although the location of the works to be undertaken is unknown at this stage. Overall, the Preferred Plan has been assessed as having a negative effect on landscape (SEA Objective 12), although some uncertainty remains.

Construction-related effects arising from the implementation of the Preferred Plan on water resources (SEA Objective 9) and cultural heritage (SEA Objective 11) have been assessed as neutral.

Operational Effects

Reflecting the three strategic choices underpinning the Revised Draft WRMP, the Preferred Plan seeks to enhance leakage reduction and improve levels of service for drought permits and orders. Additionally, Manchester and Pennine Resilience Solution D will:

- reduce the future 10 year probability that 1.2 million properties could be affected by water quality problems for at least one week from 65% to less than 5%;
- reduce the future 10 year probability that that 120,000 properties could be affected by supply interruptions for up to three months from 35% to less than 5%; and
- reduce the future 10 year probability that 240,000 properties could be affected by supply interruptions for up to two weeks from 10% to 5%.

In this context, it is expected that the Preferred Plan will help to ensure continuity of water supply to United Utilities' customers and support population and economic growth; the Plan has therefore been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

Through the implementation of the leakage reduction programme, the Preferred Plan would reduce the frequency of drought permits and orders from 1 in 20 years on average to 1 in 40 years on average, and help to improve the resilience of the water supply to the impacts of climate change. In terms of climate change mitigation, the lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. In this regard, total peak annual reductions associated with the preferred leakage reduction and network metering options would be approximately 3,500 tCO_2e per year, although during aqueduct outage (to facilitate the construction of new connections under Manchester and Pennine Resilience Option 112) there would be an increase in energy and resource use required to treat water. Overall, the Preferred Plan has been assessed as having a mixed significant positive and minor negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The operation of the leakage reduction programme detailed in the Revised Draft WRMP, meanwhile, is expected to generate a leakage reduction of 190 Ml/d, from a baseline position of 448.2 Ml/d to 259 Ml/d (see **Table 6.4**).

Table 6.4 Leakage Reduction Programme

Year	2020-25	2025-30	2030-35	2035-40	2040-45
Baseline position (Ml/d)			**448.2**		
Revised draft - further leakage reduction (Ml/d)	-67	-38	-28	-28	-28
Revised draft - Cumulative leakage reductions (Ml/d)	-67	-105	-133	-162	-190
Revised draft – leakage forecast/target level (Ml/d)	381	343	315	287	259

The operation of the leakage reduction programme would lower demand for water abstraction and would limit the requirement to take water from the environment at times of drought; this could benefit the water environment. Overall, this has been assessed as having a significant positive effect on water resources (SEA Objective 9) and a positive effect on water quantity and quality (SEA Objective 3).

No further significant positive effects have been identified during the assessment of the Preferred Plan.

No significant negative effects have been identified during the assessment of the Preferred Plan.

Once construction activity associated with the Preferred Plan is complete, there are likely to be very few adverse environmental impacts and no significant negative operational effects have been identified. As the tunnels associated with Manchester and Pennine Resilience Solution D would be constructed within the saturated zone of the aquifer, the presence of a low permeability linear structure may alter groundwater flows and levels (particularly where the tunnels are shallower and within the zone of active groundwater flow) and affect surface water. However, as noted above, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Overall, a negative effect on water quantity and quality (SEA Objective 3) has been identified at this stage, although some uncertainty remains.

No operational effects are expected on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), flood risk (SEA Objective 4), air quality (SEA Objective 5), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Summary

Overall, the Preferred Plan is expected to generate significant positive effects across several of the SEA objectives including climate change (SEA Objective 6), health (SEA Objective 7), wellbeing (SEA Objective

8), water resources (SEA Objective 9) and resource use (SEA Objective 10). This reflects the operational benefits of the Plan including increased water supply resilience, climate change adaptation and mitigation, reduced demand for water and, in terms of construction, capital investment.

Where negative effects have been identified, these are expected to be minor only, although uncertainties remain. Adverse effects associated with the construction/implementation of water management measures including Manchester and Pennine Resilience Solution D would be short term and temporary and it is expected that best practice construction techniques and methods could be implemented at the project stage to help reduce the likelihood of such effects occurring and their magnitude. The exception to this is in respect of air quality (SEA Objective 5), climate change (SEA Objective 6) and resource use (SEA Objective 10) where significant negative effects have been identified during construction. However, these effects reflect the emissions to air, energy and resource use associated with the implementation of the water management measures which is to a large extent unavoidable (although effects may be reduced at the project stage through, for example, the use of renewable energy and sustainably sourced construction materials).

Assessment of Revised Draft WRMP Alternatives

In preparing the Revised Draft WRMP, United Utilities identified two alternative combinations of preferred options (portfolios) for water trading. Both alternatives included Manchester and Pennine Resilience Solution D and the leakage reduction and network metering options that comprise the Preferred Plan, alongside different portfolios of feasible resource and demand management options to facilitate the export of up to 180 Ml/d of water to the Thames Water region during periods of drought.

An assessment of the cumulative effects of the two portfolios identified by United Utilities against the 12 SEA objectives that comprise the assessment framework (based on the findings of the feasible options assessment) is provided in **Appendix F**.

As highlighted in **Section 6.2**, a water trade from the North West is not included in the preferred plans of other water companies at this stage and whilst water trading remains United Utilities' preference for future WRMP planning rounds, the trading portfolios have not been taken forward as part of the Preferred Plan for WRMP19.

6.4 Secondary, Cumulative and Synergistic Effects

The SEA Regulations require that the cumulative effects of the Revised Draft WRMP are assessed. This includes the cumulative effects of the individual preferred options that comprise the Preferred Plan and the effects of the Revised Draft WRMP in combination with other plans and programmes.

The cumulative effects of the individual options that comprise the Preferred Plan have already been presented in **Section 6.3**. This section therefore considers the cumulative effects of the Revised Draft WRMP in combination with other plans and programmes, including:

- growth proposals and associated population change in the United Utilities region;
- National Policy Statements (NPS) and Nationally Significant Infrastructure Projects (NSIPs);
- United Utilities' Final Drought Plan 2018; and
- other water company WRMPs.

The cumulative effects of the Revised Draft WRMP are difficult to accurately assess given the inherent uncertainties concerning (inter alia): future changes to baseline environmental conditions; future population and economic growth; the deliverability of some NSIPs (and the potential for new NSIPs to be brought forward); and the proposals of emerging water company WRMPs. As such, it will be necessary to keep under review these factors as the Preferred Plan is implemented (e.g. in Environmental Impact Assessments (EIA) and HRAs) to ensure that the latest and most up to date information is taken into account.

Population Change and Economic Growth

Population change in the United Utilities region has already been considered in the Revised Draft WRMP along with the potential for further changes in demographics throughout the plan period. These forecasts have been based upon population projections published by the ONS and engagement with local and unitary authorities to determine how many household properties are likely to be built in the region over the planning horizon. The forecasts have also taken into account potential economic growth in the North West region. **Table 6.4** shows the local authority plan-based population forecast for each WRZ and for the United Utilities region as a whole.

Table 6.4 Revised Draft WRMP Local Authority Plan-based Population Forecast

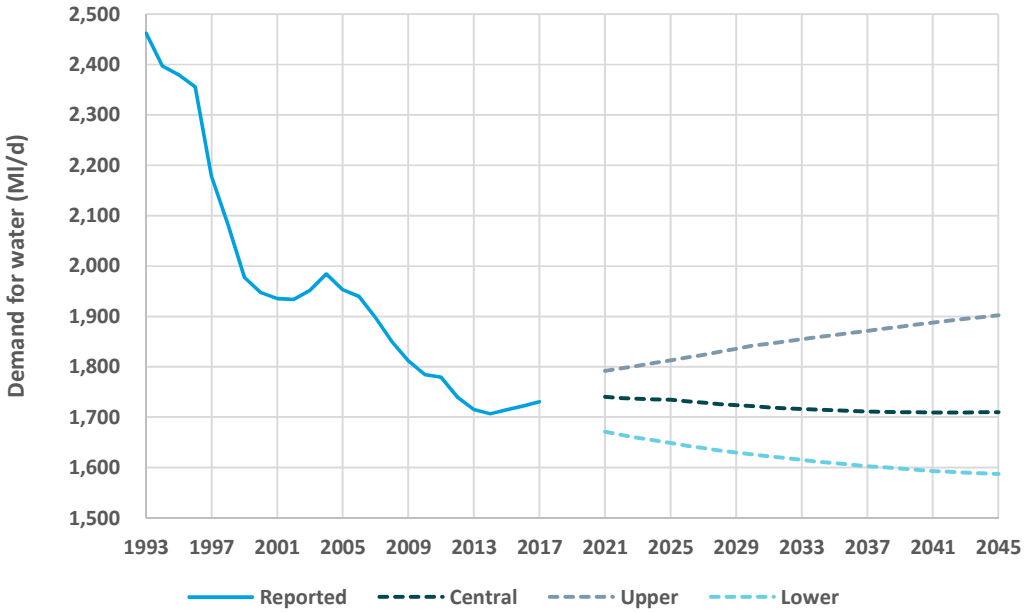
	2016/17	2020/21	2025/26	2030/31	2035/36	2040/41	2044/45
Strategic Resource Zone	7,026,586	7,301,526	7,551,216	7,732,309	7,906,330	8,075,297	8,198,640
Carlisle Resource Zone	109,877	117,287	123,395	128,284	130,955	132,873	133,820
North Eden Resource Zone	13,691	14,619	15,202	15,661	16,011	16,213	16,264
Region	7,150,154	7,433,432	7,689,812	7,876,254	8,053,296	8,224,384	8,348,723

Source: United Utilities (2018) Revised Draft Water Resources Management 2019

As a result, the 'in combination' water-resource effects of growth promoted by other plans (for example, local planning authority local plans and strategic growth plans) or projects are considered and accounted for during the WRMP development process. Arguably, therefore, potential 'in combination' effects in respect of water-resource demands due to other plans or projects are unlikely since these demands are explicitly modelled when determining the supply-demand balance. Conversely, in respect of water resources, the WRMP is not likely to make non-significant effects in other plans significant (indeed, other plans are arguably the 'source' of any potential effects in respect of water demand, with the WRMP having to manage potential effects that are not generated by the WRMP itself).

Whilst an increasing population and number of household properties would result in a higher forecast of household customer consumption, a combination of changes in water use behaviour and design standards, metering and economic conditions mean that a commensurate increase in overall demand for water may not necessarily occur. United Utilities' baseline demand forecasts are shown in **Figure 6.1**.

Figure 6.1 Reported regional demand for water, with the central forecast of dry year demand for water, as well as the upper (accounting for the "Northern Powerhouse" scenario[111]) and lower forecast of dry year demand for water



Source: United Utilities (2018) Revised Draft Water Resources Management 2019

Taking into account the baseline demand forecast, alongside water availability, dry weather demand and target headroom, United Utilities' assessment of its supply-demand balance shows that there will be a very small deficit (circa. 3 Ml/d) in the Strategic Resource Zone towards the end of the planning period.

The forecast deficit will be offset through the implementation of the demand management measures that comprise the Preferred Plan. Additionally, the Preferred Plan seeks to implement measures to enhance leakage reduction, improve levels of service for drought permits and orders and increase resilience to other hazards which is expected to help ensure that a continual supply of water is maintained to support future population, household and economic growth within United Utilities' region.

National Policy Statements and Nationally Significant Infrastructure Projects

The Planning Act 2008 introduced a procedure to streamline the decision-making process for NSIPs. Under the Act, a developer wishing to construct a NSIP must first apply to the Secretary of State for development consent. NPSs establish the need for specific types of infrastructure and provide planning guidance for promoters of NSIPs, and the basis for the examination by the Examining Authority and decisions by the Secretary of State on development consent order applications. A number of NPSs have been published which set out the definition, and in some cases the location, of NSIPs. The current status of NPSs is set out in **Table 6.5**.

[111] The Northern Powerhouse scenario envisages that the northern regions undergo a period of economic transformation.

Table 6.5 Current Status of National Policy Statements

National Policy Statement (NPS)	Status	Are Potential Locations of NSIPs included in the NPS?
Overarching Energy EN-1	Designated July 2011	No
Fossil Fuel Electricity Generating Infrastructure EN-2	Designated July 2011	No
Renewable Energy Infrastructure EN-3	Designated July 2011	No
Gas Supply Infrastructure and Oil and Gas Pipelines EN-4	Designated July 2011	No
Electricity Networks Infrastructure EN-5	Designated July 2011	No
Nuclear Power Generation EN-6	Designated July 2011	Yes
Ports	Designated January 2012	No
Waste Water Infrastructure	Designated March 2012	Yes
Hazardous Waste Infrastructure	Designated June 2013	No
National Networks	Designated January 2015	No
Airports National Policy Statement: New Runway Capacity and Infrastructure at Airports in the South East of England	Designated June 2018	Yes
Geological Disposal Infrastructure	Draft published January 2018	No
Water Resources	Draft not yet published (consultation on developing the NPS and proposals to amend the definition of nationally significant water infrastructure in the Planning Act 2008 took place between November and December 2017)	No

The Revised Draft WRMP is not expected to have any adverse cumulative effects in-combination with the NPSs listed above. This is because the NPS are either not site specific or because specific NSIP proposals are unlikely to affect, or be affected by, the measures that comprise the Preferred Plan.

The Nuclear Power NPS (EN-6) sets out eight potentially suitable sites for the deployment of new nuclear power stations in England and Wales. Of these sites, two are located within the United Utilities supply area,

Heysham and Sellafield, both of which are within the Strategic Resource Zone. Proposals for a new nuclear build at Sellafield (NuGen‟s Moorside Project) are currently at the pre-application stage (although subject to a strategic review by the project promoter) whilst National Grid's North West Coast Connections Project, a 400kV electricity transmission connection from NuGen‟s proposed new nuclear generating station to the existing transmission system in Cumbria/Lancashire, is also at the pre-application stage (although currently paused). Wylfa (Isle of Anglesey) is also identified for the deployment of a new nuclear power station. Given the distance of the options that comprise the Preferred Plan from these proposed NSIPs and/or the type/scale of associated works, no significant cumulative effects in-combination with the implementation of the Revised Draft WRMP are predicted.

Two NSIPs are set out in the Waste Water Treatment NPS; however, both of these are located in London and are not expected to have any effect on water demand in the United Utilities region. Similarly, the Airports NPS concerns runway capacity in the South East of England only.

Defra is currently preparing a NPS for water resources. This will set out the need for NSIPs related to water resources, and the Government's policies to deliver them. Whilst it is understood that this NPS will not be site specific, implementation of the Revised Draft WRMP is likely to support the objectives of the NPS which is likely to generate cumulative positive effects in respect of, in particular, health, wellbeing and climate change.

A number of further NSIPs that are not detailed in NPSs are listed on the Planning Inspectorate website[112]. At the time of writing, five additional projects in the North West region were at the pre-application stage:

- A5036 Port of Liverpool Access Scheme;
- Trans Pennine Upgrade Programme;
- A585 Windy Harbour to Skippool Improvement Scheme;
- Hillhouse Enterprise Zone Power Station;
- Hydrodec Oil Re-Refinery Eastham;
- Alexandra Dock Biomass Project.

These schemes would be located in the Strategic Resource Zone; however, they would not be in close proximity to any of the preferred options such that no significant cumulative effects are anticipated at this stage. Nevertheless, the water demands of all of these projects should be considered in their applications for development consent and if significant demand is forecast, this should be considered by United Utilities during monitoring of the WRMP and in the five year review.

United Utilities' Final Drought Plan 2018

United Utilities published its Final Drought Plan in June 2018. The Drought Plan provides a comprehensive statement of the actions that United Utilities will consider implementing during drought conditions in order to protect essential water supplies for customers and to minimise environmental impact. The Plan includes a range of drought management actions (linked to drought triggers), that can be broadly categorised as:

- operational actions;
- communication actions;
- demand side actions (water efficiency campaigns, campaign for voluntary water use restraint, Temporary Use Ban, drought order to ban non-essential use);
- leakage control actions;
- resource management actions (non-commissioned sources; tankering); and
- drought permit/order actions.

[112] See https://infrastructure.planninginspectorate.gov.uk/projects/ [Accessed August 2018].

The resource management actions and potential drought permit/order sites in the Strategic Resource Zone are summarised in **Table 6.6** and **Table 6.7** respectively.

Table 6.6 Drought Plan 2018 - Resource Management Actions

Source	Deployable Output in Drought (Ml/d)
Belle Vale Boreholes	4.0
Stocks Well Boreholes	8.0
Netherley Boreholes	11.4
Pex Hill Boreholes	5.8
Worsthorne Borehole	2.0
Walton Boreholes	3.9
Tankering to Ennerdale	0.6
Daresbury Borehole	4.5
Water Lane Boreholes	6.5
Landside Borehole	4.8
Croft Boreholes	6.0

Table 6.7 Drought Plan 2018 - Potential Drought Permit/Order Sites

Potential Drought Permit/Order Sites	Change Sought
Delph Reservoir	Reduce compensation flow from 3.7 to 1.0 Ml/d
Dovestone Reservoir	Reduce compensation flow from 15.9 to 10.0 or 5.0 Ml/d
Jumbles Reservoir	Reduce compensation flow from 19.9 to 12.0 or 6.0 Ml/d
Longdendale Reservoirs	Reduce compensation flow from 45.5 to 22.5 or 15.0 Ml/d
River Lune LCUS Abstraction	Reduce prescribed flow from 365 to a minimum of 200 Ml/d
Rivington Reservoirs – Brinscall Brook	Reduce compensation flow from 3.9 to 2.0 Ml/d

Potential Drought Permit/Order Sites	Change Sought
Rivington Reservoirs – White Coppice	Reduce compensation flow from 4.9 to 2.0 Ml/d
Ullswater	Reduce hands-off flow conditions to a minimum of 95 Ml/d Relax 12-month rolling abstraction licence limit
Lake Vyrnwy	Reduce compensation flow from 45.0 to 25.0 Ml/d
Lake Windermere	Scenario 1: Reduce hands-off flow conditions to a minimum of 95 Ml/d and relax 12-month rolling abstraction licence limit Scenario 2: Relax 12-month rolling abstraction licence limit and permit drawdown of lake level (up to a maximum of 0.5 m below weir crest). During drawdown, releases to the River Leven would be made by the Environment Agency through their fisheries sluice depending on the requirements of the river
Swineshaw Borehole	Allow a new abstraction from Swineshaw boreholes of up to 4 Ml/d
Ennerdale Water	Allow abstraction for both compensation flow provision to the River Ehen and public water supply to continue down to a lake level of 2.5 m below weir crest
Crummock Water	Allow pumping of abstraction and compensation flows at lake levels below 0.97 m below weir crest level to 1.5 m below weir crest level
Scales Boreholes	Increase the annual licence limit from 365 Ml to between 438 and 621 Ml to enable the continuation of a higher daily abstraction rate (up to the licence limit of 6 Ml/d)

As the Preferred Plan does not contain resource management options, it is not anticipated that there would be adverse cumulative effects in-combination with the Drought Plan. It should be recognised, however, that the Revised Draft WRMP complements and is consistent with the Drought Plan. Specifically, through leakage reduction and network metering, the Preferred Plan is designed to improve levels of service for drought permits and orders from 1 in 20 years on average to 1 in 40 years on average. The demand management options will also result in reduced abstraction at source.

Other Water Company WRMPs

There is potential for United Utilities' WRMP to have cumulative effects with the WRMPs of adjacent water companies. A review of the proposals in neighbouring water company areas (Dŵr Cymru Welsh Water, Severn Trent Water/Dee Valley Water[113], Yorkshire Water, Northumbrian Water and Scottish Water) is included in **Appendix B** of this report. None of the current published WRMPs or draft WRMPs have included options to draw water supply from resources in the United Utilities region and in consequence, no cumulative effects are expected to occur.

[113] From July 1st 2018, a new company, Hafren Dyfrdwy, brings together all the Welsh customers previously served by Severn Trent and by Dee Valley

6.5 Contribution of the Revised Draft WRMP to Wales' Well-being Goals and the Objective for the Sustainable Management of Natural Resources

As set out in **Section 1.7** and **Section 4.7**, United Utilities operates in Wales and therefore it is important to consider the contribution that the Draft WRMP will make to the well-being goals for Wales contained in the Well-being of Future Generations (Wales) Act 2015 and the objective for SMNR established in Environment (Wales) Act 2016.

Analysis of the Preferred Plan (**Section 6.3**) indicates that the Revised Draft WRMP is unlikely to have any significant impact on the achievement of the well-being goals or the objective for SMNR. This is because the construction and operation of the associated preferred options would not have any significant environmental effects in Wales, a reflection of their location and lack of hydrological connectivity with Welsh water bodies.

6.6 Mitigation and Enhancement

The potential effects of the Preferred Plan are described in **Section 6.3** and **Section 6.4**. In some cases, there is an opportunity to reduce some of the potential negative effects and to enhance positive effects. The detail of this mitigation needs to be considered during the planning phases of each of the individual component schemes within the Preferred Plan. Potential mitigation measures are included within each of the preferred option assessment matrices in **Appendix E**, although these should be considered as a starting point for more detailed consideration as options are planned and developed.

Species Specific Measures and Biodiversity

Most species-specific avoidance or mitigation measures can only be determined at the scheme level, following scheme-specific surveys, and 'best-practice' mitigation for a species will vary according to a range of factors that cannot be determined at this level. In addition, some general 'best-practice' measures may not be relevant or appropriate to the interest features of specific designated sites (for example, clearing vegetation over winter is usually advocated to avoid impacts on nesting birds; however, this is unlikely to be necessary to avoid effects on some SPA species (such as overwintering estuarine birds) and the winter removal of vegetation might actually have a negative effect on these species through disturbance).

However, the following general measures should be followed to minimise the potential for impacts on species that are European site interest features unless project-level environmental studies or HRA indicate that they are not required or not appropriate, or that alternative or additional measures are more appropriate / necessary:

- scheme design will aim to minimise the environmental effects by 'designing to avoid' potential habitat features that may be used by species that are European site interest features when outside the site boundary (e.g. linear features such as hedges or stream corridors; large areas of scrub or woodland; mature trees; etc.) through scheme-specific routing studies;
- the works programme and requirements for each option will be determined at the earliest opportunity to allow investigation schemes, surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England and Natural Resources Wales (as appropriate);
- night-time working, or working around dusk / dawn, should be avoided to reduce the likelihood of negative effects on nocturnal species;
- any lighting required (either temporary or permanent) will be designed with an ecologist to ensure that potential 'displacement' effects on nocturnal animals, particularly SAC bat species, are avoided;
- all compounds / pipe stores etc. will be sited, fenced or otherwise arranged to prevent vulnerable SAC species from accessing them;

- all materials will be stored away from commuting routes / foraging areas that may be used by species that are European site interest features;
- all excavations will have ramps or battered ends to prevent species becoming trapped; and
- pipe-caps must be installed overnight to prevent species entering and becoming trapped in any laid pipe-work.

Scheme Design and Planning

Manchester and Pennine Resilience Solution D will be subject to project-level environmental assessment as it is brought forward, which will include an assessment of its potential to affect European sites during construction or operation. This assessment will consider or identify (*inter alia*):

- opportunities for avoiding potential effects on European sites through design (e.g. alternative tunnel routes; micro-siting; etc); and
- construction measures that need to be incorporated into scheme design and or planning to avoid or mitigate potential effects – for example, ensuring that sufficient space is available for pollution prevention measures to be installed, such as sediment traps.
- operational regimes required to ensure no adverse effects occur.

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through construction-site derived pollutants, rather than through direct encroachment. There is a substantial body of general construction good-practice which is applicable to all of the proposed options and can be relied on (at this level) to prevent significant or adverse effects on a European site occurring as a result of construction site-derived pollutants. The following guidance documents detail the current industry best-practices in construction that are relevant to the proposed schemes:

- NRW, SEPA & NIEA, Guidance for Pollution Prevention (GPPs) (which are replacing the previous Pollution Prevention Guidelines (PPGs) when published) [online]. Available at: http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

  - PPG1: Understanding Your Environmental Responsibilities - Good Environmental Practices (July 2013; under review);

  - GPP5: Works and maintenance in or near water (January 2017);

  - PPG6: Working at construction and demolition sites (March 2012; under review);

  - GPP21: Pollution incident response planning (July 2017); and

  - PPG22: Incident response - dealing with spills (April 2011; under review).

- Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

The best-practice procedures and measures detailed in these documents will be followed for all construction works derived from the Revised Draft WRMP[114] as a minimum standard, unless scheme-specific investigations identify additional measures and / or more appropriate non-standard approaches for dealing with potential site-derived pollutants.

Effects on Water Quantity and Quality

Further detailed WFD Assessment should be undertaken at the project stage in respect of Manchester and Pennine Resilience Solution D. This should include consideration of more detailed design information,

[114] Both preferred and feasible options, if these are used.

detailed geological study and investigation of the water environment (in particular links between the groundwater and surface water environments), detailed impact assessment, and more detailed review of WFD objectives to ensure that the effects highlighted in this report are appropriately accounted for.

Effects on Human Health and Wellbeing

Construction activities should be undertaken so as to minimise short term adverse effects on recreational areas, such as footpaths, and on landscape and biodiversity. Noise, traffic disruption and visual impacts should also be considered. Care should also be taken during construction regarding the potential for contaminants such as silt, concrete or fuel oil to pollute water courses via surface run off. This can be mitigated by undertaking all construction activities in accordance with relevant best practice pollution prevention guidance.

To maximise economic benefits in the United Utilities region, it is recommended that, where possible, work is carried out by local firms and contractors or by those with a policy for training and skills development that could help contribute to the local economy and meet employment needs.

Effects on Flood Risk, Climate Change and Resource Use

To mitigate the potential effects of flooding on a scheme, infrastructure should, where possible, be located outside the 1 in 100 year indicative flood plain. Where this is not possible due to operational requirements, the infrastructure should be designed such that it can continue to operate under flood conditions and not increase flood risk elsewhere.

Where significant raw materials are required for options, this can be mitigated by utilising recycled and locally sourced materials. Construction and operational wastes should also be reused/recycled where appropriate.

Effects on Landscape

Effects on landscape character and visual amenity should be considered at an early stage in the design process. Some of the preferred options could have a negative effect on the landscape associated with, for example, pipeline works and tunnel construction; in order to minimise this effect, potential mitigation includes the adoption incorporate landscaping schemes (e.g. tree/ hedge planting). In addition, it is also expected that a landscape and visual impact assessment would be undertaken at the project stage as part of any EIA (if required).

6.7 Conclusions and Reasons for the Selection of the Preferred Options and Rejection of Alternatives

United Utilities has chosen the Preferred Plan using industry good practice methods. This includes consideration of technical feasibility, financial costs and benefits, and quantified impacts on the environment and community, taking into account the findings of the SEA, HRA and WFD Assessment as well as input from key stakeholders.

United Utilities considered four alternative plans as part of the development of the Draft WRMP. Alternative Plan 4 was selected as the Preferred Plan because it contains all of the strategic choices proposed by United Utilities to address customer and stakeholder views (see Section 6 of the Draft WRMP). The consultation process essentially confirmed support for Alternative Plan 4; however, the Revised Draft WRMP Preferred Plan essentially defaults back to Alternative Plan 3 at this time, as it does not include a water trading component. This is because a water trade from the North West is not included in the preferred plans of other water companies at this stage. It remains the company's preference to continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round, and therefore the strategy to facilitate a potential future trade has been retained within an adaptive pathway, which could form a future preferred plan if water trading was subsequently required in future.

Alternative Plan 1 has the lowest cost of all plan alternatives, but does not deliver any of the strategic choices identified by United Utilities. Alternative Plan 2 has an additional costs compared to Alternative Plan 1, but will help to meet customer and regulatory aspirations on leakage reduction, and at the same time

provide environmental benefits and allow United Utilities to improve its level of service for drought permits in 2025. However, whilst offering lower costs than Alternative Plan 3, Alternative Plan 2 would not allow United Utilities to address pressing supply system resilience needs. The justification for the strategic choices and the preferred plan are detailed further in Sections 6 and 7 of the Revised Draft WRMP19 main report.

In this context, the Preferred Plan for WRMP19 set out in the Revised Draft WRMP includes the following strategic choices:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25, United Utilities plans to reduce leakage by at least 67 Ml/d, or 15%;
- Improve the level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk);
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennine Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

The Preferred Plan encompasses a combination of preferred demand management measures and resilience options designed to achieve the three strategic choices outlined above. The preferred solution for Manchester and Pennine Resilience (solution D) has been selected over the alternatives as it has the lowest environmental risk, particularly as there are no new abstractions required under this solution.

Overall, United Utilities' comprehensive option identification and appraisal process means that, from a very large pool of options, only the most applicable have been selected in the Preferred Plan. This is critical to ensuring that WRMP19 represents the most cost effective and sustainable solution in the long term.

7. Next Steps and Proposals for Monitoring

7.1 Next Steps

United Utilities is submitting the Revised Draft WRMP and this Environmental Report to the Secretary of State. Once directed to do so, United Utilities will publish and implement the Final WRMP accordingly. In conjunction with publishing the Final WRMP, United Utilities will also issue a Post Adoption Statement. This will set out the results of the consultation and SEA processes and the extent to which the findings of the SEA have been accommodated in the Final WRMP.

7.2 How Environmental Effects will be Considered During Plan Implementation

Once the Revised Draft WRMP has been agreed, the preferred options for managing water supply and demand contained in it will need to be implemented through specific projects. As part of this process, each project may be subject to further assessment to understand and manage its potential environmental and social impacts. These assessments, which may include HRA and EIA, will take account of the issues discussed in this report but will also be informed by the greater detail available as the work progresses about construction techniques, building materials, and agreed locations and routes.

7.3 Monitoring the Effects of the WRMP

Subject to the approval of the Secretary of State, United Utilities expects to publish the Final WRMP in 2019. Once the WRMP is implemented, with its component projects in place, its effects on the environment and people will need to be taken into account. United Utilities expects to monitor the effects of the WRMP alongside the other impacts of its operations, and as such, is likely to rely on existing sources of information that are collected either by United Utilities or by other relevant organisations such as the Environment Agency. For example, United Utilities already collects certain data for an annual review process (the Annual Performance Report) that is submitted to the Ofwat. United Utilities updates its WRMP and Drought Plan every five years, and there are a number of statutory controls which must be monitored.

Monitoring Requirements

It is a requirement of the SEA Directive to establish how the significant effects of the WRMP will be monitored. Monitoring the significant effects of the WRMP can help to answer questions such as:

- Were the SEA predictions of effects accurate?
- Is the WRMP contributing to the achievement of the SEA objectives?
- Are mitigation measures performing as well as expected?
- Are there any adverse effects? Are these within acceptable limits, or is remedial action desirable?

It is not necessary to monitor everything or monitor an effect indefinitely. Instead monitoring should be focussed on:

- significant effects that may give rise to irreversible damage, with a view to identifying trends before such damage is caused; and
- significant effects where there was uncertainty in the SEA and where monitoring would enable preventative or mitigation measures to be undertaken.

United Utilities will need to take a broad view of the findings of their ongoing monitoring processes to identify whether the WRMP has any significant unforeseen effects. Where these are identified, United Utilities may

be required to put in place specific monitoring arrangements and will consider how best to mitigate or avoid the adverse consequences.

Table 7.1 indicates some of the issues currently monitored or which could be monitored in future, and how they relate to the SEA objectives used in the SEA of the Revised Draft WRMP. This list is provisional and indicative only; monitoring proposals will be considered further and a final monitoring framework that satisfies the requirements of the SEA Directive will be presented in the Post Adoption Statement.

Table 7.1 Potential Indicators for Monitoring Effects

Objective	Indicator	Source of Information	Commentary
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Condition of specific protected sites (e.g. SACs. SPAs and Ramsar)	Natural England (NE), Natural Resources Wales (NRW)	Open communication between NE, NRW and United Utilities results in up-to-date information and identification of any potential issues.
	Condition of SSSIs on water industry land holdings	NE, NRW, United Utilities	Condition assessment of designated land on United Utilities' landholdings, both area and condition may change.
	Biological monitoring (macroinvertebrates, macrophytes, fisheries, bird surveys)	Environment Agency (EA), NRW, United Utilities, Angling clubs, BTO	Using data sets and comparing them against other monitored information such as levels and flows will assist in identifying whether there are any adverse effects and if mitigation measures are performing as well as expected.
	Number and area of new or restored habitats	United Utilities	United Utilities could consider recording the number of locations and area of habitats created or restored.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Number/ floorspace of water infrastructure built on previously developed land	United Utilities	United Utilities could consider recording the number and floorspace of new above ground infrastructure built on previously developed land.
	Condition of sites designated for geological interest (e.g. geological SSSIs) on water industry land holdings	United Utilities	Condition assessment of designated land on United Utilities' landholdings, both area and condition may change.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies.	River flow and level characteristics	United Utilities, EA, NRW	Monitoring can be compared to historic records.
	River flows, river levels, lake and reservoir levels. Water quality of surface waters	United Utilities, EA, NRW	At sensitive sites previous studies should be used to inform monitoring and assessment. For example RoC documentation and any Drought Permit (DP) Environmental Assessments and associated environmental monitoring plans.

Objective	Indicator	Source of Information	Commentary
	Groundwater levels, recharge characteristics and abstracted groundwater quality	United Utilities, EA, NRW	At sensitive sites previous studies should be used to inform monitoring and assessment. For example RoC documentation and any Drought Permit (DP) Environmental Assessments and associated environmental monitoring plans.
4. To reduce the risk of flooding.	Number of properties that experience internal flooding from public sewers	United Utilities, EA, NRW	United Utilities report these data to Ofwat as part of the statutory returns process.
5. To minimise emissions of pollutant gases and particulates and enhance air quality.	Number of vehicle movements/distance travelled	United Utilities	United Utilities could considering recording the number of vehicle movements and distance travelled as an indicator of air quality impacts.
6. To limit the causes and potential consequences of climate change.	Quantity of greenhouse gas emissions per megalitre of water supplied	United Utilities	United Utilities' energy managers can use company data taken from the Annual Report, and guidance from the UKWIR greenhouse gas workbook and BEIS (Department for Business, Energy & Industrial Strategy) conversion factors to derive this information.
	Energy used in the operational phase of water treatment and supply	United Utilities	United Utilities should hold and record energy consumption data e.g. via accounts / invoices to enable quantification of the proposed indicator.
	Renewable energy generated; renewable energy purchased	United Utilities	United Utilities should record renewable energy generation data, in addition to data on renewable energy purchased e.g. via accounts / invoices.
7. To ensure the protection and enhancement of human health.	Compliance with drinking water standards at customers' taps (%)	United Utilities	United Utilities reports these data to Ofwat as part of the statutory returns process (Annual Performance Report) and to the Drinking Water Inspectorate.
	Compliance with water quality standards under the EC Bathing Waters Directive	EA	The EA monitors the compliance of bathing waters and reports this annually.
	Number of United Utilities sites with public access which provide sporting, recreational and leisure resources and number of visits per year	United Utilities	United Utilities holds information on the number of annual visitors to sites where specific visitor facilities are provided.
	Number of nuisance-related complaints e.g. noise, dust	United Utilities	United Utilities could record the number of nuisance-related complaints made in relation to implementation of the WRMP.
8. To maintain and enhance the economic and social	Population and projected population change over time (per WRZ)	United Utilities	United Utilities reports these data to Ofwat as part of the statutory returns process and

Objective	Indicator	Source of Information	Commentary
well-being of the local community.			as part of the Strategic Business Plan.
9. To ensure the sustainable and efficient use of water resources.	Levels of leakage	United Utilities	These indicators will help identify whether the WRMP does contribute to the achievement of this SEA objective.
	Trends in overall per capita consumption.	United Utilities	United Utilities should record and report these data.
10. To promote the efficient use of resources.	Amount of recycled / reused materials used	United Utilities	Information on the use of recycled / reused materials should be held by construction managers and accounts (contractors / consultants accounts, waste or procurement records).
	Proportion of waste sent to landfill	United Utilities	Information on quantities, classification and proportion of waste disposed to landfill should be held by United Utilities.
	Chemicals used in water supply	United Utilities	Information (quantities, composition) on chemical use should be held in accounts.
11. To conserve and enhance cultural and historic assets.	Loss / damage or discovery / protection of cultural, historic and industrial heritage features. Including loss of landscapes of Historic Interest and natural heritage features (including for example field systems, field boundaries) that contribute to the cultural and historic distinctiveness of the area.	United Utilities, Historic England, Cadw	Historic England/Cadw's regional field monument wardens monitor the condition of all statutorily protected monuments.
12. To conserve and enhance landscape character.	Loss or damage to landscape character and features of designated sites.	United Utilities	United Utilities could consider recording the number and floorspace of new buildings above ground infrastructure that are built within designated landscape sites.

Appendix A
Quality Assurance Checklist

The Government's Guidance on SEA[115] contains a quality assurance checklist to help ensure that the requirements of the SEA Directive are met. The checklist is reproduced below, indicating where this Environmental Report meets the requirements.

Quality Assurance Checklist	
Objectives and Context	
The plan's or programme's purpose and objectives are made clear.	The purpose of the Revised Draft WRMP is set out in **Section 1** of this report. The objectives of the Revised Draft WRMP are set out in **Section 1.**
Environmental issues and constraints, including international and EC environmental protection objectives, are considered in developing objectives and targets.	Key environmental, social and economic issues (including protection objectives) identified through a review of relevant plans and programmes (see **Section 2** of this report) and analysis of baseline conditions (see **Section 3**) have informed the development of the assessment framework presented in **Section 4.3**.
Scoping	
Consultation Bodies are consulted in appropriate ways and at appropriate times on the content and scope of the Environmental Report.	The SEA Scoping Report was consulted upon in November/December 2016 and responses are summarised in this Environmental Report (see **Appendix F**).
The assessment focuses on significant issues.	Sustainability issues have been identified in the baseline analysis contained in **Section 3** on a topic-by-topic basis. **Section 3.10** summarises the key sustainability issues identified.
Technical, procedural and other difficulties encountered are discussed; assumptions and uncertainties are made explicit.	**Section 3** describes the key difficulties encountered during the preparation of this Environmental Report.
Reasons are given for eliminating issues from further consideration.	N/a.
Alternatives	
Realistic alternatives are considered for key issues, and the reasons for choosing them are documented.	All feasible and preferred options have been assessed, as set out in **Section 5** and **Section 6** of this report. Alternative plans and trading portfolios have also been assessed (**Section 6**). The reasons for selection of the Revised Draft WRMP as proposed and for the rejection of alternatives is set out in **Section 6**.
Alternatives include 'do minimum' and/or 'business as usual' scenarios wherever relevant.	Alternative Plan 1 represents a 'do minimum' scenario. This is assessed in **Section 6**.
The environmental effects (both adverse and beneficial) of each alternative are identified and compared.	This is included in **Section 5**, **Section 6, Appendix D** and **Appendix E** of this report.
Inconsistencies between the alternatives and other relevant plans, programmes or policies are identified and explained.	No inconsistencies were identified.
Reasons are given for selection or elimination of alternatives.	The reasons for selection of the Revised Draft WRMP as proposed and for the rejection of alternatives is set out in **Section 6**.
Baseline Information	
Relevant aspects of the current state of the environment and their likely evolution without the plan or programme are described.	**Section 3** of this report characterises the current environmental baseline conditions, along with how these are likely to change in the future.

[115] Office of the Deputy Prime Minister (2005) *A Practical Guide to the Strategic Environmental Assessment Directive*.

Quality Assurance Checklist	
Environmental characteristics of areas likely to be significantly affected are described, including areas wider than the physical boundary of the plan area where it is likely to be affected by the plan.	Throughout **Section 3** of this report, reference is made to areas which may be affected by the WRMP.
Difficulties such as deficiencies in information or methods are explained.	**Section 3.11** details limitations of the data used in the report and assumptions made.
Prediction and Evaluation of Likely Significant Environmental Effects	
Effects identified include the types listed in the Directive (biodiversity, population, human health, fauna, flora, soil, water, air, climate factors, material assets, cultural heritage and landscape), as relevant; other likely environmental effects are also covered, as appropriate.	This is set out in **Sections 5, 6, Appendix D Appendix E and Appendix F** of this report.
Both positive and negative effects are considered, and the duration of effects (short, medium or long-term) is addressed.	This is set out in **Sections 5, 6, Appendix D, Appendix E and Appendix F** of this report.
Likely secondary, cumulative and synergistic effects are identified where practicable.	Likely secondary, cumulative and synergistic effects are considered in **Section 6** of this report.
Inter-relationships between effects are considered where practicable.	This is set out in **Sections 5, 6, Appendix D, Appendix E and Appendix F** of this report.
The prediction and evaluation of effects makes use of relevant accepted standards, regulations, and thresholds.	Relevant standards have been used where appropriate in undertaking the assessment.
Methods used to evaluate the effects are described.	Information on the methods used for evaluation of potential effects is included in **Section 4.**
Mitigation Measures	
Measures envisaged to prevent, reduce and offset any significant adverse effects of implementing the plan or programme are indicated.	Mitigation measures are set out in **Section 6** and **Appendix E** and of this report.
Issues to be taken into account in project consents are identified.	This is set out in **Sections 5, 6, Appendix D Appendix E** of this report..
The Environmental Report	
Is clear and concise in its layout and presentation.	We believe the report is clear and concise.
Uses simple, clear language and avoids or explains technical terms.	The report uses accessible language wherever possible.
Uses maps and other illustrations where appropriate.	Maps and illustrations have been utilised in the report.
Explains the methodology used.	The method used is set out in the report in **Section 4.**
Explains who was consulted and what methods of consultation were used.	**Appendix G** of this report outlines the consultation that has been carried out to-date.
Identifies sources of information, including expert judgement and matters of opinion.	Sources of information are included throughout the report.
Contains a non-technical summary covering the overall approach to the SEA, the objectives of the plan, the main options considered, and any changes to the plan resulting from the SEA.	A Non-Technical Summary has been included as part of the report.
Consultation	
The SEA is consulted on as an integral part of the plan-making process.	The previously issued SEA Scoping Report was consulted upon and responses to these are included in this Environmental Report (see **Appendix G**).

Quality Assurance Checklist	
Consultation Bodies and the public likely to be affected by, or having an interest in, the plan or programme are consulted in ways and at times which give them an early and effective opportunity within appropriate time frames to express their opinions on the draft plan and Environmental Report.	Consultation on the Draft WRMP Environmental Report has been undertaken and the responses received are also documented in **Appendix G**.
Decision-making and Information on the Decision	
The environmental report and the opinions of those consulted are taken into account in finalising and adopting the plan or programme.	This has been included in the Revised Draft WRMP.
An explanation is given of how they have been taken into account.	This has been included in the Revised Draft WRMP.
Reasons are given for choosing the plan or programme as adopted, in the light of other reasonable alternatives considered.	The reasons for selection of the Revised Draft WRMP as proposed and for the rejection of alternatives is set out in **Section 6**.
Monitoring Measures	
Measures proposed for monitoring are clear, practicable and linked to the indicators and objectives used in the SEA.	The report sets out potential indicators that United Utilities could use in **Section 6**.
Monitoring is used, where appropriate, during implementation of the plan or programme to make good deficiencies in baseline information in the SEA.	The suggestions for monitoring are included in **Section 6** of the report. Monitoring will take place following implementation WRMP.
Monitoring enables unforeseen adverse effects to be identified at an early stage. (These effects may include predictions which prove to be incorrect.)	The suggestions for monitoring made in **Section 6** are for United Utilities to act on, with monitoring taking place following implementation of the WRMP.
Proposals are made for action in response to significant adverse effects.	Mitigation is outlined in **Section 6** and **Appendix E** of this report.

Appendix B
Review of Plans and Programmes

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
The Aarhus Convention **United Nations Economic Commission for Europe (1998) *Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters***	
To contribute to the protection of present and future generations to live in an environment adequate to his or her health and well-being. This will be achieved through each Party subject to the convention guaranteeing the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention. To establish and maintain a clear, transparent and consistent framework to implement the provisions of this Convention. This will be achieved through each Party taking the necessary legislative, regulatory and other measures, including measures to achieve compatibility between the provisions implementing the information, public participation and access-to-justice provisions in this Convention, as well as proper enforcement measures. Responsibility for implementation is deferred to the member states.	The development of the WRMP needs to be a transparent process. SEA should show a strong sense of safeguarding the lives of future generations and ensure that enough time is provided for consultation on the SEA documents in line with the Aarhus convention of establishing and maintaining a transparent clear framework.
United Nations Convention on Biodiversity (the Rio Convention, 1992)	
The Convention on Biodiversity called for the development and enforcement of national strategies and associated action plans to identify, conserve and protect existing biological diversity, and to enhance it wherever possible. In the UK, the UK Biodiversity Action Plan was then established to conserve and enhance biodiversity in the UK through the use of Habitats and Species Action Plans to help the most threatened species and habitats to recover and to contribute to the conservation of global biodiversity.	The assessment framework should include protection and enhancement of biodiversity.
The Bathing Waters Directives ***Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water* and *Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC***	
The Bathing Waters Directive set standards for the quality of bathing waters (with the exception of water intended for therapeutic bathing purposes and water used in swimming pools). It lays down the minimum quality criteria to be met by bathing water: - the physical, chemical and microbiological parameters; - the mandatory limit values and indicative values for such parameters; - the minimum sampling frequency and method of analysis or inspection of such water. Member States fix the values that they apply to bathing water in accordance with the guidelines of Directive 76/160/EEC. Member States may fix more stringent values than those laid down in the Directive. Where it does not give any values for certain parameters, Member States are not obliged to fix any. The Directive is transposed into law in England and Wales through the Bathing Water (Classifications) Regulations 2003. In March 2006, a revised Bathing Water Directive was adopted and become law in the UK in March 2008. As well as stricter water quality standards, it contains a requirement to provide more detailed and standardised information about bathing waters across Europe. Directive 2006/7/EC will repeal the Directive 76/160/EEC in 2014. Bathing waters are protected areas under the Water Framework Directive. Mandatory standards are given for 10 parameters: total coliforms, faecal coliforms, salmonella, enteroviruses, pH, colour, mineral oils, surface active substances (detergents), phenols and transparency. The Directive also sets the minimum frequency at which bathing waters should be sampled.	The WRMP will need to comply with set limits. The SEA assessment should include a guide question relating to the effects of options on the water quality at designated bathing waters.
The Bern Convention ***Council Decision 82/72/EEC of 3 December 1981 concerning the conclusion of the Convention on the conservation of European wildlife and natural habitats***	
The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) was adopted in Bern, Switzerland in 1979, and came into force in 1982. The principal objectives are: - To conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States;	The WRMP should take into account the habitats and species that have been identified under the Convention, and should include provision for the preservation, protection and improvement of the

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- To promote such co-operation. Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species; - In order to achieve this the Convention imposes legal obligations on contracting parties, protecting over 500 wild plant species and more than 1000 wild animal species. Targets for Contracting Parties are: - Promoting national policies for the conservation of wild flora, wild fauna and natural habitats, with particular attention to endangered and vulnerable species, especially endemic ones, and endangered habitats, in accordance with the provisions of this Convention; - Undertaking in its planning and development policies, and in its measures against pollution, to have regard to the conservation of wild flora and fauna; - Promoting education and disseminating general information on the need to conserve species of wild flora and fauna and their habitats.	quality of the environment as appropriate. The SEA assessment framework should incorporate the conservation provisions of the Convention particularly the protection of wild flora, fauna and natural habitats.
The Bonn Convention (or CMS) ***The Convention on the Conservation of Migratory Species of Wild Animals***	
The Convention on the Conservation of Migratory Species of Wild Animals (also known as the Bonn Convention or CMS) is an intergovernmental treaty under the United Nations Environment Programme. The convention was signed in 1979 ratified in the UK in 1985. The convention aims to ensure contracting parties work together to conserve terrestrial, marine and avian migratory species and their habitats (on a global scale) by providing strict protection for endangered migratory species. Overarching objectives set for the Parties are: - Should promote, co-operate in and support research relating to migratory species; - Shall endeavour to provide immediate protection for migratory species; - Shall endeavour to conclude Agreements covering the conservation and management of migratory species included in Appendix II. Setting targets is the responsibility of member states.	The WRMP should take into account the habitats and species that have been identified under this directive, and should include provision for their protection, preservation and improvement. The SEA assessment framework should include biodiversity, incorporating the importance of conserving migratory species.
Council of Europe (2000) *European Landscape Convention*	
The European Landscape Convention was adopted on 20 October 2000 in Florence and came into force on 1 March 2004 (Council of Europe Treaty Series no. 176). It is open for signature by member states of the Council of Europe and for accession by the European Community and European non-member states. The UK Government signed the European Landscape Convention in 2006 and it became binding from March 2007. The aims of the Convention are to promote landscape protection, management and planning, and to organise European co-operation on landscape issues. Responsibility for implementation has been deferred to the signatories. Articles 5 (general measures) and 6 (specific measures) set out measures that the signatories will undertake, e.g. integrating landscape into policies with possible direct or indirect impact on landscape and to introduce instruments aimed at protecting, managing and/or planning the landscape.	The WRMP should take landscape into account. The SEA assessment framework should include landscape.
The Drinking Water Directive ***Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption***	
The Drinking Water Directive (DWD) concerns the quality of water intended for human consumption. The objective of the DWD is to protect the health of the consumers in the EU and to make sure the water is wholesome and clean. To do this, the DWD sets standards for 48 (microbiological and chemical) parameters that can be found in drinking water. The parameters must be monitored and tested regularly. In principle WHO guidelines for drinking water are used as a basis for the standards in the DWD. While translating the DWD into their own national legislation (transposition of the DWD), the Member States of the European Union can include additional requirements e.g. regulate additional substances that are relevant within their territory or set higher standards. However, Member States are not allowed to set lower standards as the level of protection of human health should be the same within the whole EU. Member States have to monitor the quality of the drinking water supplied to their citizens and of the water used in the food production industry. Member States report at three yearly intervals the monitoring results to the European Commission.	The WRMP should contain objectives for drinking water quality to ensure that limits are not exceeded. The SEA assessment framework should include drinking water quality.

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Standards constitute legal limits. Sets limits for microbiological and chemical parameters in drinking water. Also gives indicator parameters.	
European Commission (2006) *Thematic Strategy for Soil Protection*	
The *Thematic Strategy for Soil Protection* consists of a Communication from the Commission to the other European Institutions, a proposal for a framework Directive (a European law), and an Impact Assessment. It sets out an EU strategy for soil protection with an overall objective of the protection and sustainable use of soil, based on the following guiding principles: (1) Preventing further soil degradation and preserving its functions: - when soil is used and its functions are exploited, action has to be taken on soil use and management patterns; and - when soil acts as a sink/receptor of the effects of human activities or environmental phenomena, action has to be taken at source. (2) Restoring degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil. The strategy proposes introducing a framework Directive setting out common principles for protecting soils across the EU, with Member States deciding how best to protect soil and how use it in a sustainable way on their own territory.	The WRMP should take potential effects on soil into account. The SEA assessment framework should include soils.
European Commission (2008) *Ambient Air Quality and Cleaner Air for Europe (Directive 2008/50/EC)*	
The Directive: - defines and establishes objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment as a whole; - assesses the ambient air quality in Member States using common methods and criteria; - obtains information on ambient air quality in order to help combat air pollution and nuisance and to monitor long-term trends and improvements resulting from national and Community measures; - ensures that such information on ambient air quality is made available to the public; - seeks to maintain air quality where it is good and improving it in other cases; and - promotes increased cooperation between the Member States in reducing air pollution.	The WRMP should contribute towards achieving air quality standards set out in the Directive. The SEA assessment framework should include air quality.
European Commission (2008) *Waste Framework Directive (Directive 2008/98/EC)*	
The essential objective of all provisions relating to waste management should be the protection of human health and the environment against harmful effects caused by the collection, transport, treatment, storage and tipping of waste. Some key objectives include: - The recovery of waste and the use of recovered materials as raw materials should be encouraged; - Member States should, in addition to taking responsible action to ensure the disposal and recovery of waste, take measures to restrict the production of waste; - It is important for the Community as a whole to become self-sufficient in waste disposal and desirable for Member States individually to aim at such self-sufficiency; - Waste management plans should be drawn up in the Member States; - Movements of waste should be reduced; - Ensure a high level of protection and effective control; - Subject to certain conditions, and provided that they comply with environmental protection requirements, some establishments which process their waste themselves or carry out waste recovery may be exempted from permit requirements; - That proportion of the costs not covered by the proceeds of treating the waste must be defrayed in accordance with the 'polluter pays' principle.	The WRMP should seek to ensure the protection of human health and the environment in relation to waste management. The SEA assessment should include objectives on the protection of human health and the environment.
European Union (2006) *Sustainable Development Strategy*	
This document sets out a single coherent strategy outlining how the EU will meet long-standing commitments to sustainable development. This document presents a renewed version of the 2001 EU Sustainable Development Strategy (SDS). The aim of the SDS is to identify and develop actions to enable the EU to achieve continuous improvement of quality of life both for current and for future generations, through the creation of sustainable communities able to manage and use	The WRMP should reflect all of the aims and targets set out in the Sustainable Development Strategy.

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resources efficiently, and to tap the ecological and social innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion. The key objectives of the strategy are: - Environmental protection; - Social equity and cohesion; - Economic prosperity; and - Meeting our international responsibilities. The following key challenge areas include a number of targets in achieving their respective objectives: - Climate Change and clean energy; - Sustainable Transport; - Sustainable consumption and production; - Conservation and management of natural resources; - Public Health; - Social inclusion, demography and migration; - Global poverty and sustainable development challenges. The strategy was reviewed by the European Commission in 2009 (***Mainstreaming sustainable development into EU policies: 2009 Review of the European Union Strategy for Sustainable Development***), which underlined that the EU has mainstreamed sustainable development into a broad range of its policies in recent years, but that efforts still need to be intensified to address unsustainable trends such as energy consumption.	The SEA assessment framework should reflect the core and supporting principles of the strategy including climate change, sustainable transport, public health, social inclusion and poverty.
The Floods Directive ***Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks***	
The Floods Directive requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. Member States are required to carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding.	The WRMP should take account of the flood risk management plans as they become available through the life of the plan. The SEA assessment framework should include flood risk.
The Habitats Directive ***Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora***	
The Habitats Directive seeks to conserve natural habitats. Conservation of natural habitats requires member states to identify special areas of conservation and to maintain where necessary landscape features of importance to wildlife and flora. It is required that each Member State propose a list of sites indicating which natural habitat types and which species the sites host. The information would include a map of the site, its name, location and its extent. The Commission will then establish, in agreement with each Member State, a draft list of sites of Community importance drawn from the Member States' lists identifying those which host one or more priority natural habitat types or priority species.	The WRMP should take into account the habitats and species that have been identified under this Directive, and include provision for the preservation, protection and improvement of the quality of the environment as appropriate. The SEA assessment framework should incorporate sites protected for their nature conservation importance.
The Kyoto Protocol	
The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. It is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for industrialized countries for reducing greenhouse gas (GHG) emissions. These amounted to an average of five per cent against 1990 levels in the first commitment period (2008 to 2012). The Protocol is planned to be extended to 2020 (the Kyoto second commitment period), pending ratification of the Doha Agreement.	The WRMP should aim to reduce greenhouse gas emissions. The SEA assessment framework should include objectives/guide questions related to reducing greenhouse gas emissions.
The Paris Agreement	

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The Paris Agreement was adopted at the 2015 UN Climate Change Conference, which aims to limit global temperature rises to 2 degrees, and to pursue efforts to limit the temperature increase even further to 1.5 degrees. It was adopted by 195 countries at the Conference, and came into force in November 2016, following ratification by sufficient parties.	The WRMP should aim to reduce greenhouse gas emissions. The SEA assessment framework should include greenhouse gas emissions.
Mining Waste Directive ***Directive of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries (2006/21/EC)***	
The Directive aims to prevent or reduce as far as possible any adverse effects on the environment, and any resultant risks to human health, brought about as a result of the management of waste from the extractive industries. The Directive covers the management of waste resulting directly from prospecting, extraction, treatment and storage of mineral resources and from quarrying. Operators are required to use Best Available Techniques in the management of waste facilities and the prevention of major accidents.	The WRMP should have regard to the aim to avoid adverse effects from extractive waste. The SEA assessment framework should include consideration of waste.
The Nitrates Directive ***Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC)***	
The Nitrates Directive is designed to reduce water pollution caused by nitrate from agriculture. The directive requires Defra and the Welsh Assembly Government to identify surface or groundwaters that are, or could be high in nitrate from agricultural sources. Once a water body is identified as being high in nitrate all land draining to that water is designated a Nitrate Vulnerable Zone. Within these zones, farmers must observe an action programme of measures which include restricting the timing and application of fertilisers and manure, and keeping accurate records.	The WRMP should be consistent with the aim to reduce water pollution caused by nitrate from agriculture. The SEA assessment framework should include water quality.
UNESCO (1971) *The Ramsar Convention on Wetlands*	
The Convention on Wetlands of International Importance was signed in Ramsar, Iran in 1971. It is an intergovernmental treaty which provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources, as a means to achieving sustainable development throughout the world. The original emphasis was on the conservation and wise use of wetlands primarily to provide habitat for waterbirds, however over the years the Convention has broadened its scope to incorporate all aspects of wetland conservation and wise use, recognising wetlands as ecosystems that are extremely important for biodiversity conservation and for the well-being of human communities. *'The Convention's mission is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world'* (Ramsar COP8, 2002). A Strategic Plan 2009-2015 has been adopted to provide guidance on how efforts for implementing the Convention on Wetlands should be focussed. The strategy has 5 goals: - Wise use: The wise use of all wetlands being achieved in all Parties, including more participative management of wetlands, and conservation decisions being made with an awareness of the importance of the ecosystem services provided by wetlands; - Wetlands of International Importance: Parties designating and managing Ramsar sites within their territories with a view to supporting an international network of Wetlands of International Importance, fully implementing their reporting commitments under Articles 3 and 8.2, and using the Montreux Record as part of the Convention's governance process, as appropriate; - International cooperation: Parties developing their coherent national approaches to the implementation of the Ramsar Convention in such a way as to benefit from developing effective partnerships with related conventions and international agencies and with other Parties to the Convention on Wetlands; - Institutional capacity and effectiveness: Increasing success of the Convention in achieving the conservation and wise use of wetlands, as measured by agreed effectiveness indicators, and increased recognition of the Convention's achievements by other sectors of governments and civil society; - Membership: All countries eligible for accession to have joined the Ramsar Convention by 2015. A number of strategic key results are set out in the strategy against each of the 5 goals, e.g. by 2015 global wetland distribution and status data and information should be available through Webportal mechanisms, Ramsar guidance on the maintenance of ecological character to be have	The WRMP should ensure the protection and wise use of wetlands. The SEA assessment framework should incorporate the protection of wetland sites listed under the Ramsar convention.

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been applied with a priority upon recognized internationally important wetlands not yet designated as Ramsar sites.	
UNEP (1973) *Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)*	
CITES is an international agreement between governments which aims to ensure that international trade in wild animals and plants does not threaten their survival. It subjects international trade to certain controls, and all import, export, re-export and introduction (by sea) of species covered by the Convention has to be authorized through a licensing system. Species are listed in three Appendices according to the degree of protection needed, with differing controls for each.	The WRMP should ensure the protection of vulnerable species. The SEA assessment framework should incorporate the protection of animal and plant species.
The Urban Waste Water Directive ***Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment***	
The aim of the Urban Waste Water Directive is to protect the environment from the adverse effects of waste water discharges. It sets out guidelines and legislation for the collection, treatment and discharge of urban waste water. The Directive was adopted by member states in May 1991 and is transposed into law in England and Wales by The Urban Waste Water Treatment (England & Wales) Regulations 1994 (as amended*). The Regulations require that all significant discharges are treated to at least secondary treatment. They also set standards and deadlines for the provision of sewage systems, the treatment of sewage according to the size of the community served by the sewage treatment works and the sensitivity of receiving waters to their discharges. * The Regulations were amended in 2003 by The Urban Waste Water Treatment (England & Wales) (Amendment) Regulations 2003. Responsibility for Implementation is deferred to member states.	The WRMP needs to consider the implication of the Directive. The SEA assessment framework should include water quality.
Landfill of Waste Directive (99/31/EC)	
The Directive aims at reducing the amount of waste landfilled; promoting recycling and recovery; establishing high standards of landfill practice across the EU, and preventing the shipping of waste from one Country to another. The objective of the Directive is to prevent or reduce as far as possible negative effects on the environment (in particular on surface water, groundwater, soil, air and human health) from the land-filling of waste, by introducing stringent technical requirements for waste and landfills. The Directive requires the reduction of the amount of biodegradable municipal waste sent to landfill to 75% of the total generated in 1995 by 2006, 50% by 2009 and 35% by 2016.	The WRMP should take the effects on waste to landfill into account. The SEA assessment should consider the effects on water, soil, air, human health and waste
The Water Framework Directive ***Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy***	
The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. The framework aims to: - Protect any further deterioration and enhance the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems; - Promote sustainable water use based on a long-term protection of available water resources; - Enhance protection and improvement of the aquatic environment, *inter alia*, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances; - Ensure the progressive reduction of pollution of groundwater and prevent its further pollution; - Contribute to mitigating the effects of floods and droughts. Key targets and indicators relevant to the WRMP and SEA are: - Achievement of good ecological status and good surface water chemical status by 2015; - Achievement of good ecological potential and good surface water chemical status for heavily modified water bodies and artificial water bodies; - Prevention of deterioration from one status class to another; - Achievement of water-related objectives and standards for protected areas; - Achievement of good groundwater quantitative and chemical status by 2015; - Prevention of deterioration from one status class to another;	The WRMP needs to consider the implication of the Directive in terms of sustainable water use, protection and improvement of the aquatic environment, reducing and preventing pollution and mitigating the effects of droughts. The SEA assessment framework should include water quality, water resources, sustainable water use, and biodiversity.

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- Reversal of any significant and sustained upward trends in pollutant concentrations and prevent or limit input of pollutants to groundwater; - Achievement of water related objectives and standards for protected areas.	
The Birds Directive ***Council Directive 2009/147/EC on the conservation of wild birds***	
The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. The main provisions of the Directive include: • The maintenance of the populations of all wild bird species across their natural range (Article 2) with the encouragement of various activities to that end (Article 3). • The identification and classification of Special Protection Areas (SPAs) for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory species, paying particular attention to the protection of wetlands of international importance (Article 4). (Together with Special Areas of Conservation designated under the Habitats Directive, SPAs form a network of European protected areas known as Natura 2000). • The establishment of a general scheme of protection for all wild birds (Article 5). • Restrictions on the sale and keeping of wild birds (Article 6). • Specification of the conditions under which hunting and falconry can be undertaken (Article 7). (Huntable species are listed on Annex II of the Directive). • Prohibition of large-scale non-selective means of bird killing (Article 8). • Procedures under which Member States may derogate from the provisions of Articles 5-8 (Article 9) — that is, the conditions under which permission may be given for otherwise prohibited activities. • Encouragement of certain forms of relevant research (Article 10 and Annex V). • Requirements to ensure that introduction of non-native birds do not threatened other biodiversity (Article 11).	The WRMP should seek to protect and enhance biodiversity, particularly designated sites. The SEA assessment framework should include objectives, indicators and targets that cover biodiversity.
The World Summit on Sustainable Development, Johannesburg (September 2002)	
The World Summit resulted in the Johannesburg Declaration on Sustainable Development and a Plan of Implementation. The declaration reaffirms principles already agreed upon at the Rio Earth Summit UNCED in 1992 and the UN Millennium Summit in 1999. It recognises that poverty eradication is a key condition for sustainable development and addresses issues such as cultural diversity, patterns of production and consumption, health issues, armed conflicts, the new dimension created by globalisation, gender issues and financing for development. The implementation plan sets out actions to achieve sustainable development such as poverty eradication, changing unsustainable patterns of consumption and production, protecting and managing the natural resource base of economic and social development, sustainable development in a globalizing world and health and sustainable development. Sustainable development in England is delivered through the sustainable development strategy, Securing the Future, and in Wales through One Wales: One Planet, The Sustainable Development Scheme of the Welsh Assembly Government.	The WRMP should promote sustainable development. The SEA should help to deliver sustainable development through the balanced assessment of the WRMP.
The Environment Noise Directive (Directive 2002/49/EC)	
The END aims to “define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to the exposure to environmental noise”. For that purpose several actions are to be progressively implemented. It furthermore aims at providing a basis the harmful effects, including annoyance, due to the exposure to environmental noise”. For that purpose several actions are to be progressively implemented. It furthermore aims at providing a basis for developing EU measures to reduce noise emitted by major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery. The underlying principles of the Directive are similar to those underpinning other overarching environment policies (such as air or waste), i.e.: - Monitoring the environmental problem; by requiring competent authorities in Member States to draw up "strategic noise maps" for major roads, railways, airports and agglomerations, using harmonised noise indicators Lden (day-evening-night equivalent level) and Lnight (night equivalent level). These maps will be used to assess the number of people annoyed and sleep-disturbed respectively throughout Europe. - Informing and consulting the public about noise exposure, its effects, and the measures considered to address noise, in line with the principles of the Aarhus Convention.	The WRMP will need to have regard to the requirements of the END. The SEA assessment framework should include for the protection against excessive noise.

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- Addressing local noise issues by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain environmental noise quality where it is good. The directive does not set any limit value, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities. - Developing a long-term EU strategy, which includes objectives to reduce the number of people affected by noise in the longer term, and provides a framework for developing existing Community policy on noise reduction from source. With this respect, the Commission has made a declaration concerning the provisions laid down in article 1.2 with regard to the preparation of legislation relating to sources of noise. It is important to note, however, that the present Directive does not set binding limit values, nor does it prescribe the measures to be included in the action plans thus leaving those issues at the discretion of the competent authorities. The long-term exposure indicators supersede those in the 1999 World Health Organisation (WHO) Guidelines for Community Noise, which are now in the process of being updated in line with the Directive.	
European Commission Communication (2013) *Towards Social Investment for Growth and Cohesion – including implementing the European Social Fund 2014-2020*	
The Communication aims to directing Member States' policies towards social investment throughout life, with a view to ensuring the adequacy and sustainability of budgets for social policies. It also provides guidance to help reach the Europe 2020 targets by establishing a link between social policies, the reforms to reach the Europe 2020 targets and the relevant EU funds.	The WRMP will should have regard of the Europe 2020 targets. The SEA assessment framework should socio-economics.
WHO (2004) *Children's Environment and Health Action Plan for Europe*	
The action plan aims to address the causes of environment-related diseases in children, including the state of the physical environment, socio-economic conditions and behaviour. Key actions include: • primary prevention, i.e. policies, programmes and plans aimed at improving the state of the physical environment (air, water, soil, noise), in particular through the integration of children's needs into housing, transport, infrastructure and planning; • equity, i.e. giving priority to protection of children at highest risk, and particularly of children who are neglected, abandoned, disabled, institutionalized or exploited, by improving access to preventive health and social protection services; • poverty reduction, i.e. policies addressing the multidimensional aspects of poverty among children; • health promotion, i.e. actions aimed at preventing and reducing exposures to environmental health hazards by adopting healthy lifestyles, achieving sustainable consumption patterns and helping to create healthy and enabling human settlements.	The WRMP will should have regard to the requirements of the Action Plan. The SEA assessment framework should include for the protection of human health and vulnerable members of the community.
The Convention for the Protection of the Architectural Heritage of Europe (Granada Convention)	
The main purpose of the convention is to reinforce and promote policies for the conservation and enhancement of Europe's heritage and to foster closer European co-operation in defence of heritage. Recognition that conservation of heritage is a cultural purpose and integrated conservation of heritage is an important factor in the improvement of quality of life.	The SEA assessment framework should include an objective on the conservation and enhancement of heritage and decision making criteria on architectural heritage.
EC 2001/42/EC on the Assessment of the Effects of Certain Plans and Programmes on the Environment (SEA Directive)	
The SEA Directive provides the following requirements for consultation: • Authorities which, because of their environmental responsibilities, are likely to be concerned by the effects of implementing the plan or programme, must be consulted on the scope and level of detail of the information to be included in the Environmental Report. These authorities are designated in the SEA Regulations as the Consultation Bodies (Consultation Authorities in Scotland). • The public and the Consultation Bodies must be consulted on the draft plan or programme and the Environmental Report, and must be given an early and effective opportunity within appropriate time frames to express their opinions. • Other EU Member States must be consulted if the plan or programme is likely to have significant effects on the environment in their territories.	The Directive sets the basis for SEA as a whole and therefore indirectly covers all objectives.

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• The Consultation Bodies must also be consulted on screening determinations on whether SEA is needed for plans or programmes under Article 3(5), i.e. those which may be excluded if they are not likely to have significant environmental effects.	
UNESCO World Heritage Convention (1972)	
The Convention defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List. In addition to this, countries are required to: • Ensure that measures are taken for the protection, conservation and presentation of cultural and natural heritage • Adopt a general policy that gives cultural and natural heritage a function in the life of the community • Integrate the protection of heritage into comprehensive planning programmes	The assessment framework should include an objective on heritage and archaeological issues.
Department for Culture, Media & Sport (2013) *Scheduled Monuments & Nationally Important but Non-Scheduled Monuments*	
This policy statement sets out Government policy on the identification, protection, conservation and investigation of nationally important ancient monuments, under the provisions of the Ancient Monuments and Archaeological Areas Act 1979. It includes principles relating to the selection of scheduled monuments and the determination of applications for scheduled monument consent.	The WRMP should seek to avoid adverse impacts on scheduled and non-scheduled monuments. The SEA assessment framework should include specific objectives relating to cultural heritage
UNESCO (2001) *Convention on the Protection of Underwater Cultural Heritage*	
The Convention sets a common standard for the protection of submerged cultural heritage, with a view to preventing its being looted or destroyed. The Convention sets out basic principles for the protection of underwater cultural heritage; provides a detailed State cooperation system; and provides widely recognised practical rules for the treatment and research of underwater cultural heritage. This includes obligations to preserve such heritage, a preference for *in situ* preservation, and no commercial exploitation.	The WRMP should seek to protect cultural heritage sites. The SEA assessment framework should include an objective relating to cultural heritage.
Department for Culture, Media and Sport (2016) *The Culture White Paper*	
This white paper sets out how the government will support the cultural sectors over the coming years and how culture will play an active role in building a fairer and more prosperous nation. It includes four key themes: • everyone should enjoy the opportunities culture offers, no matter where they start in life; • the riches of our culture should benefit communities across the country; and • the power of culture can increase our international standing. The white paper includes objectives relating to the development of the historic environment sector, and the protection of world heritage.	The WRMP should seek to protect cultural heritage assets. The SEA assessment framework should include an objective relating to cultural heritage.
EU (2011) EU Biodiversity Strategy to 2020 – towards implementation	
The European Commission has adopted an ambitious new strategy to halt the loss of biodiversity and ecosystem services in the EU by 2020. The strategy provides a framework for action over the next decade and covers the following key areas: • Conserving and restoring nature; • Maintaining and enhancing ecosystems and their services; • Ensuring the sustainability of agriculture, forestry and fisheries; • Combating invasive alien species; • Addressing the global biodiversity crisis.	The WRMP should seek to protect and enhance biodiversity, particularly designated sites. The SEA assessment framework should include objectives, indicators and targets that cover biodiversity.
European Commission (2013) *Seventh Environmental Action Programme to 2020 'Living well, within the limits of our planet'*	
The seventh Environmental Action Programme defines environmental priority objectives to be achieved by the EU up to 2020. As part of the programme, the EU aims to protect natural capital; promote resource-efficient and low-carbon growth; and safeguard health and wellbeing linked to pollutants, chemicals and climate change. The nine objectives and actions set out in the programme are: • to protect, conserve and enhance the Union's natural capital; • to turn the Union into a resource-efficient, green, and competitive low-carbon economy;	The assessment framework should, where relevant, reflect the objectives of the programme.

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• to safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing; • to maximise the benefits of the Union's environment legislation by improving implementation; • to increase knowledge about the environment and widen the evidence base for policy; • to secure investment for environment and climate policy and account for the environmental costs of any societal activities; • to better integrate environmental concerns into other policy areas and ensure coherence when creating new policy; • to make the Union's cities more sustainable; and • to help the Union address international environmental and climate challenges more effectively.	
European Commission (2001) ***National Emissions Ceiling Directive 2001/81/EC***	
The Directive sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia). The UK 2010 ceilings for each of these pollutants were 585 kilotonnes, 1,167 kilotonnes, 1,200 kilotonnes and 297 kilotonnes, respectively. This is being revised through the Thematic Strategy on Air Pollution and emissions ceilings for the four compounds and particulate matter (PM2.5) up to 2020 are anticipated.	The assessment framework should include assessment criteria relating to air quality.
European Commission (2007) ***The Eel Directive 2007/1100/EC***	
The Eel Directive establishes measures for the recovery of the stock of European eel and requires member states to produce Eel management plans for each catchment.	The WRMP should ensure that there are no adverse impacts on eel as a result of water resource management measures.
European Commission (2008) ***Environmental Quality Standards Directive 2008/105/EC***	
The Directive aims to control the concentration of certain substances which pose a risk to the aquatic environment. The 33 'priority substances' addressed by the Directive are defined by the Water Framework Directive (2000/60/EC), including cadmium, lead, mercury, nickel, benzene and polyaromatic hydrocarbons. The Directive sets thresholds of concentration that must not be exceeded, with limits to average values over a year to ensure long-term water quality and maximum allowable concentrations to limit short term pollution peaks. Member States must comply with the water quality standards and record an inventory of emissions and discharges of all substances in the Directive.	The assessment framework should include assessment criteria relating to water quality.
European Commission (2008) ***Marine Strategy Framework Directive 2008/56/EC***	
The Directive sets out a framework for an ecosystem-based approach to the management of human activities which supports the sustainable use of marine goods and services. The overarching goal of the Directive is to achieve 'Good Environmental Status' (GES) by 2020 across Europe's marine environment. The Directive establishes four European Marine Regions, based on geographical and environmental criteria. The North East Atlantic Marine Region is divided into four subregions, with UK waters lying in two of these (the Greater North Sea and the Celtic Seas). Each Member State is required to develop a marine strategy for their waters, in coordination with other countries within the same marine region or subregion. Marine strategies must be implemented to protect and conserve the marine environment, prevent its deterioration, and, where practicable, restore marine ecosystems in areas where they have been adversely affected. The marine strategies must contain: • An initial assessment of the current environmental status of that Member State's marine waters; • A determination of what Good Environmental Status means for those waters; • Targets and indicators designed to show whether a Member State is achieving GES; • A monitoring programme to measure progress towards GES; • A programme of measures designed to achieve or maintain GES. The Directive also requires Marine Protected Areas (MPAs) to be established to support the achievement of GES.	The assessment framework should incorporate assessment criteria relating to the quality of the marine environment.

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European Commission (2010) *Industrial Emissions Directive (integrated pollution prevention and control) 2010/75/EU*	
This Directive brings together the IPPC Directive (2008/1/EC) and six other Directives on titanium dioxide, VOCs and waste incineration, with the aim of reducing pollutant emissions. It covers industries with high polluting potential such as energy, production and processing of metals, minerals, chemicals, waste management and rearing of animals. It defines the obligations to be met by industrial activities with a major pollution potential. This includes establishing a permit procedure, requirements for Best Available Techniques (BAT) and setting out requirements for discharges.	The assessment framework should include criteria that ensure the protection of the environment through the prevention of pollution to air, land and water.
European Commission (2010) *Energy 2020 - A Strategy for Competitive, Sustainable and Secure Energy*	
EU energy and climate goals have been incorporated into the Europe 2020 Strategy for smart, sustainable and inclusive growth. The energy strategy includes five priorities for Europe: 1. Achieving an energy-efficient Europe; 2. Building a truly pan-European integrated energy market; 3. Empowering consumers and achieving the highest level of safety and security; 4. Extending Europe's leadership in energy technology and innovation; 5. Strengthening the external dimension of the EU energy market. Energy 2020 is part of Resource-Efficient Europe, one of the seven key initiatives of Europe 2020.	The assessment framework should include criteria relating to energy where appropriate
European Commission (2010) *Europe 2020 : A strategy for smart, sustainable and inclusive growth*	
Europe 2020 is the EU's ten-year growth strategy. It aims to change the EU's growth model and create the conditions for growth that is smarter, more sustainable and more inclusive. It contains seven 'flagship initiatives' to provide a framework for innovation, the digital economy, employment, youth, industrial policy, poverty, and resource efficiency. There are also five key target areas for the EU to achieve by 2020: 1. Employment: 75% of the 20-64 year-olds to be employed. 2. R&D: 3% of the EU's GDP to be invested in R&D. 3. Climate change and energy sustainability: greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990; 20% of energy from renewable; 20% increase in energy efficiency. 4. Education: reducing the rates of early school leaving below 10%; at least 40% of 30-34–year-olds completing third level education. 5. Fighting poverty and social exclusion: at least 20 million fewer people in or at risk of poverty and social exclusion.	The assessment framework should include criteria relating to employment, R&D, climate change and poverty where relevant.
European Commission (2011) *A Roadmap for Moving to a Competitive Low Carbon Economy in 2050*	
The EU already has short term targets in place to reduce its emissions to 20% below 1990 levels by 2020; to increase the share of renewable energy to 20%; and to make a 20% improvement in energy efficiency. The 2050 roadmap looks beyond 2020 at longer term objectives. The roadmap suggests that by 2050, the EU should cut its emissions to 80% below 1990 levels through domestic reductions alone. It sets out milestones which form a cost-effective pathway to this goal - reductions of 40% by 2030 and 60% by 2040. It also shows how the main sectors responsible for Europe's emissions - power generation, industry, transport, buildings and construction, as well as agriculture - can make the transition to a low-carbon economy most cost-effectively.	The assessment framework should include assessment criteria relating to greenhouse gas emissions reductions
European Commission (2013) *Strategy on Adaptation to Climate Change*	
The EU strategy aims to make Europe more climate-resilient by adapting to the changing climate. It aims to provide a coherent approach to enhance preparedness and capacity to respond to the impacts of climate change. The three key objectives of the strategy are: • Promoting action by Member States – encouraging Member States to adopt adaptation strategies and provide funding to boost capacity; • 'Climate-proofing' action at EU level – promoting adaptation in vulnerable sectors such as agriculture and fisheries; and • Better informed decision-making – addressing gaps in knowledge and improving the European information sharing platform, Climate-ADAPT.	The assessment framework should include criteria relating to climate resilience.

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Renewable Energy Directive (2009/28/EC)	
This Directive establishes a common framework for the use of energy from renewable sources in order to limit greenhouse gas emissions and to promote cleaner transport. It encourages energy efficiency, energy consumption from renewable sources and the improvement of energy supply. The Member States are to establish national action plans which set the share of energy from renewable sources consumed in transport, as well as in the production of electricity and heating, for 2020. These action plans must take into account the effects of other energy efficiency measures on final energy consumption (the higher the reduction in energy consumption, the less energy from renewable sources will be required to meet the target). These plans will also establish procedures for the reform of planning and pricing schemes and access to electricity networks, promoting energy from renewable sources. Each Member State has a target calculated according to the share of energy from renewable sources in its gross final consumption for 2020. The UK is required to source 15 per cent of energy needs from renewable sources, including biomass, hydro, wind and solar power by 2020. From 1 January 2017, biofuels and bioliquids share in emissions savings should be increased to 50%.	The WRMP should seek to contribute towards increasing the proportion of energy from renewable energy sources. The SEA assessment framework should include consideration of use of energy from renewable energy sources.
Energy Efficiency Directive (2012/27/EU)	
The Directive establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. Under the Directive, all EU countries are required to use energy more efficiently at all stages of the energy chain from its production to final consumption. Specific measures relate to: • energy distributors achieving 1.5% energy savings per year through energy efficiency measures; • improving the efficiency of heating systems, installing double glazed windows or insulating roofs; • purchasing energy efficient buildings, products and services, and performing energy efficient renovations; • access to data on consumption; • large companies to audit energy consumption (implemented in the UK through the Energy Savings Opportunity Scheme Regulations 2014); • national incentives for SMEs to undergo energy audits; and • monitoring efficiency levels in new energy generation capacities.	The WRMP should seek to contribute towards targets for energy efficiency. The SEA assessment framework should include consideration of energy consumption and efficiency.
European Commission (2014) *A Policy Framework for Climate and Energy in the Period from 2020 to 2030*	
The 2030 climate and energy framework was adopted in 2014 and builds on the 2020 targets. It sets three key targets for 2030: • at least 40% cuts in greenhouse gas emissions (from 1990 levels); • at least 27% share for renewable energy; and • at least 27% improvement in energy efficiency. The greenhouse gas emissions and renewable energy targets are binding, while the energy efficiency target will be reviewed in 2020.	The WRMP should support longer term targets for reducing greenhouse gas emissions, increasing renewable energy and energy efficiency. The SEA assessment framework should include the consideration of energy and greenhouse gas emissions.
European Union (2015) *Invasive Alien Species Regulation (1143/2014/EU)*	
This Regulation seeks to address the problem of invasive alien species in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have.	The SEA assessment framework should include guide questions relating to invasive species.

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Department for Communities and Local Government (DCLG) (2014) *National Planning Policy for Waste*	
Sets out detailed waste planning policies for local authorities. States that planning authorities need to: • Need to use a proportionate evidence base in preparing Local Plans • Identify sufficient opportunities to meet the identifies needs of their area for the management of waste streams • Identifying suitable sites and areas for waste facilities.	The WRMP may need to consider the potential impact of proposals on waste generation and on waste management facilities in the United Utilities area. The SEA should consider the effects of the WRMP on waste generation and management capacity.
Ministry of Housing, Communities and Local Government (DCLG) (2018) *National Planning Policy Framework*	
The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications. At the heart of the NPPF is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking. The NPPF sets out three overarching objectives: a) an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure; b) a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and c) an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy. The NPPF states that these objectives should be delivered through the preparation and implementation of plans and the application of the policies in the NPPF; however, notes that the objectives are not criteria against which every decision can or should be judged. The NPPF then sets out the guidance for 12 key planning policies topics, for subjects such as the supply homes, building a competitive economy and conserving and enhancing the natural environment.	The WRMP should take into consideration the policies set out in the NPPF.
BEIS (2011) *National Policy Statements for Energy Infrastructure*	
The energy National Policy Statements (NPSs) set out national policy against which proposals for major energy projects will be assessed and decided on by the Infrastructure Planning Commission. The following six NPSs have been designated: - Overarching NPS for Energy (EN1); - Fossil Fuel Electricity Generating Infrastructure NPS (EN2); - Renewable Energy Infrastructure NPS (EN3) ; - Gas Supply Infrastructure & Gas and Oil Pipelines NPS (EN4); - Electricity Networks Infrastructure NPS (EN5); - Nuclear Power Generation NPS (EN6). The Overarching NPS for Energy sets out that the purpose of the NPSs is to develop a clear, long-term policy framework which facilitates investment in the necessary new infrastructure (by the private sector) and in energy efficiency. The NPS highlights that the construction, operation and decommissioning of this infrastructure can lead to increased demand for water, involve discharges to water and cause adverse ecological effects resulting from physical modifications to the water environment. The NPSs expect applicants to undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment. Two sites are identified in the United Utilities area (Heysham and Sellafield) as being potentially suitable for the deployment of a new nuclear power station.	The WRMP may need to consider the potential impact of major energy proposals on water resources in the United Utilities area. This may include the potential development of nuclear power stations at Heysham and Sellafield. The SEA should consider the cumulative effects of the WRMP and any major energy proposals which may affect water resources in the United Utilities area.

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The NPSs reiterate and are underpinned by the target to cut greenhouse gas emissions by at least 80% by 2050, compared to 1990 levels.	
Canal & River Trust (2015) *Living Waterways Transform Places & Enrich Lives: Our 10 Year Strategy*	
The strategy sets out goals for the organisation for the next ten years. These are themed under: – Waterways, including: '*To encourage and grow the number of people boating, using and enjoying the waterways*' and '*To look after the heritage and wildlife on our canals and rivers for people to enjoy now and in the future*'; – Place, including: '*To provide havens for people to escape to away from the pressures of modern life*' and '*Enhance wildlife habitats and the natural landscape*'; – Prosperity, including: '*Our waterways to drive and be a catalyst for regeneration and developments that make a difference to the local area'* and '*To contribute to local economies and to provide opportunities and livelihoods for local people*'; and – People, including: '*Communities to feel ownership of, and get involved with caring for, their local waterway*' and '*To offer something for everyone to enjoy'*. These are in addition to goals relating to Influence and Resources.	The WRMP should avoid causing detrimental effects on canals and rivers. The SEA assessment framework should include objectives which take into account the goals of the strategy and the protection of rivers and canals.
DCMS (2007) *Heritage Protection for the 21st Century - White Paper*	
The Consultation Paper has three core principles: • Developing a unified approach to the historic environment; • Maximising opportunities for inclusion and involvement; and • Supporting sustainable communities by putting the historic environment at the heart of an effective planning system.	The assessment framework should include objectives which take into account the White Paper's principles.
Defra (2011*) Biodiversity 2020: A strategy for England's wildlife and ecosystem services*	
This new biodiversity strategy for England provides a comprehensive picture of how we are implementing our international and EU commitments. It sets out the strategic direction for biodiversity policy for the next decade on land (including rivers and lakes) and at sea. The strategy sets 20 targets across 5 strategic goals: - Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; - Reduce the direct pressures on biodiversity and promote sustainable use; - Improve status of biodiversity by safeguarding ecosystems, species and genetic diversity; - Enhance the benefits to all from biodiversity and ecosystem services; and - Enhance implementation through participatory planning, knowledge management and capacity building.	The WRMP should contribute towards meeting the targets and objectives within the strategy. The SEA should include objectives to improve status of biodiversity and enhance benefits of biodiversity and its ecosystem services, and reduce pressures on ecosystems.
Defra (2006) *Shoreline Management Plan Guidance*	
A shoreline management plan (SMP) is a coastal defence management tool. It is a large-scale assessment of the risks associated with coastal processes and helps to reduce these risks to people and the developed, historic and natural environment. This guidance document sets out Defra's and the Welsh Government's strategy for managing flooding and coastal erosion. The guidance includes the following objectives: - set out the risks from flooding and erosion to people and the developed, historic and natural environment within the SMP area; - identify opportunities to maintain and improve the environment by managing the risks from floods and coastal erosion; - identify the preferred policies for managing risks from floods and erosion over the next century; - identify the consequences of putting the preferred policies into practice; - set out procedures for monitoring how effective these policies are; - inform others so that future land use, planning and development of the shoreline takes account of the risks and the preferred policies; - discourage inappropriate development in areas where the flood and erosion risks are high; and - meet international and national nature conservation legislation and aim to achieve the biodiversity objectives.	The WRMP should take into account its effects on areas with a SMP. The SEA assessment should take into account the effects of the options on the coast where relevant.

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Defra (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*	
The Air Quality Strategy sets out air quality objectives and policy options to further improve air quality in the UK to benefit public health, quality of life and help to protect our environment. The strategy sets out objectives relating to particles, nitrogen dioxide, ozone, sulphur dioxide, polycyclic aromatic hydrocarbons, benzene, 1,3- butadiene, carbon monoxide, lead, nitrogen oxides and sulphur dioxide.	The WRMP should take account of air quality objectives in the strategy. The SEA should include guide questions relating to the effects of options on human health and the environment.
Defra (2010) *Air Pollution: Action in a Changing Climate*	
This document highlights the health benefits that can be achieved through closer integration of air quality and climate change policies. Air pollution often originates from the same activities that contribute to climate change (notably transport and electricity generation), so linkages between these policy areas could help ensure that they are managed most effectively. Air quality/climate change co-benefits can be realised through actions such as promoting low-carbon vehicles and renewable sources of energy that do not involve combustion. The document aims to set ambitious but realistic air quality targets, and to ensure that climate and air quality targets are better aligned in future.	The WRMP should seek to ensure that air quality, climate change and human health are not adversely affected by the options. The SEA should include guide questions relating to the effects of options on human health and the environment.
Defra (2010) *2010 to 2015 Government Policy: Flooding and Coastal Change*	
This document sets out the Government's policy relating to flooding and coastal change, and the actions being taken. These include managing the risks of flooding; funding flood and coastal erosion risk management; dealing with flood emergencies; and making sure people get a fair deal for flood insurance.	The WRMP should avoid causing adverse coastal change or flooding. The SEA assessment should take into account the effects of the options on the coast and flooding where relevant.
Defra (2011) *Natural Environment White Paper*	
The Natural Environment White Paper (2011) recognises that nationally, the fragmentation of natural environments is driving continuing threats to biodiversity. It sets out the Government's policy intent to: - improve the quality of the natural environment across England; - move to a net gain in the value of nature; - arrest the decline in habitats and species and the degradation of landscapes; - protect priority habitats; - safeguard vulnerable non-renewable resources for future generations; - support natural systems to function more effectively in town, in the country and at sea; and - create an ecological network which is resilient to changing pressures. By 2020, the Government wants to achieve an overall improvement in the status of the UK's wildlife including no net loss of priority habitat and an increase of at least 200,000 hectares in the overall extent of priority habitats. Under the White Paper, the Government has also put in place a clear institutional framework to support nature restoration which includes Local Nature Partnerships creating new Nature Improvement Areas (NIAs).	The WRMP should reflect the Government's policy intent set out in the White Paper. The SEA assessment framework should include objectives, indicators and targets that reflect the Government's policy intent set out in the White Paper.
Defra (2011) *Mainstreaming Sustainable Development*	
This document sets out the Government's vision for mainstreaming sustainable development in relation to the operation of its buildings and estates, including the goods and services that it buys and the policies it makes. It builds on the principles that underpinned the UK's 2005 sustainable development strategy, and highlights that long term economic growth relies on protecting and enhancing the environmental resources that underpin it, and paying due regard to social needs. It sets out measures to achieve the mainstreaming of sustainable development, which include ministerial leadership and oversight; leading by example; embedding sustainable development in government policy; and transparency and independent scrutiny.	The WRMP should seek to be aligned with the principles of sustainable development. The SEA assessment framework should include objectives relating to the principles of sustainable development, including communities, economy and environment.
Defra (2012) *National Policy Statement for Waste Water*	
This National Policy Statement (NPS) sets out Government policy for the provision of major waste water infrastructure. It will be used by the Infrastructure Planning Commission (IPC) to guide its decision making on development consent applications for waste water developments that fall within	The WRMP should consider any unforeseen NSIP proposals that come forward prior to adoption

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the definition of Nationally Significant Infrastructure Project (NSIP) as defined in the Planning Act 2008. As well as considering the general need for new waste water infrastructure, this NPS covers two NSIPs which have been assessed as required to meet this need although these do not fall within the United Utilities or neighbouring areas and are therefore unlikely to influence, or be influenced by, the WRMP.	which may affect water resources in the United Utilities area. The SEA should consider the cumulative effects of the WRMP and any unforeseen NSIP proposals that come forward which may affect water resources in the United Utilities area.
Defra & JNCC (2012) *UK Post-2010 Biodiversity Framework*	
The Framework is to set a broad enabling structure for action across the UK between now and 2020: i. To set out a shared vision and priorities for UK- scale activities, in a framework jointly owned by the four countries, and to which their own strategies will contribute; ii. To identify priority work at a UK level which will be needed to help deliver the Aichi targets and the EU Biodiversity Strategy iii. To facilitate the aggregation and collation of information on activity and outcomes across all countries of the UK, where the four countries agree this will bring benefits compared to individual country work; and iv. To streamline governance arrangements for UK- scale activity The Framework sets out 20 new global 'Aichi targets' under 5 strategic goals: • Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society • Reduce the direct pressures on biodiversity and promote sustainable use • To improve the status of biodiversity by safeguarding ecosystems species and genetic diversity • Enhance the benefits to all from biodiversity and ecosystem services • Enhance implementation through participatory planning, knowledge management and capacity building. The Framework also references the headline target of the EU Biodiversity Strategy (2011), of 'halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss'.	The WRMP should contribute towards meeting the targets and objectives within the framework. The SEA should include objectives to improve status of biodiversity and enhance benefits of biodiversity and its ecosystem services, and reduce pressures on ecosystems.
Defra (2013) *The National Adaptation Programme – Making the Country Resilient to a Changing Climate*	
This Programme contains a mix of policies and actions to help adapt successfully to future weather conditions, by dealing with the risks and making the most of the opportunities. It sets out a number of objectives, including: • To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure that minimises vulnerability and provides resilience to the impacts of climate change. • To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them and to take action to become resilient to climate risks. To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.	The WRMP should ensure that proposals are resilient to the effects of climate change. Where possible, options should be considered that enhance resilience. The SEA should consider the effects of options on climate change resilience.
Defra (2013) *Waste Management Plan for England*	
Sets out the Government's ambition to work towards a more sustainable and efficient approach to resource use and management. The document includes measures to: • Encourage reduction and management of packaging waste • Promote high quality recycling • Encourage separate collection of bio-waste Promote the re-use of products and preparing for re-use activities.	The WRMP may need to consider the potential impact of proposals on waste generation and on waste management facilities in the United Utilities area. The SEA should consider the effects of the WRMP on waste generation and management capacity.
Defra, Scottish Government, Welsh Government (2015) *The Great Britain Invasive Non-native Species Strategy*	

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The strategy sets out key aims and actions for addressing the threats posed by invasive non-native species, including the prevention of invasive species arriving in Britain, early detection and monitoring, eradication and control. It also aims to: • get people to work better together, including the government, stakeholders, land managers and the general public; and • improve co-ordination and co-operation on issues at a European and international level. The strategy covers the period 2015 to 2020.	The WRMP should seek to avoid the spread of invasive species. The SEA should consider the effects of the WRMP on biodiversity.
Defra (2016) *Guiding Principles for Water Resources Planning - For Water Companies Operating Wholly or Mainly in England*	
The document sets out the key policy priorities the government expects water resources management plans (WRMP) to address. The four key principles are: • Take a long term, strategic approach to protecting and enhancing resilient water supplies; • Consider every option to meet future public water supply needs; • Protect and enhance our environment, acting collaboratively; and • Promote efficient water use and reduce leakage.	The WRMP should be prepared in accordance with the guiding principles.
Defra (2017) *Air Quality Plan for Nitrogen Dioxide (NO2) in UK*	
This plan sets out how the Government will improve air quality in the UK by reducing nitrogen dioxide emissions in towns and cities. The air quality plans set out targeted local, regional and national measures across 37 zone plans (areas which have identified air quality issues with nitrogen dioxide), a UK overview document and a national list of measures. Measures relate to freight, rail, sustainable travel, low emission vehicles and cleaner transport fuels, among others.	The WRMP should have regard to the air quality plans and specific local measures. The SEA should consider the effects of the WRMP on air quality.
Environment Agency and Natural Resources Wales (2017) *Water Resources Planning Guideline: Interim Update*	
The water resources planning guideline provides a framework for water companies to follow in developing and presenting their water resources plans. It sets out good practice behind the composition of a plan, the approaches to developing a plan and the information that a plan should contain. Companies should follow this guideline to ensure that their plans cover the requirements specified by the Water Industry Act 1991.	These guidelines will be used by water companies to develop their WRMP. An appreciation of the processes used to develop the WRMP will benefit the SEA.
Environment Agency (2008) *Better Sea Trout and Salmon Fisheries: Our Strategy for 2008-2021*	
The strategy has the goal of more sea trout and more salmon in more rivers bringing more benefit. This goal is to be brought about through achieving three broad targets: 1 Self-sustaining sea trout and salmon in abundance in more rivers 2 Economic and social benefits optimised for sea trout and salmon fisheries 3 Widespread and positive partnerships, producing benefits There are twelve more detailed targets lying below these broad goals which relate to salmon and fisheries. These could be relevant to monitoring the effects of the WRMP, e.g. a target of 70 per cent of rivers outside the 'at risk' (i.e. better than) the 'at risk' category in 2011 and 2021 to demonstrate rivers meeting their potential for salmon.	The WRMP should take the strategy into account where the option may have an effect on salmon and trout, e.g. where an option may involve inserting or removing a barrier to fish. The SEA should include a guide question in relation to the effects of options on recreation (i.e. recreational angling) and also appropriate targets in monitoring proposals.
Environment Agency (2009) *Water for People and the Environment: Water Resource Strategy for England and Wales*	
Environment Agency's water resources strategy sets out how Environment Agency believe water resources should be managed England and Wales to 2050 and beyond to ensure that there will be enough water for people and the environment. It sets out how water resources should be managed within Defra frameworks in its water strategy for England 'Future Water', and in Wales, the Welsh Government's 'Environment Strategy for Wales'. Objectives in the strategy are set out under four broad themes: adapting to and mitigating climate change; a better water environment; sustainable planning and management of water resources; and, water and the water environment are valued. This strategy sets out the following objectives:	The objectives for the WRMP should reflect these objectives. The SEA should seek to promote the protection and enhancement of water resources and to encourage sustainable management of the resource.

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- Ecology is more resilient to climate change because abstraction pressures have been reduced and a diverse network of habitats has been allowed to develop; - The resilience of supplies and critical infrastructure is increased to reduce the impacts of climate change; - Flexible and incremental solutions in water resources management allow adaptation to climate change as it happens; - Everyone is able to make more informed decisions and choices about managing water resources, protecting the environment and choosing options to avoid security of supply problems; - Greenhouse gas emissions from using water resources are minimised and properly considered in future decisions; - Measures will be in place to make sure that water bodies achieve Water Framework Directive objectives; - Abstraction is sustainable, the environment is protected and improved and supplies remain secure; - Environmental problems caused by historic unsustainable abstractions are resolved; - Catchment management is integrated so that impacts on water resources and the water environment are managed together; - The twin track approach of resource development with demand management is adopted in all sectors of water use; - In England, the average amount of water used per person in the home is reduced to 130 litres each day by 2030; - The Environment Agency targets and adapts its approach to reflect the location and timing of pressures on water resources; - In England, water companies implement near-universal metering of households, starting in areas of serious water stress; - Leakage from mains and supply pipes is reduced; - New and existing homes and buildings are more water efficient; - Water resources are allocated efficiently and are shared within regions where there are areas of surplus; - Water pricing for the abstraction and use of water acts as an incentive for the sustainable use of water resources; - Abstractors and users make informed choices to use water more efficiently; - Innovative tariffs are adopted by water companies to maximise savings and minimise issues of affordability; - The needs of wildlife, fisheries, navigation and recreation, as well as the environment and abstractors, are fully taken into account when allocating water resources; - Innovative technology is developed to improve water efficiency by all water users. The strategy includes a number of actions for Environment Agency and others to develop targets for water reduction and efficiency.	
Environment Agency (2009) *Water for People and the Environment: Water Resource Strategy for Wales*	
The Environment Agency's strategy for Wales sets out how the EA believe that water resources should be managed within the framework set out by the Welsh Assembly Government's 'Environment Strategy for Wales' and its 'Strategic Policy Position Statement on Water'. The objectives are the same as those outlined above in the strategy for England and Wales, although the following two objectives: - In England, the average amount of water used per person in the home is reduced to 130 litres each day by 2030; - In England, water companies implement near-universal metering of households, starting in areas of serious water stress; Are replaced by the following objective: - The average amount of water used per person in the home is reduced.	The objectives for the WRMP should reflect these objectives. The SEA should seek to promote the protection and enhancement of water resources and to encourage sustainable management of the resource.
Environment Agency (2016) *Creating a Better Place: Our Ambition to 2020*	

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Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
This document includes the EA's vision, principles and purpose, and sets out its objectives to create a cleaner healthier environment which benefits people and the economy, a nation better protected against natural threats and hazards, and its commitment to work in partnership. The key objectives for 2016 to 2020 are: - a cleaner, healthier environment which benefits people and the economy; - a nation better protected against natural threats and hazards, with strong response and recovery capabilities; and - higher visibility, stronger partnerships and local choices.	The SEA and WRMP should consider the EA's priorities.
Environment Agency (2011*) National Flood and Coastal Erosion Risk Management Strategy for England*	
This strategy builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. Risk should be managed in a co-ordinated way within catchments and along the coast and balance the needs of communities, the economy and the environment. This strategy will form the framework within which communities have a greater role in local risk management decisions and sets out the Environment Agency's strategic overview role in flood and coastal erosion risk management (FCERM).	The SEA should ensure that the WRMP contributes to the reduction in flood risk and coastal erosion.
Environment Agency (2013) *Managing Water Extraction*	
Managing Water Abstraction sets out how the EA manage water resources in England and Wales. It is the overarching document that links together our abstraction licensing strategies. The availability of water resources for abstraction is assessed through a Catchment Abstraction Management Strategy (CAMS) approach.	The WRMP will need to sustainably manage abstraction. The SEA should include a guide question relating to the sustainable use of water resources.
Environment Agency *Restoring Sustainable Abstraction Programme*	
Environment Agency note that there is evidence to suggest that unsustainable abstraction of groundwater and surface water could be contributing to environmental damage of rivers and wetlands in England and Wales, including sites of national and international conservation importance. In May 1997, at the Government's Water Summit, a commitment was made to reverse the damage caused by past decisions. Environment Agency investigates where over-abstraction has occurred and work with local people to restore sustainable supplies.	The WRMP will need to sustainably manage abstraction. The SEA should include a guide question relating to whether abstraction will contribute to environmental damage of rivers and wetlands.
Environment Agency (2013) *Areas of Water Stress: Final Classification*	
The report is the Environment Agency's formal advice on which areas in England are of serious water stress. It highlighted that United Utilities is classified as 'moderate stress', and is therefore not an area of serious water stress.	The WRMP should seek to manage the water stressed area. The SEA assessment framework should consider the effects of the WRMP on water resources and the associated socio-economic and environmental receptors.
Environment Agency (2015) *Drought Response: Our Framework for England*	
The Environment Agency's drought framework plan for the north west sets out the indicators the EA currently use to classify the different stages of drought. This plan sets out: • how drought affects different parts of England in different ways • which organisations are involved in managing drought and how they work together • how the Environment Agency and others make decisions and decide on actions to take • how the Environment Agency monitors and measures the impacts of drought • how the Environment Agency reports on drought and communicates with others.	The WRMP should take account of the Environment Agency's drought framework where appropriate. The SEA should include an objective/guide question relating to water resources.
HM Government (1979) *Ancient Monuments and Archaeological Areas Act*	
This is the main legislation concerning archaeology in the UK. This Act, building on legislation dating back to 1882, provides for nationally important archaeological sites to be statutorily protected as Scheduled Ancient Monuments. Section 61(12) defines sites that warrant protection due to their being of national importance as 'ancient monuments'. These can be either Scheduled Ancient Monuments or "any other monument which in the opinion of the Secretary of State is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attaching to it".	The WRMP should seek to avoid adverse impacts on cultural heritage assets. The SEA assessment framework should include specific objectives relating to cultural heritage.

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Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
HM Government (1981) *Wildlife and Countryside Act*	
The Act makes it an offence (with exceptions) to; - Intentionally kill, injure or take any wild bird or their eggs or nests; - Intentionally kill, injure, or take, possess, or trade in any wild animal listed in Schedule 5; - Prohibits interference with places used for shelter or protection, or intentionally disturbing animals; and - Pick, uproot, trade in, or possess (for the purposes of trade) and wild plant listed in Schedule 8. The Act also provides for the notification of Sites of Special Scientific Interest (SSSI) and require surveying authorities to maintain up to date definitive maps and statements, for the purpose of clarifying public rights of way.	The WRMP must ensure full compliance with the Act. The SEA should ensure a positive contribution to the wildlife within the operational area.
HM Government (1990) *Environmental Protection Act*	
The Act defines the legal framework for England, Wales and Scotland regarding environmental protection, including the duty of care for waste, contaminated land, and statutory nuisance. Under the Act, Local Authorities or private individuals may take action to secure abatement of any such nuisance, such as noise, and only one person need be affected for action to be possible. It also specifies offences related to the storage, movement, treatment or disposal of controlled waste, and sets out the regime for identifying and remediating contaminated land.	The WRMP must ensure compliance with the Act. The SEA assessment framework should include waste and nuisance.
HM Government (1990) *Planning (Listed Building and Conservation Areas) Act*	
This Act was passed to better regulate the way in which large and small scale developments were approved by local authorities in England and Wales. It provides local planning authorities the power to take steps requiring land to be cleaned up when conditions adversely affect the amenity of an area.	The WRMP should seek to avoid adverse impacts on cultural heritage assets. The SEA assessment framework should include specific objectives relating to cultural heritage.
HM Government (1991) *Water Industry Act 1991*	
The Water Industry Act sets out the regulatory, competition and consumer representation frameworks for the water sector in England and Wales including the duty for water companies to prepare WRMPs.	The WRMP should be prepared in accordance with the Water Industry Act 1991.
HM Government (1991) *Water Resources Act 1991*	
The Water Resources Act governs the quality and quantity of water by outlining the functions of the Environment Agency. The Act sets out offences relating to water, discharge consents, and possible defences to the offences.	The SEA assessment framework should include a specific objective(s) relating to water quality and resources.
HM Government (1994) *UK Biodiversity Action Plan (BAP)*	
The aim of the action plan is to conserve and enhance biological diversity in the UK and to contribute to the conservation of national and global biodiversity and include the following aims to maintain and, where practicable, to enhance: - The overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems; - Internationally and nationally important and threatened species, habitats and ecosystems; - Species, habitats and natural and managed ecosystems that are characteristic of Kent; - The biodiversity of natural and semi-natural habitats, where this has diminished over 3 recent decades, and - Public awareness of, and involvement in, conserving biodiversity.	Ensure that WRMP and SEA encourage conservation and offer protection to areas and species of high conservation importance as identified in this action plan.
HM Government (1995) *Environment Act 1995*	
The Act seeks to protect and preserve the environment and guard against pollution to air, land or water. The Act adopts an integrated approach to environmental protection and outlines where authorisation is required from relevant authorities to carry out certain procedures as well as outlining the responsibilities of the relevant authorities. It established the Environment Agency, the Scottish Environment Protection Agency and the National Park authorities. The Act also includes provisions relating to remediation of contaminated land, waste and the designation of Air Quality Management Areas.	The WRMP must ensure compliance with the Act. The SEA assessment framework should include waste and air quality.

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HM Government (2002) *The National Heritage Act 2002*	
This Act builds on the preceding National Heritage Acts of 1980, 1983 and 1997. All four Acts define the way in which National heritage assets are managed and protected. The 2002 Act extended the powers of the Historic Buildings and Monuments Commission to include underwater archaeology within the territorial waters of the United Kingdom.	The WRMP should be compliant with the Act. The SEA should include objectives relating to the protection of heritage features.
HM Government (2003) *Water Act*	
The four broad aims of the Act are - the sustainable use of water resources; - strengthening the voice of consumers; - a measured increase in competition; and - the promotion of water conservation. It amends the Water Industry Act 1991 so that water companies: - are given a duty to prepare and publicise drought plans; - are placed under a duty to agree and publicise water resource management plans; and - are placed under an enforceable duty to further water conservation. As part of the Act the Water Services Regulation Authority (Ofwat) became the economic regulator of the water and sewage industry in England and Wales.	The WRMP will be used by Ofwat to assess supply-demand balance and quality enhancement elements as part of the Periodic Review of Price Limits. It is therefore important that the WRMP is a fair and transparent review of water resources and is inclusive of the environmental impacts anticipated. The SEA must ensure that the full obligations are met in terms of the environmental implications to abstraction and discharges.
HM Government (2003) *The Water Environment (Water Framework Directive) (England and Wales) Regulations*	
These regulations transpose the Water Framework Directive into law in England and Wales (see Water Framework Directive 2000/60/EC above).	The WRMP should be aligned with the requirements of the Water Framework Directive. The SEA should include objectives relating to water quality, water resources, sustainable water use, and biodiversity.
HM Government (2005) *UK Sustainable Development Strategy*	
The strategy for sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations. This is implemented with 4 key priorities: - Sustainable consumption and production; - Climate change; - Natural resource protection; - Sustainable communities.	The WRMP and SEA must consider and implement the key priorities and objectives of the strategy.
HM Government (2006) *The Natural Environment and Rural Communities (NERC) Act 2006*	
The Act: • makes provision about bodies concerned with the natural environment and rural communities; • makes provision in connection with wildlife, sites of special scientific interest, National Parks and the Broads; • amends the law relating to rights of way; • makes provision as to the Inland Waterways Amenity Advisory Council; and • provides for flexible administrative arrangements in connection with functions relating to the environment and rural affairs and certain other functions; and for connected purposes.	The SEA objectives must consider the importance of conserving biodiversity and landscape features as set out in the Act.
HM Government (2007) *Water Resources Management Plan Regulations 2007*	
These Regulations set out the process for the preparation of WRMPs.	The WRMP should be prepared in accordance with these regulations.
HM Government (2008) *Climate Change Act 2008*	

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Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
This Act aims: - to improve carbon management and help the transition towards a low carbon economy in the UK; and - to demonstrate strong UK leadership internationally, signalling that the UK is committed to taking its share of responsibility for reducing emissions in the context of ratifying the global Paris Agreement. The UK Climate Change Act 2008 sets legally binding targets for the UK to reduce greenhouse gas emissions by at least 80% by 2050, and CO_2 emissions by at least 26% by 2020, against a 1990 baseline. Further the Act provides for a carbon budgeting system which caps emissions over five year periods to set out our trajectory to 2050. Budgets have been set covering the periods 2008-12, 2013-17, 2018-22, 2023-27 and 2028-32, equivalent to 22%, 28%, 34%, 50% and 57% reductions in carbon emissions compared to 1990 levels respectively.	The WRMP should contribute towards increasing the proportion of energy from renewable energy sources. The SEA assessment framework should include consideration of greenhouse gas emissions and use of energy from renewable energy sources.
HM Government (2008) *The Energy Act 2008*	
The Energy Act 2008 contains the legislative provisions required to implement UK energy policy following the publication of the Energy Review 2006 and the Energy White Paper 2007. The key elements of the Act: • Strengthens the regulatory framework for offshore gas supply infrastructure to enable private sector investment; • Creates a regulatory framework to enable private sector investment in Carbon Capture and Storage projects; • Strengthens the Renewables Obligation to drive greater and more rapid deployment of renewables in the UK; • Strengthens statutory decommissioning provisions for offshore renewables and oil and gas installations to minimise the risk of liabilities falling to the Government; • Improves the offshore oil and gas licensing regime in response to changes in the commercial environment and enable the Department for Business Enterprise and Regulatory Reform to carry out its regulatory functions more effectively; • Ensures the operators of new nuclear power stations accumulate funds to meet the full costs of decommissioning and their full share of waste management costs; and • Introduces amending powers such that Ofgem is able to run the offshore electricity transmission licensing regime more effectively. The subsequent Energy Acts (2010, 2011, 2013, 2016) contain provisions relating to carbon capture and storage, decarbonisation, fuel poverty, reductions in carbon emissions, security of energy supply, nuclear regulation and the Oil and Gas Authority, amongst others.	The WRMP should have regard to the provisions in the Act. The SEA should include objectives relating to energy and resource use.
HM Government (2009) *The Eels (England and Wales) Regulations 2009*	
The Eels Regulations afford powers to the Environment Agency to implement measures for the recovery of European eel stocks.	The WRMP should ensure that there are no adverse impacts on eel as a result of water resource management measures.
HM Government (2011) *Carbon Plan: Delivering our Low Carbon Future*	
The Carbon Plan sets out how the UK will achieve decarbonisation within the framework of energy policy: to make the transition to a low carbon economy while maintaining energy security, and minimising costs to consumers, particularly those in poorer households. It sets out policies for meeting the first four carbon budgets, and includes proposals for energy efficiency, heating, transport and industry. Specific actions relate to secure and low carbon energy, reducing energy in homes and communities, reducing business and industrial emissions, and low carbon transport.	The WRMP should contribute towards increasing the proportion of energy from renewable energy sources. The SEA assessment framework should include consideration of the use of energy from renewable energy sources.
HM Government (2009) *The UK Renewable Energy Strategy*	
The Strategy sets out to: • Put in place the mechanisms to provide financial support for renewable electricity and heat worth around £30 billion between now and 2020; • Drive delivery and clear away barriers; • Increase investment in emerging technologies and pursue new sources of supply; and • Create new opportunities for individuals, communities and business to harness renewable energy.	The WRMP should contribute towards increasing the proportion of energy from renewable energy sources. The SEA assessment framework should include consideration of the

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	use of energy from renewable energy sources.
BEIS (2011) *UK Renewable Energy Roadmap*	
The Renewable Energy Roadmap outlines the UK's framework for delivering 15% of energy demand from renewable sources by 2020 (as mandated by the EU Renewable Energy Directive). Although starting from a low-level of renewable generation, eight technologies were identified that have the potential to generate 90% of the renewable target by 2020. These are: onshore wind, offshore wind, marine energy, biomass electricity, biomass heat, ground source and air source heat pumps and renewable transport. The Roadmap includes an indication from the Welsh Government that it has the potential to double the amount of renewable energy consumption by 2025, and to deliver 4GW of power from marine energy. The 2013 update highlights that offshore wind and marine energy have the potential to make significant contributions to meeting the UK's future energy needs	The WRMP should contribute towards increasing the proportion of energy from renewable energy sources. The SEA assessment framework should include consideration of the use of energy from renewable energy sources.
HM Government (2008) *Future Water: The Government's Water Strategy for England*	
This strategy sets out how the Government want the water sector to look by 2030 and some of the steps required to achieve it. The vision is for rivers, canals, lakes and seas to have improved for people and wildlife with benefits for angling, boating and other recreational activities and that the supply of excellent quality drinking water is continued. It is for the sustainable delivery of secure water supplies and an improved and protected water environment. The strategy sets out actions to deal with water demand (e.g. introducing stricter water efficiency targets in building regulations for new homes), water supply (e.g. through use of 25 year water resources management plans and encouraging the use of rainwater harvesting where appropriate). No specific targets are listed.	The WRMP should have regard to its contribution towards achieving the strategy. The SEA assessment framework should ensure that the effects on the water sector's sustainability are fully considered.
HM Government (2009) *Marine and Coastal Access Act 2009*	
The Marine and Coastal Access Act sets out a number of measures including the establishment of Marine Conservation Zones (MCZs) and Marine Spatial Plans. It also includes amendments to the Salmon and Freshwater Fisheries Act, 1975.	The WRMP should take into account its effects on coastal areas. The SEA assessment should take into account the effects of the actions on the coast where relevant.
HM Government (2010) *Countryside and Rights of Way Act 2000*	
This act extends the public's ability to enjoy the countryside and safeguards landowners and occupiers. The Act creates a new statutory right of access to open county and registered common land, modernise the right of way system, give greater protection to Sites of Special Scientific Interest (SSSIs), provide greater protection arrangements for Areas of Outstanding Natural Beauty (AONBs) and strengthen wildlife enforcement legislation.	The SEA must make sure that the Act is supported and that public rights of way and access to the countryside are maintained and where possible enhanced.
HM Government (2010) *Flood and Water Management Act 2010*	
The Flood and Water Management Act 2010 aims to provide better, more sustainable management of flood risk for people, homes and businesses, help safeguard community groups from unaffordable rises in surface water drainage charges and protect water supplies to the consumer. The Act will also implement recommendations made by Sir Michael Pitt in his review of the 2007 floods. This will include giving water companies new powers to better control non-essential domestic uses of water during periods of water shortage. The Act does not contain any targets.	The WRMP should be in conformity with the Act. The SEA should include objectives relating to flooding and water use.
HM Government (2011) *UK Marine Policy Statement*	
The Marine Policy Statement (MPS) provides the framework for marine planning and taking decisions affecting the UK marine area. It outlines the UK Administrations' vision for the UK marine area, general principles for decision making and the high level approach to marine planning that will contribute to delivering this vision and so achievement of sustainable development. It sets out the environmental, social and economic considerations that need to be taken into account. It supports the delivery of the following high level marine objectives: - Achieving a sustainable marine economy; - Ensuring a strong, healthy and just society; - Living within environmental limits;	The WRMP should take into account its effects on coastal areas. The SEA assessment should take into account the effects of the actions on the coast/marine environment where relevant.

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- Promoting good governance; - Using sound science responsibly. Does not contain any targets.	
HM Government (2011) *Water for Life: White Paper*	
Water for Life describes a vision for future water management in which the water sector is resilient, in which water companies are more efficient and customer focused, and in which water is valued as the precious and finite resource it is. *Water for Life* includes several proposals for deregulating and simplifying legislation, to reduce burdens on business and stimulate growth. Ofwat's proposals for reducing its regulatory burdens complement these.	WRMP should ensure that future water management is resilient, efficient and customer focused In order to ensure future water management is resilient SEA should consider resilience to climate change and should consider the human environment to ensure water companies remain customer focused.
HM Government (2015) *Infrastructure Act 2015*	
The Infrastructure Act (*inter alia*) gives environmental authorities new powers to require landowners to take action on invasive non-native species or permit others to enter the land and carry out those operations.	The SEA assessment framework should include guide questions relating to invasive species.
HM Government (2015) *Ozone-Depleting Substances Regulations 2015*	
The 2015 ODS Regulations implementation of EU Ozone Depleting Substances Regulations (1005/2009). The principle objective is to phase out and control remaining uses of ozone depleting substances (ODS). ODSs commonly include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and halons, which were typically used as refrigerants, air-conditioning systems, and fire-fighting equipment. The Regulations place controls and phase-out dates on the manufacture and supply of ODSs. The Regulations also require ODSs to be removed from refrigeration equipment before such appliances are scrapped. The Regulations specify minimum qualifications for those working on the recovery, recycling, reclamation or destruction of ODS.	The WRMP should have regard to the requirements of the regulations. The SEA assessment framework should include emissions to air.
HM Government (2015) *Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015*	
The regulations implement provisions of the Water Framework Directive (Directive 2000/60/EC), the Environmental Quality Standards Directive (Directive 2008/105/EC) and the priority substances amendment of these directives (Directive 2013/39/EU). This includes directions for the classification of surface water and groundwater bodies, monitoring requirements, standards for ecological and chemical status of surface waters, and environmental quality standards for priority substances.	The WRMP should be aligned with the requirements of the Water Framework Directive. The SEA should include objectives relating to water quality, water resources, sustainable water use, and biodiversity.
HM Government (2016) *Environmental Permitting (England and Wales) Regulations 2016*	
The Regulations provide a consolidated system of environmental permitting in England and Wales, and transpose the provisions of 15 EU Directives. Provides a system for environmental permits and exemptions for industrial activities, mobile plant, waste operations, mining waste operations, water discharge activities, groundwater activities, flood risk activities and radioactive substances activities. It also sets out the powers, functions and duties of the regulators. Certain flood risk activities are now regulated under the Environmental Permitting Regulations, with environmental permits required for some activities. There are slight variations between England and Wales.	The WRMP should accord with these Regulations.
HM Government (2017) *Conservation of Habitats & Species Regulations 2017*	
These regulations consolidate all the various amendments made to the Conservation (Natural Habitats) Regulations 1994 in respect of England and Wales. The 1994 Regulations transposed Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law. The Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European Sites. Under the Regulations, competent authorities i.e. any Minister, government department, public body, or person holding public office, have a general duty, in the exercise of any of their functions, to have regard to the EC Habitats Directive. New provisions implement aspects of the Marine & Coastal Access Act 2009. These provisions provide for:	The WRMP must ensure full compliance with the Regulations. The SEA should take into account the effects of the actions on biodiversity.

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- the transfer of certain licensing functions from Natural England to the Marine Management Organisation (MMO); - Marine Enforcement Officers to use powers under the Marine Act to enforce certain offences under the Habitats Regulations.	
HM Treasury (2016) *National Infrastructure Delivery Plan*	
This document is the Government's updated National Infrastructure Delivery Plan. It sets out the plan to 2021 and beyond and takes a targeted approach to infrastructure investment and delivery across different sectors. It contains major commitments to improve the UK's transport, energy, communications, waste, water, housing and flood and coastal erosion, as well as steps to attract new private sector investment. It includes reference to the production of Water Resources Management Plans and the Ofwat price review.	The WRMP will be produced as indicated in the Delivery Plan.
National Assembly for Wales (2016) *Historic Environment (Wales) Act 2016*	
The Act improves the existing systems for the protection and sustainable management of the Welsh historic environment. It also gives more effective protection to listed buildings and scheduled monuments and enhances existing mechanisms for the sustainable management of the historic environment. The Act also creates new measures that enables authorities to halt works if protected buildings or monuments are under threat from unauthorised activities and to take action against those who have damaged or destroyed monuments.	The WRMP have regard to the requirements of the Act. The SEA assessment should include criteria relating to the protection of the historic environment.
Natural England (2011) *UK Geodiversity Action Plan*	
The UKGAP sets out a framework for enhancing the importance and role of geodiversity across the UK, and provides a shared context and direction for geodiversity action through a common aim, themes, objectives and targets which link national, regional and local activities. The themes (on which the plan's objectives are based) include: furthering our understanding of geodiversity; gathering and maintaining information on our geodiversity; conserving and managing our geodiversity; inspiring people to value and care for our geodiversity; and sustaining resources for our geodiversity. It also aims to influence planning policy, legislation and development design.	The WRMP should take into account the aims of the UKGAP. The SEA assessment should consider effects of options on geodiversity and outline enhancement and mitigation opportunities where these are identified.
Ofwat (2008) *Water Supply and Demand Policy*	
Summarised the key areas of water supply and demand, focusing on water efficiency, leakage, metering, and climate change.	The WRMP should ensure it balances demand and supply issues. The SEA assessment framework should ensure that consideration is given to the socio-economic and environmental impact of any demand and supply policies.
Ofwat (2016) Water 2020	
This document sets out Ofwat's decisions on the design of its water and wastewater services regulatory framework in England and Wales. The approach aims to deliver the following benefits: • Greater customer engagement and understanding • A sustainable investment model and a fair balance of risk and reward • Choice where possible, and ensuring markets are effective for customers • A focus on the long-term, targeted and risk-based • Support for sustainable improvements in the environment	The WRMP should take account of the regulatory framework. The SEA assessment should include criteria relating to the provision of water to customers and environmental protection.
Welsh Government (2004) *Technical Advice Note 15: Development and Flood Risk*	
TAN 15 sets out a precautionary framework to guide planning decisions. The approach seeks to first, direct new development away from those areas which are at high risk of flooding and, second, where development has to be considered in high risk areas (Zone C), allow only those developments which can be justified to be located within such areas.	The WRMP should take account of flood risk management. The SEA should include a guide question relating to flood risk.
Welsh Government (2009) *One Wales One Planet: The Sustainable Development Scheme for Wales*	
One Wales One Planet seeks to build on the two previous Sustainable Development Schemes. It sets out proposals to promote sustainable development, how the Welsh Government will make sustainable development a reality for people in Wales, and the benefits that people will see from this, particularly in less well-off communities.	The WRMP should consider effects of options on sustainable development in Wales.

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The strategy states that the Welsh Government is committed to working in partnership with others and notes that businesses can: - Develop resource efficiency within the organisation and through supply chains, improving productivity and competitiveness; - Reduce waste; - Develop environmental and sustainability policies and targets; - Monitor performance and resource use and report publicly on them; - Engage with the workforce in both adopting sustainable practices and encouraging employees to become sustainable champions in their own communities; - Engage with and support local communities.	The SEA should include guide questions relating to improving resource efficiency, reducing waste, monitoring and public reporting, encouraging sustainable practices among the workforce and engaging with and supporting local communities. The SEA should include proposals for monitoring the effects of the WRMP on the environment and sustainability and could utilise targets that arise from this document.
Welsh Government (2008) *People, Places, Futures: The Wales Spatial Plan 2008 Update*	
The *Wales Spatial Plan* provides the context and direction of travel for local development plans and the work of local service boards. The 2008 update brings the *Wales Spatial Plan* into line *with One Wales*, and gives status to the area work which has developed since 2006. The key themes of the update (and the Wales Spatial Plan before it) are set out below: **Building Sustainable Communities** Our future depends on the vitality of our communities as attractive places to live and work. We need to reduce inequalities between communities whilst retaining their character and distinctiveness. **Promoting a Sustainable Economy** We need an innovative, high value-added economy for Wales which utilises and develops the skills and knowledge of our people; an economy which both creates wealth and promotes the spreading of that prosperity throughout Wales; an economy which adds to the quality of life as well as the standard of living and the working environment. **Valuing our Environment** The quality of our natural environment has an intrinsic value as a life support system, but also promotes wellbeing for living and working and contributes to our economic objectives. Safeguarding and protecting our natural and historic assets, and enhancing resilience to address the challenges of climate change, will enable us to attract people to our communities and provide the wellbeing and quality of life to encourage them to stay and preserve the foundations for the future. **Achieving Sustainable Accessibility** We will develop access in ways that protect the environment, encourage economic activity, widen employment opportunities, ensure quality services and integrate the social, environmental and economic benefits that travel can have. **Respecting Distinctiveness** A cohesive identity which sustains and celebrates what is distinctive about Wales, in an open and outward-looking way, is central to promoting Wales to the World, as well as to our future economic competitiveness and social and environmental wellbeing.	The WRMP should have regard to the key themes of the *Wales Spatial Plan Update*. The SEA objectives should cover the key themes set out in the *Wales Spatial Plan Update.*
Welsh Government (2006) *Environment Strategy for Wales*	
The Environment Strategy for Wales sets out the challenges and vision for Wales up to 2026. It covers themes under climate change; resource use; biodiversity, landscapes and seascapes; local environment; and environmental hazards. The priorities identified in the Strategy are to - minimise greenhouse gas emissions and adapt to the impacts of climate change; - conserve and enhance biodiversity; - monitor and regulate known and emerging environmental hazards; - tackle unsustainable practices, like waste production and disposal; and - conserve and enhance land and sea, built environment, natural resources and heritage, developing and using them in a sustainable and equitable way and for the long term benefit of the people of Wales.	The WRMP should aim to contribute to the Environment Strategy for Wales. The SEA assessment should include effects of options on biodiversity, marine, flood and water management, the historic environment, people and the environment and environmental quality.
Welsh Government (2009) *Technical Advice Note 5: Nature Conservation and Planning*	
Technical Advice Note 5 sets out how the planning system should contribute to protecting and enhancing biodiversity and geological conservation. It stipulates that the planning system should:	The WRMP should seek to protect and enhance biodiversity and geodiversity.

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
- work to achieve nature conservation objectives through a partnership between local planning authorities, Natural Resources Wales, voluntary organisations, developers, landowners and other key stakeholders; - integrate nature conservation into all planning decisions looking for development to deliver social, economic and environmental objectives together over time; - ensure that the UK's international and national obligations for site, species and habitat protection are fully met in all planning decisions; - look for development to provide a net benefit for biodiversity conservation with no significant loss of habitats or populations of species, locally or nationally; - help to ensure that development does not damage, or restrict access to, or the study of, geological sites and features or impede the evolution of natural processes and systems especially on rivers and the coast; and - plan to accommodate and reduce the effects of climate change by encouraging development that will reduce damaging emissions and energy consumption and that help habitats and species to respond to climate change.	SEA objectives should reflect the need to conserve and, where possible, enhance, biodiversity and geodiversity.
Welsh Government (2010) *Climate Change Strategy for Wales*	
The Climate Change Strategy for Wales sets out the Welsh Government's policy intentions in relation to climate change and expands on the commitments set out in One Wales. The strategy re-iterates the One Wales commitments to 3 per cent annual carbon reductions and sets out, that by 2020, the Welsh Government expect to see: - Businesses have reduced energy costs and emissions; - Employees actively engaged in reducing emissions from their workplaces; - Consumers demanding low carbon goods and services and concerned about sustainability performance of businesses; - Growth of social enterprises and community businesses providing low carbon goods and services locally; - Core businesses operating, and people employed, in businesses that provide low carbon goods and services.	The WRMP should incorporate climate change mitigation and adaptation measures, e.g. reducing carbon emissions. The SEA should include a guide question relating to mitigation and adaptation to climate change.
Welsh Government (2012) *Energy Wales: A Low Carbon Transition*	
Energy Wales and the supporting delivery plan set out what the Welsh Government intends to do to drive the change to a sustainable, low carbon economy for Wales. The Welsh Government commits to: • Engage and support businesses that help to achieve Wales's low carbon ambition; • Ensure that regulatory processes are as simplified and efficient as they can be and provide businesses with clarity and stability; • Engage the UK Government to ensure that there is a credible framework for capital investment to support the transition to a low carbon economy; • Support vital energy intensive industries in the transition to a low carbon economy; • Pursue energy efficiency; • Focus on low carbon sources of energy generation and approaches which will help to deliver lower overall emissions; and • Assist the most vulnerable in Welsh society and work to ensure that costs of reform do not fall disproportionately on poor households. The delivery plan also sets out key delivery themes around low carbon energy, Anglesey Energy Island, energy efficiency and distributed energy generation.	The WRMP should seek to incorporate low carbon energy and energy efficiency. The SEA should include a guide question relating to climate change mitigation.
Welsh Government (2013) *The Historic Environment Strategy for Wales*	
This strategy summarises the areas which the Welsh Government will prioritise for action, and aims to protect Wales' heritage whilst encouraging public access, enjoyment and participation. The Strategy sets out the role of the historic environment in delivering tangible social, economic and environmental benefits for Welsh communities. It also aims to further develop the economic role of heritage in Wales and maximise educational, training and leisure opportunities.	The WRMP should protect and enhance the historic environment. The SA should include assessment criteria relating to protection and enhancement of the historic environment.
Welsh Government (2015) *Water Strategy for Wales*	

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
The strategy sets out the Welsh Government's strategic direction for water policy to 2035. It highlights the Welsh Government's vision to ensure that Wales has a thriving water environment which is sustainably managed to support healthy communities, businesses and the environment. The key actions are grouped under the following themes, and according to short, medium or long-term timescales: – Water for nature, people and business – Improving the way we plan and manage our water services – Delivering excellent services to customers – Protecting and improving drinking water quality – 21st century drainage and sewerage system – Supporting delivery.	The WRMP should take account of the Water Strategy for Wales. The SEA should include an objective/guide question relating to water resources.
Welsh Government (2015) *The Welsh National Marine Plan – Initial Draft*	

This draft plan sets out how the Welsh Government will achieve sustainable development in the Welsh marine area through the sustainable management of marine natural resources. It covers both Welsh inshore and offshore waters and sets out the following vision, which will be achieved through the plan's objectives and policies:
• By 2036, Welsh seas are clean, healthy, safe, productive and biologically diverse:
  • Through an ecosystem based approach, our seas are healthy and resilient and support a sustainable and thriving economy.
  • Through access to and enjoyment of the marine environment, health and wellbeing are improving.
  • Blue growth is creating more jobs and wealth; and, is helping coastal communities become more resilient, prosperous and equitable with a vibrant culture.
  • The Welsh marine area is making a strong contribution to energy security and climate change emissions targets through the responsible deployment of low carbon technologies	

Welsh Government (2016) *Planning Policy Wales (Edition 9)*	
Planning Policy Wales sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes and procedural advice given in National Assembly for Wales/Welsh Office circulars. It sets out key policy objectives for Local Development Plans (LDPs) in Wales which reflect the sustainable development agenda.	Options recommended in the WRMP will need to conform to LDPs. The SEA objectives should reflect the Welsh Government's commitments to sustainable development.
Welsh Government (2011) *National Strategy for Flood and Coastal Erosion Risk Management in Wales*	
The Strategy sets out the Welsh Government's policies on flood and coastal erosion risk management, and establishes a delivery framework up to 2017. The Strategy sets four overarching objectives for managing flood and coastal erosion risk in Wales: • reducing the consequences for individuals, communities, businesses and the environment from flooding and coastal erosion; • raising awareness of and engaging people on flood and coastal erosion risk; • providing an effective and sustained response to flood and coastal erosion events; and • prioritising investment in the most at risk communities.	The WRMP should contribute to the reduction in flood risk and coastal erosion where possible. The SEA should include an objective/guide question relating to flooding.
Welsh Government (2016) *The State of Natural Resources Report (SoNaRR)*	
The report sets out the states of Wales' natural resources. It assesses the extent to which natural resources in Wales are being sustainably managed, and recommends a proactive approach to building resilience. The report identifies risks and threats and opportunities for integrated solutions that provide multiple benefits (social, cultural, environmental and economic).	The WRMP should have regard to opportunities to address risks and threats identified in the report and identify integrated solutions. The SEA should have regard to the risks, threats and opportunities identified in the report and the

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
	extent to which opportunities for integrated solutions can be incorporated in the WRMP.
Welsh Government (2017) *Natural Resources Policy*	
The Natural Resources Policy (NRP) is the second statutory product of the Environment (Wales) Act. The focus of the NRP is the sustainable management of Wales' natural resources, to maximise their contribution to achieving goals within the Well-being of Future Generations Act. The policy sets out three National Priorities. These are: • Delivering nature-based solutions, • Increasing renewable energy and resource efficiency, • Taking a place-based approach. Nature-based solutions may include developing resilient ecological networks, climate change adaptation and mitigation, flood risk management, green infrastructure, better soil and peat bog management, among others.	The WRMP should have regard to the National Priorities in the NRP. The SEA should include assessment criteria relating to protection and enhancement of the environment, ecology, soils, flooding and climate change.
National Assembly for Wales (2015) *Well-being of Future Generations (Wales) Act 2015*	
The Act aims to improve the social, economic, environmental and cultural well-being of Wales. It aims to make public bodies listed in the Act take a longer-term, more joined up approach, work better with people and communities, and look to prevent problems. The Act sets seven well-being goals: - a prosperous Wales - a resilient Wales - a healthier Wales - a more equal Wales - a Wales of cohesive communities - a Wales of vibrant culture and thriving Welsh language - a globally responsible Wales. The goals include aspirations to enhance the biodiverse natural environment, to act on climate change, provide employment opportunities, maximise well-being, protect cultural heritage, promote the Welsh language and encourage recreation, among others.	The WRMP should be aligned to Welsh Government's well-being goals. The SEA should include guide questions/objectives relating to the themes covered by the well-being goals, including climate change, employment opportunities, health and cultural heritage.
National Assembly for Wales (2016) *Environment (Wales) Act 2016*	
The Act sets a more joined up legislative framework for regulating Wales' environment, and provides the core framework to manage natural resources and climate change in Wales. The Act includes the following provisions: - sets a target for greenhouse gas emissions to be reduced by at least 80% by 2050; - introduces new powers to increase the amount of materials for recycling, improve the quality of materials available for recycling and making sure that materials that could have been recycled are not wasted; - gives Welsh Ministers more control over shellfisheries and the granting of longer tenures; - provides Natural Resources Wales with a general purpose linked to 'principles of sustainable management of natural resources'.	The WRMP should consider effects of options on sustainable development, greenhouse gas emissions and resource use in Wales. The SEA should include objectives/guide questions relating to sustainable resource use and greenhouse gas emissions.

Regional Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
Water Company (various) *Drought Plans*	
Drought Plans set out the steps that each water company will take through the stages of developing drought, drought, severe drought and recovery from drought to ensure their supply of water resources. Drought Plans must be produced by all water companies to fulfil their requirements under the Water Act 2003. Those Drought Plans relevant to the WRMP are: - United Utilities' Drought Plan; - Dee Valley Water Drought Plan; - Welsh Water Drought Plan - Severn Trent Water Drought Plan; - Yorkshire Water Drought Plan; - Northumbrian Water Drought Plan. United Utilities published its Final Drought Plan in June 2018. The Drought Plan provides a comprehensive statement of the actions that United Utilities will consider implementing during drought conditions in order to protect essential water supplies for customers and to minimise environmental impact. The Plan includes a range of drought management actions (linked to drought triggers), that can be broadly categorised as: - operational actions; - communication actions; - demand side actions (water efficiency campaigns, campaign for voluntary water use restraint, Temporary Use Ban, drought order to ban non-essential use); - leakage control actions; - resource management actions (non-commissioned sources; tankering); and - drought permit/order actions.	The WRMP will need to be in accordance with United Utilities' Drought Plan and plans of neighbouring companies, taking into account those triggers and supply and demand side options which are relevant to the United Utilities area. The SEA assessment framework should include a guide question on the effects of the WRMP on water resources and commentary on whether they affect the water resource zones' ability to manage drought. The baseline should, where appropriate, take into account relevant information from neighbouring plans.
Water Company (various) *Water Resources Management Plans (published and draft)*	
Water Resources Management Plans (WRMPs) have been produced by all water companies to fulfil their requirements under the Water Act 2003. WRMPs set out how companies will manage the balance between supply and demand for water. Where supply demand deficits occur, water companies are required to identify options to address these deficits to ensure security of supply. The United Utilities' Water Resource Management Plan was published in 2015 and set out the following key issues: • Balancing the needs of all customers to ensure a reliable supply for customers, whilst protecting the environment and minimising the impact on customer water bills; • Planning for future uncertainty and climate change, by helping customers manage their use of water more efficiently, and developing a more resilient supply system; • Providing evidence based plans to enable people to make informed decisions, given the sensitivity of the West Cumbrian environment; • Carrying out our statutory duty to protect the water environment; and • Protecting the landscape and amenity of the areas we live, work and play in. Three options were identified in the plan for meeting the supply-demand deficit in the West Cumbria Resource Zone, with the first being the preferred option: (i) build a new water treatment works and a pipeline between West Cumbria and Thirlmere Reservoir in order to use some of the spare water available in the Integrated Resource Zone; (ii) build a number of new water sources in West Cumbria including boreholes and a pipeline from a lake owned by another party; and (iii) buy water from Northumbrian Water, which would require new pipelines and water treatment works. The remaining three WRZ had a supply-demand surplus. Those published neighbouring Water Resource Management Plans relevant to the plan are: - Dee Valley Water – Final Water Resources Management Plan (2013); - Severn Trent Water – Final Water Resources Management Plan (2014); - Yorkshire Water – Final Water Resources Management Plan (2014); - Northumbrian Water – Final Water Resources Management Plan (2014); - Welsh Water – Final Water Resources Management Plan (2014). **Dee Valley Water** supplies water to around 112,000 households and 8,000 business customers in north east Wales and Chester, located in two water resource zones. The company has not identified any supply demand deficits and consequently no preferred options are included in the	The WRMP should take account of neighbouring plans where appropriate. The SEA should include an objective/guide question relating to water resources.

Regional Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
company strategy that will draw water from resources in the North West. Dee Valley Water has been acquired by Severn Trent Water, but the intent is to retain two separate Water Resources Management Plans for the English and Welsh regions. **Severn Trent Water** supplies water to 7.7 million customers in the Midlands, located in 15 water resource zones. Those adjoining the United Utilities Area are Strategic Grid, North Staffs, Whitchurch and Wem, and Kinsall. The Strategic Grid zone has a forecast of 'longer term insufficient / demand headroom' from 2020 to 2035, and 'dry year supply < dry year demand' from 2040, if no action is taken. Severn Trent plans to reduce leakage, reduce demand, use water trading and develop new sources of water when required in order to meet future demands. **Yorkshire Water** The final WRMP presents two resource zones which make up the Yorkshire Water Region; Grid Surface Water Zone, which adjoins the united utilities area, and the East Surface Water Zone. Yorkshire Water forecasts a deficit in the supply demand balance from 2018/19. The forecast deficit in 2018/19 is 2.67Ml/d, increasing to 108.65Ml/d by 2039/40. This deficit is caused primarily by the loss of yield due to climate change. Yorkshire Water's preferred solution to meet the forecast deficit is a balance of demand reduction options and the development of existing or new assets. These include leakage reduction, use of an existing river abstraction licence, three groundwater schemes and customer water efficiency. **Northumbrian Water** The Northumbrian Water WRMP identifies two water resource zones; Kielder WRZ and Berwick WRZ. The Kielder WRZ lies adjacent to the UU area. The WRZ is predicted to remain in surplus of supply to the forecast demands through the end of the plan period. **Welsh Water** Welsh Water delivers water supply services to most of Wales and some parts of England, supplying water to around 1.3 million domestic and 110,000 business customers. The Welsh Water area is divided into 24 Water Resource Zones (WRZs). The ten WRZs in North Wales serve half a million people living mainly in Chester and Deeside, Anglesey, the Bangor and Caernarfon area and the north coastal strip from Llandudno to Prestatyn. These WRZs are closest to the United Utilities area. Deficits in the supply demand balance are forecast in the North Eryri/Ynys Mon and Tywyn/Aberdyfi zones. To maintain the supply demand balance in the North Eryri/Ynys Mon zone to 2040, Welsh Water will transfer water from Cwm Dulyn, actively pursue improved leakage levels, and carry out water efficiency work with customers. To address the Tywyn/Aberdyfi deficit, Welsh Water are proposing to transfer raw water from a new river abstraction at Afon Dysynni and transfer this water to Penybont WTW. The WRMP also identifies deficits are forecast for three WRZs in south Wales which are unlikely to have any implications for United Utilities. The water companies are now in the process of developing the next WRMPs, covering the period 2020-2045. None of the current draft WRMPs have included options to draw water supply from resources in the United Utilities region.	
Environment Agency (2011) *North West of England and North Wales Shoreline Management Plan SMP2*	
This second generation Shoreline Management Plan is for the shoreline which extends between Great Orme's Head in North Wales and the Scottish Border. It provides a large scale assessment of the risks associated with erosion and flooding at the coast. It also presents policies to help manage these risks to people and the developed, historic and natural environment in a sustainable manner.	WRMP options should take into account the policies and actions of the SMP. Where appropriate, the SEA should consider the cumulative effect of SMP policies and actions and WRMP options.
United Utilities (2015) *Playing our part in the North West: Our revised business plan for 2015-2020*	
The revised Business Plan sets out United Utilities commitments' across the period 2015-2020. These include commitments relating to the provision of water, disposal of wastewater, value for money, customer service and environmental protection. Specific actions include maintaining high quality supplies; reducing flooding; keeping bills affordable; investing in the region; reducing their carbon footprint; climate change resilience; and delivering cleaner rivers.	The WRMP should seek to support the delivery of the revised Business Plan. The objectives and guide questions that comprise the SEA Framework should, where appropriate, reflect the priorities set out in this Business Plan.
Canal & River Trust (2015) *North West Waterway Fisheries & Angling Action Plan*	
The action plan identifies the priority issues that need to be addressed locally in the North West to improve the angling experience, fish stocks and the water environment. The actions are grouped under 10 themes, which include: • Develop & improve access to the fishery. • Fish passage and migration. • Predation & non native species.	The WRMP should seek to avoid harm to fisheries. The SEA assessment framework should include the protection or enhancement of factors affecting fisheries.

Regional Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
• Fisheries and water quality and quantity.	

Sub-regional/ Local Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
Defra (2010) *Eel Management Plans (various)*	
A total of 15 Eel Management Plans have been prepared covering the UK's 15 river basin districts. The Plans set out actions aimed at reversing the decline in eel numbers, to ensure that at least 40% of potential adult eels will return to the sea to spawn. Those Plans relevant to the WRMP include the North West, Solway Tweed and Dee.	The WRMP should take account of relevant Eel Management Plan actions.
Environment Agency and Natural Resources Wales (2016) *Flood Risk Management Plans (various)*	
Flood Risk Management Plans (FRMPs) give an overview of the flood risk across each river catchment. They recommend ways of managing those risks now and over the next 50-100 years. FRMPs consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding. They also take into account the likely impacts of climate change, the effects of how we use and manage the land, and how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs. Policies for managing flood risk and proposed actions for implementation are set out for each of sub-areas within the FRMPs. Those FRMPs present in the United Utilities area are: • North West river basin district flood risk management plan; • Dee river basin district flood risk management plan; and • Solway Tweed river basin district flood risk management plan.	The WRMP should take FRMPs into account. The SEA should include a guide question relating to flood risk.
Environment Agency (2013) *Abstraction Licensing Strategies (Catchment Abstraction Management Strategies (CAMS) process)*	
This Licensing Strategies set out how the EA will manage the water resources of a catchment and contribute to implementing the WFD. It provides information about where water is available for further abstraction and an indication of how reliable a new abstraction licence may be. Strategies within the United Utilities area include: - Derwent and West Cumbria - Eden and Esk - South Cumbria - Lune and Wyre - Ribble, Douglas and Crossens - Lower Mersey and Alt - Northern Manchester - Upper Mersey - Weaver and Dane - Dee	The WRMP should take the Strategy into account. The SEA should include a guide question relating to sustainable water use.
Environment Agency, Defra, Natural Resources Wales and Natural Scotland (2015) *River Basin Management Plans*	
River Basin Management Plans (RBMPs) set out how the water environment will be managed and provides a framework for more detailed decisions to be made. RBMPs set out a more integrated approach to river basin management based on the following principles: - Integrate and streamline plans and processes; - Set out a clear, transparent and accessible process of analysis and decision-making; - Focus at the river basin district level; - Work in partnership with other regulators; - Encourage active involvement of a broad cross-section of stakeholders; - Make use of the alternative objectives to deliver sustainable development; - Use Better Regulation principles and consider the cost-effectiveness of the full range of possible measures;	The WRMP should reflect the broad targets set out in the RBMPs. The SEA objectives should reflect the need to manage water resources on a catchment basis in a sustainable manner to help improve the quality of water resources.

Sub-regional/ Local Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
- Seek to be even handed across different sectors of society and sectors of industry; - Seek to be even handed and transparent in the management of uncertainty; - Develop methodologies and refine analyses as more information becomes available. RBMPs relevant to the United Utilities area are the North West, Solway Tweed and Dee.	
Greater Manchester Combined Authority (emerging) *Greater Manchester Spatial Framework*	
The Greater Manchester Combined Authority (GMCA) is producing a joint plan to manage the supply of land for jobs and new homes across Greater Manchester. The Greater Manchester Spatial Framework (GMSF) will ensure that the right land is in the right places to deliver the homes and jobs needed up to 2035, along with identifying the new infrastructure required to achieve this. The GMSF will also address the environmental capacity of Greater Manchester, setting out how the GMCA can enhance and protect the quality of the natural environment, conserve wildlife and tackle low carbon and flood risk issues, so that growth can be accommodated sustainably. It sets out a vision that 'by 2035, Greater Manchester will be one of the world's leading regions, driving sustainable growth across a thriving North of England. It will be ever more connected, productive, innovative and creative, known for the excellent quality of life enjoyed by our residents who are able to contribute to and benefit from the prosperity that growth brings'.	The WRMP should have regard of the emerging spatial framework. The SEA assessment framework should consider the effects of the WRMP on the achievement of the framework's vision and the effects of options on sustainable land use.
AONB Management Units (various) *AONB Management Plans*	
The following AONBs are present in the United Utilities area: - Arnside and Silverdale; - Forest of Bowland; - North Pennines; - Solway Coast. The management plans for AONBs contain actions to ensure the protection and enhancement of the landscape.	WRMP options within AONBs should be consistent with the management plan. The SEA assessment framework should consider the effects of options on landscapes, including designated landscapes.
Local Biodiversity Action Plans (BAP) including Species and Habitats Action Plans (various)	
Each Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets. They include targets for increasing and enhancing biodiversity. Species Action Plans set objectives with regard specific species and set out proposed actions and targets along with which agency will be responsible for carrying them out. Habitat Action Plans sets objectives with regard specific UK habitats and sets out proposed actions targets along with which agency will be responsible for carrying them out. Local Biodiversity Actions Plans relevant to the United Utilities area are: - Cumbria; - Greater Manchester; - Lancashire; - Cheshire; - North Merseyside; - Powys.	WRMP options should take into account BAP objectives. The SEA assessment should consider effects of options on biodiversity and outline enhancement and mitigation opportunities where these are identified.
Local Geodiversity Action Plans (LGAPs)	
Local Geodiversity Action Plans (LGAPs) set out actions to conserve and enhance the geodiversity of a particular area. In general they aim to identify, conserve and enhance the best sites that represent the geological history of an area. They also aim to promote geological sites, provide a local geodiversity audit and influence local planning policy. Two LGAPs exist or are in development for Cheshire Region, Cumbria, Greater Manchester, Lancashire, North Pennines AONB, and Clwydian Range and Dee Valley AONB.	WRMP options should take into account the aims of the LGAPs. The SEA assessment should consider effects of options on geodiversity and outline enhancement and mitigation opportunities where these are identified.
Local Planning Authority (various) *Local Plans / Local Development Plans*	
The United Utilities area covers a large number of Local Planning Authorities. These have been identified as: - Cheshire East;	The WRMP should have regard of the Local Plans and emerging Local Plans.

Sub-regional/ Local Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
- Cheshire West and Chester; - Halton Borough Council; - Warrington Borough Council; - Allerdale Borough Council; - Copeland Borough Council; - Barrow In-Furness Borough Council; - Carlisle City Council; - Cumbria County council; - Eden District Council; - South Lakeland District Council; - Bolton Metropolitan Borough Council; - Bury Metropolitan Borough Council; - Manchester City Council; - Oldham Metropolitan Borough Council; - Rochdale Metropolitan Borough Council; - Salford City Council; - Stockport Metropolitan Borough Council; - Tameside Metropolitan Borough Council; - Trafford Metropolitan Borough; - Wigan Metropolitan Borough Council; - Blackburn with Darwen Borough Council; - Blackpool Council; - Burnley Borough Council; - Chorley Borough Council; - Fylde Borough Council; - Hyndburn Borough Council; - Lancashire County Council; - Lancaster City Council; - Pendle Borough Council; - Preston City Council; - Ribble Valley Borough; - Rossendale Borough Council; - South Ribble Borough Council; - West Lancashire Borough Council; - Wyre Borough Council; - Knowsley Metropolitan Borough Council; - Liverpool City Council; - Sefton Council; - St. Helens Metropolitan Borough Council; - Wirral Metropolitan Borough Council; - Bradford District Council; - Calderdale Metropolitan Borough Council; - Craven District Council; - High Peak Borough Council; - Kirklees Metropolitan Borough Council; - Newcastle-under-Lyme Borough Council; - Richmondshire District Council; - Staffordshire Moorlands District Council; - Lake District National Park Authority;	The SEA assessment framework should consider the effects of the WRMP on the achievement of the Plans' visions and the effects of options on sustainable land use.

Sub-regional/ Local Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	**Relationships and Influences on the WRMP and the SEA**
- Peak District National Park Authority; - Yorkshire Dales National Park Authority. Additionally, Local Development Plans prepared by local authorities in Wales may also be relevant to the WRMP and SEA. Those plans of particular relevance include, for example: - Wrexham County Borough Council; - Flintshire County Council; - Powys County Council; and - Denbighshire County Council. The main objectives of the existing and emerging Local Plans in these areas are related to the sustainable development of the area.	
National Park Management Plans (various)	
The following National Parks are present in the United Utilities area: - Lake District; - Peak District; and - Yorkshire Dales. The Snowdonia National Park Management Plan may also be relevant. The management plans for National Parks contain actions to ensure the protection and enhancement of the landscape and natural environment of these areas.	WRMP options within the National Parks should be consistent with the respective management plan. The SEA assessment framework should consider the effects of options on landscapes and the natural environment, including designated areas. Proposed extensions to the National Park boundaries should also be recognised where appropriate.
Local Wildlife Trust Strategies (various)	
The following local Wildlife Trusts are present in the United Utilities area: - Cumbria Wildlife Trust; - Lancashire Wildlife Trust; - Cheshire Wildlife Trust; and - Derbyshire Wildlife Trust. Cheshire Wildlife Trust's strategy, *Your Wildlife, Our Strategy 2015-2020 (2014)*, includes four key outcomes: Space for wildlife is created and conserved; Wildlife is enjoyed and valued by all; Our funding is sustainable; and We are an effective organisation. Derbyshire Wildlife Trust's strategy, *Strategic Plan 2015-2020*, includes the objectives of: Champion wildlife rich landscapes; Defend wildlife and wild places; Inspire people and communities to act; and Grow our resources.	The WRMP should have regard to the protection of local wildlife. The SEA assessment framework should consider the effects of the options on biodiversity.

Appendix C
Definitions of Significance

Objective	Key Questions	Effect	Description	Illustrative Guidance
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	++	Significant Positive	The option would result in a major enhancement of the quality of designated habitats due to changes in flow or groundwater levels or water quality. The option would result in a major increase in the population of a priority species.
		+	Positive	The option would result in a minor enhancement of the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels or water quality. The option would result in a minor increase in the population of a priority species.
		0	Neutral	The option would not result in any effects on European, national designated or non-designated sites and/or species.
		-	Negative	The option would result in minor, short term negative effects on non-designated sites (e.g. through decreases in flows/water quality, or some loss of habitat leading to a temporary loss of ecosystem structure and function).
		--	Significant Negative	The option would have a negative effect on European or national designated sites and/or protected species (i.e. on the interest features and integrity of the site, by preventing any of the conservation objectives from being achieved or resulting in a long term decrease in the population of a priority species). These effects could not be reasonably mitigated. The option would result in major, long term negative effects on non-designated sites (e.g. through decreases in flows/water quality, or significant loss of habitat leading to a long term loss of ecosystem structure and function).
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites	++	Significant Positive	No option is expected to have a significant positive effect on achieving this objective.
		+	Positive	The option would be located on a brownfield site and would have no effect on soils or existing land uses. The option would result in the remediation of contaminated land.
		0	Neutral	The option would have no effect on soils or land use.
		-	Negative	The option would not located on a brownfield site and/or would result in a minor loss of best and most versatile agricultural land, or would be in conflict with existing land uses. The option would result in land contamination.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	designated for their geological interest and wider geodiversity?	--	Significant Negative	The option would not be located on a brownfield site and would result in a major loss of best and most versatile agricultural land, or would be in conflict with existing land uses.
	Will the option minimise the loss of best and most versatile agricultural land?			The option would result in land contamination.
	Will the option minimise conflict with existing land use patterns?	?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
	Will the option minimise land contamination?			
	Will the option affect geomorphology?			
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies.	Will the option minimise the demand for water resources?	++	Significant Positive	The option would address failure of WFD Good Ecological Status/Good Ecological Potential.
	Will the option protect and improve surface, groundwater, estuarine and coastal water quality?	+	Positive	The option would achieve water savings through demand management and does not require abstraction to achieve design capacity.
	Will the option result in changes to river flows?	0	Neutral	The option would have no discernible effect on river flows or surface/coastal water quality or on groundwater quality or levels.
				The option would not lead to a change in WFD classification.
	Will the option result in changes to groundwater levels?	-	Negative	The option would result in minor decreases in river flows. River and/or coastal water quality may be affected and lead to short term or intermittent effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not be avoided but could be mitigated.
	Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?			The option would result in minor decreases in groundwater quality or levels.
		--	Significant Negative	The option would result in major decreases in river flows. River and/or coastal water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated.
	Will the option support the achievement of protected area objectives?			The option would result in the deterioration of WFD classification.
	Will the option support the achievement of environmental objectives set out in River Basin Management Plans?			The option would result in major decreases in groundwater quality or levels.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
	Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?			
4. To reduce the risk of flooding.	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?	++	Significant Positive	No options are expected to have a significant positive effect on achieving this objective.
		+	Positive	The option has the potential to help alleviate flooding in the catchment.
	Will the option have the potential to help alleviate	0	Neutral	The option would involve the construction of above-groundwater supply infrastructure, but is located outside floodplain areas. It is anticipated that the option would neither cause nor exacerbate flooding in the catchment.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	flooding in the catchment area now or in the future?	-	Negative	The option would involve the construction of above-ground water supply infrastructure and be located within the 1 in 1000 year floodplain.
	Will the option be at risk of flooding now or in the future?	--	Significant Negative	The option would involve the construction of above-ground water supply infrastructure and be located within the 1 in 100 year floodplain.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
5. To minimise emissions of pollutant gases and particulates and enhance air quality.	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
	Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)?	+	Positive	The option would lead to a minor improvement in local air quality from a reduction in concentrations of pollutants identified in the national air quality objectives and/or have a positive effect on local communities and biodiversity due to a reduction in air and odour pollution and particulate deposition.
		0	Neutral	The option would have no discernible effect on air quality.
	Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?	-	Negative	The option would result in a minor decrease in local air quality and/or have a negative effect on local communities and biodiversity due to an increase in air and odour pollution and particulate deposition.
	Will the option reduce the need to travel or encourage sustainable modes of transport?	--	Significant Negative	The option would cause a significant decrease in local air quality (e.g. leading to an exceedance of Air Quality Objectives for designated pollutants and the designation of a new Air Quality Management Area). The option would have a strong and sustained negative effect on local communities and biodiversity due to significant increase in air and odour pollution and particulate deposition.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
6. To limit the causes and potential consequences of climate change.	Will the option reduce or minimise greenhouse gas emissions?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
	Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?	+	Positive	The option would result in a sustained decrease in greenhouse gas emissions (100-999 tonnes CO_2e/a) and would increase resilience/decrease vulnerability to climate change effects.
		0	Neutral	The option would have no discernible effect on greenhouse gas emissions, nor would the option increase resilience/decrease vulnerability to climate change effects.
	Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?	-	Negative	The option would result in a minor or temporary major increase in greenhouse gas emissions (100-999 tonnes CO_2e) or the option would not increase resilience/decrease vulnerability to climate change effects.
	Will the option increase environmental resilience to the effects of climate change?	--	Significant Negative	The option would result in major or long term increases in greenhouse gas emissions (>1000 tonnes CO_2e) and the option would not increase resilience/decrease vulnerability to climate change effects.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.

Objective	Key Questions	Effect	Description	Illustrative Guidance
7. To ensure the protection and enhancement of human health.	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	++	Significant Positive	The option would lead to a major increase in design capacity (>10 Ml/d) of drinking water, would have a sustained positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.
		+	Positive	The option would lead to a minor increase in design capacity (1-10 Ml/d) of drinking water, would have a temporary positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.
		0	Neutral	No option is expected to have a neutral effect on achieving this objective.
		-	Negative	The option would result in the deterioration of surface water or bathing water quality and would have a temporary effect on human health (e.g. noise).
		--	Significant Negative	The option would result in the deterioration of surface water or bathing water quality and have a long term effect on human health (e.g. noise).
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
8. To maintain and enhance the economic and social well-being of the local community.	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++	Significant Positive	The option would result in a significant increase in construction jobs (capital spend of >£10m). The option would create new, and significantly enhance existing, recreational facilities within the operational area. The option would provide an additional design capacity of >10 Ml/d.
		+	Positive	The option would result in an increase in construction jobs (capital spend £5-9.9m). The option would enhance existing recreational facilities within the operational area. The option would provide an additional design capacity of 1-10 Ml/d.
		0	Neutral	The option would have no effect on local employment opportunities, the regional or local economy, or on recreational facilities. The option would provide an additional design capacity of <1 Ml/d.
		-	Negative	The option would reduce the availability and quality of existing recreational facilities within the operational area. It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity.
		--	Significant Negative	The option would result in the removal of existing recreational facilities within the operational area. It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
9. To ensure the sustainable and		++	Significant Positive	The option would involve reducing leakage from the supply network or is a water efficiency option with a design capacity of >5 Ml/d.

Objective	Key Questions	Effect	Description	Illustrative Guidance
efficient use of water resources.	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	+	Positive	The option would involve reducing leakage from the supply network or is a water efficiency option with a design capacity of <5 Ml/d.
		0	Neutral	The option is not a leakage reduction or water efficiency option.
		-	Negative	No options are expected to result in a negative effect on achieving this objective.
		--	Significant Negative	No options are expected to result in a significant negative effect on achieving this objective.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
10. To promote the efficient use of resources.	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
		+	Positive	The option would re-use or recycle substantial quantities of waste materials and any new infrastructure would incorporate substantial sustainable design measures and materials. There would be no increase in energy consumption.
		0	Neutral	The option would largely rely on existing infrastructure and only require small quantities of additional materials to realise design capacity. No additional energy use required.
		-	Negative	The option would require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. There are limited opportunities for sustainable design or the use of sustainable materials. The option would result in a minor increase in energy consumption.
		--	Significant Negative	The option would require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials. The option would result in a major increase in energy consumption.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
11. To conserve and enhance cultural and historic assets.	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings? Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with	++	Significant Positive	The option would result in enhancements to designated heritage assets and/or their setting, fully realising the significance and value of the asset, such as: • Securing repairs or improvements to heritage assets, especially those identified in the Historic England Buildings/Monuments at Risk Register; • Improving interpretation and public access to important heritage assets. There would be no damage to known archaeological sites or remains or geologically important sites.
		+	Positive	The option would result in enhancements to heritage assets and/or their setting, whether designated or not. There would be no damage to known archaeological sites or remains or geologically important sites.
		0	Neutral	The option would have no effect on cultural heritage assets or archaeological sites/remains.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	-	Negative	The option would result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There would be limited damage to known, undesignated archaeological sites/remains or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
		--	Significant Negative	The option would diminish the significance of designated heritage assets and/or their setting such as: • Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register; • Loss of public access to important heritage assets and lack of appropriate interpretation. There would be major damage to known, designated archaeological sites/remains or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	++	Significant Positive	The option would result in new, above ground infrastructure that significantly enhances the local landscape, townscape or seascape.
		+	Positive	The option would result in new, above ground infrastructure that has a minor positive effect on the local landscape, townscape or seascape.
		0	Neutral	The option would result in new, above ground infrastructure but is not located within or visible from a protected/designated landscape, townscape or seascape and would have no effect on the character or public amenity value of its setting.
		-	Negative	The option would result in new, above ground infrastructure that has a minor negative effect on the local landscape, townscape or seascape.
		--	Significant Negative	The option would have a negative effect on designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option would results in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.

Appendix D
Feasible Options Assessment Matrices

Carlisle Water Resource Zone

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR041: River Irthing to Cumwhinton Plus Castle Carrock Link	Construction	-/?	-	0	-	-	--	-	++/-	0	--	-/?	-
	Operation	?	0	-/?	-	0	0	+/?	+	0	-	0	0

Construction

This option would involve the development of a new abstraction/intake point and pumping station on the River Irthing at Newby East in order to abstract and transfer 6.5 Ml/d of water to Cumwhinton WTW via a new 9.59km raw water main. Modifications to Cumwhinton WTW may be necessary to accommodate the increased raw water input from the River Irthing. Treated output from Cumwhinton WTW would subsequently be transferred to a treated water storage facility via a new 10.1km treated water main and pumping station. Modifications to the treated water storage facility (a secondary disinfection process at its outlet in order to maintain water quality compliance) would most likely be required.

The proposed abstraction infrastructure and pumping station would be directly situated on the River Irthing and therefore the River Eden and Tributaries SAC/SSSI. The SAC/SSSI has been classified as supporting a wide range of aquatic European Directive species such as white-clawed crayfish, Atlantic salmon, and otters which could be affected by construction activity. Further, the proposed pipeline route would directly traverse the SAC/SSSI and would also be within proximity to Cotehill Pastures and Ponds SSSI (840m) and directly adjacent to the Cainbridge Sand Pit SSSI. Whilst impacts on these sites are likely to be avoidable through scheme-specific detailed design and established mitigation measures. Works at Cumwhinton WTW and the treated water storage site would be minor and take place within the footprints of existing operational facilities such that adverse impacts on biodiversity are not expected. In general, construction activity associated with this scheme may cause some loss of/disturbance to habitats and species specifically along the proposed pipeline route. Overall, this option has been assessed as having a negative effect on Objective 1 although uncertainty remains.

The new abstraction infrastructure and pumping station would be situated within an undeveloped wooded greenfield site on the bank of the River Irthing. Although the scale of these components would be small, construction would result in the loss of Grade 2 agricultural land. The proposed pipeline would be routed through Grade 2/3 agricultural land although all excavated land would be reinstated following the construction period. Modifications to Cumwhinton WTW and the treated water storage facility would take place within existing operational facilities and should not significantly affect land use/soil quality. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point and pumping station would be situated within Flood Zone 3 whilst sections of the proposed pipeline would also be routed through Flood Zone 3. Consequently, construction could be liable to flooding depending on the timing of works. It is unlikely that construction of the overall scheme would cause or exacerbate flood risk elsewhere.

There could be traffic congestion during the construction period (particularly along the A69, B6263, B6413 and local roads) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 6,541 vehicle movements during the 1.8 year construction period).

The option would generate 7,917 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, although works could result in temporary disruption to users of local open space/footpaths including along the River Irthing and at Castle Carrock Reservoir. Pipeline works and HGV movements in particular could affect residential receptors at Newby Demesne, Warwick Bridge and Warwick Mill Business Village, north and west Wetheral, Wetheral Pasture and southern Castle Carrock as well as the scattered residential dwellings and farmsteads situated along the proposed route; however, any impacts (e.g. noise/air quality impacts) would be temporary and minor. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a large capital expenditure which could have a significant positive effect on the local economy. However, pipeline works and the transportation of equipment/material could result in congestion with associated disruption/driver delay throughout the construction phase (it is noted that the proposed pipelines would cross/be within a number of roads including the A69 as well as a railway line). Overall, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The resources required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

The proposed abstraction and pumping station site would be within the buffer zone of the Frontiers of the Roman Empire (Hadrian's Wall) World Heritage Site/Scheduled Monument. However, given the scale of works in this location, no significant effects on the World Heritage Site are expected although there is a risk of disturbance to unidentified archaeological remains. Hallsteads Iron Age Camp Scheduled Monument is under 100m from the proposed pipeline route although any impacts on the setting of this asset are likely to be temporary and minor. There are also approximately 15 Grade II / II* listed buildings under 500m from the scheme; specifically, six of these assets are under 100m from the proposed pipeline route (1-6 and 8-12 High Buildings (Warwick Mill Business Village) (30m), The Mill (93m), Carin House (28m), Church of St. Mary and St. Wilfred & Priest House (50m) and Tarn Lodge (87m). The proximity between these assets and the works suggests that there could be some short term and temporary adverse impacts on their settings. Overall, this option has been assessed as having a negative effect on Objective 11, although some uncertainty remains.

The abstraction infrastructure and pumping station would be situated within a wooded greenfield site along the banks of the River Irthing which is expected to minimise any adverse landscape/visual impacts; however, recreational users of the river may be affected (although given the scale of construction, any impacts would be very minor). It is not expected that modifications to Cumwhinton WTW and the treated water storage facility would have any adverse landscape/visual impacts since works would be small in scale and take place within the footprint of existing operational facilities. Approximately 625m of the proposed pipeline route would be situated within the North Pennines AONB while 1.3km of pipeline would be adjacent to this designated landscape. Whilst pipeline works may affect the character of the AONB, any impacts would be short term and temporary with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Overall, the option has been assessed as having a minor negative effect on Objective 12.

Operation

The abstraction of 6.5 Ml/d of water from the River Irthing could have an adverse effect on in-river habitats and species and in this context, the HRA identifies the potential for significant effects on the River Eden SAC, although it is assumed that scheme level mitigation measures would help prevent and/or moderate adverse impacts. Consequently, additional analysis (modelling etc.) of scheme operation regarding permitted abstraction volumes and associated effects on the River Irthing would be required should the scheme be taken forward as a preferred option. At this stage, the option has been assessed as having an uncertain effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment concludes that the ALS (Abstraction Licensing Strategy) indicates that there is restricted water available from surface water sources at all flow regimes such that the abstraction of approximately 6.5 Ml/d of water could have a negative effect on Objective 3, although uncertainty remains.

The abstraction infrastructure and pumping station would be located within Flood Zone 3 and therefore could be liable to flooding during operation; however, the operation of the scheme is not expected to cause or exacerbate the risk of flooding elsewhere. Overall, this option has been assessed as having a minor negative effect on Objective 4.

There would be no operational effects on air quality.

Operational energy demand would be 1,036 kWh/Ml, generating 98 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The abstraction from the River Irthing could adversely impact recreational activities and in particular angling due to the reductions in river flows, although this is uncertain. It should be noted that the EA has identified the River Irthing has having 'peaty water' which would need to be addressed during the treatment process. The increased capacity of 6.5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health (with some remaining uncertainty) as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new abstraction point and pumping station would introduce new above ground infrastructure in a rural, greenfield setting although taking into account the scale of development and presence of existing screening (trees), any landscape/visual impacts are expected to be negligible. The modifications to Cumwhinton WTW and the treated water storage facility would be within the existing operational footprints of these facilities and therefore no adverse landscape or visual impacts associated with these scheme components are predicted. Overall, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR095: Roughton Gill	Construction	-	+	0	-	-	--	-	+/-	0	--	-	-
	Operation	?	0	0	0	0	0	+	+	0	-	0	-

Construction

This option would involve the reinstatement of the Roughton Gill mine abstraction source in order to abstract and transfer 1.5 Ml/d to a new WTW situated at a treated water storage site via the existing raw water main network (306m of new pipeline would additionally be required). Treated output would subsequently be transferred to two treated water storage sites (one on-site) via a new 4.5km treated water main.

The proposed abstraction infrastructure and ancillary components would be directly situated within the Skiddaw Group SSSI – Lake District High Fells SAC. It is possible that the planned construction works could affect some of the interest features indirectly such as noise disturbance/adverse air quality impacts to the site's breeding bird assemblage; however, it is unlikely that there would be any loss of designated habitat or direct risk to protected sub-montane blanket bog and heather moorland as the construction footprint would be confined within the pre-established site. Consequently, potential construction impacts from abstraction reinstatement would be minor and temporary, and more so, potentially avoidable with best-practice and option-specific mitigation. The treated pipeline route would cross a tributary of the River Caldew (part of the River Eden SAC) approximately 1km upstream of the SAC boundary whereas the new Caldbeck WTW would be situated within the same area/catchment which may result in minor noise disturbance for breeding waders which utilise the rivers and the adjacent wetland habitats. It should be noted, however, that the HRA has concluded that significant or significant adverse effects could be avoided with established mitigation measures. The proposed pipeline route would cross Whelpo Beck thus posing the risk of introducing pollution/debris within the river system which could have a residual effect on local riparian ecosystems, mobile aquatic species, and downstream habitats and wildlife though mitigation and best practice throughout construction is predicted to minimise and/or prevent any adverse effects. In general, the scheme is situated within a rural setting such that construction may cause short-term disturbance to proximate local habitats and wildlife. Overall, this option has been assessed as potentially having a minor negative effect on Objective 1.

The reinstatement of the Roughton Gill mine abstraction site would be confined within the pre-established site such that any necessary ancillary infrastructure should not adversely impact land/soil or require additional land-intake beyond the established the site (Grade 5 agricultural land). Similarly, the construction of the new WTW would be situated within the operational footprint of the treated water storage facility which should support the new facility regarding land/soil impacts. Although the development of Caldbeck WTW would require permanent land-intake, the proposed abstraction volume of 1.5 Ml/d suggests that the structural scale of the WTW would be minor thus land consumption should be negligible (Grade 4 agricultural land). The proposed excavation routes would traverse through Grade 4 agricultural land with all excavated land reinstated following the construction period. On balance, this option has been assessed as having a minor positive effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Segments of the proposed excavation route would be situated within Flood Zone 3s originating from Whelpo Beck and Dale Beck; consequently, excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts on traffic congestion during the construction period (particularly on segments of the B5299 and the residential roads overlaying or adjacent to the proposed pipeline route) which would have a negative effect on local air quality (there would be an estimated 3,378 HGV movements during the 1.5 year construction period).

The option would generate 2,101 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, the proposed works could result in a temporary disruption of use or loss of amenity to the grounds proximate to construction that host recreational activity and sport such as the various walking trails within the Lake District High Fells SAC (Lake District National Park and UNESCO WHS) and Parson's Park. Due to the rural greenfield setting of scheme, the cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material should not significantly affect regional health though farmsteads and residential settlements (Fellside, Caldbeck, and Warnell) may experience minor temporary effects due to their proximity to the proposed construction scheme. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a moderate capital expenditure which could have positive effects on the local economy but would not be of a scale likely to generate significant new employment opportunities. Notwithstanding, excavation and the transportation of equipment/material would utilise both local and regional road networks which could result in sporadic increases in congestion and disruption/driver delay throughout the construction phase. On balance, this option has been assessed as having a mixed positive and negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

There are no scheduled monuments within a 2km radius from the proposed construction scheme; specifically, the Carrock Fell tungsten/lead/copper/arsenic mines and early 20th century tungsten mill is approx. 2.3km from the Roughton Gill mine abstraction site and the Thistlebottom settlement would be 2.9km from the proposed WTW. There are approx. 24 Grade II Listed Buildings within the vicinity of the scheme whereas four of these assets would be within 100m from the scheme: Bridge End House and ancillary structures (16m), Mill House and adjoining mill (54m), Brewery House (80m), and the Old Brewery (92m). Although it is expected that mitigation measures during construction would help prevent any significantly adverse effect on the structural integrity of these assets, the proximity of construction to these buildings suggests that the temporary loss of visual amenity would remain a risk. The remaining Listed Buildings and scheduled monuments (>100m) may experience a minor loss of visual amenity regarding their settings though the route does benefit from scattered woodland and urban development which may screen visual impacts to heritage settings. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The abstraction site, the new Caldbeck WTW, and approx. 1.8km of new treated water mains would be situated within the Lake District National Park and UNESCO WHS. Collectively, these works could temporarily alter the character of the Park's protected landscapes and the wider area; specifically, the loss of visual amenity of residential and recreational receptors within the Park. Notwithstanding this, the reinstatement of the abstraction site and construction of the new WTW would be confined within previously established sites, and furthermore, construction would occur at a low-level intensity due to the minor structural scales of these components. The cumulative effect of excavation outside of the Lake District National Park could temporarily alter the wider landscape character of the region; consequently, works may be perceived by residents and recreational receptors as having an adverse effect on visual and landscape amenity of the National Park's setting. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

It is currently unknown whether the abstraction of 1.5 Ml/d from the Roughton Gill mine would result in any likely significant effects on the Lake District High Fells SAC without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures. Impacts on any other ecological receptors within the scheme's general vicinity are expected to be negligible. Consequently, this option has been assessed as having an uncertain at this stage.

There would be no expected operational effects on land use of the scheme's general area.

The option would abstract 1.5 Ml/d of groundwater which has been assessed as having a neutral effect on Objective 3.

Operation of the option would not be liable for flooding nor cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 54 kWh/Ml, generating 16 tonnes CO2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.
The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased capacity of 1.5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The reinstated Roughton Gill mine abstraction site and the Caldbeck WTW would be directly situated within the Lake District National Park and UNESCO WHS. Although these components would introduce new infrastructure within a protected landscape which could alter the character of the park's landscape character, these components would be situated within previously established sites such that operation would unlikely result in a significant loss of visual or landscape amenity as perceived by residential and recreational receptors. Consequently, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR128: Tarn Wood (North Eden to Carlisle)	Construction	-	+	0	0	-	--	0	+	0	--	-	-
	Operation	?	0	0	0	0	0	+	+	0	-	0	0

Construction

This option would involve the installation of new borehole pumps at Tarn Wood WTW to augment the current maximum flow of 2.3 Ml/d to 4 Ml/d, an increase of 1.7 Ml/d. The scheme would require a new pumping station at Tarn Wood and a new circa 14km main to Cumwhinton WTW.

The River Eden SAC, River Eden and Tributaries SSSI and River Eden Gorge SSSI are at a distance of circa 1.5km from the borehole site; however, given the scale of works and separation distance, no construction-related impacts on these sites are expected. Borehole works would take place within an existing operational facility whereas the proposed pipeline would be principally routed along roads within the River Eden catchment area. In consequence, associated impacts on habitats and species are likely to be negligible if established scheme-level avoidance or mitigation measures are utilised though the scale of the excavation suggests very minor effects. Overall, this option has been assessed as having a minor negative effect on Objective 1.

As previously noted, this option would utilise an existing site whilst the pipeline would be routed along an existing road network. This has been assessed as having a minor positive effect on soils/land use.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option would cross Flood Zone 2 at Low Hesket although this would be for a very small section of the pipeline and in consequence no effects on flood risk are anticipated.

The option would require an estimated 10,644 vehicle movements during the 1.3-year construction period in addition to plant and machinery from which emissions may have a minor negative effect on local air quality.

The option would generate 11,532 tonnes of CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

The Tarn Wood site is remote and the scale of works is such that there is unlikely to be any discernible effects on health or recreational amenity.

The option would involve a relatively small capital expenditure which may have a positive effect on the local economy. Whilst local congestion may occur during construction, any impacts would be temporary. On balance, the option has been assessed as having a positive effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a significant negative effect on Objective 10.

The Tarn Wood WTW site does not include any designated cultural heritage assets and the scale of works would be unlikely to affect the settings of listed buildings to the south east at Nord Vue Farm or to the North West at High Hesket. Pipeline works may temporarily affect the settings of listed buildings and several scheduled monuments along the proposed route including, for example, Scalesceugh Roman Kilns, although any effects are unlikely to be significant. Overall, the option has been assessed as having a minor negative effect on Objective 11.

Works at Tarn Wood WTW are unlikely to have any discernible landscape/visual amenity impacts in the context of the existing site. Pipeline works may temporarily affect the visual amenity of receptors along the proposed route and particularly in the settlement of Cumwhinton. However, any adverse effects would be temporary and felt in the short term only and have therefore been assessed as minor.

Operation

The River Eden and Tributaries SSSI/SAC is located 1.5km from the borehole site and there is a possibility that the additional abstraction may impact upon the ground and surface waterbodies. In this regard, the HRA notes that further analysis of the potential operational effects is required; specifically, evidence of any connectivity between the aquifer and the river. The increase in abstraction volume (1.7 Ml/d) is not expected to adversely affect the river, although this would need to be confirmed by the EA. At this stage, the option has therefore been assessed as having an uncertain effect on biodiversity.

No effects on soils or land use are expected during operation (discounting the initial loss of land during construction).

The abstraction licensing strategy (ALS) indicates that there is water available in the groundwater body and the increase in daily quantity is relatively small. Consequently, the abstraction of an additional 1.7 Ml/d has been assessed as having a neutral effect on Objective 3.

The option is not expected to cause or exacerbate flooding.

No effects on local air quality are anticipated.

The option would require ongoing energy use (723 KWh/Ml) with associated greenhouse gas emissions of 42 tonnes CO_2e/a which has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10.

The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water and may support population/economic growth in the Carlisle area, generating a positive effect on Objectives 7 and 8.

No impact on water efficiency or leakage is expected.

Operation of the option is not expected to affect cultural heritage assets.

New above ground infrastructure at Tarn Wood WTW would be within an existing site and therefore landscape effects are expected to be negligible.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR148: Cumwhinton Boreholes plus Castle Carrock Link	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	0	0	0	-	+	+	0	-	0	0

Construction

This option would involve the development of 2 new boreholes at Cumwhinton WTW in order to abstract a cumulative 6.5 Ml/d (3.25 Ml/d per borehole). The structural parameters of each borehole would be as such: 150m depth, new borehole pump, rising main (100m), new mechanical and electrical equipment, and new headworks to asset standard design. Output from these boreholes would be transferred to Cumwhinton WTW via an existing raw water main. It should be noted that Cumwhinton WTW may need further modification to accommodate the increased raw water input from the new boreholes. Treated output from Cumwhinton WTW would subsequently be transferred to a treated water storage facility via a new 10.5km treated water main and pumping station. Modifications to the treated water storage facility regarding a secondary disinfection process at its outlet in order to maintain water quality compliance would most likely be required.

The new boreholes would be situated within the existing structural footprint of Cumwhinton WTW thus it is considered unlikely that construction would significantly impact local habitats and wildlife within the vicinity of the facility beyond minor noise disturbance (drilling) and air quality impacts (dust). Additionally, the structural scale of these boreholes would be minor such that construction would occur at a limited intensity. The Cotehill Pastures and Ponds SSSI is the nearest statutory conservation site to Cumwhinton WTW and the borehole site (approx. 1km). there is the potential for minor adverse air quality impacts and noise disturbance to the sites breeding bird population and overwintering avifauna whose flight/migratory patterns are proximate to construction (depending on the timing of the works). In general, the utilisation of existing infrastructure is expected to help moderate any potentially adverse impacts to local biodiversity as the proposed works at Cumwhinton WTW and the treated water storage facility would be confined within their established structural footprints. Although habitats and wildlife within the vicinity of these facilities may be subject to noise disturbance, if modifications require new ancillary infrastructure or external structural refurbishments, impacts would be both minor and temporary. The proposed excavation route of the water main would be within the catchment of the River Eden and Tributaries SSSI/SAC which supports a wide range of aquatic European Directive species such as white-clawed crayfish, Atlantic salmon, and otters which could be vulnerable to the indirect introduction of pollution/debris from excavation. The HRA has concluded that significant or significant adverse effects would be avoidable with established scheme-level avoidance or mitigation measures. The proposed excavation route would pass within proximity of the Cainbridge Sand Pit SSSI (approximately 100m) such that works may pose a risk to the conservation of its designated flora and fauna. Cumwhinton Moss SSSI and Geltsdale & Glendue Fells SSSI – North Pennine Moors SAC/SPA would be 2.2km and 1.7km, respectively, from the excavation route, however, it is not expected that these sites would experience any significantly adverse impacts. In general, the scheme is situated within a primarily semi-rural setting such that construction may cause some short-term disturbance to proximate local wildlife and habitats such as Castle Carrock Reservoir, Faugh Quarry, and Castle Carrock Fell. Overall, this option has been assessed to have a negative effect on Objective 1.

Construction of the new boreholes would introduce new above ground infrastructure within the existing structural footprint of Cumwhinton WTW which is expected to assimilate the new structures and operation. Although these components would require a permanent land-intake (Grade 3b agricultural land), their structural scales are expected to be minor which should result in a negligible effect on

land/soil. Similarly, modifications of Cumwhinton WTW and the treated water storage facility would also be contained within their existing footprints (internal/external) such that any new required ancillary infrastructure should not significantly impact land/soil quality. The proposed treated water main route primarily utilises the existing local road network (7.8km of the 10.5km route) which would help decrease land disruption whereas the other segments would be routed through Grade 3b agricultural land though all excavated land would be reinstated following the construction period. Consequently, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Segments of the proposed excavation route would be situated within Flood Zone 3s originating from the River Eden, Cairn Beck, and Castle Carrock Reservoir; consequently, construction could be liable to flooding depending on the timing of works. Additionally, the installation of the secondary disinfection equipment at Castle Carrock could also be liable to flooding from Castle Carrock Reservoir though this risk is considered minor to negligible due to its required scale of construction. It is unlikely that construction of the overall scheme would cause or exacerbate flood risk elsewhere.

It is expected that there would be moderate impacts from traffic congestion due to the utilisation of the local road network for pipeline routing during the construction period in addition to the transportation of material/equipment (particularly on segments of the M6, B6263, B6413, and the segments of the local road network which either overlay or lead to the excavation route) which would have a negative effect on local air quality (there would be an estimated 3,958 HGV movements during the 1.5 year construction period).

The option would generate 4,184 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, the proposed works could result in a temporary disruption of use or loss of amenity to the grounds proximate to construction that host recreational activity and sport such as Wetheral Woods walking paths, Moss Nook rifle range, and Castle Carrock Reservoir. Due to the predominantly semi-rural setting of scheme and the utilisation of the local road network for pipeline routing, the cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction/excavation and the transportation of equipment/material would primarily impact scattered residential/agricultural farmsteads and settlements such as Wetheral Pasture and southern Castle Carrock. Overall, this option has been assessed as having a minor negative impact on Objective 7.

Construction would involve a substantial capital expenditure which could have significant positive effects on the local economy but could be of a scale likely to generate significant new employment opportunities. Notwithstanding, excavation and the transportation of equipment/material would utilise both local and regional road networks which could result in sporadic increases in congestion and disruption/driver delay throughout the construction phase. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

The Hallsteads Iron Age Camp scheduled monument is under 100m from proposed excavation locations; however, the prior establishment of a treated water storage facility on the same site as the scheduled monument suggests that excavation in comparison should not introduce any new and/or intensify present stressors to the asset beyond a minor temporary loss of visual amenity. There are approx. 18 Grade II Listed Buildings under 500m. from the scheme which may maintain vantage points to the proposed construction; specifically, 6 of these historic assets would be under or approximate to 50m from the proposed excavation route: Garth House (41m), The Lawn (58m), Village Hall (53m), Raysdale House (32m), the Rectory (28m), and the Salmon Coops at Crosby Castle (11m). Although it is expected that mitigation measures during construction would help prevent any significantly adverse effect on the structural integrity of these Listed Buildings, the proximity between these assets and the works suggests that there would still be a risk to their settings throughout construction. The remaining Listed Buildings and scheduled monuments (>100m) may experience a minor loss of visual amenity regarding their settings though the route does benefit from scattered woodland buffer which may moderate visual impacts to heritage settings. Overall, this option has been assessed as having a negative effect on Objective 11.

It is not expected that the construction of the new boreholes and the modifications of Cumwhinton WTW and the treated water storage facility would have any adverse impact on the local setting or the wider landscape character due to the confined nature of their proposed works within developed sites. The installation of the secondary disinfection equipment at the treated water storage site may, however, impact the visual amenity of the reservoir for recreational users depending on the scale of construction. Approximately 644m of excavation would be situated within the North Pennine AONB. Excavation may alter the wider landscape character of the North Pennine periphery; consequently, works may result in the loss of visual amenity of residential and recreational receptors looking in/out of the park. Excavation outside of the AONB would enjoy scattered woodland buffer although works could adversely impact the wider semi-rural landscape when routed through open greenfield areas. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

It is currently unknown whether the abstraction of 6.5 Ml/d of groundwater would have an adverse effect on the statutory/non-statutory conversation sites within the general area; specifically, the HRA has concluded that additional analysis regarding any connectivity between aquifer and the River Eden SAC would be required to clarify operational effects. Furthermore, increased abstraction volumes would need to be confirmed with the EA due to the potential for abstraction to direct river take and/or flow in addition to adversely impacting terrestrial features such as wet flushes with special plants (if groundwater dependent, e.g. Eden Gorge Woodland SSSI). Additionally, the Cotehill Pastures and Ponds SSSI could be particularly vulnerable to operation to this scheme as it supports a range of habitats and wildlife which may be indirectly dependent upon groundwater tables, e.g. pond habitats and associated aquatic flora and wading avifauna. Overall, this option has been assessed as potentially having a negative effect on biodiversity at this stage though this remains uncertain.

There would be no operational effects on soils/land use.

The WFD Assessment reports that the abstraction licensing strategy (ALS) indicates that there is water available in the groundwater body and the new licence quantity (approximately 6.5 Ml/d) is relatively small. Overall, the option has been assessed as having a neutral effect on groundwater resources.

Operation of the option would not be liable for flooding nor cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 237 kWh/Ml, generating 110 tonnes CO2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased daily abstraction by 6.5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new boreholes would be part and parcel to the existing infrastructural scheme at Cumwhinton WTW such that it is not expected their operation would result in any significantly adverse impacts on landscape character though proximate receptors may perceive the intensification of use at the facility as an adverse alteration to the local setting. Similarly, modifications of Cumwhinton WTW and the treated water storage facility would be confined to their existing operational footprints such that any adverse effects from new ancillary infrastructure would be minor, if not negligible. On balance, this option has been assessed as having a neutral effect on local landscape character.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR150: Castle Carrock Dead Water Storage	Construction	-	+	0	-	0	0	-	0	0	-	-	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	-

Construction

This option would involve modification to Castle Carrock IR's draw-off tower in order to abstract and transfer an additional 6 Ml/d to Castle Carrock WTW via a new dead water abstraction process and associated pipeline works. The scheme proposes that a new connection between the draw-off tower's scour pipe and the inlet of the treatment process through the installation of new pumped transfer pipeline (33m), gravity transfer pipeline (40m), and potentially new suction pumps would be able to access dead water currently unavailable due to present design and technical capacity. It should be noted that further modification to Castle Carrock WTW is not considered necessary to accommodate the increased dead water input from the new reservoir regarding treatment and storage.

The modification of Castle Carrock IR's draw-off tower and abstraction process would be situated within the existing structural footprint of the reservoir which should help confine any adverse impacts to the immediate setting; e.g. the potential draw-down of water during the construction phase in order to enable pipeline work. Consequently, the decrease in water volume may have an adverse effect on ecosystems dependent upon the reservoir as a habitat. Furthermore, construction within the footprint of the reservoir may also pose the environmental risk of introducing pollution/debris within the reservoir which could adversely impact aquatic features and local wildlife. Additionally, the proposed works would be approx. 1.1km from the River Gelt which is a component of the River Eden and Tributaries SSSI/SAC. Works would also be within the vicinity of the Geltsdale & Glendue Fells SSSI – North Pennine Moors SAC/SPA (1.7km). In general, the scheme is situated within a primarily semi-rural setting such that construction may cause some short-term disturbance to proximate local wildlife and habitats such as Castle Carrock Fell though the structural scale of these proposed modifications would be minor such that construction should occur at a limited intensity and any effects could be mitigated (or attenuated by the distance). Overall, this option has been assessed as having a minor negative effect on Objective 1.

Modifications to Castle Carrock IR would be situated within the existing structural footprint of the reservoir which is expected to assimilate the new ancillary infrastructure. The proposed components (suction pumps/raw water main) would be situated either within the reservoir draw-off tower or below ground such that there would be no permanent land-intake (Grade 4 agricultural land) associated with the option; however, works would result in temporary land disruption though excavated land would be reinstated following the construction period. Consequently, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed construction scheme would be situated within the Flood Zone 3 originating from the Castle Carrock Reservoir; consequently, construction could be liable to flooding depending on the timing of works. It is unlikely that construction of the overall scheme would cause or exacerbate flood risk elsewhere.

It is expected that there would be an estimated 25 HGV movements during the 2.5 month construction period which are too minor to affect existing traffic on segments of the B6413 and the local road network leading to the reservoir which would not have a negative effect on local air quality.

The option would generate 46 tonnes CO2e which has been assessed as having a neutral effect on Objective 6.

The proposed works could result in the temporary disruption of use and loss of amenity of Castle Carrock Reservoir during the construction phase; specifically, the presence of equipment, material, and the continuation of works could prevent the use of the walking paths along the banks of the reservoir. Due to the predominantly rural setting of scheme, the cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction/excavation and the transportation of equipment/material may impact scattered residential/agricultural farmsteads and settlements such as Castle Carrock though this is expected to be minor. Furthermore, the proximity of the reservoir to Castle Carrock suggests that there may be a minor loss of amenity to community facilities such as Castle Carrock Primary School (520m) due to noise disturbance. Overall, this option has been assessed as having a minor negative impact on Objective 7.

Construction would involve a modest capital expenditure which could have very limited positive effects on the local economy but would not be of a scale likely to generate significant new employment opportunities. Overall, the option has been assessed as having a neutral effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, resource use and waste generation involved would have a negative effect on Objective 10.

The option would not affect water efficiency.

The Hallsteads Iron Age Camp scheduled monument would be 171m from excavation and modification works of the draw-off tower; however, the prior establishment of the WTW/treated water storage on the same site as the monument suggests that the proposed works in comparison should not introduce any new and/or intensify present stressors to the asset beyond a minor temporary loss of visual amenity. There are approx. 4 Grade II Listed Buildings under 500m. from the scheme which may maintain vantage points to the proposed construction; specifically, Garth Foot House would be the most proximate Listed Building to the scheme at the distance of 428m. Notwithstanding, the potential draw-down of the reservoir during the construction period could indirectly impact the historic setting of Tottergill Farm House's Barn (410m) whose heritage value may partially depend on the preservation of the background reservoir setting. Consequently, the Listed Buildings and scheduled monuments may experience a minor loss of visual amenity regarding their settings throughout the construction period, however, there should be no adverse impacts on their structural integrity. It should be noted that the scheme benefits from substantial woodland buffer which should moderate visual impacts to heritage settings. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The construction scheme would be situated within the North Pennine AONB which could adversely impact the visual amenity associated with the protected landscape regarding residential and recreational receptors; specifically, the potentially draw-down of the reservoir during the construction phase may fundamentally alter its immediate setting. Although the reservoir benefits from substantial woodland buffer along its periphery, gaps within bordering woodland may provide vantage points to construction which could be perceived as detrimental to the local landscape character. Overall, this option has been assessed as having a negative effect on Objective 12.

Operation

The operation of the scheme would abstract and treat an additional 6 Ml/d of dead water from the Castle Carrock IR. A reduction in water level at Castle Carrock Reservoir (frequency of operation would vary) could potentially impact local ecosystems in addition to designated avifauna associated with the River Eden and Tributaries SSSI and Geltsdale & Glendue Fells SSSI which may use the reservoir as a secondary habitat, although the varied abstraction of 6 Ml/d is not expected to result in significant effects in this regard. Overall, the option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on soils/land use.

This option would have a design capacity of 6 Ml/d without the need for additional abstraction from the River Gelt; the option has therefore been assessed as having a neutral effect on Objective 3.

The option is not expected to cause or exacerbate flooding in the general area or further downstream.

There would be no operational effects on air quality.

Operational energy demand would be 82 kWh/Ml, generating 8 tonnes CO2e/a. This has been assessed as having a neutral effect on Objectives 6 and a minor negative effect on Objective10. The scheme would not adversely affect human health by increased noise, nuisance or disruption. Depending on the degree and permanence of reduced water volume of Castle Carrock IR, there may be minor adverse impacts on recreational activities at the reservoir such as angling and kayaking though this is currently unknown. On balance, the treatment of 6 Ml/d of dead water would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing. The option would not affect water efficiency. There would be no operational effects on designated cultural heritage assets. The operation of the scheme could potentially result in a permanent reduction of water volume at Castle Carrock IR which could be perceived by residential and recreational receptors as an adverse alteration to the immediate landscape and the wider North Pennine AONB. Overall, this option has been assessed as having a negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR824: Blenkinsopp Mine	Construction	--/?	0	0	-	-	--	0	+/-	0	--	-	--
	Operation	-/?	0	0	-	0	0	+	+	0	-	0	0

Construction

This option would involve the new abstraction and transfer of 2.2 Ml/d of raw water from the Blenkinsopp Mine to the existing Castle Carrock WTW via a new pumping station and 21km raw water main. Treated output from Castle Carrock WTW would subsequently be transferred to an existing potable storage system.

The Blenkinsopp Mine abstraction site is not within any statutory or non-statutory biodiversity designated sites, although there are two SSSIs within 2.4km of the works: Tipalt Burn (2.1km) and Allolee to Walltown (2.4km). Due to the identified geological and flora interest features identified within these sites, it is considered unlikely that construction of the abstraction equipment and pumping station would result in any significantly adverse effect. The proposed 21km raw water main route would either run within proximity to, or directly traverse, five SSSIs. Three sites adjacent to the excavation route, Lambley River Shingles SSSI (463m), Burnfoot River Shingle and Wydon Nabb SSSI – Tyne & Allen River Gravels SAC (1km), and Whitfield Moor Plenmeller and Asholme Commons SSSI – North Pennine Moors SAC/SPA (989m), are classified as supporting diverse environs and unique flora communities. The proposed excavation route would traverse approx. 5.7km of the Geltsdale and Glendue Fells SSSI (North Pennine Moors SAC). The route poses a significant risk of environmental damage and the disturbance/disruption of wildlife and their movement within site; specifically, the various breeding bird populations and wildfowl situated within Tindale Tarn (41m from proposed excavation route). It should be noted that significant and/or significantly adverse effects could be avoided if re-routing the pipeline around the SSSI/SAC. Additionally, the proposed excavation route would cross the River Gelt, a component of the River Eden and Tributaries SSSI/SAC, which could indirectly introduce pollution/debris, although site level mitigation measures are expected to prevent significant effects on local ecosystems, designated aquatic interest features, and downstream habitats and wildlife. In general, the construction is situated within a rural greenfield setting such that construction may temporarily impact local wildlife and habitats within proximity of the scheme. Overall, this option has been assessed as having a significant negative effect on Objective 1 though uncertainty remains.

The installation and development of the new abstraction infrastructure and pumping station would be situated within a semi-developed greenfield site; however, due to the scheme's operational capacity of 2.2 Ml/d, it is not expected that the structural scale of these structures would require a significant amount of land in-take (3b agricultural land). The treatment of raw water would occur within the existing Castle Carrock WTW which should have negligible impact on land/soil. Pipeline excavation would be routed through Grade 3b/4/5 agricultural land and would be reinstated following the completion of construction. Consequently, this option has been assessed as having a neutral effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction infrastructure would be situated within the Flood Zone 3 originating from the Tipal Burn whereas segments of the excavation route would be situated within Flood Zone 3s emerging from 10 various river systems. Consequently, construction of these components and excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts on traffic congestion during the construction period (particularly on segments of the A69, A689, and the local roads/paths leading to the proposed components) which would have a negative effect on local air quality (there would be an estimated 5,979 HGV movements during the 1.5 year construction period).

The option would generate 5,933 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, the proposed works could result in a temporary disruption of use or loss of amenity to the grounds proximate to construction that host recreational walking and sport such as Tindale Tarn. Due to the rural nature of this construction scheme, there would be a minor risk of temporary noise disturbance/air quality impact associated with construction on residential receptors living in Castle Carrock, Lambley, south-east Greenhead, and the scattered settlements and farmsteads within the vicinity of the scheme. Overall, this option has been assessed as having a neutral impact on Objective 7.

Construction would involve a moderate capital expenditure which could have minor positive effects on the local economy but would not be of a scale likely to generate significant new employment opportunities. The proposed works could result in a minor increase of congestion and disruption/driver delay due to the intensification of movement on the local road network, however, the rural nature of the scheme and minor use of the road network for pipelaying should help alleviate any new temporary stressors. It should be noted that the proposed excavation route would traverse a segment of the railroad network which could result in a temporary disturbance of rail services. On balance, the option has been assessed as having a mixed minor positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

Neither the Blenkinsopp Mine abstraction site nor the proposed excavation route contain any heritage assets, however, construction of the abstraction equipment and pumping station would be approx. 395m from the Frontiers of the Roman Empire (Hadrian's Wall) World Heritage site. Due to the proximity of construction to this world heritage site, works pose the risk of adversely impacting previously unidentified archaeological artefacts and the visual amenity associated with such monuments as Carvoran Roman Fort/Hadrian's Wall (1.2km) and Stanegate Roman Road (1.2km). There are another 5 scheduled monuments within proximity to the proposed excavation route; specifically, Hallsteads Iron Age camp (93m) and Roachburn Colliery (10m). Additionally, 25 Grade II/II* Listed Buildings maintain possible vantage points to the proposed construction scheme with 6 assets situated under 100m of the works: Burnside Cottage is 30m from abstraction site whereas Featherstone Bridge (58m), Lambley Farmhouse (19m), Garth Foot House (49m), Garth House (79m), and The Lawn (97m) would be within proximity to the excavation route. The proximity between these sites and the works suggests that there would be an impact on their settings throughout the construction phase. The cumulative effect of natural woodland buffer and the distance between excavation and the remaining assets (>100m) should help screen most of the construction from these assets. Overall, this option has been assessed as having a negative effect on Objective 11.

Approximately 9.2km of the proposed pipeline route would be directly situated within the North Pennines AONB with an additional 6.2km running adjacent to the designated area whereas the abstraction site would be located 995m from the Northumberland National Park. Collectively, these works could significantly alter the character of these protected landscapes and the wider area; specifically, the loss of visual amenity of residential and recreational receptors looking in/out of the parks. Furthermore, the development of the abstraction infrastructure and pumping station would be situated within a rural greenfield setting directly adjacent to the A69 such that intervening woodland buffer is expected to help moderate adverse impacts on the local setting though passing receptors may still be vulnerable to the loss of the rural landscape character when approaching the site from Haltwhistle. The remaining excavation route benefits from sporadic woodland buffer although works could adversely impact the wider landscape when excavation occurs within open flat topography. Overall, the option has been assessed as having a significantly negative effect on Objective 12.

Operation

It is currently unknown whether the abstraction of 2.2 Ml/d of groundwater from the Blenkinsopp Mine would have an adverse effect on the statutory/non-statutory conservation sites within the general area as well as local ecosystems such as the former mine itself. For example, Tipalt Burn SSSI, Allolee to Walltown SSSI, and Burnfoot River Shingle and Wydon Nabb SSSI may be vulnerable to the operation of this scheme as they support a range of flora interest features dependent upon groundwater resources, although the HRA states that there are no clear LSE alone or in combination (e.g. no impact pathways) regarding the Tyne & Allen River Gravels SAC. Furthermore, it has been documented that abandoned mines may develop unique ecosystems adapted to the physical and chemical characteristics of their settings; consequently, abstraction may inadvertently disrupt these sensitive systems. Overall, this option has been assessed as potentially having a minor negative effect on Objective 1, although this remains uncertain.

There would be no operational effects on soils/land use, however, it is expected that mitigation and best practice would be utilised due to the increased probability of water pollution resulting from prior mining operation in order to prevent ground contamination.

The WFD Assessment reports that the abstraction licensing strategy (ALS) indicates that there is water available in the groundwater body in addition to the Tipalt Burn across all flows. Consequently, the abstraction of approximately 2.2 Ml/d would have a neutral negative effect on surface water resources.

The abstraction site and ancillary infrastructure (pumping station) would be located within a Flood Zone 3 on the Tipal Burn whereas Castle Carrock WTW would be located within the Flood Zone 3 originating from Castle Carrock Beck; therefore, operation would be liable to flooding although the general operation of the scheme is not expected to increase the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 912 kWh/Ml, generating 34 tonnes CO2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objectives 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased capacity of 2.2 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The operation/standing of the abstraction infrastructure and pumping station may result in a minor decrease in visual amenity associated with the heritage setting of the Grade II Burnside Cottage (31m) though the assumed structural scale of the equipment is expected to be minor, and ultimately, negligible.

The new abstraction infrastructure and pumping station at Blenkinsopp Mine would introduce new above ground infrastructure within a semi-developed greenfield site. The abstraction site would benefit from moderate woodland buffer along its periphery such that development should not significantly impact the wider setting. The treatment of abstracted water would occur within the existing Castle Carrock WTW thus operation would be part and parcel to existing services. Additionally, Castle Carrock WTW benefits from significant woodland buffer within its vicinity which should help screen any new structural additions to the site. Overall, this option has been assessed as having a neutral effect on Objective 12.

Strategic Resource Zone

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR001: River Alt to Prescot WTW	Construction	-	0	0	0	-	--	0	++/-	0	--	-	-
	Operation	?	0	-/?	0	0	-	++/?	++/?	0	-	0	0

Construction

This option comprises a new abstraction on the River Alt and the transfer of raw water to Prescot WTW for treatment and storage. The raw water transfer/treatment would require c.18.5km of new pipeline and a new WTW at Prescot, or alternatively, modifications to the existing Prescot WTW if a new WTW is not seen as viable. A new abstraction licence would be required; average abstraction is assumed at 13.5 Ml/d with a proposed range from 5Ml/d to 20Ml/d.

There are no designated nature conservation sites close to Prescot WTW or along the route of the transfer pipeline. The abstraction point is approximately 6km upstream from the Sefton Coast SSSI/SAC and Ribble and Alt Estuaries SPA/Ramsar/SSSI/NNR via the River Alt. These could potentially be impacted by any debris/pollution associated with construction of the abstraction infrastructure, although this is very unlikely assuming construction best practice and mitigation measures are employed. Furthermore, the utilisation of existing infrastructure and developed sites is expected to help minimise the potential for direct impacts on biodiversity. HRA Screening has concluded that adverse construction impacts could potentially be avoided with established mitigation measures. Notwithstanding, the construction phase may cause some localised, short-term disturbance to habitats and species along the new pipeline route although any adverse impact resulting from this construction phase would be temporary. On balance, this option has been assessed as having a minor negative effect on Objective 1.

It is assumed that there would be no significant new land take associated with this option due to the utilisation of the existing Prescot WTW site. The new pipeline routes through sections of Grade 1 and Grade 2 agricultural land which may temporarily disrupt agricultural activities during the construction phase but this has not been assessed as an overall risk to soil quality (due to the reinstatement of excavated land once works are complete). Additionally, the construction of a new WTW (if required) would be situated within an existing operational site such that development would not intensify land use. Overall, the option has been assessed as having a neutral effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option is not envisaged to cause or exacerbate flooding.

The construction of the option would generate 27,688 vehicle movements during the 1.9 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality.

Construction of the scheme would generate 24,986 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

There would be no impact upon recreational activities as a result of the construction of the option. There would, however, be some noise as a result of construction which may affect residential receptors near the development sites, although works would be temporary such that any nuisance is likely to be negligible.

The construction of the option, particularly the potential development of a new WTW (if required), represents a significant capital investment which may create a number of employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. The construction of the WTW and the laying of new pipework during the construction phase could place additional stress on the local transportation networks (congestion/delay). Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a significantly negative effect on Objective 10.

Construction of the new pipeline may temporarily affect the settings/visual amenity of listed buildings along its route, particularly those clustered within Melling and Sefton. In consequence, the option has been assessed as having a minor negative effect on Objective 11.

The development site and proposed pipeline route are not within or in proximity to any landscape designations. The construction of the new WTW / modifications should not introduce any significant new infrastructure beyond what has previously been established at the site. Construction on the River Alt may temporary disrupt the rural amenity of its setting and, allied with temporary landscape/visual impacts related to the construction of the pipeline, has been assessed as having an overall minor negative effect on Objective 12.

Operation

The Sefton Coast SSSI/SAC and Ribble and Alt Estuaries SPA/Ramsar/SSSI/NNR are 6km downstream of the proposed abstraction location on the River Alt and there is the potential for adverse effects on this site as well as the ecology of the River Alt due to reduced flows. Consequently, the availability of the abstraction volumes would need to be confirmed by the EA, and the acceptability of this option regarding effects on European sites would need to be established if it is pursued as a preferred option thus further analysis (modelling etc.) is required. Overall, this option has been assessed as having an uncertain effect on the River Alt (subject to finalised abstraction volume).

No effects on soils or land use are expected during operation (discounting the initial excavation of land during construction).

The WFD Assessment has reported that there is water available for abstraction at all flows in respect of the River Alt; however, the abstraction of 13.5 Ml/d (potential range of 5-20 Ml/d) is moderate in size, and could subsequently impact the hydrological regime of the river thus this option has been assessed as having a negative effect on Objective 3, although some uncertainty remains.

The option is not expected to cause or exacerbate flooding. No effects on local air quality are anticipated.

The option would require ongoing energy use of 348 kWh/Ml to pump and treat 13.5 Ml/d (5-20 Ml/d range) of water with associated greenhouse gas emissions of 101 tCO_2e which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption beyond what is currently experienced at existing sites.

The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water and may support population/economic growth within the region. The option overall has the potential to have a significant positive effect on Objectives 7 and 8 although some uncertainty remains as the actual level of abstraction/output has yet to be determined.

No impact on water efficiency or leakage is expected.

Operation of the option is not expected to affect cultural heritage assets.

The proposed operational site is not within or in proximity to any landscape designations. Operation of the option will not utilise any significantly new infrastructure beyond what has previously been established on the Prescot WTW site. The introduction of abstraction infrastructure on the River Alt will result in new above ground development within a rural setting, however, the scale of development is expected to be minor and therefore effects on landscape have been assessed as neutral.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR003: Fisher Tarn (Kendal) to Thirlmere Aqueduct and Lostock for Treatment	Construction	-	-	0	0	-	--	-	0	0	--	-	-
	Operation	0	0	0	0	0	0	+/-	+	0	-	0	0

Construction

This option would involve the reinstatement of Fisher Tarn Reservoir in order to abstract and transfer a maximum of 5 Ml/d via a new 1.75km raw water main to the Mint South Well (Thirlmere Aqueduct) for treatment at Lostock WTW. Ancillary development may be required to facilitate the operation of this option such as a new pumping station and modification to the Mint South Well. Currently, it is not expected that Lostock WTW will require any modification to accommodate the increased raw water input from Fisher Tarn.

Neither Fisher Tarn Reservoir nor the proposed pipeline route contain/traverse statutory biodiversity designations. The closest sites to this option are the Morecambe Bay Pavements SAC (not vulnerable to construction impacts) and the Morecambe Bay SAC / SPA / Ramsar sites which are downstream receptors via the St. Sunday Beck and River Bela. Additionally, the River Kent and Tributaries SSSI/SAC is approximately 1.8km from Mint South Well and the proposed pipeline, although it is not expected that construction will result in any adverse impacts (noise disturbance / air pollution – dust) on its interest features (white-clawed crayfish and fresh water mussel (*Margaritifera margaritifera*) populations) due to the distance between the sites. Notwithstanding, the general construction area is situated within a rural greenfield setting such that construction/excavation may cause some short-term disturbance to/loss of local habitats and species, although it is assumed that established scheme-level avoidance and/or mitigation measures will be utilised to help control any adverse impact. Overall, this option has been assessed as having a potentially minor negative effect on Objective 1.

This option would involve construction work on Grade 4 agricultural land and the land required for the excavation of the treated water main would be reinstated following the construction phase. Any required modification of the Mint South Well would occur within the existing infrastructural footprint of the site. Overall, a minor negative effect has been identified in respect of Objective 2.

The construction of this option is not expected to have effects on water quality or water resources provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area, nor would the development sites be at risk from flooding.

The construction of the option would generate 1,568 vehicle movements during the 1.5-year construction period, the emissions from which, in conjunction with plant and machinery, may have a minor negative effect on local air quality.

The option would generate 1,802 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

Fish Tarn Reservoir is a popular fly fishing area due to its populations of rainbow and brown trout. The reinstatement of the Reservoir and excavation of the pipeline could temporarily restrict access to the Reservoir for angling during the construction phase. Additionally, excavation of the pipeline could temporarily disrupt access to land on/adjacent to the pipeline route for recreation; however, any disruption or restriction would be temporary. There may be a risk of noise disturbance/air quality impacts associated with the excavation of the pipeline and associated HGV movements which may affect residential receptors situated along the A684, Paddy Lane, and Sedbergh Road; however, potential impacts would be temporary. Overall, the option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a relatively modest capital expenditure which is considered insufficient to have a substantive effect on the local economy and local employment creation though the influx of investment may improve social-wellbeing on an indiscernible scale. The works could temporarily result in increased congestion and disruption/driver delay due to the close proximity of the pipeline to the A684, Paddy Lane, and Sedbergh Road and potential intensification of movement on the local transportation network. On balance, the option has been assessed as having a neutral effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

Fisher Tarn Reservoir is within the setting of the Dam and Machinery House of Fisher Tarn Reservoir which has been designated as a Grade II Listed Building. Reinstatement works and excavation within the vicinity of the Reservoir therefore pose a risk to the setting of this asset. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The scheme is situated between two National Parks; Lake District National Park / UNESCO World Heritage Sites (WHS) to the west (3.3km) and the Yorkshire Dales to the east (5.6km). Due to the relative distance between the designated landscapes and construction sites in addition to the proposed scale of development (excavation and modification), it is not expected that construction will adversely affect the qualities of these areas. Due to the area's rural greenfield character, the introduction of a new pumping station and excavation works could temporarily disrupt the visual amenity of recreational receptors during the construction phase, thus having a minor negative effect on Objective 12.

Operation

The operation of the scheme would abstract a maximum of 5 Ml/d from Fish Tarn Reservoir which could potentially impact native aquatic species and habitats of the reservoir due to the increased magnitude and frequency of drawdown though it is not expected that potential effects would be significant. The HRA concludes that a 5Ml/d abstraction in general from this source would be inconsequential compared to other inputs to the River Bela and hence the section of Morecambe Bay SAC/SPA/Ramsar that the River Bela discharges to. It is not expected that the operation of the option would significantly impact other habitats and species within the general area, specifically nearby conservation sites such as River Kent and Tributaries SSSI/SAC. Overall, operational effects are possible but significantly adverse effects would be avoidable with established operational mitigation such that this option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

Although the yield of the reservoir is uncertain, it is assumed to equate to the previous licence condition of 5 Ml/d. There is also a requirement to maintain an existing compensation flow condition of 0.273 Ml/d from the reservoir to Stainton Beck which should have a minor, if not negligible effect, on water quantity as the EA's Abstraction Licensing Strategy for South Cumbria shows water available at all flow regimes. Overall, the option would have a neutral effect on surface water resources.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 15 kWh/Ml, generating 2 tonnes CO2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The increased magnitude and frequency of drawdown of Fisher Tarn Reservoir may impact fish populations (rainbow and brown trout) stocked by the local angling club such that operation may have a minor adverse effect on recreational angling within the reservoir. The increased capacity of 5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth. On balance, this option has been assessed as having a mixed positive and minor negative effect on Objectives 7 and a positive effect on Objective 8.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets, e.g. the Dam and Machinery House of Fisher Tarn Reservoir, as it is assumed that new components would be within the context of the existing infrastructure of the reservoir and be designed to be in-keeping with local surroundings.

The only new above ground infrastructure associated with the operation of this option would be the pumping station which is currently under consideration. If the pumping station is required, its footprint would be minor and within the larger operational footprint of the Reservoir, thus negligible to the wider landscape. The new raw water main connecting Fisher Tarn Reservoir and the Mint South Well would be below ground and would therefore not have an impact on the local landscape. Overall, the option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR004: Longsleddale Reservoir	Construction	--/?	-	0	--	-	--	-	++/-	0	--	-	--
	Operation	--/?	0	--	0	0	-	++/?	++	0	-	0	--

Construction

This option would involve the development of a new impounding reservoir with a capacity of 1,897Ml on the River Spirit. The proposed dam would be 368m long with a new access road 1.4km in length. Additionally, a new pumping station would be installed on an off-road site near Garnett Bridge. Raw water from the reservoir would be transferred to Watchgate WTW via a new raw water main (circa 10km in length). The option has a design capacity of 25Ml/d.

The proposed reservoir site is not within a designated nature conservation site but would be approximately 2.3km upstream from the River Kent and Tributaries SAC/SSSI via the River Sprint. The proposed raw water main would run adjacent to a length of the River Sprint included within the River Kent and Tributaries SAC/SSSI the majority of its route. The River Kent and Tributaries SAC/SSSI supports nationally/internationally significant species including white-clawed crayfish and freshwater mussels. HRA Screening has concluded that construction of the new reservoir would likely result in significant effects such as the restriction of movement of mobile species and introduction of pollution which could affect the interest features of the SAC/SSSI. Furthermore, the WFD Assessment has reported that temporary habitat changes will result from the diversion of the Sprint during construction; specifically, there is a potential risk of suspended sediment to enter the Sprint and affect the ecology (i.e. smothering, reduction in light) including fish, macrophytes/phytobenthos and invertebrates. Sediment loss downstream of the reservoir would deplete habitats, affect fish migration, and decrease flow within the watercourse. In general, construction would be a significant undertaking and there is a risk of un-mitigatable effects due to e.g. sediment release. Pipeline works may also affect designated sites within Longsleddale Vale including Browgill and Stockdale Becks SSSI, Longsleddale Wood SSSI and Beech Hill Wood SSSI. At this stage, the option has been assessed as having a significant negative effect on Objective 1 though this remains uncertain.

Construction would involve the loss of a significant area of greenfield land, although this would be of relatively poor (Grade 5) agricultural land quality. The proposed raw water main would be routed through Grade 4/5 agricultural land which would be reinstated following the completion of construction. On balance, this option has been assessed as having a minor negative effect on Objective 2.

The WFD Assessment states that the diversion of the Sprint during construction would result in temporary changes to its hydrological regime, continuity, and morphological conditions, e.g. the initial flooding of the valley may result in a "pulse" of poor quality water due to disturbance of contaminated sediment. It is expected, however, that best practices will be adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures) such that this option would have a neutral effect on Objective 3.

The reservoir and proposed pipeline route would be located within Flood Zone 3. Construction could therefore be liable to flooding depending on the timing of works and in view of the scale of construction activity associated with this option, a significant negative effect has been identified in respect of Objective 4.

There could be traffic congestion during the construction period (particularly along the A6, A591, A592 and the local road network between Sadgill and Garnett Bridge) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 33,189 vehicle movements during the 2.6 year construction period).

The option would generate 7,930 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The construction of the reservoir could affect approximately 6km of footpaths within Longsleddale Vale which may impact upon recreational receptors. As the development is situated within a rural setting, significant noise/vibration disturbance and air quality impacts are not anticipated, although HGV movements could give rise to temporary adverse health impacts along transport routes. Overall, this option has been assessed as having a negative effect on Objective 7.

The construction of the option would represent a large capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. However, construction activity including the laying of new pipework along/adjacent to an unnamed road between Sadgill and Garnett Bridge and HGV movements could cause congestion/driver delay. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The proposed reservoir site does not contain, and is not in close proximity to, any designated heritage assets. There are approximately eight Grade II listed buildings under 200m from the proposed pipeline route including five equal to or under 100m (Sadgill Bridge (29m), Sadgill Farm House (100m), High House Cruck Barn (14m), Garnett Bridge (43m), and Mill Cottage/Mill/Attached (63m). In consequence, there is the potential for temporary, adverse impacts on the settings of these assets during the construction period. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The proposed reservoir is located within the Lake District National Park and World Heritage Site and works of this scale are expected to have a significant negative effect on landscape character and the visual amenity of recreational receptors. Consequently, the option has been assessed as having a significant negative effect on Objective 12.

Operation

The HRA reports that operation of Longsleddale Reservoir would likely result in significant effects on downstream ecology including the interest features of the River Kent and Tributaries SAC/SSSI, although some potential operational effects, e.g. flow change impacts in the River Sprint, may be avoidable using established measures such as a compensation flow release and freshet releases. The WFD Assessment highlights that long-term changes to the hydrological regime of the Sprint would result from the presence of the reservoir: alterations to high and low flows, changes to morphological conditions due to alterations of the river's sediment transport regime, and interruption of the Sprint's continuity by the embankment. Potential impacts on migratory fish species including salmon and sea trout are currently unknown. The new reservoir might help contribute to the creation of new habitat although this would depend on its design and management, and should be considered during design if the option is taken forward. Overall, the operation of this option has been assessed as having a significant negative effect on biodiversity, although some uncertainty remains, e.g. potential benefits regarding habitat creation.

There would be no operational effects on soils/land use.

The WFD Assessment states that long term water quality changes are likely to occur due to the stilling and storage of water in the reservoir, and furthermore, the construction of the reservoir could result in the re-designation of the Sprint as a highly modified water body for water supply. Consequently, it is unlikely that the reservoir could be constructed/operated without a deterioration of status in one or more WFD elements. As noted above, it is likely that a compensation flow regime would be established. At this stage, the option has been assessed as having a significant negative effect on Objective 3.

The option is not expected to cause or exacerbate flooding in the area. New infrastructure would be located in Flood Zone 3 and may therefore be susceptible to flooding; however, the new reservoir could provide additional buffer storage and therefore limit the downstream effects of flooding. Overall, this option has been assessed as having a neutral effect on Objective 4.

There would be no operational effects on air quality.

Operational energy demand would be 248 kWh/Ml, generating 104 tonnes CO_2e/a. This has been assessed as having minor negative effects on Objectives 6 and Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. Whilst the option may create recreational opportunities associated with the new reservoir, changes in river flows may affect downstream rivers which are used for kayaking. Impacts on river flows and potential impacts on fish migration may also have impacts on angling. The increased capacity of 25 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health, although uncertainty remains regarding recreational impacts as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency. There would be no operational effects on designated cultural heritage assets. As noted above, the proposed reservoir would be located within the Lake District National Park and World Heritage Site and would be of a scale likely to generate a significant negative effect on landscape character and the visual amenity of recreational receptors.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR006: Glaze Brook	Construction	--/?	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	-	0	0	++	++	0	-	0	0

Construction

This option would involve the provision of a new lowland river raw water abstraction on Glaze Brook and construction of a pumping station. A new c.11km raw water main to Lightshaw WTW would be required together with a new WTW process for river water. Treated water would be transferred to a treated water storage facility. The option would have a capacity of 15Ml/d.

The proposed development sites (including the abstraction point and the pipeline route from Glaze Brook to Lightshaw WTW) are not within any statutory or non-statutory nature conservation designations. The abstraction point and proposed pipeline route would, however, be within and proximate to Holcroft Moss (a SSSI and part of the Manchester Mosses SAC). HRA Screening concluded that significant effects would be likely without appropriate mitigation therefore rerouting of the pipeline alignment would be necessary should this scheme be included as a preferred option. More generally, construction of the abstraction/pumping station and pipeline works could result in the loss of/disturbance to habitats and species. Overall, this option has been assessed as having a significant negative effect on Objective 1 although this remains uncertain.

Development associated with the abstraction, pumping station and pipeline would result in the loss of agricultural land which may include land classified as 'best and most versatile' (Grades 1 and 2), although land required for the excavation of the pipeline would be reinstated following the construction phase. This has been assessed as having a negative effect on Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The site of the proposed abstraction point and pumping station would be within Flood Zone 3 whilst sections of the pipeline would also cross Flood Zones 2 and 3. In consequence, works may be liable to flooding (depending on timing) and a negative effect has therefore been identified in respect of Objective 4.

Construction is expected to generate 17,016 vehicle movements during the 1.9 year construction period from which emissions, in conjunction with plant and machinery operation, may have a negative effect on local air quality though impacts would be short term and temporary.

Construction of the scheme would generate 20,023 tCO_2e/a which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Construction could affect human health due to noise disturbance and air quality impacts, in particular on residential properties along the route of the pipeline (e.g. properties in Lowton). However, any adverse effects on these receptors would be temporary and have therefore been assessed as minor.

Construction would involve a large capital expenditure, resulting in a significant positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. However, the works could result in increased congestion and disruption/driver delay on the road network due to associated vehicle movements and the requirement for pipeline crossings/works within roads which together could affect, for example, the B5212, A574, A580 and Newton Road (it is also noted that a rail crossing would be required). Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy consumption and generate waste which has been assessed as having a significant negative effective on Objective 10.

Promontory fort 300m west of Great Woolden Hall Farm Scheduled Monument is circa 1km from the abstraction site and there are also two Grade II listed buildings to the north and south. Given the distance of these assets from the site, the scale of works and the presence of physical barriers, effects on their setting are not expected. There are a very small number of listed buildings in close proximity to the proposed pipeline route and in consequence, there is the potential for minor, temporary adverse effects on their setting during construction. Overall, this option has been assessed as having a minor negative effect on cultural heritage (Objective 11).

The development site and proposed pipeline route are not within or in proximity to any landscape designations. However, construction could have short term, temporary negative effects on local landscape features. The pipeline works in particular could affect the visual amenity of residential receptors where the route is in close proximity to dwellings (e.g. to the north of Lowton). Development of the abstraction and pumping station could also affect the visual amenity of the users of Glazebrook Trail to the east of the site. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The operation of this option would involve the abstraction of 15Ml/d from Glaze Brook which may result in adverse effects on in-river habitats and native species in addition to downstream ecological receptors due to the change to river flow regime; consequently, the EA would need to confirm that water is available for use in order to issue a new abstraction licence. HRA Screening has concluded that operation is unlikely to result in any significant effects on European designated sites, subject to established operational mitigation. The option has therefore been assessed as having an uncertain, though potentially negative, effect on local biodiversity at this stage.

No operational effects on soils/land use are anticipated (initial land take assessed at construction stage).

The option would involve the abstraction of 15Ml/d from Glaze Brook which has been reported by the WFD Assessment as potentially having a moderate impact on the hydrological regime of Glaze Brook, particularly at low flows. This option has therefore been assessed as having a negative effect on Objective 3, although some uncertainty remains.

As noted above, the site of the proposed abstraction point and pumping station would be within Flood Zone 3. In consequence, infrastructure may be liable to flooding, although flood risk is not expected to be increased elsewhere. Overall, this option has been assessed as having a minor negative effect on Objective 4.

The option would have a neutral effect on air quality in the area.

Operational energy usage would be 300 kWh/Ml and would result in emissions of 72 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect in respect of Objective 10.

The option would provide 15Ml/d of safe drinking water when operational and would not impact upon the recreational potential of the area. This has been assessed as having a significant positive effect on Objective 7.

There is unlikely to be any direct impact on employment levels during operation but the supply of 15Ml/d may support economic and population growth which has been assessed as having a significant positive effect on Objective 8.

The option would not affect water efficiency.

No operational effects on cultural heritage assets are anticipated.

The operational site is not within or in proximity to any landscape designations. The option would involve the development of new above-ground infrastructure which could have adverse landscape impacts and affect the visual amenity of residential and recreational receptors. However, taking into account the likely scale of development, any effects are expected to be negligible and a neutral effect has therefore been identified in respect of Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR007: Sankey Brook	Construction	-	-	0	0	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	0	0	0	+	+	0	-	0	0

Construction

This option would involve the development of a new abstraction from Sankey Brook that would transfer 10 Ml/d of raw water to a new WTW at a treated water storage facility via a new c5.5km main. Following water treatment, output from Hill Cliffe WTW would be transferred to a treated water storage facility.

Neither the proposed Hill Cliffe WTW site nor the proposed pipeline route are within or cross any statutory or non-statutory designated nature conservation sites. Paddington Meadows LNR and the Woolston Eyes SSSI are approximately 3.8km from the Sankey Brook abstraction site. Woolston Eyes SSSI, designated due to its significance as a lowland open water breeding ground for birds as well as a habitat for amphibians including great crested newts, is upstream of the abstraction site, although disturbance to the bird population (depending on the time of year) from construction and pipeline excavation remains a possible risk though birds do habituate to construction noise and visual disturbance when not directly threatened. The Mersey Estuary SPA/Ramsar/SSSI is approximately 9.2km downstream from the Sankey Brook abstraction point via the River Mersey which could potentially be impacted by any debris/pollution associated with construction of the abstraction infrastructure or the pipeline river crossing at Atherton's Quay though this would be unlikely if site specific mitigation/best practice is established. HRA Screening concluded that potential adverse impacts on the Mersey Estuary should be avoidable with appropriate scheme level mitigation. Notwithstanding, the proposed pipeline crosses St. Helens Canal (disused) and the Manchester Ship Canal. Construction of the abstraction point, pipeline, and the new WTW are within the general vicinity of greenfield land such as Sankey Valley Park, Moss Wood, Morley Common, and Hillcliffe such that construction may cause some short-term, localised disturbance to/loss of habitats and species although this would be temporary. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Development associated with this option would require construction work on greenfield land, specifically south of the Manchester Ship Canal which has been classified as Grade 3 agricultural land. However, the majority of development within this area would be the construction of the pipeline (land would be reinstated following the construction phase) and the WTW (which is located within the operational vicinity of the treated water storage site). Development of the Sankey Brook abstraction site would also be situated within a greenfield site; however, the scale of development is negligible. Overall, this option has been assessed as having a minor negative effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area, nor would the development sites be at risk from flooding.

There could be impacts from traffic congestion during the construction period (particularly along the A57, A56, and local routes such as Walton Lea Road) which may have a negative effect on local air quality (there would be an estimated 10,794 vehicle movements during the 1.8 year construction period). In consequence, a negative effect has been identified in respect of Objective 5.

The option would generate 11,044 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, there may be temporary restrictions of use to portions of Sankey Valley Park (recreational grounds and playing fields), Morley Common and the sports ground adjacent to Walton Lea Road due to pipeline excavation. Additionally, there may be noise/vibration disturbance and air quality impacts associated with the pipeline excavation which could affect residential receptors and educational facilities around Sankey Valley Park (Kimberly Street, St. Gregory's Catholic High School, and Sacred Heart Roman Catholic Primary School) and residential properties around Atherton's Quay. Development of the new WTW at Hill Cliffe, meanwhile, poses a potential risk to the residential amenity of dwellings at Firs Street; however, there is a significant woodland buffer between residences and the proposed development site. Overall, this option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a large capital investment resulting in a significant positive effect on the local economy associated with potential employment opportunities and supply chain benefits. However, the option would require the laying of pipeline along roads which could increase congestion and disruption/driver delay. Any effects on the local transportation network, however, would be temporary and felt in the short term only. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

The Sankey Brook abstraction point / WTW site do not contain any heritage features although there are approximately six listed buildings and a scheduled monument situated along the proposed pipeline route. Excavation of the pipeline may temporary impact the settings of these assets and therefore the option has been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations and are located within urban and semi-rural areas. The construction of the abstraction site and development south of the Manchester Ship Canal (pipeline / WTW) may result in temporary adverse effects on the local landscape character and visual amenity during construction. Overall, a minor negative effect has been identified in respect of Objective 12.

Operation

The operation of this option would involve the abstraction of 10Ml/d from Sankey Brook. This could have effects on the Mersey Estuary SPA/Ramsar/SSSI, approximately 9.2km downstream from the Sankey Brook abstraction point, due to reduced river flow from increased abstraction. The EA would need to confirm that water is available for use in order to issue a new abstraction licence. HRA Screening has concluded that possible effects are avoidable with established operational mitigation (e.g. licence controls). The option has therefore been assessed as having an uncertain though potentially negative effect on biodiversity at this time.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 10 Ml/d from Sankey Brook which has been found to have available water at all flows. The WFD Assessment states, however, that the abstraction of 10 Ml/d is of moderate volume, and could consequently impact the hydrological regime of lower part of Sankey Brook. This option has therefore been assessed as having a negative effect on Objective 3, although some uncertainty remains.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 365 kWh/Ml, generating 56 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

Operation of the scheme would not adversely affect human health. The increased capacity of 10 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on cultural heritage assets.

The operational sites would not be within or in proximity to any landscape designations. The new Sankey Brook abstraction and Hill Cliffe WTW would introduce new above ground infrastructure on greenfield sites; however, the scale of development at Sankey Brook would be minor and have a negligible impact on the landscape character of the area whereas the WTW would be within the operational context of the adjacent treated water storage site. Additionally, the Hill Cliffe site enjoys a significant quantity of woodland buffer on its boundaries that would help mitigate any potential impact associated with the introduction of the new WTW. The new raw water main connecting Sankey Brook abstraction point to the new WTW/treated water storage facility would be below ground and therefore would not have an impact on the local landscape. Overall, the option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR009: River Rawthey to Watchgate	Construction	-	-	0	-	-	--	0	++/-	0	--	-	-
	Operation	-/?	0	-/?	0	0	-	++/?	++/?	0	-	0	-

Construction

This option would involve the development of a new abstraction intake on the River Rawthey near Sedbergh in order to abstract and transfer an average of 15 Ml/d (it should be noted that 10 Ml/d and 20 Ml/d sub-options are also under consideration) to Watchgate WTW via a new raw water main (c15.5kmin length). The exact abstraction volume has not yet been determined although it is assumed that 20 Ml/d will be the maximum amount. Ancillary infrastructure including two new pumping stations would also be implemented to facilitate the transfer of water to Watchgate WTW. Modifications to Watchgate WTW would be necessary to accommodate the increased raw water input from this option.

The closest European designated sites to this option are the Morecambe Bay Pavements SAC (assessed as not vulnerable to construction phase impacts) and the River Kent SAC – River Kent and Tributaries SSSI. Specifically, the proposed pipeline route is likely to cross the River Mint, a component of the River Kent SAC/SSSI, at two different locations. The River Kent SAC/SSSI is designated for species including white-clawed crayfish and fresh water mussels. HRA Screening concluded that adverse construction effects on the River Kent SAC/SSSI and other watercourse crossings could be avoided with established avoidance and mitigation measures (e.g. timing works to avoid fish migration periods; construction best practice). More broadly, the construction of the overall scheme would occur in a predominantly rural greenfield setting and works may therefore cause short-term, localised disturbance to habitats and species within close proximity of the proposed pipeline route/development sites. Overall, this option has been assessed as having a negative effect on Objective 1.

Development associated with this option would consist primarily of pipeline excavation which would be routed through Grade 3 agricultural land near the Rawthey abstraction point as well as Grade 4/5 classified land. It should be noted that excavated land would be reinstated following the completion of construction thus disruption to agricultural operation would be temporary. The new abstraction infrastructure on the River Rawthey and the pumping stations would introduce new above ground infrastructure on previously undeveloped greenfield sites though the structural footprint of these components would be minor. Any works to upgrade Watchgate WTW, meanwhile, would be within an existing operational site. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point on the River Rawthey in addition to sections of the proposed transfer pipeline which either cross or are within proximity to the Lambrigg Beck, River Mint, Deep Gill, Davy Bank Wheel, and the River Lune are within Flood Zone 3. In consequence, construction/excavation, especially at river crossings, may be liable to flooding during the construction period (depending on the timing of installation). The option would be unlikely to increase flood risk elsewhere. Overall, a minor negative effect has been identified in respect of Objective 4.

Construction would generate a total of 19,230 vehicle movements during the 1.9 year construction period from which emissions, in conjunction with plant and machinery operation, may have negative effects on local air quality.

The option would generate 17,519 tCO_2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be noise/vibration disturbance and air quality impacts associated with pipeline excavation which could affect residential receptors around southwestern Sedbergh, Marthwaite, Beckfoot, Grayrigg and Patton Bridge and residential properties and farmsteads along the proposed pipeline route. However, due to the rural setting and temporary nature of these works, this option has been assessed as having a neutral effect on Objective 7.

The construction of the option would represent a substantial capital investment that could create a number of jobs resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the laying of c15.5km of new pipeline could adversely impact the local road network (congestion/delay), although any effects would be temporary. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

There are approximately 20 Grade II / II* listed buildings under 500m from the general area of the scheme including Garth's Farmhouse (40m), Sunny Bank Milestone (77m), Lune Viaduct (78m), and Lowgill Viaduct and Packhorse Bridge (28m). Although it is expected that mitigation measures implemented during construction will prevent any significantly negative effect on the integrity of these listed buildings, the proximity between these assets and the works suggests that there could be a temporary impact on setting. Overall, this option has been assessed as having a minor negative effect on Objective 11.

Construction of the abstraction infrastructure and approximately 7.3km of pipeline would be situated within the Yorkshire Dales National Park. Although pipeline excavation would be temporary, development could adversely impact the landscape character of the National Park in the short term. Furthermore, a pumping station and approximately 2km of pipeline originating from the abstraction site would be directly adjacent to the Lake District National Park and World Heritage Site boundary. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

The operation of this option would involve the abstraction of 15Ml/d from the River Rawthey. This could have effects on the Lune Estuary SSSI and Morecambe Bay SAC/SPA/Ramsar, which are approximately 40km downstream from the proposed abstraction point, due to reduced flow. The relative distance between these sites, however, may help avoid any adverse impacts in addition to significant flow accretion from various intervening tributaries which feed into the River Lune. Notwithstanding this, reduced flow within the River Rawthey may result in adverse localised effects on in-river habitats, local and migratory wildlife, e.g. salmon and sea trout, and further downstream sites. HRA Screening has concluded that possible effects are avoidable with established operational mitigation (e.g. licence controls) though the EA would need to confirm that water is available for use in order to issue a new abstraction licence. The option has therefore been assessed as having an uncertain though potentially negative effect on biodiversity at this time.

There would be no operational effects on soils/land use.

The option would result in abstraction of approximately 15 Ml/d (10 and 20 Ml/d variants) from the River Rawthey which has water available at high flows with limited availability at medium and low flows. Consequently, the WFD Assessment has reported that abstraction at this volume, particularly at 20 Ml/d, could have an impact on the hydrological regime of the river thus this option has been assessed a having a negative effect on Objective 3, although some uncertainty remains.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 1,516 kWh/Ml, generating 620 tCO_2e/a. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The potential reduction of flow within the River Rawthey may adversely affect native and migratory fish species which could subsequently impact recreational angling, although this remains uncertain. Overall, the increased capacity of 15 Ml/d (10 - 20 Ml/d variants) would help ensure a continual supply of clean

drinking water, generating a potential significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing. It should be noted that some uncertainty regarding the magnitude of benefit on Objectives 7 and 8 remains as the exact option capacity has yet to be determined.

The option would not affect water efficiency.

There would be no operational effects on cultural heritage assets. As noted above, the scheme would require approximately 7.3km of pipeline within the Yorkshire Dales National Park and 2km of pipeline adjacent to the Lake District National Park and World Heritage Site, however, the new water main would be below ground and therefore would not have any lasting impact on the special qualities of these sites. The new River Rawthey abstraction site and ancillary infrastructure (pumping stations) would introduce new above ground infrastructure on rural greenfield sites both within and outside of the national parks; however, the footprints of these components would be very small. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR012: Borrow Beck Reservoir	Construction	--/?	--	0	--	-	--	-	++/-	0	--	--	--
	Operation	--	0	--	-	0	-	++	++	0	-	0	--

Construction

This option would involve the development of a new impounding reservoir in Borrow Beck between Shooter Howe and Belt Howe. A new pumping station would be installed to facilitate the transfer of raw to the inlet at Watchgate WTW via a new raw water main (circa 6.5km in length). The option has a design capacity of 60 Ml/d.

There are no designated nature conservation sites situated within or directly proximate to the reservoir site. The HRA concludes that, in view of the scale of works, it is unlikely that the scheme has the potential to affect sites within separate catchments though there would be a small risk of air quality deterioration during construction which could affect some habitats within, for example, the Lake District High Fells SAC, the Asby Complex SAC, Bretherdale Meadows SSSI, Borrow Beck Meadows SSSI and Tebay Road Cuttings SSSI or the North Pennine Dales Meadows SAC/SSSI due to their proximity (e.g. dust deposition; increases in NOx deposition). The pipelines would need to cross Bannisdale Beck, a component of the River Kent and Tributaries SAC/SSSI, and although this would probably use an existing road crossing, it would need to be carefully managed through mitigation measures to ensure no significantly adverse effects. The WFD Assessment has concluded that construction of the reservoir would result in temporary habitat changes (variations in the hydrological regime, river continuity and morphological conditions) due to the diversion of the Borrow Beck during construction period. There would also be potential for suspended sediment to enter the Borrow Beck and affect the ecology (i.e. smothering, reduction in light) including fish, macrophytes/phytobenthos and invertebrates though site level mitigation should prevent significant effects. Overall, significant effects resulting from construction are likely to be avoidable with established measures although impacts cannot be excluded at this stage and further identification of bespoke mitigation measures or amendments to scheme design at the plan level may be required.

Construction would involve the loss of a significant area of greenfield land (although this would be of relatively poor (Grade 5) agricultural land quality) as well as an existing farm. The proposed raw water main would be routed through Grade 4/5 agricultural land which would be reinstated following the completion of construction. Overall, this option has been assessed as having a significant negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The reservoir and proposed pipeline route would be located within Flood Zone 3. Construction could therefore be liable to flooding depending on the timing of works and in view of the scale of construction activity associated with this option, a significant negative effect has been identified in respect of Objective 4.

There could be traffic congestion during the construction period (particularly along the A6, A685 and the local roads leading to the proposed reservoir site) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 36,798 vehicle movements during the 2.6-year construction period).

The option would generate 17,302 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

Air quality and noise impacts would have the potential to cause increased nuisance and disruption to the limited number of residential properties in the area and recreational users and the option would require footpaths along the bottom of the valley to be re-routed during construction. Kayaking opportunities in the area would also be affected. This has been assessed as having a minor negative effect on health.

The construction of the option represents a large capital investment that has been assessed as having a significant positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. However, construction activity including the laying of new pipework along/adjacent to local roads and HGV movements could cause congestion/driver delay. Further, there would also be permanent adverse impacts associated with the loss of agricultural land. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

Construction of the proposed reservoir would result in the loss of Low Borrowdale Farm House Grade II Listed Building whilst the settings of a small number of listed buildings along the proposed pipeline route may be temporarily affected by construction works. Overall, this option has been assessed as having a significant negative effect on Objective 11.

The proposed reservoir is located within the Lake District National Park / UNESCO WHS thus works of this scale are expected to have a significant negative effect on landscape character and the visual amenity of recreational receptors. Consequently, the option has been assessed as having a significant negative effect on Objective 12.

Operation

The HRA concludes that operation of a new impounding reservoir in Borrow Beck would not result in any clear effects or LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.). The creation of the Borrow Beck Reservoir would result in long term local habitat changes from the flooding of the Borrow Beck valley though this may be partly mitigated by fish passes. In itself, the new reservoir and its surroundings might help contribute to the creation of new habitat, although this would depend on its design and management, and should be considered during design if the option is taken forward. Furthermore, long term changes to the hydrological regime of the Borrow Beck will result from the presence of the reservoir; specifically, both high and low flows will be changed in addition to changes to the beck's morphological conditions from variations to its sediment transport regime. River continuity will be interrupted by the embankment. On balance, the operation of this option has been assessed as having a significant negative effect on local biodiversity at this stage regarding the alternation and potential loss of established ecosystems within the proximate area.

There would be no operational effects on soils/land use (land take and associated effects on agricultural land uses have been assessed at the construction stage).

The option would result in a decrease of water flow in Borrow Beck and the River Lune. The abstraction of water would take place from the Middle and Upper Lune which has a water availability status of 'no water available' and indicates that there would be no water available for further licensing at low flows. However, it is assumed that compensation flows would be maintained. The WFD Assessment concludes that long term water quality changes within Borrow Beck are likely to occur due to the stilling and storage of water in the reservoir. Overall, the construction of a new reservoir may result in the re-designation of the Borrow Beck as a highly-modified water body for water supply such that it is unlikely that the reservoir could be constructed/operated without a deterioration of status in one or more elements. At this stage, the option has been assessed as having a significant negative effect on Objective 3.

There would be no operational effects on air quality.

Operational energy demand would be 756 kWh/Ml, generating 511 tonnes CO_2e/a. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. It is assumed that operation may have a negative effect on existing recreational activities in the form of fishing and angling established within the surrounding Borrow Beck area due to change in water levels; however, the option may create and/or provide alternative recreational opportunities, e.g. fishing, associated with the new reservoir. The increased capacity of 60 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting

economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing. Permanent adverse economic impacts associated with the loss of agricultural land have been assessed at the construction stage.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

As noted above, the proposed reservoir would be located within the Lake District National Park / UNESCO WHS and would be of a scale likely to generate a significant negative effect on landscape character and the visual amenity of recreational receptors.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR026a: River Ribble Support to Stocks Reservoir	Construction	--	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	-	0	-	+/?	+	0	-	0	-

Construction

This option would involve the development of a new abstraction/intake point on the River Ribble near Clitheroe in order to abstract and transfer an average of 6.67 Ml/d (range of 5 – 10 Ml/d to be determined) to Stocks impound reservoir via a new raw water main (c15km in length). Ancillary infrastructure will also be installed to facilitate the transfer of water to Stocks impound reservoir including a new pumping station and a new break pressure tank. Currently, treatment work modifications to the existing Hodder WTW are not considered necessary to accommodate the increased raw water input from this option.

The closest European designated sites to this option are the North Pennines Dales Meadows SAC and the Bowland Fells SPA. HRA Screening has concluded that there are no immediate impact pathways to these sites if established scheme-level avoidance and/or mitigation measures are utilised. Approximately 4km of the proposed pipeline would be routed within the area between Slaidburn and Stocks impounding reservoir which includes several SSSIs (including Barn Gill (0.6km), Standridge Farm Pasture (1km), Field Head Meadow (0.7km), Langcliff Cross Meadow (1km), and Myttons Meadows (1.4km). However, given the type/scale of development and the distance to these sites, it is not expected that the works would result in any adverse effects on these sites. The Bell Sykes Meadows SSSI is directly traversed by the proposed pipeline and in consequence, there is the potential for significant adverse effects on this protected site. Works on the River Ribble could also affect the biodiversity it supports, although this is expected to be managed by implementation of best practice construction mitigation measures. Overall, this option has been assessed as having a significant negative effect on Objective 1.

The proposed pipeline would be routed through approx. 7km of Grade 3 agricultural land with the remaining length of the pipeline situated within Grade 4/5 classified land. It should be noted that excavated land would be reinstated following the completion of construction thus disruption to agricultural operation would be temporary. The new abstraction infrastructure on the River Ribble, pumping station and the break pressure tank would introduce new above ground infrastructure on previously undeveloped sites though the footprints of these components would be minor and not expected to significantly impact land use or quality. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Sections of the proposed transfer pipeline and pumping station would either cross or be routed within or in proximity to Flood Zone 3s. In consequence, works, especially at river crossings, may be liable to flooding during the construction period (depending on the timing of installation). The option would be unlikely to increase flood risk elsewhere.

There may be impacts from traffic congestion during the construction period (particularly along the B6243, B6478 Rabbit Lane, Cross Lane, The Skaithe, and local roads/paths within the vicinities of the proposed abstraction point, pipeline route, and ancillary infrastructure) which could have a negative effect on local air quality (there would be an estimated 16,257 vehicle movements during the 2 year construction period). This has been assessed as having a negative effect on Objective 5.

The option would generate 14,827 tCO_2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be noise/vibration disturbance and air quality impacts associated with pipeline excavation which could affect residential receptors around Bashall Town, Bashall Eaves and eastern Slaidburn as well as the adjacent residential properties and farmsteads along the proposed pipeline route. The transportation of equipment/material could further intensify the potential risk of nuisance and disturbance, especially for those properties situated along primary transportation routes. Overall, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a large capital investment that could create a number of jobs resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the laying of 15km of new pipeline could adversely impact the local road network (congestion/delay), although any effects would be temporary. Overall, the option has been assessed as having a mixed significant positive and negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

The proposed pipeline route runs directly adjacent to the scheduled monument Ashnott lead mine and lime kiln such that construction works could adversely impact the setting of this asset (it is not expected that the integrity of the monument will be compromised in the longer term). There are approximately 15 Grade II / II* listed buildings under 500m from the general area of the scheme with six assets under approximately 100m including Moss Barn (15m), Talbot Bridge and House (50m), Long Stripes Farmhouse (28m), Holmhead Bridge (59m), Hammerton Hall (68m), and Foulscales (55m). Although it is expected that mitigation measures implemented during construction would help prevent any significantly negative effects on these assets, there may be impacts on their setting. Overall, this option has been assessed as having a negative effect on Objective 11.

The proposed pipeline route runs for approximately 11km within the Forest of Bowland AONB. Although pipeline excavation would be temporary, development could adversely impact the landscape character of the AONB. Construction of components outside of the AONB such as the abstraction infrastructure, pumping station, and the remaining length of pipeline could temporarily disrupt the rural setting of the wider local landscape. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

The operation of this option would involve the abstraction of 6.67Ml/d from the River Ribble. This could have effects on Ribble and Alt Estuaries SPA / Ramsar, which are approximately 30km downstream from the proposed abstraction point, due to reduced flows. The relative distance between these sites would help avoid any adverse impacts in addition to flow accretion from various intervening tributaries which feed into the River Ribble. HRA Screening has concluded that possible effects are avoidable with established operational mitigation (e.g. licence controls) though the EA would need to issue a new abstraction licence. There is, however, some uncertainty regarding whether the abstraction would negatively impact the local River Ribble ecology due to a change in flow regime, e. g.adverse impacts on migratory fish species such as salmon and trout. The option has therefore been assessed as having an uncertain though potentially negative effect on biodiversity at this time.

There would be no operational effects on soils/land use.

The option would result in abstraction of an average of 6.67 Ml/d (range of 5 – 10 Ml/d to be determined) from the River Ribble which has been identified as having water available at all flows. Notwithstanding this, the WFD Assessment has concluded that operation of the scheme may have a moderate impact on the hydrological regime of the River Ribble thus this option has been assessed as having a negative effect on Objective 3, although some uncertainty remains.

The abstraction site and pumping station would be located within Flood Zone 3 and therefore may be liable to flooding during operation. However, operation of the scheme is not expected to increase the risk of flooding elsewhere. Overall, the option has been assessed as having a minor negative effect on Objective 4.

There would be no operational effects on air quality.

Operational energy demand would be 1,100 kWh/Ml, generating 126 tCO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The potential reduction of flow within the River Ribble may adversely affect native and migratory fish species which could impact recreational angling, although this remains uncertain. The increased capacity of an average of 6.67 Ml/d (range of 5 – 10 Ml/d to be determined) would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on cultural heritage assets. The new water main would be below ground and therefore would not have any impact on landscape or visual amenity. The new Clitheroe abstraction site and ancillary infrastructure (pumping station and breaking tank) would introduce new above ground infrastructure on rural greenfield sites both within and outside of the Forest of Bowland AONB. However, the footprints of these scheme components would be very minor and therefore a minor negative effect has been identified in respect of Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR037a: Haweswater Reservoir (Raise Embankment Structure)	Construction	--/?	+	0	--	-	-	-	++/-	0	-	-	--
	Operation	--	0	0	0	0	-/?	++	++	0	-/?	0	-

Construction

This option would involve the raising of Haweswater impound reservoir Dam by 0.5m to increase water storage. It is assumed that an increase of 0.5m would result in an increased storage capacity of 1,950Ml with a use benefit of 11.5 Ml/d. Ancillary refurbishments and structural modifications would be required to accommodate the increased storage capacity of the reservoir including: raising of the reservoir's inlet tower and access bridge; installation of a new steelwork platform at the spillway; increase in the size of the existing stilling pools downstream of the dam; a new road bridge; minor perimeter works to the reservoir (7.5km); and remedial works to the proposed site compound (1000m^2).

The western and eastern boundary of the reservoir falls within the Naddle Forest SAC/SSSI designation. There is an additional SSSI (Blea Water) 500m to the south-west, from which water flows into the reservoir. Furthermore, the land to the immediate east of the reservoir is a RSPB Reserve. The WFD Assessment has concluded that expansion of the reservoir could potentially introduce suspended sediment into the waterbody thus impacting established ecological features (i.e. smothering, reduction in light) including fish, macrophytes/phytobenthos and invertebrates. Any impacts to the reservoir would, however, be temporary and restricted to the downstream section of the reservoir, close to the embankment. Haweswater Beck, downstream of the dam is a tributary of the River Eden SAC and this site could also be vulnerable to adverse effects from the introduction of suspended sediments, although it is assumed that impacts could be avoided with bespoke mitigation measures and scheme design amendments. Overall, this option has been assessed as having a significant negative effect on Objective 1, although this remains uncertain as construction will require the identification and application of bespoke mitigation measures.

Construction would take place on existing dam infrastructure which has been assessed as having a positive effect on land use/soils.

The WFD Assessment has noted that the initial flooding of the new reservoir volume may result in a "pulse" of poor quality water within Haweswater Reservoir whereas associated sediment release may have a short term impact on the morphological conditions of Haweswater Beck. It is expected that best practices will be adhered to (compensation flows from the reservoir would be maintained during construction) and mitigation implemented (such as dust suppression, soil containment and emergency response procedures) such that no long term or extensive changes to the hydrological regime of the Haweswater Beck or Haweswater Reservoir are expected. Overall, this option has been assessed as having a neutral effect on Objective 3.

Construction would not cause or exacerbate flooding in the area although the site itself and its waterway network are within a Flood Zone 3, and therefore construction may be liable to flooding depending on the timing of work.

The option would generate 18,216 vehicle movements during the 2 year construction period from which emissions, in addition to plant and machinery operation, would have negative effects on local air quality.

The option would generate 473 tCO_2e which, together with resource use and waste generation, has been assessed as having a minor negative effect on Objectives 6 and 10.

It is expected that there would be a temporary restriction of use/access for recreational activities such as walking and fishing during the construction period. There may also be noise/vibration disturbance and air quality impacts (dust) associated with construction and the transportation of equipment/material on residential receptors within proximity/ along the route to the reservoir; specifically, Burnbanks, Bampton, and surrounding farmsteads. These effects would, however, be short term and generally limited to working hours. It is likely that existing footpaths would have to be relocated to facilitate the rise in water level although alternative routes would be provided such that the effects on recreational users of the reservoir would be negligible. Overall, the option has been assessed as having a minor negative effect on health.

Construction would require a large capital expenditure which could result in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The local tourism sector may experience minor losses from the temporary restriction of recreational activities at the reservoir; however, effects are likely to be negligible. The transportation of equipment/material may result in adverse impacts on the local transportation network (delay/congestion) though this would be temporary. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a negative effect on Objective 10.

There are several scheduled monuments on site or in close proximity (Castle Crag Hillfort, Romano-British farmstead, standing stones, cairns, Settlements) and a Grade II Listed Building (Naddle Old Bridge) approximately 1km to the west of the dam wall. Construction activity may therefore temporarily affect the settings of these assets.

The reservoir is located within the Lake District National Park and World Heritage Site (WHS) and in consequence, there is potential for significant landscape impacts during construction, although it is noted that effects may be mitigated by local topography and woodland to the east of the dam wall.

Operation

The operation of the scheme would raise the reservoir water level by 0.5m. The WFD Assessment concludes that it is unlikely that enlargement of the reservoir would adversely impact aquatic biology and furthermore, it is assumed that current compensation flow releases, fish pass arrangements, and the characteristics of the banks of the reservoir would be maintained. The most direct impact would be on the Naddle Forest SAC. Precise effects cannot be determined without micro-topographical analysis, but a 0.5m increase in levels would likely reduce the SAC area by at least 0.13 ha and potentially more depending on local topography. Furthermore, HRA Screening has concluded that this loss of land within the Naddle Forest would potentially be a significant adverse effect on the SAC and more so, unavoidable. Operation of the option may also impact the River Eden SAC through any changes to frequency of reservoir spill to Haweswater Beck; specifically, part of the upper reaches of the Haweswater Beck will be flooded due to the increased volume of the reservoir which would result in changes to habitats in the effected reach. However, this is expected to be a small reach of water course, and an extension of the existing reservoir habitats so a deterioration of the status of the WFD water body is unlikely. It is also assumed that current compensation flow releases and fish pass arrangements would be maintained within the beck. Should this option be taken forward to the preferred options stage, scheme level investigations and appropriate assessment would need to be undertaken. Overall, the option has been assessed as having a significant negative effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The WFD Assessment concludes that it is unlikely that enlargement of Haweswater would adversely impact the hydromorphology, chemical, and physiochemical elements of the reservoir thus operation should not cause a deterioration in WFD status. As previously noted, the upper reaches of the Haweswater Beck will be flooded due to the increased volume of the reservoir which is expected to change the hydromorphology, chemical and physiochemical elements in the effected reach. This is expected, however, to be a small reach of water course, and more so, an extension of the existing reservoir such that a deterioration of the status of the WFD water body is unlikely. On balance, this option has been assessed as having a neutral effect on Objective 3.

The option is not expected to cause or exacerbate flooding in the general area or further downstream.

There would be no operational effects on air quality.

Operational energy demand is currently unknown although negative effects on Objectives 6 and 10 are predicted.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. Although the potential yield benefit has not yet been calculated for this option, it is estimated that 11.5 Ml/d would be achieved that would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The reservoir is located within the Lake District National Park and WHS. The option would involve a higher dam wall and water level in the reservoir but would not be expected to have significant adverse effects on the local landscape in the context of the existing reservoir and associated infrastructure.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR037b: Haweswater Reservoir (Raise Embankment Structure)	Construction	--/?	+	0	--	-	-	-	++/-	0	-	-	--
	Operation	--	0	0	0	0	-/?	++	++	0	-/?	0	-

Construction

This option would involve the raising of Haweswater IR Dam by 1.0m to increase water storage. It is assumed that an increase of 1.0m would result in an increased storage capacity of 3,900Ml with a use benefit of 23 Ml/d. Ancillary refurbishments and structural modifications would be required to accommodate the increased storage capacity of the reservoir including: raising of the reservoir's inlet tower and access bridge; installation of a new steelwork platform at the spillway; increase in the size of the existing stilling pools downstream of the dam; a new road bridge; minor perimeter works to the reservoir (7.5km); and remedial works to the proposed site compound (1000m^2).

The western and eastern boundary of the reservoir falls within the Naddle Forest SAC/SSSI designation. There is an additional SSSI (Blea Water) 500m to the south-west, from which water flows into the reservoir. The land to the immediate east of the reservoir is an RSPB Reserve where Golden Eagles have been recorded. Haweswater Beck is a tributary of the River Eden SAC, however, impacts as a result of construction activities can be avoided with established measures although the proximity of the SAC will require that this be clearly established at the scheme level. The most direct impact would be on the Naddle Forest SAC regarding the increased reservoir levels. Precise effects cannot be determined without micro-topographical analysis, but a 0.5m increase in levels at minimum would likely reduce the SAC area by at least 0.13 ha, and potentially more at 1m depending on local topography as reported by the HRA. Should this option be taken forward to the preferred options stage, impacts on those features of designated sites that may be significantly affected will be considered in more detail and mitigation measures identified. There is the potential for suspended sediment to enter Haweswater Reservoir and Haweswater Beck which would affect the ecology (i.e. smothering, reduction in light) including fish, macrophytes/phytobenthos and invertebrates; however, any impacts would be temporary, and potentially negligible under established mitigation measures. Furthermore, no long term or extensive changes to the hydrological regime of the Haweswater Beck are expected, as it is assumed that compensation flows from the reservoir would be maintained during construction. Overall, this option has been assessed as having a significantly negative effect on Objective 1 though this remains uncertain.

Construction would take place on existing dam infrastructure which has been assessed as having a positive effect on land use/soils.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area although the site itself and its waterway network are within a Flood Zone 3, and therefore construction may be liable to flooding depending on the timing of work.

The option would generate a large number of vehicle movements (18,682) during the 2 year construction period which, in addition to emissions from plant and machinery, would have minor negative effects on local air quality.

The option would generate 473 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a negative effect on Objectives 6 and 10.

It is expected that there would be a temporary restriction of use/access for recreational activities such as walking and fishing during the construction period. There may also be noise/vibration disturbance and air quality impacts (dust) associated with construction and the transportation of equipment/material on residential receptors within proximity/ along the route to the reservoir; specifically, Burnbanks, Bampton, and surrounding farmsteads. These effects would, however, be short term and generally limited to working hours. It is likely that existing footpaths would have to be relocated to facilitate the rise in water level although alternative routes would be provided such that the effects on recreational users of the reservoir would be negligible. Overall, the option has been assessed as having a minor negative effect on health.

Construction would require a large capital expenditure which could result in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The local tourism sector may experience minor losses from the temporary restriction of recreational activities at the reservoir; however, effects are likely to be negligible. The movement of material/equipment could adversely impact the local road network (congestion/delay) although any effects would be temporary and be felt in the short term only. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a negative effect on Objective 10.

There are several scheduled monuments on site or in close proximity (Castle Crag Hillfort, Romano-British farmstead, standing stones, cairns, Settlements) and a Grade II Listed Building (Naddle Old Bridge) approximately 1km to the west of the dam wall. Construction activity may therefore temporarily affect the settings of these assets.

The reservoir is located within the Lake District National Park / UNESCO WHS, and in consequence, there is potential for significant landscape impacts during construction, although it is noted that effects may be mitigated by local topography and woodland to the east of the dam wall.

Operation

The operation of the scheme would raise the reservoir water level by 1.0m. Assuming that current operation would not be altered (compensation releases etc. maintained), adverse effects on the River Eden SAC would not necessarily be expected although there may be changes in spill frequency particularly during the filling period. Nonetheless, an increase at a minimum of 0.05m would likely reduce the Naddle Forest SAC area by at least 0.13 ha and potentially more depending on local topography which is expected to be a significant effect, potentially adverse, and unavoidable. A greater degree of effect would be assumed at the proposed 1m increase. Furthermore, rising water levels and the subsequent relocation of paths, access routes, and ancillary infrastructure could potentially encroach on the border of Naddle Forest which could adversely impact traditional feeding/nesting habitats of various breeding bird species in addition to red/roe deer, pine martens, red squirrels within the vicinity of the site. Overall, the option has been assessed as having a significantly negative effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The flows in/out of the reservoir are not expected to significantly change during operation although part of the upper reaches of the Haweswater Beck will be flooded by the increased volume of the reservoir. However, this is expected to be a small reach of water course (an extension of the existing reservoir habitats) so a deterioration of the status of the WFD water body is unlikely. Furthermore, it is assumed that current compensation flow releases and fish pass arrangements would be maintained. Overall, this option has been assessed as having a neutral effect on Objective 3.

The option is not expected to cause or exacerbate flooding in the general area or further downstream.

There would be no operational effects on air quality.

Operational energy demand is currently unknown although negative effects on Objectives 6 and 10 are predicted.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. Although the potential yield benefit has not yet been calculated for this option, it is estimated that 23Ml/d would be achieved that would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The option would involve a higher dam wall and water level in the reservoir but would not be expected to have significant adverse effects on the local landscape in the context of the existing reservoir and associated infrastructure.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR039a: River Eden (Temple Sowerby) to Watchgate	Construction	--/?	0	0	-	--	--	-	++/--	0	--	-	-
	Operation	--/?	0	--	-	0	-	++/?	++	0	-	0	-

Construction

This option would involve the development of a new abstraction intake and pumping station on the River Eden within the vicinity of Temple Sowerby in order to abstract and transfer up to 50 Ml/d of water to a new upfront WTW situated on the existing Watchgate WTW site via a new 46.9km raw water main. It should be noted that the exact quantities available for abstraction will need to be confirmed with the Environmental Agency, e.g. a 25 Ml/d variant is under consideration.

The proposed abstraction infrastructure and pumping station would be directly adjacent to the River Eden SAC/SSSI. Construction could pose the risk of introducing pollution/debris into the River Eden which could adversely impact European designated species included in the site's citation, e.g. white-clawed crayfish, Atlantic salmon, lamprey species, and otters, although site specific mitigation and established best practice is expected to prevent any significant effects. The proposed abstraction infrastructure is also 1.7km from the Temple Sowerby Moss SSSI; however, due to the distance from the site, it is unlikely that construction would result in any adverse effects on this SSSI. The proposed pipeline route would directly traverse the River Eden SAC through crossings of the River Eden and River Leith in addition to 13 other watercourse crossings. This could adversely impact aquatic habitats and species. The excavation of the pipeline route would also cross approx. 5.7km of the Crosby Ravensworth Fell – Asby Complex SAC which would pose a significant risk to the health and integrity of its lowland hearth environs and associated moorland breeding avifauna. HRA Screening has noted that route modification would be essential in supporting this scheme as a preferred option. The excavation route would be close to a diverse range of other conservation sites ranging from approx. 3.1km (Orton Pastures SSSI), Langdale-Bowerdale & Carlin Gill SSSI, Bretherdale Meadows SSSI – North Pennine Dales Meadows SAC (2.6km), Hollin Hill SSSI, Raisheck Meadows SSSI, Shap Fells SSSI – Lake District High Fells SAC (1.1km), and Wet Sleddale Meadows SSSI. It is not expected that excavation works would result in any significantly adverse effects on the other designated or local biodiversity supported by these sites beyond temporary noise disturbance and minor air quality impacts (dust) due to relative distance and/or lack of impact pathways. Construction of the new WTW at the existing Watchgate WTW site would be contained within the existing site footprint which is predicted to minimise any potentially adverse impacts such as noise disturbance. In general, the scheme is situated within a rural/semi-rural setting such that construction may cause short-term disturbance to proximate local habitats and wildlife throughout the scheme's footprint. Overall, this option has been assessed to have a significant negative effect on Objective 1 though uncertainty remains, as there is the potential for avoidance and mitigation of the effects through the use of bespoke mitigation measures or amendments to scheme design.

Development of the new abstraction infrastructure and pumping station would result in the permanent land-intake of Grade 3 agricultural land; however, the minor structural scale of these components suggests that land consumption would be minor. The construction of the new Watchgate WTW would be contained within the existing WTW site footprint such that new infrastructure should not significantly impact land/soil quality (depending on scale). The proposed excavation route would traverse through approx. 12.2km of Grade 3 agricultural land with the remaining route situated within Grade 4/5 agricultural land which has been assessed as having a negligible effect on land-use and soil. Nonetheless, all excavated land would be reinstated following the construction period. On balance, this option has been assessed as having a neutral effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction infrastructure and pumping station would be situated within a Flood Zone 3 emerging from the River Eden whilst the proposed raw water main would traverse through Flood Zones 2/3 originating from 8 different river systems; consequently, construction activity may be liable to flooding (depending on the timing of works) and a negative effect has therefore been identified in respect of Objective 4. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

There could be traffic congestion during the construction period (particularly the along M6, A6, A66, A685, B6412, B6260, B6261, B6257, and the local road network overlaying or adjacent to the proposed pipeline route and abstraction/WTW site) which may have a negative effect on local air quality (there would be an estimated 87,121 vehicle movements during the 2.6 year construction period). This has been assessed as having a significant negative effect on Objective 5.

The option would generate 96,032 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, the proposed works could result in a temporary disruption of use or loss of amenity to the grounds proximate to construction that host recreational activity (hiking/angling/canoeing) and sport such as the Tebay football pitches. Due to the rural/semi-rural greenfield setting of scheme, the cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material may adversely impact both residential dwellings, farmsteads and communities such as Culgaith, Morland, and Tebay. Furthermore, the proximity of the excavation route to these community areas suggests that there may be a loss of amenity to institutional and community facilities such as Tebay Primary School and Morland Area Primary School due to noise disturbance. Overall, this option has been assessed as having a negative impact on Objective 7.

The construction of the option would represent a substantial capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. However, pipeline works (where these cross or are within roads) and associated vehicle movements could affect a number of roads including, in particular, the M6, A66 and A6 as well as local roads, although any effects (such as congestion and driver delay) would be temporary. Additionally, the proposed excavation route would traverse a segment of railway which could result in a temporary disruption of service. On balance, the option has been assessed as having a mixed significant positive and significant negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy consumption and generate waste which has been assessed as having a significantly negative effective on Objective 10.

The proposed abstraction/pumping station site is within approximately 346m of Winderwath Romano-British farmstead and length of Roman Road scheduled monument in addition to seven other scheduled monuments within 500m from the proposed excavation route; specifically, the Low Borrowbridge Roman Fort would be less than 50m from excavation. Additionally, there are approximately 36 Grade II/II* listed buildings within the vicinity of the scheme including ten buildings under 100m. Although it is expected that mitigation measures during construction would help prevent any significant adverse effects on these assets, there is the potential for short term, adverse effects on their setting. The remaining Listed Buildings and scheduled monuments (>100m) may experience a minor loss of visual amenity regarding their settings though the route does benefit from scattered woodland buffer which may screen visual impacts to heritage settings. Overall, this option has been assessed as having a negative effect on Objective 11.

Neither the abstraction/pumping station site nor the existing WTW site are within or in proximity to any landscape designations whereas approximately 12.5km of excavation would be directly adjacent to the Yorkshire Dales National Park and a further 3km routed within the Lake District National Park and World Heritage Site. Should construction occur within the peak summer tourist months, excavation works could be perceived by recreational and residential receptors as adversely altering the protected landscape and its setting regarding the loss of visual and landscape amenity. Overall, adverse effects resulting from excavation would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). The abstraction infrastructure and pumping station would be situated within a greenfield site adjacent to the River Eden which would be visible to proximate recreational users of the river systems in addition to recreational walkers though the scale of construction is expected to be minor. It is not expected that the construction of the new WTW would have any adverse impact on the local setting or the wider landscape character due to its confinement within the existing WTW site footprint. In general, development would be within a rural/semi-rural setting and in consequence, there remains the potential for adverse effects on local landscape character and the visual amenity of residential receptors along the pipeline route. Consequently, this option has been assessed as having a negative effect on Objective 12.

Operation

The operation of this option would involve the abstraction of 25 or 50 Ml/d from the River Eden. This could have effects on River Eden SSSI/SAC through changes to the river flow regime and potential impacts on aquatic receptors listed as the primary reason for designation of this site, for example migratory fish species. HRA Screening could not rule out the potential for the abstraction to have likely significant effects at this stage and additional investigation would be required to confirm effects on the river and permitted abstraction volumes if the option is selected as a preferred option. The option has therefore been assessed as having an uncertain though potentially significant negative effect on biodiversity at this time.

There would be no expected operational effects on land use or the fluvial geomorphology of the scheme's general area.

The option would result in the abstraction of 25 or 50 Ml/d from the River Eden which has been identified as having water available for use at all flows. Notwithstanding this, the WFD Assessment has concluded that the large abstraction volume proposed could potentially have significant impacts on the hydrological regime of the River Eden in addition to reducing leakage from the river to the area's principal aquifer which may be dependent on leakage from overlying water courses to maintain its quantitative water balance. Consequently, this option has been assessed as having a significant negative effect on Objective 3.

The abstraction infrastructure and pumping station would be located within a Flood Zone 3 on the River Eden; consequently, operation could be liable to flooding depending on the timing of works although it is not expected that operation of the general scheme would cause or exacerbate flood risk elsewhere. Overall, the option has been assessed as having a negative effect on Objective 4.

There would be no operational effects on air quality.

Operational energy demand would be 1,010 kWh/Ml, generating 592 tCO2e/a. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it significantly affect opportunities for recreation (although a potential change in flow regime may impact kayaking and fishing on the River Eden (as a result of any impacts on fish migration). The increased capacity of 25 or 50 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health though uncertainty regarding recreational effects remain as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The proposed abstraction/pumping station site is within approximately 346m of Winderwath Romano-British farmstead and length of Roman Road scheduled monument in addition to eight Listed Buildings ranging from approximately 509m to 1.6km. Due to the minor structural scale of these components in addition to the relative distance between these assets and equipment, it is considered unlikely that operation would result in a discernible effect on the visual amenity of these heritage assets or their settings. The new WTW would become part-and-parcel to the existing water treatment facility such that operation should not introduce new and/or intensify stressors on the four proximate listed buildings (589m – 961m). Should abstraction significantly alter the River Eden, the potential loss of visual amenity may indirectly effect the settings of proximate heritage assets whose amenity may partially depend on the river although this remains uncertain. Overall, this option has been assessed as having a neutral effect on Objective 11.

Neither the abstraction/pumping station site nor the new WTW are within or in proximity to any landscape designations. The new abstraction equipment and pumping station would be, however, situated within a greenfield site adjacent to the River Eden which would be visible to proximate recreational and residential receptors although the structural scale of these components is expected to be minor thus unlikely to significantly impact the rural local setting. It is not expected that operation of the new WTW would have any adverse impact on the local setting or the wider landscape character due to its confinement within the existing WTW site footprint. It is currently unknown whether the 25 or 50 Ml/d abstraction from the River Eden would adversely alter the river's flow, velocity, or wetted perimeter which could, if significant, impact the river's setting and the wider landscape. This option has therefore been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR047a: Milwr Tunnel, Bagillt (Transfer to Huntington)	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	?	0	-/?	-	0	-	++	++	0	-	0	0

Construction

This option would involve the development of a new abstraction/intake point on theMilwr Tunnel at Bagillt in order to abstract and transfer 70 Ml/d with a range of 50 - 100 Ml/d for treatment at Huntington WTW via a new 30.5km raw water main and ancillary pumping stations. Huntington WTW would require modifications and structural enlargement in order to accommodate the increased raw water input. Treated water would then be transferred to two treated water storage sites via the existing Dee LDTM and WELM, respectively.

This option would utilise an existing mine water discharge from the Milwr Tunnel. The abstraction infrastructure would be situated on previously developed land within a site within 10m of Dee Estuary Ramsar/SAC/SPA/SSSI. This has been classified as an internationally/nationally important habitat for the wintering of waterfowl, wildfowl, and wading bird species in addition to its use as a staging post for migrating birds. Construction of the abstraction infrastructure poses the risk of introducing pollution/debris within the water system which may adversely impact the local ecosystem which includes food sources for these designated bird species, aquatic mobile features, and the wider downstream marine/coastal environ though site level mitigation should prevent significant effects. Additionally, the proposed raw water main route would directly cross the River Dee SSSI and River Dee and Bala Lake SAC close to the Huntington WTW (although whether this could utilise the existing A55 bridge to cross the river, or excavation would be required, is unclear at this stage). Similarly, the proposed raw water main route would also cross Nant-y-Flint, Afon Conwy, Northop Brook, and Alltami Brook which suggests a moderate risk to the wider water system and biodiversity. Excavation could potentially introduce debris into the water system as well as temporarily restrict the movement of species within the river. Consequently, construction works within the Dee catchment could result in significant effects although adverse impacts are expected to be avoidable through established scheme-level avoidance or mitigation measures. Additionally, the proposed excavation route would be in the vicinity of the Buckley Claypits and Commons SSSI/Dee Side and Buckley Newt sites SAC (directly adjacent to within 50m). Excavation of the route could potentially result in a direct effect and loss of these habitats, as well as noise disturbance, air pollution (dust), and a restriction of wildlife movement in/out of these sites, particularly the Dee Side and Buckley Newt sites due to their great crested newt population. However, effects could be avoided through alternative route selection (likely to be achievable). Additional designated sites (Maes y Grug SSSI (0.6km), and the Halkyn Common and Holywell Grasslands SSSI/Halkyn Mountains SAC (0.9km) are within 1km of the proposed work; however, distance and the nature of the designations make adverse effects less likely for these sites. In addition to avoidance measures (such as routing), mitigation measures would need to be taken at infrastructure sites and along the route to ensure that construction activities and any resulting dust and disturbance do not have an adverse effect on habitats and any associated species. Overall, construction and excavation would occur within a semi-rural setting such that proposed works may cause short-term disturbance to proximate local habitats and wildlife. This option has been assessed as having a potentially negative effect (subject to the utilisation of established scheme-level mitigation) on Objective 1.

The new abstraction infrastructure on the Milwr Tunnel would be situated on a previously developed semi-urban site which suggests that construction would have a negligible effect on the land/soil objective. The refurbishment/modification of Huntington WTW would be contained within its existing operational site such that any new ancillary infrastructure and/or additional land-intake should not have an adverse

impact (Grade 3b agricultural land). The proposed raw water main routes primarily through Grade 3b agricultural land within England although the Welsh land classification between junction 36 and 32 of the A55 is currently unknown. Notwithstanding, the proposed route would primarily follow the A55 with minor deviations on greenfield land which would subsequently be reinstated following the completion of construction. Consequently, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction infrastructure would be situated within a Flood Zone 3 originating from the Dee Estuary whereas segments of the proposed excavation route would traverse Flood Zone 3s derived from the River Dee, Afon Conwy, Alltami Brook, Wepre Brook, and the Balderton drain system. Consequently, construction of the abstraction infrastructure and excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the A55 and the local road network within the vicinity of the pipeline route) which would have a negative effect on local air quality (there would be an estimated 73,387 HGV movements during the 2.6-year construction period).

The option would generate 80,621 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, construction may result in a temporary disruption of use or loss of amenity to proximate grounds which host recreational walking and sport such as the Old Hall Country golf course, Bilberry Wood and Wared Wood walking paths, Halkyn cricket pitch, and Northorp Country Park golf course and cricket pitch. Additionally, there may be noise/vibration disturbance and air quality impacts associated with the development of the abstraction infrastructure, WTW, and the pipeline excavation which could affect nearby communities, farmsteads, and residential dwellings; specifically, northern Bagillt, southern Huntington, and communities and residential dwellings situated along the A55. Overall, this option has been assessed as having a minor negative impact on Objective 7.

Construction of the option represents a significant capital investment that could create a substantial number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Notwithstanding, most of the proposed excavation route would overlay the A55 which could result in a significant increase in congestion and disruption/driver delay throughout the local and wider area during construction phase. On balance, the option has been assessed as having a significant positive/negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significantly negative effect on Objective 10.

The option would not affect water efficiency.

The proposed construction scheme would be within the vicinity of the Huntington Hall moated site (approx. 0.1km from the WTW and directly adjacent to the proposed pipeline route) in addition to several other scheduled monuments ranging from 0.1km (Mill House Farm moated site) to 0.9km from the proposed pipeline route. Additionally, there are approx. 37 Grade II/II* Listed Buildings within proximity to the proposed construction scheme; specifically, there are 2 Listed Buildings under 0.1km: Huntington Old Hall farm buildings (30m) and Lower Lodge (45m). Although it is expected that mitigation measures during construction would help prevent any significantly adverse effect on the integrity of these scheduled monuments and listed buildings, the proximity between these assets and the works suggests that there would remain a risk to their settings. The remaining assets (>0.1km) may experience a temporary loss of visual amenity regarding their settings, however, the scheme enjoys substantial woodland buffer which may help negate the cumulative impact of construction. Overall, this option has been assessed as having a negative effect on Objective 11.

The development of the intake equipment and ancillary infrastructure (pumping stations) would be situated within a partially industrialised site such that works should not adversely impact or alter the local setting. Refurbishment/modification of the Huntington WTW may adversely impact the amenity of the surrounding semi-rural greenfield setting; however, construction would be confined to its existing operational footprint such that any adverse impact on the landscape would be minor. The proposed excavation route enjoys segments of woodland buffer although works could adversely impact the wider landscape character and the visual amenity associated with such when excavation occurs within open flat greenfield areas. Consequently, the option has been assessed as having a negative effect on Objective 12.

Operation

It is currently uncertain whether the abstraction of 70 Ml/d with a range 50 - 100 Ml/d of existing mine water discharge from Milwr Tunnel would have an adverse effect on the Dee Estuary's ability to support its local and designated populations of flora and fauna as well as the wider downstream marine/coastal environment. Abstraction would presumably reduce flows into the Dee Estuary SAC / SPA / Ramsar thus significant effects are likely and so additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes if selected as a preferred option although it is unlikely that adverse effects would occur. It is not expected that abstraction, treatment, and or transference of water would impact any other designated/non-designated environ within the vicinity of the operational scheme. On balance, this option has been assessed as having an uncertain effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 70 Ml/d with a range of 50 - 100 Ml/d which is expected to have negative effects on surface water resources though it should be noted that there is no Abstraction Management Strategy (NRW) for this transitional waterbody. Consequently, this option has been assessed as having a negative effect on Objective 3 though uncertainty remains.

The abstraction site and ancillary infrastructure (pumping station) would be located within a Flood Zone 3 on the Dee Estuary, and therefore, would be liable to flooding during operation though general operation of the scheme is not expected to increase the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 368 kWh/Ml, generating 669 tonnes CO2e/a. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it significantly affect opportunities for recreation. Overall, the increased capacity of 70 Ml/d with a range of 50 - 100 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

It is not expected that there would be any adverse operational effects on designated cultural heritage assets; however, a significant enlargement of the Huntington WTW could result in a minor encroachment on the setting of the Huntington Hall moated site and listed buildings which could reduce the visual amenity associated with said assets. Overall, this option has been assessed as having a neutral effect on Objective 11.

The new abstraction infrastructure, WTW, and ancillary pumping stations would introduce new above ground infrastructure within a primarily semi-rural setting. Because the structural scale of the intake equipment and pumping stations should to be minor and are situated within partially industrialised setting, it is not expected that their operation would result in any discernible effect on the wider landscape character. Modifications to the Huntington WTW would be contained within the existing operational footprint of the site, and thus part and parcel to the existing infrastructural scheme. It should be noted, however, a significant increase in size could result in an alteration of its local setting. On balance, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR049b: River Ribble (Transfer to Anglezarke IR)	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	-	0	-	++	++	0	-	0	0

Construction

This option would involve the provision of a new river intake, screen and pumping station on the River Ribble at Samlesbury. Subject to obtaining an abstraction licence, the scheme would abstract 30 - 40 Ml/d of raw water from the River Ribble to transfer to the Anglezarke IR for primary treatment at Rivington WTW via 15.5km of pipeline.

The abstraction point is not within any statutory or non-statutory designated sites; however, the HRA has identified that development of abstraction infrastructure has the potential to affect the Ribble and Alt Estuaries SPA/Ramsar/SSSI via the River Ribble as there is a clear pathway for potential construction impacts on this site. Notwithstanding, significant or significant adverse effects could be managed/avoided with scheme specific mitigation. Additionally, Red Scar and Tun Brook Woods SSSI is approximately 0.9km from the abstraction point which, given the proximity, may be susceptible to disturbance from construction work. The proposed pipeline route does not cross any internationally or nationally designated sites though two SSSIs, Darwin River Section and Beeston Brook Pasture, are within the general vicinity of the routing. Consequently, there may be potential for localised disturbance to biodiversity during its installation at these sites in addition to several LNRs along the proposed route. Should this option be taken forward to the preferred options stage, impacts on those features of designated sites that may be significantly affected will be considered in more detail and mitigation measures identified. Further, scheme level investigations and appropriate assessment (if required) would also be undertaken at the project stage should the option form part of the final Water Resources Management Plan. Overall, the prosed development has been assessed as having a negative effect on Objective 1.

The new intake structure, screens, pumping station and pipeline would be located on greenfield land and therefore negative effects have been identified in respect of soils and land use.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The site of the proposed new intake and pumping station is in Flood Zones 2/3 and therefore may be liable to flooding during the construction period (depending on the timing of installation). However, the option would be unlikely to increase flood risk elsewhere.

Construction is expected to generate either 12,425 (30 Ml/d option) or 20,310 (40 Ml/d option) vehicle movements during the 2 year construction period, the emissions from which, in conjunction with plant and machinery, may have a negative effect on local air quality. However, any impacts would be short term and temporary and may be mitigated to an extent through best practice and therefore this option has been assessed as having a negative effect on Objective 5.

Construction of the scheme would generate 12,243 tonnes CO_2e under the 30 Ml/d option and 25,787 tonnes CO_2e under the 40 Ml/d option which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Construction could affect human health through noise disturbance and air quality impacts; specifically, on residential properties within the proximity of the abstraction equipment and pumping station (e.g. along Potters Lane) and communities situated along the proposed pipeline route such as Coup Green, Gregson Lane, and Brindle. Construction may also affect the use of the site for recreational walkers for the duration of the works. However, any adverse effects on these receptors would be temporary and have therefore been assessed as minor.

Construction would involve a large capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The laying of 15.5km of new pipeline could adversely impact the local road network (congestion/delay) although any effects would be temporary and be felt in the short term only. Overall, the option has been assessed as having a mixed significant positive and negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effective on Objective 10.

The development sites do not include any historic designated sites. There are approximately 30 listed buildings primarily clustered around Wheelton, South Hill and Heapy, ranging from grade II to grade II*, within 0.5km of the overall development scheme with 11 of those designations being equal to or under 0.1km. For example, the nearest designation to the new abstraction point is the Grade II Roman Catholic Church in Samlesbury which is 200 meters to the east. Due to the potential for short-term impacts on the settings of these heritage assets, the option has been assessed as having a negative impact on Objective 11.

The development sites are not within or in proximity to any landscape designations but construction would have short term, temporary negative effects on local landscape features and visual amenity.

Operation

The operation of this option would involve abstraction of 30 - 40 Ml/d from the River Ribble which may result in adverse impacts on in-river habitats and species downstream as a result of the reduced flow. The proposed abstraction is located on the Lower Ribble which has a water resource availability status of 'water available' for abstraction without flow constraints for 20 Ml/d but there is a degree of uncertainty regarding the 30 Ml/d and 40 Ml/d. The HRA states that additional analysis (modelling etc.) of scheme operation and / or identification of acceptable operational mitigation measures would be required to support the chosen option with respect to impacts as a result of reduced freshwater flow into the Ribble and Alt Estuaries SPA / Ramsar. Overall, the option has been assessed as having a negative effect on Objective 1 though uncertainty remains.

No effects on land use/soils are anticipated following the reinstatement of land following the construction stage.

The scheme would have negative effects on Objective 3 due to increased abstraction, although some uncertainty remains. The ALS (Abstraction Licensing Strategy) indicates that there is water available from the Ribble, however, the maximum 40 Ml/d abstraction is relatively large such that impacts on the hydrological regime may occur.

The abstraction facility is located in Flood Zones 2/3 and would therefore be liable to flooding during operation although it is not expected that operation would increase the risk of flooding elsewhere.

The option would have a neutral effect on air quality.

Operational energy usage would be either 840 kWh/Ml for the 30 Ml/d option or 721 kWh/Ml for the 40 Ml/d option, and could result in emissions of either 425 tonnes CO_2e/a (30 Ml/d) or 486 tonnes CO_2e/a (40 Ml/d). This has been assessed as having a negative effect in respect of Objectives 6 and 10.

Due to the rural nature of the abstraction site and its distance from residential receptors, it is not expected that the operation of the scheme would have any acute negative health impacts. The option would have a design capacity of 30 - 40Ml/d which would have significant positive effects on human health by ensuring a continued supply of safe drinking water. However, a decrease in river flow because of abstraction could pose a risk to recreational and physical activity associated with the River Ribble due to its use as a coarse and game fishery. On balance, the option has been assessed as having a significant positive effect on Objective 7. The additional capacity would also have a significant positive effect on the local economy as the increase would support economic and population growth.

The option would not affect water efficiency.

No operational effects on cultural heritage assets are anticipated.

The introduction of abstraction infrastructure on the River Ribble will result in new above ground development; however, the proposed scale of development would be small and therefore effects on landscape and visual amenity are expected to be neutral.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR062a: Worthington WTW	Construction	0	+	0	-	-	--	-	++	0	--	0	0
	Operation	0	0	0	-	0	0	++	++	0	-	0	0

Construction

This option would involve the recommissioning of Worthington WTW in order to treat up to 12 Ml/d of raw water. The proposed scheme would utilise existing infrastructure and treatment processes to abstract and treat the raw water; specifically, Worthington WTW would utilise the existing intake infrastructure and filtration equipment throughout operation. Treated water output from the WTW facility would be transferred to a treated water storage facility via existing treated water mains.

The works involved in the option will not affect any European conservation sites. The closest designated conservation areas are the Hic Bibi Coppull LNR (2.5km) and Red Moss SSSI (5.1km) Because any modification or refurbishment to Worthington WTW's treatment process would be confined within its existing operational footprint, it is considered highly unlikely that works would disturb or result in any detrimental impacts on these sites. Notwithstanding, required alteration to the facility could temporarily disturb proximate habitats and wildlife such as birds who utilise the reservoir as a roosting/wading site. Overall, this option has been assessed as having a neutral effect on Objective 1.

The refurbishment/modification of Worthington WTW would be contained within its pre-existing operational site such that any new ancillary infrastructure should not impact on land/soil quality, and would be making best use of existing developed land. Overall, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Worthington WTW is situated with a Flood Zone 3 originating from Worthington Reservoir; consequently, potential refurbishment and modification would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is not expected that there would be significant impacts on traffic congestion during the construction period such that the option would have a minor negative effect on local air quality (there would be an estimated 2,145 HGV movements during the 1.5-year construction period).

The option would generate 1,892 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, refurbishment may result in a temporary loss of amenity to the grounds within proximity to construction which host recreational walking and sport such as Wigan Golf Course and Worthington Reservoir. Additionally, there may be noise/vibration disturbance should refurbishment be required which could affect residential receptors situated on the A5106 as well as the Lake Side and Mayflower Cottages. Overall, this option has been assessed as having a minor negative impact on Objective 7.

Construction of the option represents a significant capital investment that could create a substantial number of jobs resulting in a significantly positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. It is not expected that required works would result in a significant intensification of movement on the local road network. On balance, the option has been assessed as having a significant positive effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

Worthington WTW does not include any historic designated site, however, there is one scheduled monument, Arley Hall moated sited and ancillary structures, and 10 Grade II/II* Listed Buildings within its vicinity. The Lake Side Cottages (6) are directly adjacent to the WTW facility such that refurbishment may result in a temporary disturbance to their setting though this is expected to by minor, if not negligible, due to the potential scale of refurbishment. The remaining Listed Buildings (>100m) are not expected to experience any discernible effect associated with potential refurbishment works to the facility. Overall, this option has been assessed as having a neutral effect on Objective 11.

It is not expected that potential refurbishment work would have any adverse impact on the semi-rural setting or wider landscape character due to the confined nature of the proposed works within the pre-existing WTW site. Consequently, this option has been assessed as having a neutral effect on Objective 12.

Operation

The HRA confirms that operation of the option would have no effects alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.) on any European conservation site. It is currently uncertain whether the abstraction of up to 12 Ml/d of surface water from the Worthington Reservoir would have an adverse effect on local ecosystems which may have developed within the reservoir during inactive operation, although it is considered unlikely. Overall, this option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The option would result in the abstraction of up to 12 Ml/d which would have no or minimal impacts on water quality/quantity.

Worthington WTW site is located within a Flood Zone 3 originating from the Worthington Reservoir and therefore, may be liable to flooding during operation, however, operation of the general scheme is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 31 kWh/Ml, generating 27 tonnes CO2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health by increased noise, nuisance, or disruption. It is unknown whether a decrease of water volume within the reservoir could adversely impact recreational fishing within the site. Overall, the increased abstraction of up to 12 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The potential refurbishment/modification of Worthington WTW would be part and parcel to the existing structural footprint established on this site such that any adverse impact on the surrounding rural landscape would be minor, if not negligible, as there would be no significantly new infrastructure introduced within the site. Overall, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR062b: Worthington WTW (Rivington)	Construction	-	0	0	-	-	--	-	++/-	0	--	-	0
	Operation	-	0	0	0	0	0	++/?	++	0	-	0	0

Construction

This option would utilise existing intake infrastructure to transfer up to 12 Ml/d of raw and/or partially treated water from Worthington IR to Rivington WTW via a new 6.53km water main. It is expected that Rivington WTW would treat both Worthington IR and Rivington IR waters.

The works involved in the option will not affect any European conservation sites; specifically, the proposed pipeline route does not traverse any statutory or non-statutory nature conservation designations. There are, however, several LNRs and SSSI sites within the general vicinity of the pipeline route: Hic Bibi Coppull LNR (2.5km); Bridge St. Horwich LNR (1.8km); Red Moss SSSI (2.2km); and the West Pennine Moors SSSI (1.2km / adjacent to Rivington Reservoir). Due to the proposed scale and temporary nature of the works, it is not expected that any significant impact from construction would occur on these sites. It should be noted that the proposed pipeline route would cross the Leeds – Liverpool Canal and the River Douglas which poses the risk of pollution and debris to these water sources and downriver habitats although it is assumed site level mitigation / best practice would prevent significant effects. As the pipeline route traverses through a semi-rural setting composed predominantly of greenfield land, excavation may also cause short term disturbance to habitats and species although works would be temporary. Overall, this option has been assessed as having a potentially minor negative effect on Objective 1.

This option would not require permanent land take with excavated land being reinstated following the construction phase. A neutral effect on Objective 2 is therefore predicted.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Parts of the proposed pipeline route are in Flood Zone 3 and therefore works may be liable to flooding during the construction period (depending on the timing of installation). Excavation of the pipeline would be unlikely to increase flood risk elsewhere.

It is expected that there would be impacts on traffic congestion during the construction period (particularly on the A6, M61, and A673) which, together with emissions associated with the use of plant and machinery, could have a negative effect on local air quality (there would be an estimated 6,417 vehicle movements during the 1.8 year construction period).

The option would generate 4,638 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The proximity of the proposed pipeline route to Wigan Golf Course, the Leeds – Liverpool Canal towpath, and Mill Stone Embankment could temporarily restrict access and use of these facilities which in-turn could negatively impact local opportunities for recreation and physical activity. There may also be temporary noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors along the proposed route. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a large capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The laying of new pipeline could adversely impact the local road network (congestion/delay) although any effects would be temporary. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

The proposed pipeline route is within close proximity to the listed Lakeside Cottages (57m) near Worthington WTW and the Arley settlement (50m) which consists of a schedule monument and various Grade II listed buildings. Additionally, the proposed pipeline route passes within the general vicinity of four listed bridges (Anderton, Aberdeen, Waterhouse, and Heskins) located on the Leeds – Liverpool Canal at a range of approximately 85m to 157m. Due to the potential short-term impact on the settings of these heritage assets, the option has been assessed as having a minor negative effect on Objective 11.

Landscape and visual impacts associated with pipeline works would be minor and temporary. Consequently, this option has been assessed as having a neutral effect on Objective 12.

Operation

The operation of the option is not expected to significantly affect biodiversity; however, the increased drawdown of up to 12 Ml/d may have a minor effect on the reservoir's fish population, e.g. roach, bream, perch, tench, and carp. Consequently, this option has been assessed as having a minor negative effect on Objective 1.

It is not expected that operation would have a discernible effect on land/soil.

Effects on surface water resources associated with this option are expected to be negligible.

The option is not expected to cause or exacerbate flooding.

There would be no operational effects on air quality.

Operational energy demand would be 319 kWh/Ml, generating 75 tonnes CO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health. As noted above, the potential impact on fish species within the reservoir may have an impact on angling at the reservoir, although this is uncertain. The increased capacity of up to 12 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new raw water main connecting Worthington IR to Rivington WTW would be below ground and therefore would not have an impact on the local landscape or visual amenity.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR074: River Darwen (Transfer to Fishmoor WTW)	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	?	-/?	0	0	-	+	+	0	-	0	0

Construction

This option would involve the development of a new abstraction/intake point on the River Darwen near Roach Bridge in order to abstract and transfer 10 Ml/d to Fishmoor IR via a new raw water main (14.7km in length). Ancillary infrastructure would also be installed to facilitate the operation of this option including a new pumping station and intake screens on the abstraction site. It is not expected that Fishmoor WTW would require modifications to accommodate the additional 10 Ml/d.

The proposed abstraction point and initial 1.2km of pipeline from the abstraction point are within the general vicinity of the Beeston Brook Pasture SSSI (626m) in addition to downstream receptors such as the Ribble and Alt Estuaries SPA/Ramsar (via the River Ribble). Additionally, there are several LNRs within proximity of the proposed pipeline route at a range of 1.5km to 2.8km. Due to their distance to the construction works, effects on these sites are considered to be unlikely. The proposed pipeline route does traverse through the River Darwen Parkway LNR for approximately 340m and in consequence, there is the potential for minor adverse impacts on the associated river valley habitat and wildlife (bird population). Works across the River Darwen, River Roddlesworth and the Leeds and Liverpool Canal also pose a risk of introducing pollution/debris to the river ecosystems although appropriate mitigation measures should prevent any significant effect. More generally, construction of the scheme may cause short-term disturbance to habitats and species within proximity of the abstraction site and proposed pipeline route. Overall, construction effects can be avoided with established scheme-level avoidance or mitigation measures such that this option has been assessed as having a negative effect on Objective 1.

This option would introduce new above ground infrastructure (the intake and pumping station) on a previously undeveloped greenfield site though the structural footprints would be very small. The proposed pipeline route primarily follows the existing road network which decreases the need for additional land intake. For those segments of the pipeline route which do traverse greenfield land, excavated land would be reinstated following the completion of construction. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point and sections of pipeline would be located within Flood Zones 2/3. Construction works could therefore be liable to flooding during the construction period (depending on the timing of works). It is unlikely that construction would increase flood risk elsewhere.

Construction would be likely to result in traffic congestion (particularly along the A666, A6062, B6231, A662, A674, A675 and the residential roads overlaying the proposed pipeline route) which, together with emissions associated with the use of plant and machinery, could have a negative effect on local air quality (there would be an estimated 15,550 vehicle movements during the 2 year construction period).

The option would generate 13,849 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, there may be temporary disruption to the use of some open space and recreational facilities such as Higher Croft Playing Field and Cockridge and Green Hills Woods. As the scheme would require works within an urban area, there is an increased likelihood that there may be noise/vibration disturbance and air quality impacts on residential and other receptors (such as schools and community facilities). The transportation of equipment/material could further exacerbate these impacts, especially for those receptors situated along primary transportation routes. Overall, this option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a significant capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the laying of 14.7km of new pipework crossing/traversing three A roads and a railway line would affect the local transport network (albeit temporarily). Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

There are approximately 10 Grade II / II* listed buildings under 200m from the general area of the scheme with five listed buildings equal to or under 100m from the pipeline excavation (Mawdesley Fold (20m), Stanley Coppice Farm House (100m), Lane Side Farm House (84m), Church of the Holy Trinity and School (99m), and Dover Farm House (79m). It is not expected that there would be direct impacts on these assets although there may be effects on their setting. A minor negative effect has therefore been identified in respect of Objective 11.

Neither the proposed River Darwen abstraction site nor the pipeline route are within or in proximity to any landscape designations. Development of the abstraction infrastructure and pumping station may adversely affect the amenity of the surrounding greenfield setting; however, moderate woodland buffer on both banks of the river could help minimise any potential impact. Excavation of the pipeline within the semi-rural setting outside of Blackburn may adversely impact the wider landscape character whilst works within the urban area in particular may affect the visual amenity of residential receptors along the pipeline route. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The abstraction of 10 Ml/d of water from the River Darwen is not expected to adversely impact the Beeston Brook Pasture SSSI, or the several LNRs within the surrounding area due the abstraction point's downstream location. It is unknown whether the abstraction would impact statutory conservation sites further downstream such as the Ribble and Alt Estuary SPA/Ramsar/SSSI (16.5km) via the River Ribble (although this would seem unlikely) or habitats adjacent to the river such as Beeston Wood, Rass Wood, and Holland Wood which may support wildlife dependent upon the river. The abstraction of 10 Ml/d could negatively impact in-river habitats and species of the River Darwen due to reduced flows. Consequently, the availability of the abstraction volumes would need to be confirmed by the EA and the acceptability of this option regarding effects on downstream European sites would need to be established if pursued as a preferred option. Overall, the option has been assessed as having a minor negative effect on biodiversity at this stage though uncertainty remains.

The abstraction of 10 Ml/d from the River Darwen could affect the Darwen River Section SSSI, a significant geological study site containing high quality marine clay which has been used to help study the geology of the Carboniferous Period. Consequently, it is uncertain whether the increased drawdown of the river, though minor, would result in significant effects on geological processes. This option has therefore been assessed as having an uncertain effect on Objective 2 at this time.

The option would result in the abstraction of approximately 10 Ml/d which may have negative effects on surface water resources, although some uncertainty remains. The ALS (Abstraction Licensing Strategy) indicates that there is water available at all flow regimes, however, the abstraction is moderate in size and could have a medium impact on the hydrological regime of the River Darwen.

Operation of the scheme is not expected to be affected by flooding or increase the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 670 kWh/Ml, generating 134 tonnes CO_2e/a. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of 10 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new abstraction infrastructure and pumping station would introduce new above ground structures within a greenfield setting; however, given their small footprint, any landscape/visual impacts are expected to be negligible.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR076: River Bollin	Construction	-	-	0	--	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	--	0	-	++	++	0	-	-	-

Construction

This option would involve the provision of a new river abstraction and intake on the River Bollin in the vicinity of Lymm. In addition, a new WTW facility at the same location would be required together with a pumping station and treated water main (c. 6.5km) to transfer water to a treated water storage facility. The option would have a capacity of 25Ml/d.

The proposed abstraction point/WTW site and pipeline route are not within any designated nature conservation sites. The nearest designated site is Dunham Park SSSI which is circa 3.5km from the abstraction point/WTW site and, at its closest point, 0.1km from the pipeline route which may result in moderate noise disturbance and adverse air quality impacts (subject to the use of mitigation). Additionally, the Mersey Estuary SPA / Ramsar sites are downstream receptors (via the River Mersey / Ship Canal) from the proposed location of the abstraction intake; however, the utilisation of scheme level mitigation measures is expected to prevent adverse effects on the interest features of this designated site. Construction activity may result in the loss of/disturbance to habitats and species at the WTW development site and along the proposed pipeline route, however, many of the impacts would be effectively mitigated using established best practice measures. Overall, the option has been assessed as having a minor negative effect on biodiversity.

Development of the new abstraction infrastructure, WTW, and pumping station would result in the loss of greenfield land which may include Grade 2/3 agricultural land. Excavated land associated with pipeline works would be reinstated following the completion of construction. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point/WTW site and pipeline route are within/in close proximity to Flood Zones 2/3 and therefore construction activity may be liable to flooding (depending on timing). The option has therefore been assessed as having a significant negative effect on Objective 4.

Construction is expected to generate 21,470 vehicle movements during the 1.9 year construction period from which the emissions, in conjunction with plant and machinery operation, may have a negative effect on local air quality. However, any impacts resulting from intensified movement on the road network would be temporary and felt in the short term.; therefore, this option has been assessed as having a negative effect on Objective 5.

Construction of the scheme would generate 23,057 tCO_2e/a which has been assessed as having a significantly negative effect on Objective 6 (and Objective 10).

Construction activity and associated HGV movements associated with the pipeline works in particular could have short term, temporarily noise and air quality impacts on a small number of residential receptors along the proposed route. Pipeline works may also affect users of the Mersey Path, Dunham Forest Golf and Country Club and Dunham New Park, although any adverse impacts would be temporary. Overall, the option has been assessed as having a minor negative effect on Objective 7.

The construction of the option would represent a substantial capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. The transportation of equipment/material may result in adverse impacts on the local transportation network (delay/congestion) though this would be temporary. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy consumption and generate waste which has been assessed as having a significant negative effect on Objective 10.

The abstraction/WTW site is approximately 300m to the south of a cluster of five Grade II listed buildings. The proposed pipeline route is also within close proximity of a number of listed buildings at Dunham Town. There is the potential for short term, temporary adverse effects on the settings of these designated heritage assets as a result of construction works and in consequence, a negative effect has been identified in respect of Objective 11.

The abstraction/WTW site and proposed pipeline route are not within or in proximity to any landscape designations. Development would be within a rural setting and in consequence, there is the potential for adverse effects on local landscape character. The visual amenity of residential and recreational receptors along the pipeline route may also be temporarily affected. Overall, this option has been assessed as having a negative effect on Objective 12.

Operation

The operation of this option would involve the abstraction of 25Ml/d from the River Bollin. This could have effects on Mersey Estuary SPA / Ramsar sites which are downstream from the proposed abstraction point due to reduced freshwater flow to the estuary. It should be noted, however, the contribution of the Bollin to flows in the Mersey Estuary is limited and other inputs are considered to be more significant. HRA Screening has concluded that possible effects are likely to be avoidable with established operational mitigation (e.g. licence controls) although the EA would need to confirm that water is available for use in order to issue a new abstraction licence. There is, however, some uncertainty regarding whether the abstraction would negatively impact the local River Bollin ecosystem due to a change in flow regime. The option has therefore been assessed as having an uncertain though potentially negative effect on biodiversity at this time.

There would be no operational effects on soils/land use.

The option would result in the abstraction of 25Ml/d from the River Bollin which has been identified as having available water for use at all flow levels. Notwithstanding this, the WFD Assessment has concluded that due to the relatively large size of the proposed abstraction, operation of the scheme may have a moderate impact on the hydrological regime of the River Bollin thus this option has been assessed as having a negative effect on Objective 3, although some uncertainty remains.

The abstraction point and WTW would be within Flood Zone 3 and may be liable to flooding. The option has therefore been assessed as having a significant negative effect on Objective 4, although operation of the scheme is not expected to increase the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 336 kWh/Ml, generating 117 tCO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The increased capacity of 25 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

As noted above, the abstraction/WTW sites is approximately 300m to the south of a cluster of five Grade II listed buildings. The presence of the WTW in particular could affect the setting of these assets, although impacts are unlikely to be significant.

The operational sites are not within or in proximity to any landscape designations. This option would result in new above ground infrastructure on a greenfield site within a rural setting which could affect local landscape character. The option has therefore been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR079b: Appleton Reservoir, Warrington	Construction	-	0	0	-	-	--	-	++	0	--	-	-
	Operation	?	0	-/?	0	0	0	+/?	+	0	-	0	-

Construction

This option would involve the reinstatement of Appleton Reservoir comprising a new or refurbished abstraction point at the draw-off tower on its northern embankment and a new raw water pumping station. A new raw water main would be constructed to connect Appleton Reservoir to a new WTW at a treated water storage facility (1.39km). The option would have a capacity of 6 Ml/d.

Appleton Reservoir, Hill Cliffe nor the proposed pipeline route include or cross statutory or non-statutory nature conservation sites. Paddington Meadows LNR and Woolston Eyes SSSI are approximately 4km from the proposed Hill Cliffe WTW site whilst Daresbury Firs LNR is 4.1km from Appleton Reservoir, although works would not be expected to affect this site due to relative distance. Construction of the pumping station, pipeline and the new WTW could cause short term, localised disturbance to habitats and species within the general vicinity of the works although established mitigation measures are expected to prevent any significant effects. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Pipeline works would involve the excavation of land including Grade 3 agricultural land; however, this land would be reinstated following the construction phase. The proposed WTW would be located within the operational footprint of a treated water storage site and is therefore not expected to result in a significant adverse impact on land use/soil. Overall, this option has been assessed as having a neutral effect on Objective 2.

The construction of this option is not expected to have any significant effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area although the pipeline crosses a drain system which is within a Flood Zone 3. Works could therefore be liable to flooding depending on timing although this is considered to be unlikely and therefore a minor negative effect only has been identified in respect of Objective 4.

There could be traffic congestion during the construction period (particularly along the A56 and local roads such as Park Lane, Firs Lane, Walton Lea Road, and Hough's Lane) which may, together with emissions associated with the use of plant and machinery, have a minor negative effect on local air quality (there would be an estimated 3,376 vehicle movements during the 1.5 year construction period).

The option would generate 4,766 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, there may be minor, temporary disruption to the use of Walton Hall Golf Course. Additionally, there may be noise/vibration disturbance and air quality impacts associated with pipeline excavation which could affect residential receptors around Beechtree Farm while development of the new WTW at Hill Cliffe poses a potential risk to the residential amenity of those situated on Firs Street (although there is a woodland buffer between residences and the proposed development site). The transportation of equipment/material could also cause nuisance and disturbance to receptors along transport routes. Overall, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a significant capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The transportation of equipment/material could increase congestion and disruption/driver delay, although any effects on the local road network would be temporary and minor. On balance, the option has been assessed as having a significant positive effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The option would not affect water efficiency.

Appleton Reservoir and the Hill Cliffe WTW site do not contain any heritage assets; there are approximately three scheduled monuments at distances of 1.5km – 2.9km from the proposed scheme although it is not expected that construction would result in any adverse impacts on these assets or their settings. There are also several Grade II listed buildings situated along the proposed pipeline route within the range of 135m (Hough's Bridge) to 400m (Walton Hall and Bridge House / Walton Lee Bridge). Excavation of the pipeline may temporarily affect the setting of these assets and the option has therefore been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. Works may have short term, minor impacts on local landscape character and visual amenity although the Hill Cliff site does benefit from a woodland buffer which may provide screening to nearby residential receptors. Overall, a minor negative effect has been identified in respect of Objective 12.

Operation

The operation of the scheme would abstract 6 Ml/d of water from Appleton Reservoir. HRA Screening has concluded no effects on European sites due to operation of the scheme; however, the abstraction of 6 Ml/d may result in localised effects such as fluctuations of water levels which could disturb ecosystems established during the reservoir's inactivity. Consequently, this option has been assessed as having an uncertain effect on Objective 1.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 6 Ml/d from Appleton Reservoir which is within the existing abstraction licence (12 Ml/d) though operation under this licence has been redundant. Notwithstanding this, river flows within Weaver Lower catchment in which Appleton Reservoir resides are below the level required to support good ecological status such that reinstating operational abstraction has the potential to reduce flows further, and subsequently, resulting in the deterioration in the status of the water body. Downstream surface water bodies have been assessed as having water available at all flows thus residual effects from renewed abstraction at Appleton Reservoir are unlikely to be widespread or prolonged for downstream receptors. Overall, the WFD Assessment concludes that if the water environment which supports the current WFD status was established in the absence of abstraction then reinstatement may cause long-term adverse effects on the WFD status of the lake water body. This option has therefore been assessed as having an uncertain though potentially negative effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 354 kWh/Ml, generating 42 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The abstraction of 6 Ml/d from Appleton Reservoir may adversely affect established fish populations which could subsequently impact recreational angling, although this remains uncertain. The increased capacity of 6 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The new abstraction infrastructure and pumping station at Appleton Reservoir would introduce new above ground infrastructure on a greenfield site; however, the footprints of these components would be very small. The new WTW would also be within the established operational footprint of the adjacent treated water storage site and would benefit from a woodland buffer on its boundaries which may help mitigate any potential impact the introduction of the new WTW would have on the local landscape and visual amenity. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR079c: Appleton Reservoir, Warrington	Construction	-	0	0	-	-	--	-	++	0	--	-	-
	Operation	?	0	-/?	0	0	0	+/?	+	0	-	0	-

Construction

This option would involve the reinstatement of Appleton Reservoir comprising a new or refurbished abstraction point at the draw-off tower on its northern embankment and a new raw water pumping station. A new raw water main would be constructed to connect Appleton Reservoir to a new WTW at a treated water storage site (1.39km). The option would have a capacity of 9 Ml/d.

Appleton Reservoir, Hill Cliffe nor the proposed pipeline route contain/traverse statutory or non-statutory nature conservation sites. Paddington Meadows LNR and Woolston Eyes SSSI are approximately 4km from the proposed Hill Cliffe WTW site whilst Daresbury Firs LNR is 4.1km from Appleton Reservoir, although works would not be expected to affect this site due to relative distance. Construction of the pumping station, pipeline and the new WTW could cause short term, localised disturbance to habitats and species within the general vicinity of the works. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Pipeline works would involve the excavation of land including Grade 3 agricultural land; however, this land would be reinstated following the construction phase. The proposed WTW would be located within the operational footprint of a treated water storage site and is therefore not expected to result in a significant adverse impact on land use/soil. Overall, this option has been assessed as having a neutral effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area although the pipeline crosses a drain system which is within Flood Zone 3. Works could therefore be liable to flooding depending on timing although this is considered unlikely and therefore a minor negative effect only has been identified in respect of Objective 4.

There could be traffic congestion during the construction period (particularly along the A56 and local roads such as Park Lane, Firs Lane, Walton Lea Road, and Hough's Lane) which may, together with emissions associated with the use of plant and machinery, have a minor negative effect on local air quality (there would be an estimated 3,784 vehicle movements during the 1.8 year construction period).

The option would generate 2,915 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, there may be minor, temporary disruption to the use of Walton Hall Golf Course. Additionally, there may be noise/vibration disturbance and air quality impacts associated with pipeline excavation which could affect residential receptors around Beechtree Farm while development of the new WTW at Hill Cliffe poses a potential risk to the residential amenity of those situated on Firs Street (although there is a woodland buffer between residences and the proposed development site). The transportation of equipment/material could also cause nuisance and disturbance to receptors along transport routes. Overall, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a significant capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The transportation of equipment/material could increase congestion and disruption/driver delay, although any effects on the local road network would be temporary and minor. On balance, the option has been assessed as having a significant positive effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The option would not affect water efficiency.

Appleton Reservoir and the Hill Cliffe WTW site do not contain any heritage assets; there are approximately three scheduled monuments at distances of 1.5km – 2.9km from the proposed scheme although it is not expected that construction would result in any adverse impacts on these assets or their settings. There are also several Grade II listed buildings situated along the proposed pipeline route within the range of 135m (Hough's Bridge) to 400m (Walton Hall and Bridge House / Walton Lee Bridge). Excavation of the pipeline may temporarily affect the setting of these assets and the option has therefore been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. Works may have short term, minor impacts on local landscape character and visual amenity although the Hill Cliff site does benefit from a woodland buffer which may provide screening to nearby residential receptors. Overall, a minor negative effect has been identified in respect of Objective 12.

Operation

The operation of the scheme would abstract 9 Ml/d of water from Appleton Reservoir. HRA Screening has concluded no effects on European sites due to operation of the scheme; however, the abstraction of 9 Ml/d may result in localised effects such as fluctuations of water levels which could disturb ecosystems established during the reservoir's inactivity. Consequently, this option has been assessed as having an uncertain effect on Objective 1.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 9 Ml/d from Appleton Reservoir which is within the existing abstraction licence (12 Ml/d) though operation under this licence has been redundant. Notwithstanding this, river flows within Weaver Lower catchment in which Appleton Reservoir resides are below the level required to support good ecological status such that reinstating operational abstraction has the potential to reduce flows further, and subsequently, resulting in the deterioration in the status of the water body. Downstream surface water bodies were assessed as having water available at all flows thus residual effects from renewed abstraction at Appleton Reservoir are unlikely to be widespread or prolonged for downstream receptors. Overall, the WFD Assessment concludes that if the water environment which supports the current WFD status was established in the absence of abstraction then reinstatement may cause long-term adverse effects on the WFD status of the lake water body. This option has therefore been assessed as having an uncertain though potentially negative effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 257 kWh/Ml, generating 44 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The abstraction of 9 Ml/d from Appleton Reservoir may adversely affect established fish populations which could subsequently impact recreational angling, although this remains uncertain. The increased capacity of 9 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The new abstraction infrastructure and pumping station at Appleton Reservoir would introduce new above ground infrastructure on a greenfield site; however, the footprints of these components would be very small. The new WTW would also be within the established operational footprint of a treated water storage site and would benefit from a woodland buffer on its boundaries which may help mitigate any potential impact the introduction of the new WTW would have on the local landscape and visual amenity. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR079d: Appleton Reservoir, Warrington	Construction	-	0	0	-	-	--	-	++	0	--	-	-
	Operation	?	0	-/?	0	0	0	++/?	++	0	-	0	-

Construction

This option would involve the reinstatement of Appleton Reservoir comprising a new or refurbished abstraction point at the draw-off tower on its northern embankment and a new raw water pumping station. A new raw water main would be constructed to connect Appleton Reservoir to a new WTW at a treated water storage site (1.39km). The option would have a capacity of 12.5 Ml/d.

Appleton Reservoir, Hill Cliffe nor the proposed pipeline route contain/traverse statutory or non-statutory nature conservation sites. Paddington Meadows LNR and Woolston Eyes SSSI are approximately 4km from the proposed Hill Cliffe WTW site whilst Daresbury Firs LNR is 4.1km from Appleton Reservoir, although works would not be expected to affect this site due to relative distance. Construction of the pumping station, pipeline and the new WTW could cause short term, localised disturbance to habitats and species within the general vicinity of the works. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Pipeline works would involve the excavation of land including Grade 3 agricultural land; however, this land would be reinstated following the construction phase. The proposed WTW would be located within the operational footprint of a treated water storage site and is therefore not expected to result in a significant adverse impact on land use/soil. Overall, this option has been assessed as having a neutral effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area although the pipeline crosses a drain system which is within Flood Zone 3. Works could therefore be liable to flooding depending on timing although this is considered to be unlikely and therefore a minor negative effect only has been identified in respect of Objective 4.

There could be traffic congestion during the construction period (particularly along the A56 and local roads such as Park Lane, Firs Lane, Walton Lea Road, and Hough's Lane) which may, together with emissions associated with the use of plant and machinery, have a minor negative effect on local air quality (there would be an estimated 4,618 vehicle movements during the 1.8 year construction period).

The option would generate 6,329 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, there may be minor, temporary disruption to the use of Walton Hall Golf Course. Additionally, there may be noise/vibration disturbance and air quality impacts associated with pipeline excavation which could affect residential receptors around Beechtree Farm while

development of the new WTW at Hill Cliffe poses a potential risk to the residential amenity of those situated on Firs Street (although there is a woodland buffer between residences and the proposed development site). The transportation of equipment/material could also cause nuisance and disturbance to receptors along transport routes. Overall, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a significant capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The transportation of equipment/material could increase congestion and disruption/driver delay, although any effects on the local road network would be temporary. On balance, the option has been assessed as having a significant positive effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The option would not affect water efficiency.

Appleton Reservoir and the Hill Cliffe WTW site do not contain any heritage assets; there are approximately three scheduled monuments at distances of 1.5km – 2.9km from the proposed scheme although it is not expected that construction would result in any adverse impacts on these assets or their settings. There are also several Grade II listed buildings situated along the proposed pipeline route within the range of 135m (Hough's Bridge) to 400m (Walton Hall and Bridge House / Walton Lee Bridge). Excavation of the pipeline may temporarily affect the setting of these assets and the option has therefore been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. Works may have short term, minor impacts on local landscape character and visual amenity although the Hill Cliff site does benefit from a woodland buffer which may provide screening to nearby residential receptors. Overall, a minor negative effect has been identified in respect of Objective 12.

Operation

The operation of the scheme would abstract 12.5 Ml/d of water from Appleton Reservoir. The HRA concludes no effects on European sites due to operation of the scheme; however, the abstraction of 12.5 Ml/d may result in localised effects such as fluctuations to water levels which could disturb ecosystems established during the reservoir's inactivity. Consequently, this option has been assessed as having an uncertain effect on Objective 1.

There would be no operational effects on soils/land use.

The option would result in the abstraction of up to 12.5 Ml/d from Appleton Reservoir which would potentially exceed the existing abstraction licence (12 Ml/d) for the reservoir though operation under this licence has been redundant. Notwithstanding, river flows within Weaver Lower catchment in which Appleton Reservoir resides are below the level required to support good ecological status such that reinstating operational abstraction has the potential to reduce flows further, and subsequently, resulting in the deterioration in the status of the water body. Downstream surface water bodies were assessed as having water available at all flows thus residual effects from renewed abstraction at Appleton Reservoir are unlikely to be widespread or prolonged for downstream receptors. Overall, the WFD Assessment concludes that if the water environment which supports the current WFD status was established in the absence of abstraction then reinstatement may cause long-term adverse effects on the WFD status of the lake water body. This option has therefore been assessed as having an uncertain though potentially negative effect on Objective 3

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 261 kWh/Ml, generating 63 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The abstraction of 12.5 Ml/d from Appleton Reservoir may adversely affect established fish populations which could subsequently impact recreational angling, although this remains uncertain. The increased capacity of 12.5 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The new abstraction infrastructure and pumping station at Appleton Reservoir would introduce new above ground infrastructure on a greenfield site; however, the footprints of these components would be very small. The new WTW would also be within the established operational footprint of a treated water storage site and would benefit from a woodland buffer on its boundaries which may help mitigate any potential impact the introduction of the new WTW would have on the local landscape and visual amenity. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR099a: Worsthorne Borehole (Compen-=sation)	Construction	**0**	**+**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
	Operation	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**+**	**0**	**-**	**0**	**0**

Construction

This option comprises the recommissioning and refurbishment of Worsthorne borehole providing a yield of up to 4Ml/d. Refurbishments would include a new pump, new/improved headworks, and the construction of a new 375m extension of the existing raw water main to divert flow into the River Brun as a compensation flow.

The South Pennine Moors, approx. 1.3 km from the borehole, is designated as a SSSI, SAC, and SPA site**.** Given the scale of works, no significant construction-related impacts are expected to these sites. Notwithstanding, the construction phase may cause some short-term minor disturbance to habitats and species along the new pipeline. Refurbishments and upgrades will utilise the existing site which is expected to minimise the potential for impacts on biodiversity. Overall, there are no clear impacts or likely significant effects alone or in combination (e.g. not impact pathways; features not sensitive) on nationally/internationally designated conservation sites resulting from construction. This option has therefore been assessed as having a neutral effect on Objective 1.

It is assumed that there would be no new land take associated with this option due to the utilisation of the existing site with any soil displaced through excavation returned following the completion of works.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option is not envisaged to cause or exacerbate flooding; however, a minor segment of the new raw water main would be situated within a Flood Zone 3 emerging from the River Brun which may be vulnerable to flooding though it is assumed that timing of the works could be adapted to avoid likely periods of flooding.

It is not expected that there would be impacts on traffic congestion during the construction period such that the option would have a neutral effect on local air quality (there would be an estimated 239 HGV movements during the 1.2-year construction period).

Construction of the scheme would generate 107 tonnes of CO_2e which has been assessed as having a minor negative effect on Objective 6 (and Objective 10).

There would be no impact upon recreational activities as a result of the construction of the option. There would, however, be some noise as a result of construction which may affect residential receptors although the works are temporary and the location is semi-rural such that any nuisance is likely to be negligible.

Construction of the option requires a minor capital investment which is not expected to have an effect upon local employment opportunities and supply chain benefits due to the scale of the development. Furthermore, laying of 375m of new pipework during construction could generate temporary disruption of the local road network but should not significantly impact ease of access/mobility. Overall, the option has been assessed as having a neutral effect on Objective 8. The option would not affect water efficiency. Construction would increase resource use and generate waste which has been assessed as having a negative effective on Objective 10. No designated cultural heritage assets have been identified near the borehole or the route of the proposed pipeline. The refurbishment of the existing borehole site should not introduce new visible infrastructure beyond what has previously been established. The construction of the new pipeline may have some minor and temporary landscape impacts; however, the option has overall been assessed as having a negligible impact on Objective 12.
Operation The South Pennine Moors SSSI/SAC/SSSI is located 1.3km from the borehole site and is downstream of the River Brun; however, there is an existing abstraction licence which is assumed to have been reviewed by the EA under the Review of Consents process such that it is unlikely the reinstatement of the boreholes would result in significant adverse operational effects regarding water levels/quality. Consequently, this option has been assessed as having a neutral effect on Objective 1. No effects on soils or land use are expected during operation (discounting the initial loss of land during construction). The abstraction of up to 4 Ml/d would have a negligible effect on groundwater. The option is not expected to cause or exacerbate flooding. No effects on local air quality are anticipated. The option would require ongoing energy use of 828 kWh/Ml, generating 43 tonnes of CO_2e/a which has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10. The scheme would not adversely affect human health by increased noise, nuisance or disruption. The option would not affect opportunities for recreation. Overall, the increased abstraction of 4 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing, thus generating a positive effect on Objectives 7 and 8. No impact on water efficiency or leakage is expected. Operation of the option is not expected to affect cultural heritage assets. Operation of the option will not utilise any new infrastructure beyond what has previously been established on site and therefore landscape effects are expected to be negligible.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR099b: Worsthorne Borehole (Hurstwood IR)	Construction	-	+	0	0	0	-	0	0	0	-	0	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	0

Construction

This option comprises the recommissioning and refurbishment of Worsthorne borehole in order to abstract a maximum capacity of 4 Ml/d. Refurbishments would include a new pump, new/improved headworks and M & E together with the construction of a new 1.1km main to transfer water to Hurstwood IR.

South Pennine Moors SAC/SPA/SSSI is approximately 1.3km from the borehole site and circa 350m from the proposed pipeline route (at Hurstwood IR); however, given the type/scale of works, adverse construction effects on the protected interest features can be avoided with established measures such as construction best-practice or timing works to avoid avifauna breeding / migration periods. Construction activity may cause some short-term disturbance to habitats and species, particularly along the new pipeline route, and therefore this option has been assessed as having a minor negative effect on Objective 1.

It is assumed that there would be no substantial new land take associated with this option (due to the utilisation of the existing borehole site) with any soil displaced through excavation of the pipeline returned following the completion of works. This has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option is not expected to cause or exacerbate flooding.

The construction of the option would generate a relatively small number of vehicle movements (448) during the 1.3 year construction period thus no significant air quality impacts are therefore expected.

Construction of the scheme would generate 317 CO2e which has been assessed as having a minor negative effect on Objective 6 (and Objective 10).

No effects on health are expected.

It is not expected that construction of this option would have any discernible effect upon employment opportunities or the supply chain which reflects the type/scale of the development proposed.

The option would not affect water efficiency. Construction would increase resource use and generate waste which has been assessed as having a minor negative effect on Objective 10. There are no designated cultural heritage assets near the borehole or the route of the proposed pipeline and in consequence, a neutral effect has been identified in respect of Objective 11. The refurbishment of the Worsthorne borehole would occur within an existing site which is not expected to result in a significant impact on landscape character or visual amenity. Pipeline works may have a temporary impact on the local landscape character although any effects would be very minor. Overall, this option has been assessed as having a minor negative effect on Objective 12.
Operation The South Pennine Moors SAC/SPA/SSSI is located 1.3km from the borehole site and is directly adjacent to Hurstwood IR. As there is an existing abstraction licence in place which is assumed to have been reviewed by the EA under the Review of Consents process, it is not expected that operation would have any significant effects on the Moors. No effects on soils or land use are expected during operation. The abstraction of up to 4 Ml/d would have a negligible effect on groundwater. The option is not expected to cause or exacerbate flooding. No effects on local air quality are anticipated. Operational energy demand would be 828 kWh/Ml, generating 43 tonnes CO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10. The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of up to 4 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing. The option would not affect water efficiency. There would be no operational effects on designated cultural heritage assets. This option would not result in significant new above ground infrastructure and in consequence, a neutral effect on landscape is predicted.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR099c: Worsthorne Borehole (Worsthorne WTW)	Construction	0	+	0	0	0	-	0	0	0	-	0	0
	Operation	0	0	0	0	0	0	+	+	0	-	0	0

Construction

This option comprises the recommissioning and refurbishment of Worsthorne borehole. Refurbishments would include a new pump, new/improved headworks and M & E. The option would utilise the existing raw water mains to Worsthorne WTW where treatment processes would be modified to accommodate the up to 4Ml/d of water from the borehole.

South Pennine Moors SAC/SPA/SSSI is approximately 1.3km from the borehole site; however, given the type/scale of works, adverse construction effects on the protected interest features can be avoided with established measures such as construction best-practice or timing works to avoid avifauna breeding / migration periods. Overall, the HRA concludes that there are no clear effects or likely significant effects alone or in combination (e.g. no impact pathways; features not sensitive) resulting from construction such that this option has been assessed as having a neutral effect on Objective 1.

It is assumed that there would be no substantial new land take associated with this option (due to the utilisation of the existing borehole site). This has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option is not expected to cause or exacerbate flooding.

The construction of the option would generate a relatively small number of vehicle movements (274) during the 1.3 year construction period thus no significant air quality impacts are therefore expected.

Construction of the scheme would generate 124 CO2e which has been assessed as having a minor negative effect on Objective 6 (and Objective 10).

No effects on health are expected.

It is not expected that construction of this option would have any discernible effect upon employment opportunities or the supply chain which reflects the type/scale of the development proposed.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a minor negative effect on Objective 10.

There are no designated cultural heritage assets near the borehole and in consequence, a neutral effect has been identified in respect of Objective 11.

The refurbishment of the Worsthorne borehole would occur within an existing site which is not expected to result in a significant impact on landscape character or visual amenity. Overall, this option has been assessed as having a neutral effect on Objective 12.
Operation The South Pennine Moors SAC/SPA/SSSI is located 1.3km from the borehole site. As there is an existing abstraction licence in place which is assumed to have been reviewed by the EA under the Review of Consents process, it is not expected that operation would have any significant effects on the Moors. No effects on soils or land use are expected during operation. The abstraction of up to 4 Ml/d would have a negligible effect on groundwater. The option is not expected to cause or exacerbate flooding. No effects on local air quality are anticipated. Operational energy demand would be 828 kWh/Ml, generating 43 tonnes CO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10. The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of up to 4 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing. The option would not affect water efficiency. There would be no operational effects on designated cultural heritage assets. This option would not result in significant new above ground infrastructure and in consequence, a neutral effect on landscape is predicted.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR100: Thorncliffe Road Borehole, Barrow-in-Furness	Construction	-	+	0	0	-	--	-	+	0	--	0	0
	Operation	0	0	+/?	0	0	0	+	+	0	-	0	0

Construction

This option would involve the development of a new duplicate borehole at the Thorncliffe Road WTW site in addition to a new WTW. Development of the borehole would include the installation of new pump equipment, rising mains, M/E equipment and new headworks to asset standard design. A new inlet to an existing treated water storage facility would be developed to facilitate the transfer of a cumulative 9 Ml/d of treated water from the new and existing boreholes. Once operational, the new borehole/WTW would abstract, treat, and transfer 4.5 Ml/d to the treated water storage facility via a new 92m treated water main. In conjunction with this scheme, abstraction from the Schneider Road boreholes would be reduced in order to ensure no deterioration in WFD objectives for the Furness aquifer.

Construction activity associated with this option would take place within an existing operational site. The new borehole is within 1km of the Morecambe Bay SAC and Duddon Estuary SPA / Ramsar site though the HRA concludes that significant or significant adverse effects resulting from construction would be avoidable with established scheme-level avoidance or mitigation measures. Due to the assumed low intensity construction work required to develop the new borehole and WTW in regard to their minor structural scales, it is expected that works would result in minor temporary noise disturbance (drilling) and adverse air quality (dust) within the established operational site whereas excavation (92m) may adversely impact local habitats and wildlife along the route though this is expected to be negligible. On balance, this option has been assessed as having a minor negative effect on local biodiversity.

This option would utilise existing operational land which has been assessed as having a positive effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

There could be traffic congestion during the construction period (particularly on segments of the A590, Devonshire Road and Thorncliffe Road) which, together with emissions associated with the use of plant and machinery, may have a negative effect on local air quality (there would be an estimated 1,408 vehicle movements during the 1.5 year construction period).

The option would generate 1,302 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period although there may be a temporary disruption to the access and amenity of facilities adjacent to the Thorncliffe site (Hawcoat Park Sports Club and Playing Fields). There may also be a risk of noise disturbance/air quality impacts associated with construction of the WTW, drilling/excavation of the borehole and HGV movements which could affect residential receptors and community facilities (including schools) situated throughout central and western Barrow-in-Furness and particularly adjacent to the development site. Overall, the option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a moderate capital investment that could create a number of jobs resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Construction works and associated HGV movements could cause congestion and disruption/driver delay on the local road network, particularly given the need for a crossing across Thorncliffe Road; however, any impact would be temporary. On balance, the option has been assessed as having a positive effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The Thorncliffe Road site does not include, nor is it situated within close proximity to, any heritage features. The closest heritage assets are two Grade II listed buildings, North Lodge and Ramsden Vault, which are approximately 119m and 254m respectively from the development site. It is not expected that construction works would result in any adverse effect on the integrity or settings of these heritage assets.

The Thorncliffe Road site is not within or in proximity to any landscape designations. Development would be situated within an established operational area and therefore landscape/visual impacts are likely to be very minor (although works could have short term adverse impacts on local receptors including residential properties and adjacent schools). Overall, this option has been assessed as having a neutral effect on Objective 12.

Operation

This scheme would abstract 4.5 Ml/d of groundwater from one new borehole. However, there would be no net increase in the abstraction licensed quantity from the Furness aquifer as the scheme would effectively utilise spare licence capacity from the Schneider Road boreholes. It should also be noted that United Utilities' abstraction licences for the Furness aquifer were assessed under the Review of Consents process and were not found to be affecting the abstraction-sensitive features of Morecambe Bay SAC and Duddon Estuary SPA / Ramsar site, including the dune systems of Sandscale Haws; the shift in abstraction location (i.e. from Schneider to Thorncliffe) would not affect this. In addition, it is likely that the scheme will allow for a net reduction in abstraction from the aquifer. Overall, this option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 4.5 Ml/d. The Abstraction Licensing Strategy (ALS) indicates that there is limited water available in the associated groundwater body (there is a licence restriction of 4.2 Ml/d water available from the South Furness Groundwater Management Unit); however, in conjunction with this scheme, a reduction in abstraction from the Schneider Road boreholes would be implemented to avoid negative impacts on the quantitative water balance of the groundwater body. Further, the scheme may allow for a net reduction in abstraction from the aquifer, although the associated volume is currently uncertain. On balance, this option has been assessed as having a positive effect on Objective 3, although uncertainty remains.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 852 kWh/Ml, generating 59 tonnes CO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of 4.5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new borehole and WTW at Thorncliffe Road would introduce new above ground infrastructure within an urban/residential setting albeit within an existing operational area. Any visual impact is expected to be very minor and a neutral effect has been identified in respect of Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR101: Franklaw Z Site Plus Increased Franklaw WTW Treatment Capacity	Construction	0	+	0	-	-	--	-	++/-	0	--	0	0
	Operation	0	0	-/?	-	0	-	++	++	0	-	0	0

Construction

This option would involve the reinstatement and refurbishment of two existing boreholes at the Franklaw Z site in order to abstract and transfer a maximum of 18 Ml/d of raw groundwater to the existing Franklaw WTW via an existing raw water pipeline. Additionally, new borehole pumps would be installed at 10 other existing/utilised Franklaw/Broughton boreholes in order to abstract an additional 12 Ml/d and the capacity of Franklaw WTW would be increased.

The development sites are not within any European designated conservation sites nor are they within local statutory nature conservation sites, and as works associated with this option would be at existing operational sites, no significant effects on biodiversity are expected.

This option would utilise existing operational land which has been assessed as having a positive effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

The Franklaw Z borehole site is located within Flood Zone 2 and therefore construction could be liable to flooding depending on the timing of works. It is unlikely that construction would cause or exacerbate flooding in the area.

There could be impacts on traffic congestion resulting from 6,939 traffic movements during the 1.8 year construction period (particularly on segments of the A6, Lancaster Road, Wyre Lane and Catterall Lane) which, together with emissions associated with the use of plant and machinery, could have a negative effect on local air quality.

The option would generate 6,987 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There is a risk of noise disturbance/air quality impacts associated with the refurbishment of the boreholes and HGV movements in particular which may affect residential receptors within north-eastern Garstang; especially at Wyre Lane and Peacock Drive. Although any potential impact would be temporary, this has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a significant capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Construction works and associated HGV movements could cause congestion and disruption/driver delay on the local road network though impacts would be temporary. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The development sites do not include any designated heritage assets. The closest heritage assets to the general scheme include four Grade II listed buildings and a scheduled monument at an average distance of 0.8km from the borehole site (The Forge (885m), the Garstang Arts Centre (749m), Toll Bar (763m), a Milestone/Boundary stone (445m), and Greenhalgh Caste and Manor House (1.1km). There are also three listed buildings within 500m of the WTW site. Taking into account the distance of the assets from the works and the fact that activities would be focused within existing operational sites, any effect on the setting of these assets is expected to be negligible.

The development sites are not within or in proximity to any landscape designations. The refurbishment of the existing boreholes and works to Franklaw WTW would be situated within established operational areas and although there is the potential for short term adverse impacts on the visual amenity of residential receptors (particularly at Peacock Drive), they are expected to be very minor. Overall, this option has been assessed as having a neutral effect on Objective 12.

Operation

The operation of the scheme would abstract a combined 30 Ml/d of groundwater from the two newly reinstated/refurbished boreholes and the 10 modified Franklaw/Broughton boreholes.

The abstraction of up to 30 Ml/d may have residual effects on the hydrological regime of the River Wyre due to proximity of the boreholes to the river which may subsequently effect in-river habitats and aquatic wildlife. The HRA Screening states, however, that operation is unlikely to adversely or significant effect any European designated conservation sites, e.g. Morecambe Bay Ramsar/SAC/SPA (c.32km downstream from the boreholes via the River Wyre), which suggests that intervening tributaries may mitigate adverse effects on the river's quantitative water balance prior to Morecambe Bay. Due to the moderately sized abstraction volume in conjunction with the restricted availability of water within the principal aquifer, abstraction may also affect groundwater dependent flora within conservation areas such as Rough Hey Wood SSSI, Winmarleigh Moss SSSI, and Bowland Fells SSSI, although it is expected that distance between the boreholes and these sites will minimise any significant effects. On balance, this option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on soils/land use.

The WFD Assessment notes that the increased abstraction quantity would be within the current licence quantity for the borehole group (maximum aggregated daily peak of 190 Ml/d) but that the Abstraction Licensing Strategy (ALS) indicates that there is no water available for the groundwater body in which the abstraction boreholes are located. Overall, the options has therefore been assessed as having a negative effect on Objective 3, although some uncertainty remains.

The Franklaw Z borehole abstraction site would be located within Flood Zone 2 and therefore may be liable to flooding during operation, however, its operation is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 851 kWh/Ml, generating 323 tonnes CO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of 30 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The newly reinstated boreholes at the Franklaw Z site and increased capacity of Franklaw WTW would introduce some new above ground infrastructure. However, this would be within existing operational sites and in consequence, no long term landscape or visual impacts are expected. The option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR102a: Widnes Boreholes to Prescot WTW	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	-	0	-	++	++	0	-	0	-

Construction

This option comprises the refurbishment of Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites, which are currently out of service. Borehole restoration would include new headworks, pumps, M&E, civils, and kiosks/buildings at 11 boreholes excluding those situated at Stockswell. Additional refurbishment at Pex Hill would introduce a new break tank and pumping station, refurbishment of Cronton Booster PS to permit required flow transfer to Pex Hill, and two new watermains: one pipeline connecting Pex Hill to Prescot WTW (7.2km) and the other from Pex Hill to DMA 127-1 (6.1km). New WTW plant at Prescot would be developed to treat the blended water from the open reservoirs and boreholes. The scheme would have a capacity of 52.3 Ml/d.

There are no designated conservation areas close to any of the borehole sites or along the routes of the transfer pipelines and the majority of the refurbishments and upgrades will utilise existing sites which is expected to minimise the potential for impacts on biodiversity. Notwithstanding, works may cause some short-term minor disturbance to habitats and species specifically along the proposed excavation routes. Overall, this option has been assessed as having a minor negative effect on Objective 1.

It has been assumed that the majority of development would take place at existing sites and where soil is displaced through excavation, the land would be reinstated following the completion of works. Overall, the option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The Greensbridge Lane and Water Lane BHs are situated within Flood Zone 3 which increases the risk for flooding depending on the time of construction, although it is assumed that the sites benefit from existing, appropriate flood mitigation. Overall, a minor negative effect has been identified in respect of Objective 4.

The construction of the option would result in a large number of vehicle movements (33,222) during the 1.9 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality.

Construction of the scheme would generate 34,874 tonnes CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Although minor temporary disruption to the use of recreational facilities such as Eccleston Golf Park and Rainhill playing fields may occur, there would be no permanent impact upon recreational activities as a result of the construction of the pipeline. There may be temporary noise disruption due to the proximity of residential receptors to the Belle Vale, Netherley, and Greensbridge Lane boreholes and to sections of the proposed pipelines although the overall routing of the pipeline is semi-rural. Notwithstanding, the option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a large capital investment that is likely to create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the option would require the laying of approximately 13.3km of new pipework which could increase congestion and cause disruption/driver delay (the option utilises public highways for the Pex Hill to Prescot WTW route). On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a significant negative effective on Objective 10.

Water Lane BH and Pex Hill are within the general vicinity (< 1km) of grade ll listed buildings such as Tarbock Hall Farmhouse (Water Lane) and Wayside and The Field (Pex Hill);however, any disturbance to the setting of these assets would be temporary and minor if any impact were to occur. Pipeline excavation between Pex Hill and Prescot WTW may temporarily affect the setting of a scheduled monument along its route, St. Anne's Well, in addition to any unknown archaeological assets. Overall, the option has been assessed as having a negative effect on Objective 11.

Despite the utilisation of existing sites, the construction of new infrastructure such as borehole kiosks, Pex Hill's break tank and pumping station, Prescot WTW, and the pipelines may result in some minor and temporary landscape and visual impacts.

Operation

The operation of the option would not affect biodiversity as the scheme would be recommissioning existing boreholes / licences which will have been subject to review under the EA Review of Consents process nor would there be any anticipated adverse effects on land use/soils.

The abstraction of up to 52.3 Ml/d would reduce groundwater levels; however, this would be within existing licensed volumes. Overall, the option has been assessed as having a neutral effect on Objective 3.

The Greensbridge Lane and Water Lane boreholes are situated within Flood Zone 3 which increases the risk for flooding, although it is assumed that the sites benefit from existing appropriate flood mitigation. Overall, a minor negative effect has been identified in respect of Objective 4.

The option would have a neutral effect on air quality in the area.

The operation of the option would generate 965 tCO_2e/a, requiring 1,153 KWh/Ml of power to pump and treat up to 52.3 Ml/d of water. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water, generating a significant positive effect on health. The option would help ensure the continuity of supply and may support economic/population growth, resulting in a significant positive effect on the local economy.

The option would not affect water efficiency.

There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

Operation of the option would not utilise any new infrastructure significantly beyond what has previously been established on the borehole sites. The semi-rural setting of some sites may be adversely impacted by the introduction of permanent above-ground development, although any effects are expected to be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR102ai: Widnes Boreholes to Prescot WTW	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	-	0	--	++	++	0	--	0	-

Construction

This option comprises the refurbishment of Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites, which are currently out of service. Borehole restoration would include new headworks, pumps, M&E, civils, and kiosks/buildings at 11 boreholes excluding those situated at Stockswell. Additional refurbishment at Pex Hill would introduce a new break tank and pumping station, refurbishment of Cronton Booster pumping station to permit required flow transfer to Pex Hill, and two new watermains: one pipeline connecting Pex Hill to the Prescot WTW (7.2km) and the other from Pex Hill to DMA 127-1 (6.1km). New WTW plant at Prescot would be developed to treat the blended water from the open reservoirs and boreholes. The scheme would have a capacity of 52.3 Ml/d. It should be noted that this option includes water softening within the treatment process.

There are no national or European designated conservation areas close to any of the borehole sites although there are some local designated sites within 3km of the boreholes e.g. Pickering Pasture and Childwall Woods and Fields Local Nature Reserves, although utilisation of established best practice and scheme level mitigation should prevent any significant effects to these sites. There are also no designated nature conservation areas along the routes of the transfer pipelines. The majority of the refurbishments and upgrades will utilise existing sites which is expected to minimise the potential for impacts on biodiversity though works may cause some localised short-term disturbance to habitats and species. Overall, this option has been assessed as having a minor negative effect on Objective 1.

It has been assumed that the majority of development would take place at existing sites and where soil is displaced through excavation, the land would be reinstated following the completion of works. Overall, the option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The Greensbridge Lane and Water Lane BHs are situated within Flood Zone 3 which increases the risk for flooding depending on the time of construction, although it is assumed that the sites benefit from existing, appropriate flood mitigation. Overall, a minor negative effect has been identified in respect of Objective 4.

The construction of the option would result in a large number of vehicle movements (34,237) during the 1.9 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality.

Construction of the scheme would generate 34,554 tonnes CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Although minor temporary disruption to the use of recreational facilities such as Eccleston Golf Park and Rainhill playing fields may occur, there would be no permanent impact upon recreational activities as a result of the construction of the pipeline. There may be temporary noise disruption due to the proximity of residential receptors to the Belle Vale, Netherley, and Greensbridge Lane boreholes and to sections of the proposed pipelines although the overall routing of the pipeline is semi-rural. Notwithstanding, the option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a large capital investment that is likely to create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the option would require the laying of approximately 13.3km of new pipework which could increase congestion and cause disruption/driver delay (the option utilises public highways for the Pex Hill to Prescot WTW route). On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a significant negative effective on Objective 10.

Water Lane BH and Pex Hill are within the general vicinity (< 1km) of grade II listed buildings such as Tarbock Hall Farmhouse (Water Lane) and Wayside and The Field (Pex Hill); however, any disturbance to the setting of these assets would be temporary and minor if any impact were to occur. Pipeline excavation between Pex Hill and Prescot WTW may temporarily affect the setting of a scheduled monument along its route, St. Anne's Well, in addition to any unknown archaeological assets. Overall, the option has been assessed as having a negative effect on Objective 11.

Neither the existing sites nor the proposed construction works are within or in proximity to any landscape designations. Despite the utilisation of existing sites, the construction of new infrastructure such as borehole kiosks, Pex Hill's break tank and pumping station, Prescot WTW, and the pipelines may result in some minor and temporary landscape and visual impacts.

Operation

HRA Screening has concluded that operation of the option would have no effects alone or in combination on any European conservation site as this option involves recommissioning existing boreholes with existing abstraction licences which are assumed to have been reviewed by the EA under the Review of Consents process.

No effects adverse effects on land use/soils were identified.

The abstraction of up to 52.3 Ml/d would reduce groundwater levels, although this would be within existing licensed volumes. Overall, the option has been assessed as having a neutral effect on Objective 3.

The Greensbridge Lane and Water Lane boreholes are situated within Flood Zone 3 which increases the risk for flooding, although it is assumed that the sites benefit from existing appropriate flood mitigation. Overall, a minor negative effect has been identified in respect of Objective 4.

The option would have a neutral effect on air quality in the area.

The operation of the option would require 1,153 KWh/Ml of power to pump and treat up to 52.3 Ml/d of water, which would generate 1,106 tCO_2e/a. This has been assessed as having a significant negative effect in respect of Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water, generating a significant positive effect on health. The option would help ensure the continuity of supply and may support economic/population growth, resulting in a significant positive effect on the local economy.

The option would not affect water efficiency.

There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

The operational sites are not within or in proximity to any landscape designations. Abstraction of groundwater would not utilise any new infrastructure significantly beyond what has previously been established on the borehole sites. The semi-rural setting of some sites, e.g. the new Prescot WTW and modifications to Pex Hill, may be adversely impacted by the introduction of permanent above-ground development, although any effects are expected to be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR102b: Widnes Boreholes to Liverpool and Warrington DMZs	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	-	0	--	++	++	0	--	0	-

Construction

This option comprises the refurbishment of Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites. Borehole restoration would include new headworks, pumps, M&E, civils, and kiosks/buildings at 11 boreholes excluding those situated at Stockswell. Development within the Liverpool DMZ would include an upgrade to Netherley WTW in order to treat the combined raw water transfer from Belle Vale, Netherley, Water Lane, and Greensbridge Lane, a new pumping station at Netherley, and new treated water mains between Netherley WTW and two treated water storage sites (approx. 4.35km) and Pex Hill to DMA 127-1 (6.1km). Development within the Warrington DMZ would include the refurbishment of Stockswell WTW, a new WTW at Pex Hill, slip lining of the existing treated water main between the Stockswell WTW and Pex Hill, and the abandonment of the Cronton Booster Pumping Station. The overall scheme is estimated to abstract, transfer, and treat up to 55.3 Ml/d from the refurbished boreholes. The scheme would have a capacity of 55.3 Ml/d (an annual average of 46.6 Ml/d).

There are no national or European designated conservation areas close to any of the borehole sites such that HRA Screening has concluded there is a lack of impact pathways for construction effects. There are, however, some local designated sites within 3km of the boreholes e.g. Pickering Pasture and Childwall Woods and Fields Local Nature Reserves, although utilisation of established best practice and scheme level mitigation should prevent any significant effects to the sites. There are also no designated nature conservation areas along the routes of the transfer pipelines. The majority of the refurbishments and upgrades will utilise existing sites which is expected to minimise the potential for impacts on biodiversity though works, particularly along the proposed excavation routes, may cause some localised short-term disturbance to habitats and species. Overall, this option has been assessed as having a minor negative effect on Objective 1.

It has been assumed that the majority of development would take place at existing sites and where soil is displaced through excavation, the land would be reinstated following the completion of works. Overall, the option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The Greensbridge Lane and Water Lane BHs are situated within Flood Zone 3 which increases the risk for flooding depending on the time of construction, although it is assumed that the sites benefit from existing, appropriate flood mitigation. Overall, a minor negative effect has been identified in respect of Objective 4.

The construction of the option would result in a large number of vehicle movements (19,068) during the 1.9 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality.

Construction of the scheme would generate 20,520 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Although minor temporary disruption to the use of recreational facilities such as Lee Park Golf Club and Woolton Woods/Ashton Square may occur, there would be no permanent impact upon recreational activities because of pipeline excavation. There may be temporary noise disruption due to the proximity of residential receptors to the Belle Vale, Netherley, and Greensbridge Lane BHs and to sections of the proposed pipelines, especially those within Woolton. The remaining components of the scheme are primarily situated within semi-rural areas. Overall, the option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a large capital investment that is likely to create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the option would require the laying of approximately 10.45km of new pipework during which could increase congestion and disruption/driver delay, and in this respect, it is noted that this option utilises residential roads for the Netherley WTW to a treated water storage site and treated water storage pipeline route. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a significant negative effective on Objective 10.

Water Lane BH and Pex Hill are within the general vicinity (< 1km) of grade ll listed buildings such as Tarbock Hall Farmhouse (Water Lane) and Wayside and The Field (Pex Hill) although any disturbance to the setting of these assets would be temporary and most likely negligible. There is a large cluster of listed buildings around High Street, Church Road, and their branch streets (Woolton) which comprise the primary pipeline route between Netherley WTW and a treated water storage site. Consequently, there is a risk that pipeline construction would temporarily affect the setting of these heritage assets. Overall, the option has been assessed as having a negative effect on Objective 11.

Neither the existing sites nor the proposed construction works are within or in proximity to any landscape designations. Despite the utilisation of existing sites, the construction of new infrastructure such as borehole kiosks, Pex Hill's break tank and pumping station, and water main pipelines may result in some minor and temporary landscape impacts on the semi-rural setting.

Operation

HRA Screening has concluded that operation of the option would have no effects alone or in combination on any European conservation site as this option involves recommissioning existing boreholes with existing abstraction licences which are assumed to have been reviewed by the EA under the Review of Consents process.

No effects on land use/soils are anticipated.

The abstraction of up to 55.3 Ml/d would reduce groundwater levels, although this would be within existing licensed volumes. Overall, the option has been assessed as having a neutral effect on Objective 3.

The Greensbridge Lane and Water Lane boreholes are situated within Flood Zone 3 which increases the risk for flooding, although it is assumed that the sites benefit from existing appropriate flood mitigation. Overall, a minor negative effect has been identified in respect of Objective 4.

The option would have a neutral effect on air quality in the area.

The operation of the option would require 2,022 KWh/Ml of power to pump and treat up to 55.3 Ml/d of water which would generate 1,315 tCO_2e/a. This has been assessed as having a significant negative effect in respect of Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water, generating a significant positive effect on health. The option would help ensure the continuity of supply and may support economic/population growth, resulting in a significant positive effect on the local economy.

The option would not affect water efficiency.

There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

The operational sites are not within or in proximity to any landscape designations. Operation of the option would not utilise any new infrastructure significantly beyond what has previously been established on the borehole sites. The semi-rural setting of some sites, e.g. the new Prescot WTW and modifications to Pex Hill, may be adversely impacted by the introduction of permanent above-ground development, although any effects are expected to be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR102c: Widnes Boreholes to Runcorn and Warrington DMZs	Construction	-	-	0	-	--	--	-	++/--	0	--	-	-
	Operation	0	0	0	-	0	--	++	++	0	--	0	-

Construction

This option would involve the recommissioning and refurbishment of the existing Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell, and Pex Hill boreholes. Development within the Runcorn DMZ would consist of installing a new raw water main connecting Belle Vale, Netherley, Water Lane, and Stockswell BHs to the Greensbridge Lane BH site to facilitate the transfer of 30 Ml/d – 48 Ml/d of raw water to a new WTW at Hale Bank. Output from the Hale Bank WTW would subsequently be transferred to the treated water storage site via a new pumping station and treated water main for distribution as required by demand. Development within the Warrington DMZ would consist of a new WTW situated within an existing treated water storage site to treat and transfer 5.8Ml/d – 9.1 Ml/d to customers within DMA 127-1 via a new treated water. Because the cumulative abstraction amount of 57.1 Ml/d is greater than the existing conjunctive licence of 55 Ml/d, maximum capacities of the treated water storage sites would be reduced to 47 Ml/d and 8 Ml/d, respectively, to maintain a total scheme capacity of 55 Ml/d (46.6 Ml/d on average).

There are no national or European designated conservation areas close to any of the borehole sites although there are some local designated sites within 3km of the boreholes e.g. Pickering Pasture and Childwall Woods and Fields Local Nature Reserves. The proposed treated water main would be routed along the banks of the Mersey Estuary Ramsar/SSSI/SPA for approx. 2.2km until traversing the Estuary via Runcorn/Widnes Bridge. Excavation of the water main route poses the risk of introducing pollution/debris in addition to resulting in moderate noise disturbance. However, the HRA concludes that any such effects are avoidable with established mitigation measures. Construction would occur within a semi-rural setting bordered by extensive urban development such that works may cause short-term disturbance to proximate habitats (agricultural, grassland, and woodland) and wildlife. Due to the potential local effects, this option has been assessed as having a minor negative effect on Objective 1.

Borehole refurbishment would be contained within existing sites such that new ancillary infrastructure should not significantly impact on land/soil quality. It should be noted, however, that Water Lane and Stockswell BHs are on Grade 2 'best and most versatile' agricultural land whereas Greensbridge Lane and Pex Hill BHs are situated within Grade 3a agricultural land though it is not expected that the construction of the kiosks/buildings would be outside the existing site footprint. Similarly, Pex Hill WTW would be situated within the operational footprint of a treated water storage site. However, the development of Hale Bank WTW would require a substantial land-take of Grade 2 agricultural land. Pipeline excavation would be routed through urban, Grade 2, and Grade 3 agricultural land which would have a mixed effect on land/soil though excavated land would be reinstated following the completion of construction. Overall, this option has been assessed as having negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Segments of the proposed excavation route would be situated within Flood Zone 3s originating from Netherley Brook, Dog Clog Brook, Ditton Brook, and the Mersey Estuary (Flood Zone 2 and 3). Additionally, Greensbridge Lane and Water Lane BHs are located within Flood Zone 2/3s of Netherley Brook and Dog Clog Brook, respectively. Therefore, the reinstatement of theboreholes and segments of excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the A533, B5178, and the residential roads overlaying or adjacent to the proposed pipeline route) which would have a significant negative effect on local air quality (there would be an estimated 47,421 HGV movements during the 1.9-year construction period).

The option would generate 30,165 tCO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The proposed pipeline route would overlay approx. 2.6km of the Trans Pennine Trail (east) along the Mersey Estuary which could result in a significant disruption of physical activity for residents and tourists alike. It is not expected that construction of the remaining components would significantly affect other opportunities for recreation and physical activity though proposed works may result in a temporary disruption of use or loss of amenity to the grounds which host recreational walking and sport such as Runcorn Hill, Lee Park Golf course, and Netherley Playing Field. Because the scheme is situated within an urbanised area, there is an increased likelihood that there may be noise/vibration disturbance and air quality impacts associated with the proposed works and pipeline excavation on residential receptors. There are also various educational and community facilities situated near the proposed excavation route and borehole/WTW works such that works may temporary disrupt the accessibility and amenity of their use. Overall, this option has been assessed as having a negative effect on Objective 7.

Construction of the option represents a significant capital investment that could create a number of jobs resulting in a significantly positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, most of the pipeline route is adjacent and/or overlaying transportation infrastructure (road network/Runcorn Widnes Bridge) which poses a significant risk to residential mobility and ease of access (congestion/delay) although impacts would be temporary. On balance, the option has been assessed as having a mixed significantly positive and significant negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significantly negative effect on Objective 10.

The option would not affect water efficiency.

Neither the borehole sites nor WTWs are within any historic designations, however, there are several Grade II Listed Buildings and scheduled monuments within proximity of these components. The Duck Decoy Pond scheduled monument is approx. 731m from the proposed Hale Bank WTW which could result in adverse impacts on the visual amenity associated with the Pond due to the structural scale of the WTW in conjunction with the flat topography between the two sites. Additionally, 9 Grade II Listed Buildings maintain possible vantage points to the scheme; however, all Listed Buildings would be situated at a minimum of 150m from the BHs and WTWs such that assets may experience a loss of visual amenity regarding their settings, however, this would be temporary and negligible to their structural integrity. The proposed excavation route would be within proximity of 15 Grade II/II* Listed Buildings; specifically, 12 of these assets would be under 100m which suggests a moderate risk to the integrity and settings of these assets as exemplified by the Grade II Runcorn Widnes Road Bridge which would be utilised as a component within the pipeline route.

Neither the boreholes and WTWs nor the proposed excavation route are within or in proximity to any landscape designations. Refurbishment/modification of the boreholes and development of Pex Hill WTW may adversely impact the amenity of the surrounding urban greenfield setting; however, construction would be confined to existing operational footprints such that any adverse impact on the landscape would be minor. Depending on the scale of Hale Bank WTW, construction may adversely impact the local setting and landscape character of the Estuary due to its flat and open typography. The proposed excavation route enjoys segments of woodland buffer although works could adversely impact the more rural landscapes and the residential visual amenity associated with such when excavation occurs within open areas. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

HRA Screening has concluded that operation of the option would have no effects alone or in combination on any European conservation site. It is currently uncertain whether the additional abstraction of groundwater would have any other adverse effects; however, abstraction of 8.45 Ml/d would be within the existing abstraction licence limit such that it is assumed to have been reviewed by the EA under the Review of Consents process thus no significant operational effects on biodiversity are anticipated. Overall, this option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The abstraction of up to 55 Ml/d would reduce groundwater levels, although this would be within existing licensed volumes. Overall, the option has been assessed as having a neutral effect on Objective 3.

The Netherley Brook and the Dog Clog Brooke's Flood Zones 2/3 designations along their banks pose a risk and liability of flooding to the Greensbridge Lane and Water Lane BHs which could damage equipment or disrupt service. Overall, operation of the general scheme is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 1,348 kWh/Ml, generating 1,098 tCO2e/a which has been assessed as having a significantly negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the cumulative abstraction of up to 55 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

Approximately 9 Listed Buildings are be within the general vicinity of the Belle Vale, Water Lane, and Pex Hill BHs and WTW. Due to the scale of the boreholes and their ancillary infrastructure, it is not expected that operation of the sites would result in any discernible effect on these assets. Overall, this option has been assessed as having a neutral effect on Objective 11.

The operational sites are not within or in proximity to any landscape designations. The refurbishment/modification of the boreholes would be part and parcel to the existing structural footprints established on these sites such that any adverse impact on the surrounding semi-rural landscape would be minor, if not negligible. The structural scale of Pex Hill and Hale Banks WTWs may alter their urban greenfield settings and wider semi-rural landscape character as the flat and open typography would preserve the vantage points on the WTWs from passing and residential receptors. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR102d: Eccleston Hill Borehole to Prescot WTW	Construction	-	+	0	0	-	--	0	0	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	0

Construction

This option comprises the refurbishment of Eccleston Hill boreholes (2), which is currently permitted to abstract up to 3.18 Ml/d, with an assumed maximum yield of 5 Ml/d. Refurbishment would include two new pumps, new headworks, M & E, civils, and new kiosks/buildings for both boreholes together with the construction of a new 1.5km raw water main to the Prescot open reservoirs.

There are no designated conservation areas within the proximity of the Eccleston boreholes site or along the route of the transfer pipeline to Prescot. Notwithstanding, the construction of the pipeline may cause some short-term minor disturbance to habitats and species along the route. Overall, the option has been assessed as having a minor negative effect on Objective 1.

It has been assumed that the majority of development would take place at existing sites and where soil is displaced through excavation, the land will be reinstated following the completion of works. The option has therefore been assessed as having a positive effect on soil/land use.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option is not expected to cause or exacerbate flooding.

The construction of the option would result in 1,071 vehicle movements during the 1.2 year construction period from which emissions, in conjunction with plant and machinery, may have a minor negative effect on local air quality.

Construction of the scheme would generate 1,110 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Although minor temporary disruption to the use of recreational facilities such as West Park Rugby Football Club may occur, there would be no permanent impact upon recreational activities because of construction. There may be some noise disturbance due to the refurbishment of the boreholes and the construction of the pipeline which could affect residential receptors adjacent to the boreholes site (Prescot Road and Eccleston Gardens); however, the refurbishment work is temporary and the pipeline route is semi-rural such that the overall effect on health is likely to be negligible.

The construction of the option represents a small capital investment and no significant economic benefits are anticipated. A neutral effect has therefore been identified in respect of Objective 9. The option would not affect water efficiency. Construction would increase resource use and generate waste which has been assessed as having a minor negative effective on Objective 10. No heritage sites have been identified near the boreholes site or pipeline route considered in this option. In consequence, a neutral effect has been identified in respect of Objective 11. Despite the utilisation of an existing boreholes site and Prescot WTW, the construction of new infrastructure such as borehole kiosks, pumps, potential booster pumping station, and raw water main pipelines may result in some minor and temporary landscape and visual impacts.
Operation The operation of the option would not affect biodiversity as the scheme would be recommissioning existing boreholes / licences which will have been subject to review under the EA Review of Consents process nor would there be any anticipated adverse effects on land use/soils. The abstraction licensing strategy (ALS) indicates that there is restricted water available in the groundwater body; specifically, there may be localised temporary changes to the status of the groundwater body, but as the overall abstraction quantity is unchanged, these should not have a long term impact on the status of the water body as a whole. Overall, the option has been assessed as having a neutral effect on Objective 3. The operation of the option would not cause or exacerbate flooding. The option would have a neutral effect on air quality in the area. The operation of the option would generate 47 tCO_2e/a, requiring 522 KWh/Ml of power to pump and treat up to 5Ml/d of water. This has been assessed as having a neutral effect on Objective 6 and a negative effect in respect of Objective 10. The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water, generating a positive effect on health. The option would help ensure the continuity of supply (the option has a design capacity of up 5 Ml/d) and may support economic/population growth, resulting in a positive effect on the local economy. The option would not affect water efficiency. There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme. Operation of the option will not utilise any new infrastructure significantly beyond what has previously been established on the boreholes site, thus landscape effects are expected to be negligible.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR102e: Bold Heath Boreholes to Prescot WTW	Construction	-	+	0	0	-	--	-	+/-	0	--	-	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	0

Construction

This option comprises the recommissioning of Bold Heath boreholes. Refurbishment would include new headworks, M & E, new pumps, new kiosks at both boreholes, and the construction of a new 9km raw water main to Prescot WTW to provide up to 9 Ml/d.

There are no designated conservation areas close to the Bold Health borehole site or along the route of the transfer pipeline. Refurbishments and upgrades would utilise the existing site which is expected to minimise the potential for impacts on biodiversity. Notwithstanding, the construction phase may cause some short-term disturbance to habitats and species along the new pipeline route. Overall, this option has been assessed as having a minor negative effect on Objective 1.

It is assumed that there would be no new land take associated with this option due to the utilisation of the existing site with any soil displaced through excavation returned following the completion of works. A minor positive effect has therefore been identified in respect of Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The option would not cause or exacerbate flooding.

The construction of the option would result in 5,533 vehicle movements during the 1.3 year construction period from which emissions, in conjunction with plant and machinery, may have a minor negative effect on local air quality.

Construction of the scheme would generate 6,263 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Although minor temporary disruption to the use of recreational facilities such as Eccleston Golf Park and Rainhill playing fields may occur, there would be no permanent impact upon recreational activities as a result of construction. There would be some noise due to construction of the pipeline which may affect residential receptors although the works are temporary such that any nuisance is likely to be minor.

The construction of the option represents a modest capital investment which may create some employment opportunities and supply chain benefits. However, the laying of 9km of new pipeline during construction could adversely impact the local transport network, particularly where it crosses the M62, A roads and a railway line, although any effects would be temporary and felt in the short term only. On balance, the option has been assessed as having a mixed positive and negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use and generate waste which has been assessed as having a significant negative effect on Objective 10.

There are several heritage assets within the general vicinity of the proposed development scheme. There are two Schedule Monuments within 1.5km from Bold Heath borehole (Southland Farm heavy anti-aircraft gun site (1.1km) and Old Bold Hall moated site (1.3km), although it is considered unlikely that construction would result in any adverse effects on either their structural integrity or settings due to the relative distance between the assets and the proposed refurbishment work. Additionally, the proposed pipeline route would be within close vicinity of Cranshaw Hall moated site (181m) and directly adjacent to Rainhill Hall Farm moated site and 12 fish ponds and consequently, works may pose a risk of detrimentally impacting the settings of these sites, although it is assumed that site specific mitigation measures and established best practice would be implemented to manage such impacts. There are no listed buildings directly adjacent to either Bold Heath boreholes or Prescot water treatment works; notwithstanding this, there are a number of Grade II/II* listed buildings situated along the proposed pipeline route. Specifically, 29 listed buildings range from 837m to less than 10m from the route with twelve of those assets under 400m. It is assumed that established best practice and intervening buffer (woodland and the urban environment) will minimise any significantly adverse effects on the integrity and/or visual amenity of these assets in regard to their settings. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. The refurbishment of the existing boreholes would take place within an established operational area and although there is the potential for short term adverse impacts on the visual amenity of nearby residential receptors, effects are expected to be very minor. Pipeline works may temporarily affect landscape character and visual amenity particularly where they are routed through Prescot. A minor negative effect has therefore been identified in respect of Objective 12.

Operation:

The operation of the option would not affect biodiversity as the scheme would be recommissioning existing boreholes / licences which will have been subject to review under the EA Review of Consents process nor would there be any anticipated adverse effects on land use/soils.

The Abstraction Licensing Strategy (ALS) for Lower Mersey and Alt indicates that there is restricted water available in the groundwater body; however, communication from the EA to United Utilities indicates that there is 3 Ml/d of available resource in the Groundwater Management Unit (annual daily average volume) and that a peak abstraction rate of 9 Ml/d may be possible. The option has therefore been assessed as having a neutral effect on Objective 3.

The operation of the option would not cause or exacerbate flooding.

The option would have a neutral effect on air quality in the area.

The operation of the option would generate 131 tCO_2e/a, requiring 1,035 KWh/Ml of power. This has been assessed as having a minor negative effect in respect of Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The option would not affect opportunities for recreation but would help to ensure a continual supply of clean drinking water, generating a positive effect on health.

The option would help ensure the continuity of supply (the option has a design capacity of up to 9 Ml/d) and may support economic/population growth, resulting in a positive effect on the local economy.

The option would not affect water efficiency.

There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme. As new above ground infrastructure would be located within an existing site, effects on landscape are also expected to be negligible.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR105a: Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook)	Construction	-	-	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	-

Construction

This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes (abstraction of 9.1 Ml/d). Utilising existing raw water mains and pumping infrastructure, the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at Sow Brook. Output from the new WTW would be pumped into an existing treated water main and transferred to the Manchester DMZ.

The proposed Sow Brook WTW site is not within or in the vicinity of any statutory or non-statutory nature conservation sites including European designated sites; however, development of the WTW could result in the loss of/disturbance to local habitats and species, although any affects are expected to be very minor. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Construction of the new WTW would occur on Grade 2 agricultural land (albeit adjacent to an existing pumping station) which has been assessed as having a negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed WTW would be adjacent to Flood Zones 2/3 of Sow Brook; consequently, there is a marginal risk of flooding during the construction period although this is considered unlikely. It is not expected that construction would increase flood risk elsewhere.

There could be local traffic congestion during the construction period (particularly along the A56, A6144 and local roads such as Lymmhay Lane) which may, together with the operation of plant and machinery, have a negative effect on local air quality (there would be an estimated 3,337 vehicle movements during the 1.5-year construction period).

The option would generate 3,249 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, construction may temporarily affect access to Lymm Golf Club, adjacent allotments and Sow Brook Playing Fields. There may be a risk of temporary noise disturbance/air quality impacts associated with construction of the WTW and related HGV movements which could

affect residential receptors situated within central Lymm; Lymmhay Lane, Brooklyn Drive, Brook Road, Danebank, and along the A6144. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a substantial capital expenditure which could have a significant positive effect on the local economy. The works could temporarily result in increased congestion and disruption/driver delay on the local road network although any impact would be temporary. Overall, this option has been assessed as having a significant positive effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The proposed Sow Brook WTW site does not include any designated heritage assets. There are two scheduled monuments, Rixton Old Hall moated site and Lymm Hall moated site and icehouse, approximately 1.6km and 700m from the site respectively whilst there are a number of listed buildings to the south. However, it is not expected that construction of the WTW would result in any adverse effect on the setting of these assets given the presence of physical barriers. Overall, this option has been assessed as having a neutral effect on Objective 11.

The WTW site is not within or in proximity to any landscape designations; however, works would be located on a greenfield site and development could affect local landscape character and the visual amenity of nearby residential and recreational receptors.

Operation

The abstraction of 9.1 Ml/d from the Lymm boreholes would be within the existing abstraction licence limit which will have been subject to review under the EA Review of Consents process thus no adverse effect on biodiversity is anticipated.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 9.1 Ml/d which, as concluded by the WFD Assessment, would have no or minimal effect on groundwater.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be circa 120 kWh/Ml, generating 33 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The supply of 9.1 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The WTW would introduce new above ground infrastructure on a greenfield site, although this would be adjacent to an existing pumping station. The presence of the WTW could have minor effects on the visual amenity of residential receptors to the south and nearby recreational receptors such as users of Lymm Golf Club and the adjacent allotments. This has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR105ai: Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook)	Construction	-	-	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	-

Construction

This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes (abstraction of 9.1 Ml/d). Utilising existing raw water mains and pumping infrastructure, the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at Sow Brook. Output from the new WTW would be pumped into an existing treated water main and transferred to the Manchester DMZ. This option would include water softening within the treatment process.

The proposed Sow Brook WTW site is not within or in proximity to any statutory or non-statutory nature conservation sites including European designated sites; however, development of the WTW could result in the loss of/disturbance to local habitats and species, although any affects are expected to be very minor. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Construction of the new WTW would occur on Grade 2 agricultural land (albeit adjacent to an existing pumping station) which has been assessed as having a negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed WTW would be adjacent to Flood Zones 2/3 of Sow Brook; consequently, there is a marginal risk of flooding during the construction period although this is considered unlikely. It is not expected that construction would increase flood risk elsewhere.

There could be local traffic congestion during the construction period (particularly along the A56, A6144 and local roads such as Lymmhay Lane) which may, together with the operation of plant and machinery, have a negative effect on local air quality (there would be an estimated 3,514 vehicle movements during the 1.5-year construction period).

The option would generate 3,310 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, construction may temporarily affect access to Lymm Golf Club, adjacent allotments and Sow Brook Playing Fields. There may be a risk of temporary noise disturbance/air quality impacts associated with construction of the WTW and related HGV movements which could

affect residential receptors situated within central Lymm; Lymmhay Lane, Brooklyn Drive, Brook Road, Danebank, and along the A6144. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a substantial capital expenditure which could have a significant positive effect on the local economy. The works could temporarily result in increased congestion and disruption/driver delay on the local road network although any impact would be temporary. Overall, this option has been assessed as having a significant positive effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The proposed Sow Brook WTW site does not include any designated heritage assets. There are two scheduled monuments, Rixton Old Hall moated site and Lymm Hall moated site and icehouse, approximately 1.6km and 700m from the site respectively whilst there are a number of listed buildings to the south. However, it is not expected that construction of the WTW would result in any adverse effect on the setting of these assets given the presence of physical barriers. Overall, this option has been assessed as having a neutral effect on Objective 11.

The WTW site is not within or in proximity to any landscape designations; however, works would be located on a greenfield site and development could affect local landscape character and the visual amenity of nearby residential and recreational receptors.

Operation

The abstraction of 9.1 Ml/d from the Lymm boreholes would be within the existing abstraction licence limit which will have been subject to review under the EA Review of Consents process thus no adverse effect on biodiversity is anticipated.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 9.1 Ml/d which, as concluded by the WFD Assessment, would have no or minimal effect on groundwater.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be circa 313 kWh/Ml, generating 63 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect in respect of Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The supply of 9.1 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The WTW would introduce new above ground infrastructure on a greenfield site, although this would be adjacent to an existing pumping station. The presence of the WTW could have minor effects on the visual amenity of residential receptors to the south and nearby recreational receptors such as users of Lymm Golf Club and the adjacent allotments. This has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR105b: Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Hill Cliffe)	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
(No water softening)	Operation	0	0	0	0	0	0	+	+	0	-	0	-

Construction

This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes (abstraction of 9.1 Ml/d). Utilising a new pumping main (8.4km), the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW at an existing treated water storage facility.

The proposed Hill Cliffe WTW site and pipeline route are not within or in proximity to any European designated conservation sites nor statutory nature conservation sites. Whilst the WTW would be located at an existing site (helping to minimise impacts on biodiversity), pipeline works in particular may cause some short term, localised disturbance to habitats and species. Additionally, excavation would cross Massey Brook and Dingle Brook which could introduce pollution/debris into these river systems (although this is likely to be mitigated). Overall, this option has been assessed as having a minor negative effect on Objective 1.

Development of the new WTW would take place on land currently housing water supply infrastructure and it is assumed that any soil displaced through excavation as part of the laying of the pipeline would be returned following the completion of works. In consequence, the option has been assessed as having a minor positive effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area although it should be noted that a section of pipeline would be routed across Flood Zones 2/3 and therefore works may be liable to flooding (depending on timing).

There could be traffic congestion during the construction period (particularly along the A56, A50, A49 and local roads) which may, together with the operation of plant and machinery, have a negative effect on local air quality (there would be an estimated 6,213 vehicle movements during the 1.5 year construction period).

The option would generate 8,152 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, works may result in temporary disruption to the use of open space within the vicinity of the proposed pipeline route which may support recreational walking and sport such as Lumb Brook Millennium Green and Broomfields Recreation Centre and Playing Fields.

Construction of the WTW may also result in temporary disruption to the users of Walton Hall Golf Course. There may be a risk of temporary noise disturbance/air quality impacts associated with the pipeline works which could affect residential receptors situated within High Warren, Dudlow's Green, Grappenhall and western/central Lymm while development of the new WTW at Hill Cliffe could affect the residential amenity of receptors on Firs Street. Overall, this option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a moderate capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the transportation of equipment/material and pipeline works (including across A roads and the M6) could affect the local road network and temporarily increase congestion and disruption/driver delay. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The proposed Hill Cliffe WTW site does not include any designated heritage assets although there are approximately four Grade II listed buildings situated along the periphery of Hill Cliffe at a range of 0.5km - 0.9km from the site. However, it is not expected that construction of the WTW would adversely impact the setting of these assets due to their relative distance from the development site. There are two scheduled monuments, Bradley Hall moated site and Lymm Hall moated site and Icehouse, approximately 1.7km and 283m respectively from the proposed pipeline route; however, works are unlikely to affect these assets. Additionally, there are approximately seven Grade II listed buildings under 300m from the proposed pipeline route, four of which are under or equal to 100m from the route (Brookfield Fourways (112m), Brookfield House (36m), 11, 13, 15, 17, and 19 Church Road, and Booth's Hill Road Milestone (5m). Although it is expected that mitigation would prevent any significantly adverse effects on the integrity of these buildings from occurring, there may be a temporary impact on their setting. Overall, this option has been assessed as having a negative effect on Objective 11.

Neither the Hill Cliffe WTW site nor the proposed pipeline route are within or in proximity to any landscape designations. Construction of the WTW may adversely impact the surrounding local landscape character as well as the visual amenity of local residential and recreational receptors. However, a moderate woodland buffer along the periphery of the proposed site could help minimise any impacts in this regard. Excavation of the pipeline between Hill Cliffe and Lymm may adversely impact the semi-rural character of the local landscape although any impacts would be temporary. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The abstraction of 9.1 Ml/d from the Lymm boreholes would be within the existing abstraction licence limit which will have been subject to review under the EA Review of Consents process thus no adverse effect on biodiversity is anticipated.

There would be no operational effects on soils/land use.

The option would result in the abstraction of approximately 9.1 Ml/d which would have no or minimal effect on groundwater.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 453 kWh/Ml, generating 85 tonnes CO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The supply of 9.1 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new WTW would introduce new above ground infrastructure; however, it would be situated within the operational footprint of the treated water storage site which benefits from a woodland buffer along its periphery and therefore any landscape and visual effects are expected to be very minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR105bi: Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Hill Cliffe)	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	-

Construction

This option would involve the decommissioning of Lymm WTW while intensifying the operation of the Quarry and Dingle boreholes (abstraction of 9.1 Ml/d). Utilising a new pumping main (8.4km), the 9.1 Ml/d from the Lymm boreholes would be transferred and treated at a new WTW located at a treated water storage facility. It should be noted that this option includes water softening within the treatment process.

The proposed Hill Cliffe WTW site and pipeline route are not within or in proximity to any statutory or non-statutory nature conservation designated sites. Whilst the WTW would be located at an existing site (helping to minimise impacts on biodiversity), pipeline works in particular may cause some short term, localised disturbance to habitats and species. Additionally, excavation would cross Massey Brook and Dingle Brook which could introduce pollution/debris into these river systems (although this is likely to be mitigated). Overall, this option has been assessed as having a minor negative effect on Objective 1.

Development of the new WTW would take place on land currently housing water supply infrastructure and it is assumed that any soil displaced through excavation as part of the laying of the pipeline would be returned following the completion of works. In consequence, the option has been assessed as having a minor positive effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area although it should be noted that a section of pipeline would be routed across Flood Zones 2/3 and therefore works may be liable to flooding (depending on timing).

There could be traffic congestion during the construction period (particularly along the A56, A50, A49 and local roads) which may, together with the operation of plant and machinery, have a minor negative effect on local air quality (there would be an estimated 6,350 vehicle movements during the 1.5 year construction period).

The option would generate 8,213 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, works may result in temporary disruption to the use of open space within the vicinity of the proposed pipeline route which may support recreational walking and sport such as Lumb Brook Millennium Green and Broomfields Recreation Centre and Playing Fields.

Construction of the WTW may also result in temporary disruption to the users of Walton Hall Golf Course. There may be a risk of temporary noise disturbance/air quality impacts associated with the pipeline works which could affect residential receptors situated within High Warren, Dudlow's Green, Grappenhall and western/central Lymm while development of the new WTW at Hill Cliffe could affect the residential amenity of receptors on Firs Street. Overall, this option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a moderate capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the transportation of equipment/material and pipeline works (including across A roads and the M6) could affect the local road network and temporarily increase congestion and disruption/driver delay. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The proposed Hill Cliffe WTW site does not contain any designated heritage assets although there are approximately four Grade II listed buildings situated along the periphery of Hill Cliffe at a range of 0.5km - 0.9km from the site. However, it is not expected that construction of the WTW would adversely impact the setting of these assets due to their relative distance from the development site. There are two scheduled monuments, Bradley Hall moated site and Lymm Hall moated site and Icehouse, approximately 1.7km and 283m respectively from the proposed pipeline route; however, works are unlikely to affect these assets. Additionally, there are approximately seven Grade II listed buildings under 300m from the proposed pipeline route, four of which are under or equal to 100m from the route (Brookfield Fourways (112m), Brookfield House (36m), 11, 13, 15, 17, and 19 Church Road, and Booth's Hill Road Milestone (5m). Although it is expected that mitigation would prevent any significantly adverse effects on the integrity of these buildings from occurring, there may be a temporary impact on their setting. Overall, this option has been assessed as having a negative effect on Objective 11.

Neither the Hill Cliffe WTW site nor the proposed pipeline route are within or in proximity to any landscape designations. Construction of the WTW may adversely impact the surrounding local landscape character as well as the visual amenity of local residential and recreational receptors. However, a moderate woodland buffer along the periphery of the proposed site could help minimise any impacts in this regard. Excavation of the pipeline between Hill Cliffe and Lymm may adversely impact the semi-rural character of the local landscape although any impacts would be temporary. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The abstraction of 9.1 Ml/d from the Lymm boreholes would be within the existing abstraction licence limit which is assumed to have been reviewed by the EA under the Review of Consents process thus no significant operational effects on biodiversity are anticipated. Furthermore, HRA Screening concludes no adverse effects of operation on European designated sites.

There would be no operational effects on soils/land use.

The abstraction of up to 9.1 Ml/d would reduce groundwater levels though this would be within existing licensed volumes. Overall, the option has been assessed as having a neutral effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 647 kWh/Ml, generating 115 tonnes CO_2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The supply of 9.1 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The new WTW would introduce new above ground infrastructure; however, it would be situated within the operational footprint of a treated water storage site which benefits from a woodland buffer along its periphery and therefore any landscape and visual effects are expected to be very minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR106: Walton and Daresbury Boreholes	Construction	-	+	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	-

Construction

This option would involve the reinstatement and refurbishment of existing boreholes at Walton and Daresbury. Refurbishment of the three boreholes would include three new borehole pumps, rising mains mechanical and electrical equipment and improved headworks to asset standard design. A new raw water main (approximately 3.6km in length) would be constructed between the Walton and Daresbury borehole sites as well as a new 500m main between a treated water storage facility and a new WTW at Hill Cliffe. The option would have a capacity of up to 8.45 Ml/d.

There are no national or European designated conservation sites that are within close proximity to the scheme although there is a local designated site (Daresbury Firs LNR), situated less than 0.5km from the Daresbury borehole. HRA Screening does not identify any likely significant effects from the proposed scheme on European designated sites and their interest features. Whilst the majority of development would take place at existing sites (helping to minimise impacts on biodiversity), pipeline works in particular may cause short term, localised disturbance to habitats and species. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Development of the new WTW facilities would take place on land currently housing water supply infrastructure and it is assumed that any soil displaced through excavation as part of the laying of the pipeline would be returned following the completion of works. In consequence, the option has been assessed as having a minor positive effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area although it should be noted that a section of pipeline would be routed across Flood Zone 3 and therefore works may be liable to flooding (depending on timing).

Construction would generate a total of 7,300 vehicle movements during the 1.8 year construction period. The emissions from these movements, in conjunction with plant and machinery operation, may have minor negative effects on local air quality.

The option would generate 8,547 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, there may be temporary disruption to Walton Hall Golf Course. There may also be noise/vibration disturbance and air quality impacts associated with the pipeline excavation (which could affect residential receptors around Daresbury, Beechtree Farm and Lower Walton)

while development of the new WTW at Hill Cliffe could affect the residential amenity of receptors on Firs Street. The transportation of equipment/material could further exacerbate these impacts. Overall, this option has been assessed as having a negative effect on Objective 7.

The construction of the option represents a large capital investment that could create a number of jobs resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Adverse effects on the local road network from construction would be temporary and felt in the short term only. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The option would not affect water efficiency.

The development sites do not contain any heritage features although there are approximately three scheduled monuments at 1.5km – 2.6km from the proposed scheme. It is not expected, however, that construction would result in any adverse impact on the monuments or their settings. Additionally, there are various clusters of Grade II and II* listed buildings situated along the proposed pipeline route including, for example, Daresbury Hall, Church of All Saints and Hough's Bridge. Excavation of the pipeline may temporary impact the setting of these assets and in consequence, this option has been assessed as having a minor negative effect on Objective 11.

The sites are not within or in proximity to any landscape designations although works may have a temporary, localised landscape impact. There is also the potential for short term visual impacts on residential properties and recreational receptors (including a golf course) in close proximity to the development sites/proposed pipeline route. A minor negative effect has therefore been identified in respect of Objective 12.

Operation

The abstraction of 8.45 Ml/d from the Walton and Daresbury boreholes would be within the existing abstraction licence limit which is assumed to have been reviewed by the EA under the Review of Consents process thus no significant operational effects on biodiversity are anticipated. Furthermore, HRA Screening concludes no adverse effects of operation on European designated sites.

There would be no operational effects on soils/land use.

The abstraction of up to 8.45 Ml/d would reduce groundwater levels though this would be within existing licensed volumes. Consequently, the option has been assessed as having a neutral effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 1,157 kWh/Ml, generating 149 tCO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of up to 8.45 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The refurbished boreholes and the new Hill Cliffe WTW would introduce new above ground infrastructure. However, this would be within existing sites which benefit from existing screening and therefore any landscape/visual impacts are expected to be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR107a: Aughton Park Moss End Boreholes	Construction	-	+	0	0	-	--	0	++/-	0	--	0	-
	Operation	0	0	-/?	0	0	-	+	+	0	-	0	0

Construction

This option would involve fully commissioning two existing boreholes located at Aughton Park and Moss End including new headworks, pumps, M&E, civils and kiosks/buildings. A new raw water main would transfer water from the two sites to the existing Royal Oak WTW which would be modified to allow the additional water to be treated. The option would have a capacity of 10Ml/d.

The proposed development sites are not within or in proximity to any designated nature conservation sites. Construction works may cause some short-term disturbance to habitats and species, particularly along the pipeline route which is primarily routed along the local road network. Through the utilisation of scheme level mitigation and best practice, it is not expected that excavation would result in any significant effects. The HRA has concluded that there are no likely significant effects on European designated sites. Overall, this option has been assessed as having a minor negative effect on local biodiversity at this stage.

This option would utilise existing borehole sites and Royal Oak WTW whilst any soil displaced through excavation as part of the laying of the pipeline would be returned following the completion of works. In consequence, the option has been assessed as having a minor positive effect on Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The boreholes and connection to Royal Oaks WTW are in Flood Zone 1 and therefore works are not expected to be affected by flooding. The option would also be unlikely to increase flood risk elsewhere.

Construction is expected to generate 4,382 vehicle movements during the 0.2 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality. However, any impacts would be short term and temporary and may be mitigated to an extent through best practice and therefore negative effects on Objective 5 have been assessed as minor.

Construction of the scheme would generate 4,267 tCO_2e/a which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be a risk of noise disturbance/air quality impacts associated with the borehole and pipeline works as well as associated HGV movements, although due to the rural nature of the scheme, very few receptors would likely be affected. Overall, the option has been assessed as having a neutral effect on Objective 7.

The construction of the option represents a large capital investment that has been assessed as having a significant positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, works and associated HGV movements could cause congestion and disruption/driver delay on the local road network, particularly given the need for crossing the A506; however, any impact would be temporary. On balance, this option has been assessed as having a mixed significantly positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The development sites do not include any designated heritage assets with the nearest assets being a small cluster of Grade II listed buildings circa 500m to the south east of Aughton Park and north west of Moss End respectively. Effects on the setting of these assets are not expected. Whilst the pipeline route has not yet been confirmed, there are only a limited number of listed buildings in the general vicinity of the scheme which are unlikely to be affected by the works. Overall, this option has been assessed as having a neutral effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. The borehole sites and proposed pipeline route are located within a rural setting and in consequence, development may have short term adverse impacts on local landscape character. Works at Royal Oak WTW, meanwhile, are not expected to have any landscape or visual impacts as this is an existing operational site. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The closest European site to the newly commissioned boreholes are Martin Mere SPA / Ramsar at approximately 5km such that significant or significantly adverse effects resulting from abstraction is expected to be avoidable with established operational mitigation. Consequently, this option has been assessed as having a neutral effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment reports that there may be effects on the quantitative water balance of the aquifer as the abstraction licensing strategy (ALS) indicates that there is restricted water available in the groundwater body. The abstraction of 10 Ml/d has therefore been assessed as having a negative effect on Objective 3, although some uncertainty remains.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

There would be 141 tCO_2e/a produced and 1,044 kWh/Ml of energy consumed during the operation of the option which has been assessed as having a minor negative effect upon Objectives 6 and 10.

The option would provide 10Ml/d of safe drinking water when operational and would not impact upon the recreational potential of the area. A positive effect has therefore been identified in respect of Objective 7.

There is unlikely to be any direct impact on employment levels during operation but the supply of 10Ml/d may support economic and population growth. This has been assessed as having a positive effect on Objective 8.

The option would not affect water efficiency.

There are unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

There would be new above ground development (borehole infrastructure) associated with this option within a rural setting. However, this would be within existing sites and therefore any adverse landscape impacts are expected to be very minor and in consequence, a neutral effect has been identified in respect of Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR107ai: Aughton Park Moss End Boreholes	Construction	-	+	0	0	-	--	0	++/-	0	--	0	-
	Operation	0	0	-/?	0	0	-	+	+	0	-	0	0

Construction

This option would involve fully commissioning two existing boreholes located at Aughton Park and Moss End including new headworks, pumps, M&E, civils and kiosks/buildings. A new raw water main would transfer water from the two sites to the existing Royal Oaks WTW which would be modified to allow the additional water to be treated. The option would have a capacity of 10Ml/d. It should be noted that water softening (ion exchange) is included within the treatment process.

The proposed development sites do not include and are not in the vicinity of any European designated nature conservation sites. The Martin Mere SPA / Ramsar is approximately 5km away. HRA Screening has concluded that there are no likely significant effects on Martin Mere SPA/Ramsar alone or in combination (e.g. no impact pathways; features not sensitive) resulting from the construction phase. Construction works may cause some short-term disturbance to habitats and species, particularly within the vicinity of pipeline excavation (3.73km) which is primarily routed along the local road network. Overall, this option has been assessed as having a minor negative effect on local biodiversity at this stage.

This option would utilise existing borehole sites and Royal Oak WTW whilst any soil displaced through excavation as part of the laying of the pipeline would be returned following the completion of works. In consequence, the option has been assessed as having a minor positive effect on Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The boreholes and connection to Royal Oak WTW are in Flood Zone 1 and therefore works are not expected to be affected by flooding. The option would also be unlikely to increase flood risk elsewhere.

Construction is expected to generate 5,541 vehicle movements during the 0.2 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality though any adverse impacts would be felt in the short term. On balance, this option has been assessed as having a negative effect on Objective 5.

Construction of the scheme would generate 4,706 tCO_2e/a which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be a risk of noise disturbance/air quality impacts associated with the borehole and pipeline works as well as associated HGV movements, although due to the rural nature of the scheme, very few receptors would likely be affected. Overall, the option has been assessed as having a neutral effect on Objective 7.

The construction of the option represents a large capital investment that has been assessed as having a significant positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, works and associated HGV movements (which could equate to an approximate average of between 90 – 130 per day) could cause congestion and disruption/driver delay on the local road network, particularly given the need for crossing the A506; however, any impact would be temporary. On balance, this option has been assessed as having a mixed significantly positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The development sites do not contain any designated heritage assets with the nearest assets being a small cluster of Grade II listed buildings circa 500m to the south east of Aughton Park and north west of Moss End respectively. Effects on the setting of these assets are not expected. Whilst the pipeline route has not yet been confirmed, there are only a limited number of listed buildings in the general vicinity of the scheme which are unlikely to be affected by the works. Overall, this option has been assessed as having a neutral effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. The borehole sites and proposed pipeline route are located within a rural setting and in consequence, development may have short term adverse impacts on local landscape character. Works at Royal Oaks WTW, meanwhile, are not expected to have any landscape or visual impacts as this is an existing operational site. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The closest European site to the newly commissioned boreholes is Martin Mere SPA / Ramsar at approximately 5km and significant or significantly adverse effects resulting from abstraction is expected to be avoidable with established operational mitigation. The abstraction of 10 Ml/d may reduce the water levels of tributaries and watercourses within the surrounding area which could potentially affect local and nearby in-river ecological features, e.g. habitats, native wildlife, and migratory species, although the minor abstraction volume suggests that the scheme is unlikely to result in significant impacts (in conjunction with established operational mitigation). Consequently, this option has been assessed as having a neutral effect on Objective 1. There would be no operational effects on soils/land use.

The increased abstraction of 10 Ml/d from the newly commissioned boreholes at Aughton Park and Moss End could potentially result in adverse effects on the quantitative water balance of the aquifer as the abstraction licensing strategy (ALS) indicates that there is restricted water available in the groundwater body. Consequently, this option has been assessed as having a negative effect on Objective 3, although uncertainty remains.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

There would be 2,755 tCO_2e/a produced and 304 kWh/Ml of energy consumed during the operation of the option which has been assessed as having a minor negative effect upon Objectives 6 and 10.

The option would provide 10Ml/d of safe drinking water when operational and would not impact upon the recreational potential of the area. A positive effect has therefore been identified in respect of Objective 7.

There is unlikely to be any direct impact on employment levels during operation but the supply of 10Ml/d may support economic and population growth. This has been assessed as having a positive effect on Objective 8.

The option would not affect water efficiency.

There are unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

The operational sites are not within or in proximity to any landscape designations. There would be new above ground development (borehole infrastructure) associated with this option within a rural setting. However, this would be within existing sites and therefore any adverse landscape impacts are expected to be very minor and in consequence, a neutral effect has been identified in respect of Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR107b: Randles Bridge, Knowsley, Primrose Hill	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	-/?	-	0	-	++	++	0	-	0	0

Construction

This option would involve the recommissioning of the Randles Bridge boreholes (2), Knowsley boreholes (2), and the Primrose Hill borehole which would involve the fitting of new headworks, fixed speed submersible pumps, mechanical & electrical equipment, civils, and associated kiosks/buildings in order to abstract a maximum of 4 Ml/d per site. A cumulative 12 Ml/d of raw water would be abstracted and transferred to Royal Oak WTW via new raw water mains: Randles Bridge/Knowsley main (14.2km) and Primrose Hill main (8.9km). Royal Oak WTW's treatment processes would subsequently be modified to accommodate the increased 12 Ml/d input (54 Ml/d to 65 Ml/d). Additional modifications to Royal Oak WTW's output and distribution network would occur as appropriate to permit the WTW's increased capacity to function within the Southport and Liverpool DMZs.

Due to the wide scale of development proposed by this option, a range of statutory conservation sites are within proximity of the scheme; however, it is expected that the utilisation of the previously established BH sites and Royal Oak WTW should help mitigate against adverse impacts on local biodiversity due to the contained nature of the refurbishment/modification. The Primrose Hill BH is within the vicinity of various SSSIs which include Martin Mere Ramsar - Martin Mere, Burscough SSSI/SPA (4.9km), Ribble and Alt Estuaries Ramsar/SPA – Sefton Coast SSSI/SAC (8km), Mere Sands Woods SSSI (8km), and Downholland Moss (6km). Due the relative distance between the works and the conservation areas in addition to the scale of works proposed on site, it is not expected that construction would result in any significantly adverse impacts on their interest features, and in consequence, the HRA concludes no effects alone or in combination with other projects as there are no impact pathways. Randles Bridge BHs and a section of the proposed pipeline are approx. 0.9km and 0.4km, respectively, from the Crowteth LNR which supports various species of bird, small mammal, insects, and flora. Due to the proximity of works to the site, excavation could result in minor noise disturbance and loss of air quality (dust) during the construction period. The proposed pipeline route would be directly adjacent to Acornfield Plantation LNR. However, because the site has been designated primarily due to its flora, it is considered unlikely that excavation would result in any detrimental effect on the site beyond temporary noise disturbance and a restriction of movement in/out of Acornfield Plantation for local wildlife. It should also be noted that the proposed pipeline excavation would cross various river systems such as Knowsley Brook, Simonswood Brook, and Bickerstaffe Brook which poses the risk of introducing pollution/debris within local river ecosystems, although site level mitigation should prevent significant effects. In addition to avoidance measures (such as further consideration of routing), mitigation would need to be taken at infrastructure sites and along the route to ensure that construction activities and any resulting dust, discharges and disturbance do not have an adverse effect on habitats and any associated species. Outside designated sites, construction would occur within a rural/semi-rural greenfield setting which may cause short-term disturbance to woodland and meadow habitats and local wildlife within proximity of the works. Overall, this option has been assessed as having a negative effect on Objective 1.

The reinstatement/modification of boreholes and Royal Oak WTW would be contained within operational or existing sites such that new ancillary infrastructure should not impact land/soil quality. It should be noted, however, that Randles Bridge BHs are situated on Grade 2 'best and most versatile' agricultural land whereas Royal Oak WTW, Knowsley BHs, and Primrose Hill BH are situated within Grade 1

agricultural land though it is not expected that the construction of the kiosks/buildings would result in significant land take due to their minor structural footprints. Pipeline excavation would be routed through Grade 1 and 2 agricultural land which may temporarily disrupt agricultural operations though land would be reinstated following the completion of construction. Overall, this option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The Randles Bridge BHs and a segment of the proposed excavation route would be situated within a Flood Zone 2 originating from Croxteth Brook whereas other segments of excavation would be located within Flood Zone 3s of Simonswood Brook, Bickerstaffe Brook, and the Simonwood Moss drainage system. Consequently, reinstatement of the Randles Bridge BHs and excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the M57, M58, A580, B5202, and the local road network within the vicinities of the proposed components) which would have a negative effect on local air quality (there would be an estimated 11,461 HGV movements during the 1.8-year construction period).

The option would generate 14,977 tCO2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, construction may result in a temporary disruption of use or loss of amenity to the grounds within proximity to construction which host recreational walking and sport such as the Aughton Village Hall Playing Fields, Mossock Hall Golf Course, Googies Field Croxteth, and Knowsley Park. Additionally, there may be noise/vibration disturbance and air quality impacts associated with the refurbishment and modification of the boreholes/WTW and the pipeline excavation which could affect residential receptors near Croxteth, Kirkby, Knowsley, Aughton, and the scattered residential dwellings and farmsteads within the vicinity of the scheme. Overall, this option has been assessed as having a negative impact on Objective 7.

Construction of the option represents a significant capital investment which could create a substantial number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, pipeline excavation in addition to the transportation of equipment/material could temporarily increase congestion and disruption/driver delay on the regional and local road networks. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The option would not affect water efficiency.

Neither the borehole and WTW sites nor the proposed excavation route contain any historic designations, however, there are several Grade II/II* Listed Buildings and scheduled monuments within proximity of the scheme. Halsall Medieval Rectory scheduled monument is approx. 1.6km from the Primrose Hill BH whereas the Cunscough Hall moated site is approx. 1.1km from a segment of excavation. Due to the relative distance between these sites and the proposed works in addition to the scattered woodland buffer which characterises the landscape, it is not expected that construction would result in any adverse effects beyond a minor temporary loss of visual amenity regarding their settings visual during construction. Additionally, 28 Grade II / II* Listed Buildings maintain possible vantage points to the proposed works; specifically, there are 3 Listed Buildings under 100m from the excavation route: Church of St. Mary (98m), Knowsley Old Vicarge (98m), and Simmonswood Hall (91m). Although it is expected that mitigation measures will be utilised during construction, the proximity between these heritage assets and the works suggests a moderate risk to the integrity and settings of these heritage assets. The remaining Listed Buildings (>100m) may experience a loss of visual amenity regarding their settings, however, this would be temporary.

Neither the borehole and WTW sites nor the proposed excavation route are within or in proximity to any landscape designations. Refurbishment/modification of the boreholes and the WTW may adversely impact the amenity of the surrounding semi-rural/rural greenfield setting; however, construction would be confined within the existing structural footprints of these components such that any adverse impact on the landscape would be minor. The proposed excavation route benefits from screening from segments of woodland buffer although works could adversely impact the wider semi-rural landscape and the residential visual amenity associated with such when excavation occurs within open greenfield areas. Consequently, the option has been assessed as having a negative effect on Objective 12.

Operation

The HRA confirms that operation of the option would have no effects alone or in combination on European conservation sites, e.g. Martin Mere SPA / Ramsar and Ribble and Alt Estuaries Ramsar/SPA, and Sefton Coast SSSI/SAC (subject to the EA confirming the extension of the existing abstraction licence which will have been subject to review under the EA Review of Consents process). Notwithstanding this, the distance from the operation site to these designated sites suggests that significant effects resulting from abstraction would be avoidable with established operational mitigation. Overall, this option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The option would result in the abstraction of an additional 12 Ml/d which could have minor negative effects on groundwater resources, although uncertainty remains.

Randles Bridge BHs are located within a Flood Zone 2 originating from the Croxteth Brook whereas Knowsley boreholes and the Primrose Hill borehole are situated within Flood Zone 1 classified land. Consequently, this option may be liable to flooding during operation, however, operation of the general scheme is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 744 kWh/Ml, generating 341 tCO2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased abstraction of 12 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

Approximately 5 listed buildings are within 0.7km of the Randles Bridge BH: Sefton Arms Cottages and four properties along Ribbler's Lane. Due to the scale of the borehole and ancillary infrastructure, it is not expected that operation of the site would result in any discernible effect on these sites beyond a slight alteration of their wider setting. Furthermore, there are no proximate cultural heritage assets to the Knowsley boreholes whereas the closest asset to Primrose Hill BH is over approximately 800m thus effects are expected to be negligible. Overall, there would be no operational effects from the wider scheme on designated cultural heritage assets.

The refurbishment/modification of the boreholes and WTWs would be part and parcel to the existing structural footprint established on these sites such that any adverse impact on the surrounding semi-rural landscape would be minor, if not negligible. Additionally, most sites within the scheme benefit from minor to substantial woodland buffer which should help screen any new structural additions to the sites.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR109: Swineshaw Boreholes (Buckton Castle WTW)	Construction	0	+	0	0	0	-	0	0	0	-	0	0
	Operation	--/?	0	0	0	0	0	+	+	0	-	0	0

Construction

This option involves the recommissioning and refurbishment of three existing boreholes located on the Swineshaw Brook catchment and the transfer of up to 4 Ml/d (1.33 Ml/d per borehole) of raw water to Buckton Castle WTW via existing raw water transfer infrastructure. This would require refurbishment works for all boreholes, new borehole pumps and rising mains, M&E equipment, and new or improved headworks.

The boreholes are located adjacent to designated sites (Dark Peak SSSI, South Pennine Moors SSSI/SPA/SAC, and the Peak District Moors SAC) and two boreholes are located within 50m of the site boundaries. It is possible that the planned construction works could affect some of the interest features indirectly; however, given the type/localised scale of works, adverse construction effects on the protected interest features can be avoided with established measures such as construction best-practice or timing works to avoid avifauna breeding / migration periods. Consequently, this option has been assessed as having a neutral effect on Objective 1.

The borehole refurbishment would take place on existing sites without any additional land-take; therefore, the option has been assessed as having a positive effect on soil/land use.

It is not expected that construction would have an effect on water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The sites are not located in areas at risk of flooding.

A total of 548 vehicle movements during the 1.5 year construction period which is expected to have a neutral effect on local air quality.

Construction would generate 696 tCO_2e which, together with resource use and waste generation, has been assessed as having a negative effect on Objectives 6 and 10.

Although there could be emissions of noise and dust during construction, it is assumed that any impacts would be of short duration and no effect is expected on human health, particularly given the remoteness of the sites.

The option would involve a relatively small capital expenditure which has been assessed as having a neutral effect on Objective 8. The option would not affect water efficiency. There are no known heritage assets that may be affected by the works. There would be temporary landscape impacts from construction, but any effects are likely to be negligible given the scale of works.
Operation All three boreholes are located outside the designated site boundaries noted above (Dark Peak SSSI, South Pennine Moors SAC, and the Peak District Moors SPA). The boreholes' abstraction licences were surrendered in 1992 and were last operated during the 1995-1996 drought event. There is a degree of uncertainty regarding the option's operational impact on groundwater fed features of the designated sites identified and this is currently under investigation by United Utilities and the Environment Agency. The primary features of the designated sites are moorland and are therefore water dependent (some of which may be groundwater dependent). Walkover surveys in 2017 have highlighted this potential issue. The local topography and hydrogeological complexity is such that resumption of groundwater abstraction may affect the interest features of the sites but this may be difficult to ascertain with any certainty. Overall, this option has been assessed as having a significant negative effect on Objective 1 at this present time, although this is uncertain and remains under investigation. No effects on land use/soils are anticipated. There is no groundwater management unit defined in the ALS for this location as indicated by the WFD Assessment. The River Tame has water available across all flows, indicating that groundwater may be available for this relatively small new licence such that the abstraction of up to 4 Ml/d has been assessed as having a neutral effect on Objective 3. The option is not expected to cause or exacerbate flooding or affect local air quality. Once operational, the option would require ongoing energy use (487 kWh/Ml) and would generate 34 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10. The additional design capacity would help ensure a continued supply of safe drinking water which will benefit the local health of the area as well as potentially supporting population/economic growth. The option would not affect water efficiency. No effects on heritage assets are expected once the option is operational. Minimal permanent landscape impacts are expected as the new facilities would be constructed at existing sites resulting in a neutral assessment of the option against Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR110: Rushton Spencer Boreholes	Construction	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Operation	**0**	**0**	**-/?**	**0**	**0**	**0**	**+**	**+**	**0**	**-**	**0**	**0**

Construction

This option would involve increasing the licenced abstraction rate of the two existing Rushton Spencer boreholes in order to abstract and transfer an additional 2 Ml/d to Hug Bridge WTW via an existing raw water main. Neither the Rushton Spencer boreholes nor Hug Bridge WTW are expected to require any modifications to accommodate the increased abstraction, transference, and treatment of raw water. Treated output from Hug Bridge WTW would subsequently be transferred to SRZ potable water storage via existing treated water main infrastructure.

As this option would not involve any construction activities, it has been assessed as having a neutral effect across the SEA objectives.

Operation

It is not expected that the abstraction of an additional 2 Ml/d of groundwater would have any adverse effect on biodiversity.

There would be no operational effects on soils/land use.

The ALS does not identify a groundwater management unit in this area as indicated by the WFD Assessment, but the River Dane has limited water available indicating there is some pressure on water resources in the area. However, the new licence quantity is relatively small such that the increased abstraction of approximately 2 Ml/d would on balance have a negative effect on groundwater resources, although uncertainty remains.

The option is not expected to cause or exacerbate flooding.

There would be no operational effects on air quality.

This option would generate 28 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased daily abstraction by 2 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets or landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR111: Woodford Borehole	Construction	-	-	0	0	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	-

Construction

This option involves increasing the capacity of Woodford borehole from 9 Ml/d to 12 Ml/d via the installation of a new submersible pump and upgraded raw water control. The option would also require a new WTW at an existing treated water storage facility and (potentially) circa 7.8km of upgraded pipeline. The additional output would be 6 Ml/d.

There are no national or international designated nature conservation sites near the proposed Hazel Grove WTW site, the Woodford borehole site (which comprises an existing pumping station), or along the present raw water main between Woodford and Hazel Grove. HRA Screening concluded there are no clear impact pathways emerging from development. The Woodford site and Hazel Grove are both situated within semi-rural settings and the present raw water main crosses large swaths of greenfield land such that construction and any upgrading of the pipeline may cause some short-term disturbance to habitats and species which has been assessed as having a minor negative effect on Objective 1.

It is assumed that the option would utilise the existing Woodford borehole site along with the raw water main; however, the construction of the Hazel Grove WTW would involve development on Grade 3 agricultural land. On balance, the option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would have an effect on water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The works are not located in an area at risk of flooding.

A total of 10,201 vehicle movements would be required over the 2 year construction period. The emissions from these movements, in conjunction with plant and machinery operation, may have some minor negative effects on local air quality.

The option would generate 9,224 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

Depending on whether the raw water main is upgraded, the use of Richard Green Golf Course may be temporary disrupted but overall, there would be no significant impact upon recreational activities as a result of the construction of the option. There could potentially be noise disturbance as a result of construction which could affect residential receptors to the north-east and north-west of the Woodford

borehole site and along the raw water main if upgraded (specifically Moor Lane and A5149, Woodford / A523 / south-east Hazel Grove). Consequently, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a substantial capital investment that is likely to create a number of jobs resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. However, the option may require the upgrading of approximately 7.8km of pipeline which could increase congestion and disruption/driver delay and in this respect, it is noted that portions of the raw water main cross 'A' roads (A6, A5149 and A523). Additionally, the transportation of material/equipment may also contribute to disruption of the local road network, although any effects would be temporary. It is also noted that pipeline works could affect a railway line. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction works are not expected to directly impact upon heritage assets although they may temporarily affect the setting of approximately six Grade II listed buildings near the Woodford borehole site and along the pipeline route, if upgraded, such as the Milestone along the A523 (22m) and Moor Farm (46m). Therefore, the option has been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. Development of the Woodford borehole site, potential excavation of the raw water main, and the construction of the new WTW at a treated water storage site may result in temporary adverse impacts on the visual amenity of nearby receptors and local landscape character.

Operation

Although the EA would need to confirm the increase in daily abstraction volume, HRA Screening concludes that it is unlikely that any European designated conservation sites would be significantly affected due to the lack of discernible impact pathways. Operation (subject to EA confirmation for abstraction increase) may reduce the water levels of tributaries and watercourses within the surrounding area which could potentially affect local and nearby in-river ecological features, e.g. habitats, native wildlife, and migratory species, although the small abstraction volume suggests that the scheme is unlikely to result in significant impacts. Furthermore, operation is not anticipated to adversely impact local or nearby ecological features due to the proposed abstraction volume which is considered to be minor. Consequently, this option has been assessed as having a neutral effect on Objective 1.

Operation of the option is not expected to affect land use/soils.

The increase in abstraction volume at Woodford borehole from the current licensed quantity of 9 Ml/d to 12 Ml/d is considered unlikely to have widespread or prolonged effects on either the hydrological regime of surface watercourses or the quantitative water balance of the groundwater body due to the availability of surface water at high flows (greater limitation at lower flow levels), the existing abstraction licence currently in place, and the relatively small increase in abstraction volume. The option has therefore been assessed as having a neutral effect on Objective 3.

The option is not expected to cause or exacerbate flooding.

No further effects on air quality are expected during operation.

The ongoing energy requirements (625 kWh/Ml) and emission of 98 tCO_2e/a have been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased capacity of 6 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

No effects on heritage assets are expected once the option is operational.

The operational sites are not within or in proximity to any landscape designations. Although some landscape /visual impacts can be expected from the introduction of the new Hazel Grove WTW, the facility would be within the relative operational context of a treated water storage site. Overall, the option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR112: Bramhall Borehole	Construction	-	-	0	0	-	--	-	++/-	0	--	-	-
	Operation	0	0	-/?	0	0	-	+	+	0	-	0	-

Construction

This option involves the development of a new borehole and pumping stations within the Bramhall area in order to abstract an average of 5 Ml/d. A new 5.3km raw water main, partially following an existing treated water main, would transfer raw water from the Bramhall borehole to a new WTW adjacent to the treated water storage site.

There are no national or international designated nature conservation sites near the proposed Hazel Grove WTW site, Bramhall borehole, pumping stations or along the pipeline route. HRA Screening concludes there are no clear impact pathways on European designated sites emerging from development. There are several small LNRs (Happy Valley, Jackson's Brickworks and Poynton Coppice) in the vicinity of the proposed works; however, these are located at a minimum distance of 1 km from the development sites. In consequence, any adverse effects on biodiversity are expected to be minor and would be likely to be related to disturbance associated with, for example, the drilling of boreholes and excavation work.

The construction of the Hazel Grove WTW and associated infrastructure would require additional land take (including Grade 3 agricultural land). There would also be the loss of greenfield land associated with the development of the Bramhall borehole and pumping stations. Any soil displaced through excavation of the pipeline would be returned following the completion of works. On balance, the option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would have an effect on water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The works are not located in an area at risk of flooding.

There could be traffic congestion during the construction period (particularly along Woodford Road (A5102) and London Road North (A523)) which may, together with the use of plant and machinery, have a minor negative effect on local air quality (there would be an estimated 9,648 vehicle movements during the 1.8 year construction period).

The option would generate 11,362 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period although the proposed pipeline would cross a golf course (which could temporarily affect users of this facility) as well as other recreational routes/footpaths in the area. There may be noise/vibration disturbance and air quality impacts associated with the works which could

affect residential receptors along the A5149 / north and north-west Poynton / south-east Hazel Grove and those adjacent to the Bramhall borehole in particular. This has been assessed as having a negative effect on Objective 7.

The construction of the option represents a moderate capital investment that is likely to create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, construction may cause some congestion and in this respect, it is noted that parts of the proposed water main would follow/cross A roads (as well as a railway line). Additionally, the transportation of material/equipment may also contribute to any disruption on the local road network, although any effects would be temporary. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction works are not expected to directly impact upon heritage assets although there could be temporary impacts on the setting of approximately six Grade II listed buildings along the proposed pipeline route and at the site of the proposed pumping station. Therefore, the option has been assessed as having a minor negative effect on Objective 11.

The development sites are not within or in proximity to any landscape designations. Construction at the proposed Bramhall borehole site, pumping station, along the proposed pipeline route, and at a treated water storage site would take place on undeveloped greenfield land which may result in adverse impacts on local landscape character and the visual amenity of nearby residential and recreational receptors, although any effects are expected to be minor.

Operation

The abstraction of 5 Ml/d (subject to EA confirmation for abstraction increase) may reduce the water levels of tributaries and watercourses within the surrounding area which could potentially affect local and nearby in-river ecological features, e.g. habitats, native wildlife, and migratory species, although the small abstraction volume suggests that the scheme is unlikely to result in significant impacts. Additionally, the HRA Screening has concluded that operation is not anticipated to significantly affect any European designated conservation sites due to a lack of impact pathways. Overall, this option has been assessed as having a neutral effect on Objective 1.

No effects on land use/soils are anticipated.

The abstraction of 5Ml/d from the new borehole at Bramhall may result in widespread or prolonged effects on the quantitative water balance of the groundwater body. The WFD Assessment also concludes that abstraction could potentially affect dependent surface water bodies as there are likely to be good connections between the principal aquifer and surface water bodies due to surface water availability, e.g. availability at high flows with greater limitation at lower flows. Consequently, this option has been assessed as having a negative effect on Objective 3, although uncertainty remains.

The option is not expected to cause or exacerbate flooding.

No operational effects on air quality are anticipated.

The ongoing energy requirements (626 kWh/Ml) and emission of 142 tCO_2e/a have been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of 5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

No operational effects on heritage assets are predicted.

The operational sites are not within or in proximity to any landscape designations. The Hazel Grove WTW would introduce new above ground infrastructure on a greenfield site; however, it would be within the relative operational context of a treated water storage site. The new water main connecting the borehole to the WTW would be below ground and therefore would not have an impact on the local landscape. The borehole and pumping stations, meanwhile, could have very minor adverse impacts on the visual amenity of nearby residential and recreational receptors. Overall, a minor negative effect has been identified in respect of Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR113: Tytherington Boreholes	Construction	0	+	0	0	-	--	-	0	0	--	-	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	0

Construction

This option would involve the replacement of an existing treated water main between Tytherington WTW and a treated water storage facility to permit an additional 3Ml/d treated water transfer to existing storage. It would also comprise the replacement of existing borehole pumps at Tytherington and modifications to the WTW. The option would have a capacity of 6.4 Ml/d.

The Tytherington borehole/WTW site and proposed pipeline route are not within or in proximity to any designated nature conservation sites. Riverside Park Macclesfield LNR is located approximately 370m to the west but would not be affected by construction activity. Borehole and WTW works would take place at an existing operational site whilst the pipeline is routed along a road. Overall, the HRA has concluded that there are no clear effects or likely significant effects alone or in combination (e.g. no impact pathways; features not sensitive) resulting from construction which has been assessed as having a neutral effect on Objective 1.

This option would utilise the existing Tytherington WTW/borehole site and it is assumed that no additional land take would be required (any soil displaced through excavation as part of the laying of the pipeline would be returned following the completion of works). The option has therefore been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The development sites and proposed pipeline route are within Flood Zone 1 and the option would be unlikely to increase flood risk elsewhere.

Construction is expected to generate 2,743 vehicle movements during the 1.4 year construction period from which emissions, in conjunction with plant and machinery, may have a negative effect on local air quality. However, any impacts would be short term and temporary and may be mitigated to an extent through best practice and therefore negative effects on Objective 5 have been assessed as minor.

Construction of the scheme would generate 3,371 tonnes CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

The route of the pipeline is generally urban, passing by residential and employment areas which may be affected by air quality and noise/vibration impacts during the construction period. Construction works at Tytherington WTW would also be within close proximity to residential receptors. However, any effects on health would be temporary and have therefore been assessed as minor.

It is considered that the option is not of a scale to generate significant positive effects on the local economy (although there may be some minor supply chain benefits). The replacement of the pipeline may cause congestion, particularly along the A538 and Hulley Road, although this would be temporary. Overall, the option has been assessed as having a neutral effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The Tytherington WTW/borehole site is located circa 120m from Oldhams Hollow Farmhouse Grade II listed building, although works are not expected to have an effect on the setting of this asset. The pipeline route passes Macclesfield Canal Bridge which is a Grade II listed building and therefore measures would need to be taken to ensure that damage to this asset is avoided. Overall, the option has been assessed as having a minor negative effect on Objective 11.

The development site and pipeline route are not within or in proximity to any landscape designations. Construction could have short term, temporary negative effects on the visual amenity of residential receptors adjacent to the WTW/borehole site and along the pipeline route which has been assessed as having a minor negative effect on Objective 12.

Operation

The operation of this option is not expected to affect biodiversity as it would not alter the level of abstraction under current licensed volumes which will have been subject to review under the EA Review of Consents process.

There would be no operational effects on soils/land use.

Any impacts on the status of the groundwater body are likely to be temporary and localised as there is no overall increase in annual abstraction (6.4 Ml/d) and the peak daily increase is relatively small such that operation would have a neutral effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

There would be 27 tCO_2e/a produced and 390 kWh/Ml of energy consumed during the operation of the option which has been assessed as having a neutral effect on Objective 6 and a minor negative effect upon Objective 10.

The option would provide up to 6.4 Ml/d of safe drinking water when operational and would not impact upon the recreational potential of the area. This has been assessed as having a minor positive effect on Objective 7.

There is unlikely to be any direct impact on employment levels during operation but the supply of up to 6.4 Ml/d may support economic and population growth. A minor positive effect has therefore been identified in respect of Objective 8.

The option would not affect water efficiency.

There would be no operational effects on historic assets.

The replacement boreholes and WTW modifications would be within an existing operational area and in consequence, no landscape or visual effects are predicted.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR114: Python Mill Borehole	Construction	-	+	0	-	-	--	-	0/-	0	--	-	-
	Operation	?	0	-/?	-	0	0	+	+	0	-	0	0

Construction

This option comprises the reinstatement and refurbishment of Python Mill borehole and the transfer of raw water to Rochdale Canal, offsetting compensation from the Chelburn system. It would require a new borehole pump, rising main, headworks modifications and M&E equipment in addition to 3km of new transfer pipeline along a road from Python Mill to Rochdale Canal. A new discharge scour into the canal and new sewer connection at Python Mill would also be required. The option would have a capacity of 3 Ml/d.

Works associated with the reinstatement and refurbishment of the borehole is not expected to have any effects on biodiversity. Pipeline construction would take place within 200m of the Rochdale Canal SAC/SSSI, the South Pennine Moors SAC/SSSI and the South Pennine Moors Phase 2 SPA although the HRA states that, as construction works would be fairly small scale, any potential effects could easily be avoided at the scheme level with normal best-practice. The works would also require construction of a new discharge to Rochdale Canal although this would be outside the SAC, and as the HRA concludes, adverse construction effects on the protected interest features can be avoided with established scheme-level avoidance or mitigation measures. Overall, this option has been assessed as having a minor negative effect on Objective 1.

The option would utilise an existing site whilst the pipeline is not expected to cross greenfield land. This has been assessed as having a minor positive effect on soils/land use.

It is not expected that construction of this option would have an effect on water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction works would be located in Flood Zones 2 and 3 and therefore may be liable to flooding (depending on the timing of installation). However, the option would be unlikely to increase flood risk elsewhere.

The option would generate a total of 2,735 vehicle movements during the 1.4 construction period from which emissions, together with the operation of plant and machinery, may have a minor negative effect on Objective 5, particularly given the option's location within an urban area.

The option would generate 3,127 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

Construction works are not expected to affect recreational activities. There may be short term noise and dust disturbance associated with construction activities and HGV movements, although any effects would be temporary. Overall, a minor negative effect has been identified in respect of Objective 7.

It is considered that the option is not of a scale to generate significant positive effects on the local economy (although there may be some minor supply chain benefits). The replacement of the pipeline may cause congestion, particularly along the A6033 (which the pipeline would follow) though this would be temporary. Overall, the option has been assessed as having a mixed neutral and minor negative effect on Objective 8.

The option would not have an effect on water efficiency. The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10. There are no designated heritage assets within/in close proximity to the borehole site. There are a number of listed buildings along the pipeline route, the settings of which could be temporarily affected by construction activity and the option has therefore been assessed as having a minor negative effect on Objective 11. No landscape impacts are expected from the construction works due to the context of the built-up area and the existing Python Mill borehole site. However, there is potential for short term visual impacts on receptors along the route of the transfer main and a minor negative effect has therefore been identified in respect of Objective 12.
Operation The HRA concludes that analysis (modelling etc.) of scheme operation would be required to understand the effects of the option on the Rochdale Canal SAC, particularly as the previous licence was revoked by the EA. Specifically, it would be necessary to determine whether the water quality of the Python Mill source is the same or equal to the Chelburn Reservoir release, since poorer quality water could lead to the deterioration of aquatic plant Floating Water Plantain (*Luronium natans*) which is the primary reason for designation of this SAC. It is also possible that the operation of the borehole would result in drawdown within the South Pennine Moors SAC, which may affect groundwater dependent terrestrial ecosystems, but this is very unlikely based on the topography and the location of the borehole (it is separated from the SAC by the River Roach). The option would result in storage being maintained within the Chelburn Reservoirs over a longer period than under current operation, although this is not expected to affect the adjacent designated sites. Overall, the option has been assessed as having an uncertain effect on biodiversity at this stage. Operation is not expected to have an effect on land use or soil quality. The ALS does not define a groundwater management unit for this area (as reported by the WFD Assessment); however, the River Roch has been found to have no water available across all flows, indicating there may be pressure on water resources. Consequently, the abstraction of 3 Ml/d has been assessed as having a negative effect on groundwater resources, although uncertainty remains. New infrastructure may be vulnerable to flood risk. The option would be unlikely to affect local air quality. Ongoing operational energy requirements would be 585 kWh/Ml and the option would generate 30 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10. The operation of this option is not expected to affect recreational activities as there would be no change to water flows or canal access. The increased capacity of 3 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing. The option would not affect water efficiency. No effects on designated heritage assets are expected once the option is operational. No landscape impacts are expected due to the borehole infrastructure being located at an existing site, in the context of a built-up area. The pipeline would have no long term visual impacts once buried.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR119a: Egremont Boreholes (Existing)	Construction	-	+	0	-	-	--	-	++/-	0	--	0	-
	Operation	0	0	0	0	0	-	++	++	0	-	0	-

Construction

This option would involve the continued use of the South Egremont boreholes (Merry Hill, Kellhead, Gulley Flatts, and Black Ling) and associated pipeline network to abstract and transfer 11 Ml/d to Ennerdale WTW and a treated water storage facility. This option also proposes a new WTW at Nannycatch and a new treated water main between the Nannycatch WTW and a treated water storage facility (6.16 km). The new WTW would be developed to accommodate the existing abstraction licence of 11 Ml/d.

The proposed new WTW at Nannycatch would be approximately 0.6km south of the River Ehen SAC/SSSI whereas the proposed pipeline would directly cross through the River Ehen SAC/SSSI. HRA Screening concluded that there is the potential for significant negative effects on the River Ehen, although it is possible to minimise these effects through established scheme-level avoidance or mitigation measures (e.g. routing and/or utilisation of directional drilling/pipebridge). Native mussel species within the River Ehen would remain sensitive to excavation works throughout the year, although the mussel population size within the proposed excavation site may be smaller compared to other parts of the river. Additionally, pipeline excavation would also be within close proximity of Yeathouse Quarry SSSI and High Leys NNR/SSSI. At this stage, the option has been assessed as having a negative effect on Objective 1.

Construction of this option would require pipeline excavation through Grade 3 agricultural land; however, excavated land would be reinstated following the completion of construction. Development of Nannycatch WTW would be located within the operational footprint of an existing treated water storage site. On balance, the option has been assessed as having a positive effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed pipeline would cross Flood Zones 2/3 and therefore development may be liable to flooding during the construction period (depending on the timing of installation). The option would be unlikely to increase flood risk elsewhere.

There could be impacts associated with traffic congestion during the construction period (particularly along the A5086 between Cleator Moor and Arlecdon and local roads such as Nannycatch Road and Skelsceugh) which may, in conjunction with plant and machinery operation, have a minor negative effect on local air quality (there would be an estimated 7,927 vehicle movements during the 1.8 year construction period.

The option would generate 8,793 tCO_2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be noise/vibration disturbance and air quality impacts associated with the pipeline works which could affect residential receptors around eastern Cleator Moor, Parkside, Winder, and Arlecdon/Rowrah. The transportation of equipment/material could further exacerbate these impacts. Overall, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a substantial capital investment that could create a number of jobs resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Any adverse effects on the local transportation network from construction would be temporary and felt in the short term only. On balance, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

The proposed Nannycatch WTW site and water main do not contain/traverse any designated heritage assets. Rowrah Hall and Farm and the Church of St. Michael and its War Memorial Grade II listed buildings are situated to the north west of an treated water storage site although pipeline works are unlikely to affect the setting of these assets.

The new WTW at Nannycatch would be approximately 300m to the south and east of the Lake District National Park and World Heritage Site (WHS) whereas the proposed pipeline would directly cross through the Park (albeit for a short distance of circa 300m). However, adverse effects associated with pipeline works would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Development at the WTW site, meanwhile, is unlikely to substantially affect the National Park and WHS as this would be within/in close proximity to an existing operational site. On balance, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The abstraction of 11 Ml/d from the Egremont boreholes would be within the existing abstraction licence limit which is assumed to have been reviewed by the EA under the Review of Consents process thus no significant operational effects on biodiversity are anticipated. The HRA Screening has concluded no adverse effects of operation on European designated sites. Overall, this option has been assessed as having a neutral effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment reports that there is groundwater available which would help support the abstraction of up to 11 Ml/d. In consequence, this option has been assessed as having a neural effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 1,059 kWh/Ml, generating 222 tCO_2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The continued supply of 11 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new Nannycatch WTW would introduce new above ground infrastructure within 300m of the Lake District National Park and World Heritage Site boundary. However, as the WTW would be within/in close proximity of a treated water storage, significant landscape and visual impacts are not expected. Overall, the option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR119b: Egremont Boreholes (New)	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	?	0	--/?	0	0	-	++	++	0	-	-	-

Construction

This option would involve the continued use of the South Egremont boreholes (Merry Hill, Kellhead, Gulley Flatts, and Black Ling) as well as the development of three new boreholes located at Sandwith, Rottington and Moor Platts. The Catgill borehole would also be refurbished with a new break tank and RWPS to be developed on site. A new raw water mains would transfer water from the new and refurbished boreholes to the Catgill site, and then subsequently to the treated water storage facility as a new combined 10 Ml/d. A new WTW at Nannycatch and a new treated water main between the Nannycatch WTW and a treated water storage facility (6.16 km) would be developed to treat and transfer a combined 21 Ml/d from the new and existing boreholes.

The proposed new WTW at Nannycatch would be approximately 0.6km south of the River Ehen SAC/SSSI whereas the proposed pipeline would directly cross through the River Ehen SAC/SSSI. HRA Screening concluded that there is the potential for significant negative effects on the River Ehen, although it is possible to minimise these effects through established scheme-level avoidance or mitigation measures (e.g. routing and/or utilisation of directional drilling/pipebridge). Native mussel species within the River Ehen would remain sensitive to excavation works throughout the year, although the mussel population size within the proposed excavation site may be smaller compared to other parts of the river. Additionally, pipeline excavation would also be within close proximity of Yeathouse Quarry SSSI and High Leys NNR/SSSI. At this stage, the option has been assessed as having a negative effect on Objective 1.

Construction of this option would require pipeline excavation and borehole development on Grade 3 agricultural land, although development of Nannycatch WTW and Catgill break tank/RWPS would be located within the operational footprint of existing infrastructure. On balance, the option has been assessed as having a negative effect on Objective 2.

The construction of this option is not expected to have effects on water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed pipeline would cross Flood Zones 2/3 and therefore development may be liable to flooding during the construction period (depending on the timing of installation). The option would be unlikely to increase flood risk elsewhere.

There could be impacts associated with traffic congestion during the construction period (particularly on the A595, B5345 and A5086 between Cleator Moor and Arlecdon) which may, in conjunction with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 16,975 vehicle movements during the 1.8 year construction period).

The option would generate 18,154 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be noise/vibration disturbance and air quality impacts associated with the pipeline works which could affect residential receptors around Egremont, St. Bees, Rottington, Sandwith, eastern Cleator Moor, Parkside, Winder, and Arlecdon/Rowrah. The transportation of equipment/material could further exacerbate these impacts. Overall, this option has been assessed as having a minor negative effect on Objective 7.

The construction of the option represents a large capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Pipeline works would involve a number of road and rail crossings which could temporarily affect the local transport network. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

The borehole sites do not contain, and are not within close proximity to, any designated cultural heritage assets with the exception of Moor Platts which would be adjacent to a Grade II listed building (Moorleys Farmhouse), the setting of which may be affected by construction activity. Pipeline works could also potentially affect the setting of several listed buildings along the proposed route, although any adverse impacts would be temporary. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The borehole sites are in a rural setting and with the exception of the Catgill, would be located on greenfield land such that construction activity may have adverse landscape/visual impacts. The new WTW at Nannycatch would be approximately 300m to the south and east of the Lake District National Park and World Heritage Site whereas the proposed pipeline would directly cross through the Park (albeit for a short distance of circa 300m). However, adverse effects associated with pipeline works would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Development at the WTW site, meanwhile, is unlikely to substantially affect the National Park as this would be within/in close proximity to an existing operational site. On balance, this option has been assessed as having a minor negative effect on Objective 12.

Operation

Operation would require increased exploitation of the West Cumbria aquifer. It is currently unknown whether there is a hydrological link between groundwater and surface water such that whilst significant effects on this site or the tributaries of the river due to drawdown (etc.) would not necessarily be expected, some uncertainty remains without further investigation (modelling etc.). Additionally, it is not clear whether the additional abstraction from the new boreholes would impact ecological features outside of the SAC such as in-river habitats and mobile species (Atlantic salmon) migrating through the local water network. Consistent with the findings of the HRA, overall, the option has been assessed as having an uncertain effect on biodiversity at this stage and should this option be taken forward, further investigation in respect of potential effects on the River Ehen SAC and the surrounding area would be required. It should be noted that the existing boreholes would be within the existing abstraction licence limit and it is assumed they have been reviewed by the EA under the Review of Consents process thus no significant operational effects on biodiversity are anticipated from their operation. Overall, this option has been assessed as having an uncertain effect on Objective 1 at this time.

There would be no operational effects on soils/land use.

The WFD Assessment reports that there is groundwater available which would help support the abstraction of 10 Ml/d. However, the availability of surface water varies between the boreholes; there is surface water available across the flow regime in the water bodies associated with the three new boreholes (Sandwith, Rottington, Moor Platts) whereas there is no water available across the flow regime in the surface water body (River Ehen) associated with the refurbished Catgill borehole. Although the proposed new abstraction volume from Catgill is relatively small, there is likely to be a strong hydraulic connection between the aquifer and the overlying surface water courses thus abstraction could have significant effects on the hydrological regime of the River Ehen. Operation is unlikely to have an adverse effect on the quantitative water balance of the groundwater body as a whole although there is a significant risk that abstraction may adversely affect the quantitative status of dependent surface water bodies. Additionally, the boreholes are located close to the coast so consideration should be given to the risk of saline intrusion into the aquifer. Overall, this option has been assessed as having a significant negative effect on Objective 3, although uncertainty remains.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 827 kWh/Ml, generating 323 tCO_2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The cumulative capacity of 21 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

As noted above, the Moor Platts site is adjacent to a Grade II listed building (Moorleys Farmhouse), the setting of which may be affected by new above ground infrastructure (although any adverse effects could be mitigated by adequate screening).

The borehole sites are in a rural setting and with the exception of Catgill would be located on greenfield land. In consequence, there is potential for minor landscape and visual impacts from new above ground infrastructure. The operational sites are not within or in proximity to any landscape designations, although the new Nannycatch WTW would introduce new above ground infrastructure within 300m of the Lake District National Park and World Heritage Site boundary. However, as the WTW would be within/in close proximity to an existing treated water storage facility, significant landscape and visual impacts are not expected. Overall, the option has been assessed as having a negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR120: Cross Hill Boreholes, Wirral	Construction	-	+	0	0	-	--	-	++/-	0	--	0	-
	Operation	?	0	-/?	0	0	-	++	++	0	-	0	-

Construction

This option would involve the construction of three new boreholes and a new WTW at a treated water storage facility, located at Thingwall on the Wirral, in order to abstract/transfer 15 Ml/d (3 x 5 Ml/d) to the treated water storage site. Additionally, the revocation of existing abstraction licences at Hooton, Gorston, and Springhill would be included within the abstraction licence proposal. Development of the boreholes would consist of new borehole pumps, mechanical and electrical equipment, headworks, and new raw water main piping to connect the individual boreholes.

There are no designated sites within close proximity to the site, which is also currently operational land. Construction would require a new WTW and boreholes approximately 3km from the Dee Estuary SAC / SPA / Ramsar sites and 6.5km of the Mersey Estuary SPA; therefore, any adverse effects on biodiversity are expected to be minor and will be likely to be related to disturbance associated with, for example, the drilling of boreholes and other construction activity. Overall, the HRA concluded that potentially adverse construction impacts on the interest features of these sites could be avoided with established measures such as construction best-practice or timing works to avoid avifauna breeding / migration periods thus this option has been assessed as having a minor negative effect on Objective 1.

It has been assumed that development would take place at the existing site and therefore the option has been assessed as having a minor positive effect on soil/land use.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

Construction would generate a total of 5,319 vehicle movements within the 1.8-year construction period from which emissions, in conjunction with plant and machinery operation, may have negative effects on local air quality.

The option would generate 5,591 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

The site is adjacent to two residential streets (Barnsdale Avenue and Gwendoline Close) which may be affected by noise disturbance, vibration and dust/air quality impacts during construction. However, any effects would be temporary and felt in the short term and therefore adverse effects on health have been assessed as minor.

Construction would require a large capital expenditure which could result in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The movement of material/equipment could adversely impact the local road network (congestion/delay) although any effects would be temporary and be felt in the short term only. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effective on Objective 10.

No heritage assets have been identified near to the site. The site is not within or in proximity to any landscape designations and is in existing operational use. However, works may have a temporary impact on landscape and visual amenity, particularly on residential receptors to the north and west.

Operation

There are no designated conservation areas in close proximity to the treated water storage site. Operation would require increased exploitation of the Wirral aquifer Cumbria aquifer although the precise operation is not clear as the option will also involve revocation of some licences. Furthermore, uncertainties regarding how the proposed abstraction may affect spring (etc.) flows into the Dee Estuary (3km) in addition to how groundwater in the Wirral interacts with the Dee and the Mersey estuaries suggests that additional investigation would be required to exclude the possibility of significant impacts. Consequently, this option has been assessed as having an uncertain effect on Objective 1.

No effects on land use/soils are anticipated.

The abstraction licensing strategy (ALS) indicates that there is restricted water available in the groundwater body as indicated by the WFD Assessment; however, the option includes the potential revocation of existing abstraction licences (Hooton, Gorston, and Springhill). This may offset the impacts of the new abstraction, although the magnitude of benefit generated from the revocation of these licences is currently uncertain such that the abstraction of 15 Ml/d is assessed as having a negative effect on Objective 3, with some remaining uncertainty.

The operation of the option is unlikely to cause or exacerbate flooding.

The option would have neutral effects on air quality in the area.

There would be 123 tCO_2e/a produced and 826 kWh/Ml of energy consumed during the operation of the option which has been assessed as having a minor negative effect upon Objectives 6 and 10.

The option would provide 15Ml/d of safe drinking water when operational and will not impact upon the recreational potential of the area. There is unlikely to be any direct impact on employment levels during operation but the supply of 15Ml/d may support economic and population growth.

The option would not affect water efficiency.

There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

There would be new above ground infrastructure associated with this option such as the new WTW. Whilst residential receptors are located to the north and west of the site, the new infrastructure would be within an existing operational site and therefore any landscape/visual impacts are expected to be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR120i: Cross Hill Boreholes, Wirral	Construction	-	+	0	0	-	--	-	++/-	0	--	0	-
	Operation	?	0	-/?	0	0	-	++	++	0	-	0	-

Construction

This option would involve the construction of three new boreholes and a new WTW at an existing treated water storage facility, in order to abstract/transfer 15 Ml/d (3 x 5 Ml/d) to another treated water storage site. Additionally, the revocation of existing abstraction licences at Hooton, Gorston, and Springhill would be included within the abstraction licence proposal. Development of the boreholes would consist of new borehole pumps, mechanical and electrical equipment, headworks, and new raw water main piping to connect the individual boreholes. It should be noted that water softening (ion exchange) is included within the treatment process for this option.

There are no designated sites within close proximity to the site. Construction would require a new WTW and boreholes approximately 4km of the Dee Estuary SAC / SPA / Ramsar sites and 6.5km of the Mersey Estuary SPA. HRA Screening has concluded that potentially adverse construction impacts on the interest features of these sites could be avoided with established measures such as construction best-practice or timing works to avoid avifauna breeding / migration periods due to distance. Any adverse effects on local biodiversity features are expected to be minor and will likely to be related to disturbance associated with, for example, the drilling of boreholes and other construction activity which can be effectively mitigated using best practice construction mitigation measures. Thus this option has been assessed as having a minor negative effect on Objective 1.

It has been assumed that development would take place at the existing site and therefore the option has been assessed as having a minor positive effect on soil/land use.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

Construction would generate a total of 5,319 vehicle movements within the 1.8-year construction period from which emissions, in conjunction with plant and machinery operation, may have minor negative effects on local air quality.

The option would generate 4,775 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

The site is adjacent to two residential streets (Barnsdale Avenue and Gwendoline Close) which may be affected by noise disturbance, vibration and dust/air quality impacts during construction. However, any effects would be temporary and felt in the short term and therefore adverse effects on health have been assessed as minor.

Construction would require a large capital expenditure which could result in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. The movement of material/equipment could adversely impact the local road network (congestion/delay) although any effects would be temporary and be felt in the short term only. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effective on Objective 10.

No heritage assets have been identified near to the site.

The site is not within or in proximity to any landscape designations and is in existing operational use. However, works may have a temporary impact on landscape and visual amenity, particularly on residential receptors to the north and west.

Operation

There are no designated conservation areas in close proximity to the treated water storage site. Operation would include asset rationalisation on the Wirral to include revocation of existing abstraction licences at: Hooton, Gorston and Springhill. Uncertainties regarding how the proposed abstraction may affect spring (etc.) flows into the Dee Estuary SAC/SPA and Ramsar in addition to how groundwater in the Wirral interacts with the Dee Estuary and the Mersey Estuary SPA would require additional investigation to exclude the possibility of significant impacts. The abstraction of 15 Ml/d may reduce the water levels of tributaries and watercourses within the surrounding area which could potentially affect local and nearby in-river ecological features, e.g. habitats, native wildlife, and migratory species, though the revocation of the Hooton, Gorston, and Springhill licences may offset the new abstraction volume. Overall, this option has been assessed as having an uncertain effect on Objective 1.

No effects on land use/soils are anticipated.

The WFD Assessment reports that there is restricted water availability in the associated groundwater body but water available across all flows in the surface water body. The option includes revocation of existing licences at Hooton, Gorston and Spring HIll which may offset the impacts of the new abstraction, and furthermore, support the proposed abstraction volume of 15 Ml/d. It should be noted, however, that the exact location and the licenced quantities of these abstractions (Hooton, Gorston, and Spring Hill) is unknown thus there may be strong connections between surface water and the aquifer and new abstraction may have an impact on the hydrological regime of the surface water body. Overall, this option has been assessed as having a negative effect on Objective 3, although uncertainty remains regarding residual effects on surface waterbodies.

The operation of the option is unlikely to cause or exacerbate flooding.

The option would have neutral effects on air quality in the area.

There would be 123 tCO2e/a produced and 826 kWh/Ml of energy consumed during the operation of the option which has been assessed as having a minor negative effect upon Objectives 6 and 10.

The option would provide 15Ml/d of safe drinking water when operational and will not impact upon the recreational potential of the area. There is unlikely to be any direct impact on employment levels during operation but the supply of 15Ml/d may support economic and population growth.

The option would not affect water efficiency.

There is unlikely to be any long term effects on cultural heritage assets as a result of this scheme.

There would be new above ground infrastructure associated with this option such as the new WTW. Whilst residential receptors are located to the north and west of the site, the new infrastructure would be within an existing operational site and therefore any landscape/visual impacts are expected to be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR121a: Eaton Boreholes (Hollins Hill)	Construction	-	-	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	-

Construction

This option would involve the reinstatement and refurbishment of the two Eaton boreholes and development of a new WTW at the site. Development of the Eaton boreholes would include the installation of new pumps, rising main, and M/E equipment. An outlet booster pumping station may also be included within this development scope if required. Once operational, up to 6.7 Ml/d of treated water would be transferred to a treated water storage facility via an existing main, sections of which may need to be replaced.

The Eaton site is not within, or in the vicinity of any statutory or non-statutory biodiversity designated sites. The nearest European designated site is the Oak Mere SAC / Midland Meres and Mosses Phase 2 Ramsar which is over 4km away such that there are no clear impact pathways emerging from construction. However, development of the new WTW would take place outside of the existing site boundary and on greenfield land, and therefore, there is potential for short term disturbance and habitat loss during construction, although established site level mitigation should prevent significant adverse effects. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Whilst this option would utilise existing infrastructure, construction of the new WTW and the potential outlet booster pumping station would involve the development of Grade 2 agricultural land. In consequence, a negative effect has been identified in respect of Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

Construction would generate a total of 2,423 vehicle movements during the 1.5 year construction period from which emissions, in conjunction with plant and machinery operation, may have minor negative effects on local air quality.

The option would generate 3,415 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period nor should construction of the WTW or borehole infrastructure result in noise/vibration disturbance. There may be a minor risk of noise disturbance/air quality impacts associated with HGV movements and potential pipeline excavation which could affect residential receptors within Eaton and Cotebrook; however, these potential impacts would be temporary and are assumed to be minor.

Construction would involve a large capital expenditure which could have positive effects on the local economy. The potential refurbishment of approximately 4km of existing pipeline in addition to the transportation of material/equipment could increase congestion and disruption/driver delay, although as stated, any impact would be temporary. On balance, the option has been assessed as having a significant positive effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The development site does not contain any heritage features, but would be located <500m to several listed buildings. However, construction works are not expected to have adverse effects on the integrity or settings of these features.

The site is not within or in proximity to any landscape designations but it is located in a rural area. In consequence, there may be short term negative effects on local landscape character during construction.

Operation

The abstraction yield would remain within the terms of the existing licence which is assumed to have been reviewed by the EA under the Review of Consents process and therefore no significant operational effects on biodiversity are anticipated. HRA Screening has concluded that there would be no likely significant effects on any European designated conservation sites such as the Oak Mere SAC (also a component of the Midlands Meres and Mosses Phase 2 Ramsar), which is approximately 4km to the north of the boreholes (although it is not within the same surface water catchment). Overall, the option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on soils/land use.

The abstraction of up to 6.7 Ml/d would reduce groundwater levels, although this would be within existing licensed volumes (7.3 Ml/d). The WFD Assessment concludes that with an abstraction licence already in place, a moderate abstraction volume, and the availability of surface water across the full flow regime within the area, operation of the boreholes should not result in a widespread or prolonged impact on WFD status. Consequently, the option has been assessed as having a neutral effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 1,589 kWh/Ml, generating 126 tCO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of up to 6.7 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational site is not within or in proximity to any landscape designations, although the new WTW would be in a rural setting, and in consequence, it may have a minor negative effect on local landscape character.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR121b: Eaton Boreholes (Mid Cheshire Main)	Construction	-	-	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	-

Construction

This option would involve the reinstatement and refurbishment of the two Eaton boreholes and development of a new WTW at the site. Development of the Eaton boreholes would include the installation of new pumps, rising main, and M/E equipment. An outlet booster pumping station may also be included within this development scope if required. Once operational, up to 6.7 Ml/d of treated water would be transferred to the Mid Cheshire Main via an existing main, sections of which may need to be replaced.

The Eaton site is not within, or in the vicinity of statutory or non-statutory biodiversity designated sites. The nearest European designated site is the Oak Mere SAC / Midland Meres and Mosses Phase 2 Ramsar which is over 4km away such that there are no clear impact pathways. However, development of the new WTW would take place outside of the existing site boundary and on greenfield land, and therefore, there is potential for short term disturbance and habitat loss though established site level mitigation should prevent significantly adverse effects. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Whilst this option would utilise existing infrastructure, construction of the new WTW and the potential outlet booster pumping station would involve the development of Grade 2 agricultural land. In consequence, a negative effect has been identified in respect of Objective 2.

The construction of this option is not expected to have effects on water quality or water resources.

Construction would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

Construction would generate a total of 2,425 vehicle movements during the 1.5 year construction period from which emissions, in conjunction with plant and machinery operation, may have minor negative effects on local air quality.

The option would generate 3,567 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period nor should construction of the WTW or borehole infrastructure result in noise/vibration disturbance. There may be a minor risk of noise disturbance/air quality impacts associated with HGV movements and potential pipeline excavation which could affect residential receptors within Eaton and Cotebrook; however, these potential impacts would be temporary and are assumed to be minor.

Construction would involve a large capital expenditure which could have positive effects on the local economy. The potential refurbishment of approximately 4km of existing pipeline in addition to the transportation of material/equipment could increase congestion and disruption/driver delay, although as stated, any impact would be temporary. On balance, the option has been assessed as having a significant positive effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The development site does not contain any heritage features, but would be located <500m to several listed buildings. However, construction works are not expected to have adverse effects on the integrity or settings of these features.

The site is not within or in proximity to any landscape designations but it is located in a rural area. In consequence, there may be short term negative effects on local landscape character during construction.

Operation

The abstraction yield would remain within the terms of the existing licence which is assumed to have been reviewed by the EA under the Review of Consents process thus no significant operational effects on biodiversity are anticipated. HRA Screening has concluded that there would be no likely significant effects on any European designated conservation sites such as the Oak Mere SAC (also a component of the Midlands Meres and Mosses Phase 2 Ramsar), which is approximately 4km to the north of the boreholes (although it is not within the same surface water catchment). Overall, the option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The abstraction of up to 6.7 Ml/d would reduce groundwater levels, although this would be within existing licensed volumes (7.3 Ml/d). The WFD Assessment concludes that with an abstraction licence already in place, a moderate abstraction volume, and the availability of surface water across the full flow regime within the area, operation of the boreholes should not result in a widespread or prolonged impact on WFD status. Consequently, the option has been assessed as having a neutral effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 1,893 kWh/Ml, generating 147 tCO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of up to 6.7 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational site is not within or in proximity to any landscape designations, although the new WTW would be in a rural setting, and in consequence, it may have a minor negative effect on local landscape character.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR122: Newton Hollows Boreholes	Construction	-	+	0	0	-	--	-	++	0	--	0	0
	Operation	0	0	-/?	0	0	0	+	+	0	-	0	0

Construction

This option would involve reinstating and refurbishing three boreholes at Newton Hollows. A new WTW within the existing WTW site would be required together with three new borehole pumps, rising main and headworks on the new boreholes. An existing main between the WTW and treated water storage facility would be recommissioned as part of the scheme. The proposed abstraction yield is 9 Ml/d (average of 5 Ml/d as dictated by annual licence).

The proposed development site is an existing facility and is not within any statutory or non-statutory biodiversity designations. The nearest European designated nature conservation sites are the Midlands Meres and Mosses Phase 2 Ramsar (4km) and Mersey Estuary SPA/Ramsar which is over 5km, whereas the closest SSSI (Dunsdale Hollow) is 2km away. Consequently, HRA Screening has concluded that construction is not anticipated to significantly affect European designated sites due to the lack of clear impact pathways emerging from the proposed works. Notwithstanding this, construction of the new WTW in conjunction with the refurbishment of the existing boreholes may result in localised noise disturbance and adverse air quality impacts which may temporarily effect proximate habitats and wildlife, although established mitigation measures are expected to prevent significant adverse effects. Consequently, this option has been assessed as having a minor negative effect on Objective 1.

The works are expected to take place within the existing infrastructure footprint, resulting in a positive effect on land use/soils.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposal is located in Flood Zone 1 and therefore, construction would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

Construction would generate a total of 3,552 vehicle movements over the 1.8 year construction period. The emissions from these movements, in conjunction with plant and machinery operation, may have minor negative effects on local air quality.

The option would generate 5,059 tCO_2e which has been assessed as having a significantly negative effect on climate change (and Objective 10).

The surrounding area is sparsely populated although there are 10-30 residential properties within 200m of the site. Construction may therefore have short term negative effects on these receptors as a result of noise, dust and air quality impacts. However, any impacts would not be significant and a minor negative effect has therefore been identified in respect of Objective 7.

Construction would involve a large capital expenditure, resulting in a significant positive effect on the local economy associated with potential employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. There may be some minor disruption to the local road network due to vehicle movements although any impacts would be temporary. On balance, this option has been assessed as having a significant positive effect on Objective 8.

The use of materials required to construct this option, in addition to energy demand, would have significant negative effects on resource use.

There are no heritage features within the development site or in close proximity, save for a Roman Camp situated 200m to the south. Construction would not have any adverse effects on this asset due to distance and the presence of screening to the south of the site.

The site is not within or in proximity to any landscape designations and works would be undertaken at an existing site. The surrounding countryside is also undulating with high hedgerows and intermittent woodland. These features would help screen construction activities. Overall, there are not expected to be any effects on landscape.

Operation

The abstraction yield would remain within the terms of the existing licence which is assumed to have been reviewed by the EA under the Review of Consents process therefore no significant operational effects on biodiversity are anticipated. HRA Screening has concluded that there would be no likely significant effects on any European designated conservation sites such as the Mersey Estuary SPA/Ramsar (5km away) or Midlands Meres and Mosses Phase 2 Ramsar (circa 4km). As noted above, the closest SSSI is approximately 2 km away at Dunsdale Hollow (Broadleaved, Mixed and Yew woodland). Its citation does not suggest its condition is linked to any surface or groundwater flows. Hatchmere SSSI is located 4km to the south east. This is assumed to be too distant to be hydrologically affected by abstraction from the site. Overall, no operational effects on biodiversity are anticipated.

There would not be operational effects on soils or land use.

The WFD Assessment reports that there is restricted water availability in the associated groundwater body as well as surface water bodies (not available for licensing at flows of Q95 and Q50 and restricted at Q30 and Q70). Although there is an abstraction licence in place and the proposed abstraction yield would remain within the licenced limitation, restarting operational abstraction could adversely impact the hydrological regime of the surface water body, as water courses are likely to have a good hydraulic connection with the underlying principal aquifer, in addition to impacting the quantitative water balance of the aquifer. Overall, this option has been assessed as having a negative effect on Objective 3, although uncertainty remains.

The proposal is located in Flood Zone 1 and therefore, would not cause or exacerbate flooding in the area, nor would the site be at risk from flooding.

There would be no operational effects on local air quality.

Operational energy demand would be 978 KWh/Ml and the option would generate 83 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10.

The option would have a design capacity of 9 Ml/d which would have positive effects on human health (there would be no operational effects on any recreational activities). Additional capacity may also support economic and population growth in the area resulting in a positive effect on Objective 8.

The option would not affect water efficiency.

No operational effects on heritage assets are expected.

The operational site is not within or in proximity to any landscape designations and the new WTW infrastructure (e.g. kiosks) would be within an existing site. The site is also screened from the road. In consequence, the option has been assessed as having a neutral effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR125: Bearstone Boreholes	Construction	0/?	+/-	0	-	-	--	-	++	0	--	-	-
	Operation	0	0	-/?	-	0	-	+	+	0	-	0	0

Construction

This option would involve the reinstatement and refurbishment of two of the three Bearstone boreholes which would involve the fitting of improved headworks to asset standard design, borehole pumps, mechanical & electrical equipment, and rising mains (assumed 150m long) in order to abstract 4.98 Ml/d to 6.36 Ml/d. The Bearstone WTW's treatment processes would subsequently be modified to accommodate the increased abstraction output. The cumulative output from Bearstone WTW would be transferred to a treated water storage facility via an existing 3.38km treated main though pipeline modification may occur if deemed appropriate. Similarly, a new outlet booster pumping station may be included within the scheme if required.

Neither the Bearstone site nor the existing treated water main are within, or in the vicinity of statutory or non-statutory nature conservation designations. The nearest European designated site is the Midland Meres and Mosses Phase 1 Ramsar which is over 9km away. Maer Pool SSSI and Burnt Wood SSSI are the two closest designated conservation areas to the Bearstone site at 6.2km and 3.7km, respectively. There are no clear impact pathways emerging from construction on these sites. Due the relative distance between the works and the conservation areas in addition to the scale of works proposed on site, it is not expected that construction would result in any significantly adverse impacts on their interest features or residing local wildlife. Construction activities would occur within the confined rural setting of the Bearstone site which may cause minor short-term disturbance to the proximate woodland and grassland habitats and wildlife though the severity of impact on biodiversity could increase if extensive pipeline excavation is required. Overall, this option has been assessed as having a neutral effect on Objective 1 though some uncertainty remains regarding potential pipeline modification.

The reinstatement/modification of the boreholes and Bearstone WTW would be contained within an existing operational site such that new ancillary infrastructure should not significantly impact land/soil quality. It should be noted, however, that the Bearstone site is situated within Grade 3a 'best and most versatile' agricultural land though it is not expected that the construction of ancillary infrastructure such as the outlet booster pumping station would result in significant land take due to its minor structural footprint. Pipeline excavation would be routed through Grade 3 and 2 agricultural land which may temporarily disrupt agricultural operations though land would be reinstated following the completion of construction. Overall, this option has been assessed as having a minor positive and negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The Bearstone site is partially situated with a Flood Zone 3 originating from the River Tern; consequently, reinstatement and modification of the boreholes and WTW would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the A53, B5415, and the local road network within the vicinity of the scheme) which would have a minor negative effect on local air quality (there would be an estimated 1,938 HGV movements during the 1.5 year construction period).

The option would generate 2,877 tCO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, construction may result in a temporary disruption of use or loss of amenity to the grounds within proximity to construction which host recreational walking and sport. Additionally, there may be noise/vibration disturbance and air quality impacts associated with the refurbishment and modification of the boreholes/WTW and potential pipeline excavation which could affect residential receptors within Bearstone, Knighton, and the scattered residential dwellings and farmsteads within the vicinity of the scheme. Overall, this option has been assessed as having a minor negative impact on Objective 7.

Construction of the option represents a large capital investment which could create a substantial number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, pipeline excavation in addition to the transportation of equipment/material could temporarily increase congestion and disruption/driver delay on the local road networks. On balance, this option has been assessed as having a significant positive effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

Neither the Bearstone site nor the treated water main route are within any historic designations, however, there are several Grade II Listed Buildings and scheduled monuments within proximity of the scheme. Willoughbridge Park moated site is approx. 1.8km from the Bearstone site whereas Bowl Barrier (Dorrington cottage) and Sillenhurst moated site are 1.1km and 0.5km, respectively, from the treated water main route. Due to the relative distance between these sites and the proposed works, it is not expected that construction would result in any adverse effects beyond a minor temporary loss of visual amenity regarding their settings during construction. Additionally, 9 Grade II Listed Buildings maintain possible vantage points to the proposed works; specifically, there are 2 Listed Buildings under 100m from the Bearstone site and potential excavation route: Bearstone Bridge and Milepost (94m from BHs/WTW) and Dorrington Hall Farmhouse (98m from pipeline). It is expected that mitigation measures will be utilised during construction; however, the distance between these assets and the works suggests a minor potential risk to the settings of these structures. The remaining Listed Buildings (>100m) may experience a loss of visual amenity regarding their settings, however, this would be temporary.

Neither the Bearstone site nor the potential excavation route are within or in proximity to any landscape designations. Refurbishment/modification of the boreholes and the WTW and potential installation of the outlet booster pumping station may adversely impact the amenity of the surrounding rural greenfield setting; however, construction would be confined within the existing site footprint such that any adverse impact on the landscape would be minor. The potential excavation route could temporarily impact the wider rural landscape and the residential visual amenity associated with such due to the flat open topography of the landscape. Consequently, the option has been assessed as having a minor negative effect on Objective 12.

Operation

The abstraction yield would remain within the terms of the existing licence which is assumed to have been reviewed by the EA under the Review of Consents process and therefore no significant operational effects on local or proximate biodiversity features, e.g. Maer Pool SSSI and Burnt Wood SSSI, are anticipated. HRA Screening has concluded that operation of the option would have no effects alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.) on any European conservation site. Overall, this option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on soils/land use.

The WFD Assessment reports that there is restricted water availability in the associated groundwater body as well as in the overlying surface water body (limited at flows of Q50, Q70, and Q95). Although there is an abstraction licence in place and the proposed abstraction yield would remain within the licenced limitation, restarting operational abstraction with the restricted availability of water could adversely impact the quantitative water balance of the aquifer. Additionally, abstraction would be within proximity to the River Tern which could also adversely impact its quantitative dependent surface water body status. Overall, this option has been assessed as having a negative effect on Objective 3, although uncertainty remains.

The newly refurbished/modified Bearstone site would be partially located within a Flood Zone 3 originating from the River Tern and therefore, may be liable to flooding during operation, however, operation of the general scheme is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 1,127 kWh/Ml, generating 109 tCO2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased abstraction of 4.98 – 6.36 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The Bearstone Bridge and Milepost Listed Buildings would be approx. 94m from the Bearstone site; however, due to the scale of the borehole and ancillary infrastructure within the context of the established site, it is not expected that there would result in any discernible effect on these assets beyond a slight alteration of their setting. Overall, there would be no operational effects from the wider scheme on designated cultural heritage assets.

The operational site is not within or in proximity to any landscape designations; specifically, the refurbishment/modification of the boreholes and WTW would be with the existing structural footprint already established on the site. In consequence, any adverse impact on the surrounding rural landscape would be minor, if not negligible, as there would be no significantly new infrastructure introduced within the site beyond the potential outlet booster pumping station. Additionally, the Bearstone site benefits from moderate woodland buffer within its vicinity which should help screen any new structural additions to the sites. Overall, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR129: North Cumbria Boreholes	Construction	-	-	0	-	-	--	-	++/-	0	--	-/?	-
	Operation	?	0	0	0	0	-	+	+	0	-	0	-

Construction

This option would involve the continued abstraction and transfer of 6 Ml/d from the three Scales boreholes to Quarry Hill WTW. Additionally, new boreholes would be developed at Waverton and Thursby with each borehole producing 2 Ml/d. New raw water mains (15.8km combined) would transfer water from both boreholes to a new blending tank and then to Quarry Hill WTW which would be refurbished to treat the combined 10 Ml/d from all five boreholes. Treated water would then be transferred to a treated water storage facility via a new treated water main (9.8km).

A wide range of statutory nature conservation sites are within the general vicinity of the new boreholes and the proposed pipelines; specifically, the new boreholes would be approximately 5km from the River Caldew (River Eden SAC) although these (and other construction elements) would be outside the River Eden SW catchment. Additionally, a section of the proposed treated water main would be situated within 0.5km of Clints Quarry SAC – Moota SSSI. HRA Screening has concluded that adverse construction effects can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods which is expected to prevent significant effects on these designated European sites. The Development at the borehole sites in addition to segments of the new raw water main would occur on greenfield land, and in consequence, there may be disturbance/habitat loss during the construction period, e.g. drilling of the boreholes and other construction activity. This option has consequently been assessed as having a minor negative effect on Objective 1.

Whilst this option would utilise/refurbish existing infrastructure, development would result in the loss of some greenfield land. In consequence, the option has been assessed as having a minor negative effect on soils/land use

The construction of this option is not expected to have effects on water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Sections of the proposed pipelines would cross Flood Zones 2/3 and therefore works may be affected by flooding (depending on the timing of installation). The option would be unlikely to increase flood risk elsewhere.

There could be traffic congestion during the construction period (particularly along the A595, A596, B5299, and the local roads within the vicinities of the proposed boreholes, WTW, and pipeline routes) which may, in conjunction with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 25,687 vehicle movements during the 1.8 year construction period).

The option would generate 29,682 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be noise/vibration disturbance and air quality impacts associated with the pipeline works and borehole drilling which could affect residential receptors including around western Thursby, eastern Waverton, Boltongate, Mealsgate, Kirkland, western Bothel, Threapland, and properties adjacent to the A595, A596, and B5299. The transportation of equipment/material could further exacerbate these impacts. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option represents a large capital investment that could create a number of jobs resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. However, utilisation of the road network for the majority of the pipeline route and HGV movements could result in congestion and delay during the construction period. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The option would not affect water efficiency.

Development at the borehole/WTW sites is unlikely to affect the setting of listed buildings. The pipeline as proposed would cross through Old Carlisle Scheduled Monument and works may affect the setting of other scheduled monuments and listed buildings along the proposed routes. However, taking into account the potential for mitigation to avoid direct impacts on designated heritage assets arising from pipeline works (such as routing), the option has been assessed as having a minor negative effect on cultural heritage, although some uncertainty remains.

The proposed pipeline route runs approximately 1.5km along the boundary of the Lake District National Park and World Heritage Site. Additionally, other sections of the pipeline and the WTW are approximately 2.3 – 2.8km from the Park's boundary. In consequence, there is potential for substantial landscape effects associated with construction activity. However, the majority of the pipeline route would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Development at the WTW site, meanwhile, is unlikely to affect the National Park and World Heritage Site as this is an existing operational site. The visual amenity of properties and public footpaths within the vicinity of the borehole/WTW sites may be affected by construction activity although the rural setting and sparsely located properties mean that the minor intrusion would only be to very few people. Overall, this option has been assessed as having a negative effect on Objective 12.

Operation

Operation would require increased exploitation of the North Cumbria aquifer; the proposed boreholes are over 5km from the River Caldew in a separate surface water catchment so significant effects on this site due to drawdown (etc) would not be expected although additional investigation would be required to confirm this and permitted abstraction volumes (hence operational effects uncertain). Notwithstanding this, new borehole abstractions at Waverton and Thursby may have the potential to impact the nearby River Waverly and River Wampool which discharge into the Solway Firth. The Waverton site is located approximately 12km upstream of Solway Firth whilst Thursby is around 17 km upstream of the same site (SAC, SPA and Ramsar Site). It has been assumed a 1.5km reach downstream of the abstraction could be impacted, however, HRA Screening has concluded that significant effects on this site would not be expected. The option may though affect water dependent SSSIs downstream of the borehole sites, although no readily available flow data could be found for the River Waverley or Wampool to contextualise the abstraction volumes and current flow. Consequently, additional investigation (modelling etc) of scheme operation would be required to confirm this and permitted abstraction volumes; therefore, the option has been assessed as having an uncertain effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The WFD Assessment reports that there is groundwater available which would help support the abstraction of 10 Ml/d (6 Ml/d from the Scales boreholes due to expire in 2022); however, the availability of surface water varies between the two new boreholes. Specifically, there is surface water available across the total flow regime of the water body associated with Waverton borehole whereas the surface water body linked with Thursby borehole has limited water availability at Q95 with greater availability at medium and higher flows. Given that the proposed sources (Scales boreholes) are already licenced and operational, in addition to surface water being generally available, the WFD Assessment concludes that the new minor abstraction volume in conjunction with existing operation is unlikely to have a widespread or prolonged effect on the quantitative water balance of the groundwater body or on dependent surface water bodies. Overall, this option has been assessed as having a neutral effect on Objective 3.

The option would not cause or exacerbate flooding in the area.

There would be no operational effects on air quality.

Operational energy demand would be 878 kWh/Ml, generating 173 tCO_2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The additional capacity of 4 Ml/d with a cumulative yield of 10 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The new boreholes and ancillary infrastructure such as the break tank would introduce new above ground infrastructure on semi-rural greenfield sites; however, the footprints would be relatively minor and in consequence, significant landscape and visual impacts are not expected. The WTW, meanwhile, would be within the existing footprint of Quarry Hill WTW and therefore no substantial landscape and visual impacts are predicted. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR140: Horwich WwTW – Final Effluent Reuse	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	-	0	0	+	+	+	-	0	0

Construction

This option would involve the development of a new abstraction/intake point on Pearl Brook/the River Douglas in order to abstract and transfer final effluent from Horwich WwTW to Rivington WTW via a new 1.99km raw water main and pumping station. Rivington WTW would be modified in order to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water (5 Ml/d) would then be transferred into an existing distribution system from Rivington WTW. The option would have a design capacity of 5 Ml/d.

Neither the proposed abstraction site nor the pipeline route include or cross statutory or non-statutory nature conservation designations; consequently, HRA Screening has concluded that there are no likely significant effects on European designated sites (e.g. no impact pathways). There is a LNR and two SSSIs under 1.5km from the proposed scheme: Bridge Street Horwich LNR (1.5km), West Pennine Moors SSSI (1km), and Red Moss SSSI (1.4km). Taking into account the type/scale of construction activity and distance to these sites, no effects on their features are anticipated. Construction of abstraction infrastructure and the pumping station on the River Douglas could introduce pollution/debris into the river ecosystem (although this is likely to be avoided through appropriate mitigation). Sections of the pipeline would also cross fields, and therefore, there is potential for short term disturbance to biodiversity during construction. Overall, this option has been assessed as having a minor negative effect on Objective 1.

The new abstraction infrastructure and pumping station would be situated on a greenfield site adjacent to Horwich WwTW that is of Grade 4 agricultural land quality. It is expected that the footprint of the abstraction infrastructure and pumping station would be minor and therefore any land take would be small. Modifications to Rivington WTW would be contained within the current operational footprint of the facility whilst any soil displaced due to pipeline works would be reinstated following the completion of construction. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point, pumping station and a section of the pipeline would be located within Flood Zones 2/3. The construction of these components could therefore be liable to flooding depending on the timing of works. Construction is not expected, however, to cause or exacerbate flooding in the area.

There could be traffic congestion during the construction period (including along the M61, A6, A673 and local roads) which may, together with the operation of plant and machinery, have a negative effect on local air quality (there would be an estimated 3,338 vehicle movements during the 0.2 year construction period). However, any impacts would be temporary and a negative effect has therefore been identified in respect of Objective 5.

The option would generate 3,611 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be a risk of temporary noise disturbance/air quality impacts associated with construction of the abstraction infrastructure and pumping station on residential receptors situated within eastern Blackrod, although given the distance of the works to these receptors and the scale of construction activity, this is unlikely. Pipeline works may temporarily disturb farmsteads along the proposed pipeline route, although the number of receptors likely to be affected is very small. The transportation of equipment/material could result in some short term disturbance to residential receptors along local access routes. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a large capital expenditure which has been assessed as having a significant positive effect on the local economy associated with supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Pipeline works affecting local roads (and, potentially, the M61) together with the transportation of equipment/material could temporarily increase congestion and cause disruption/driver delay. Overall, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

Neither the abstraction site nor the proposed pipeline route contain any designated heritage assets. There are two Grade II listed buildings adjacent to the pipeline route, the settings of which may be temporarily affected during construction. Overall, this option has been assessed as having a minor negative effect on Objective 11.

Construction works may be visible from the M61 and residential properties to the south/east of the abstraction site and pipeline works may also affect the visual amenity of a very small number of farmsteads. However, the site/pipeline route are not within any landscape designations and are in a semi-urban environment (fringe of Horwich built up area). Modifications to Rivington WTW would be contained within the present operational footprint and therefore no landscape impacts are predicted in respect of this component of the scheme. Overall, the option has been assessed as having a minor negative effect on landscape.

Operation

HRA Screening has concluded that operation of the option would have no effects alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.) on any European conservation site. Operation of the scheme would, however, indirectly utilise final effluent from Horwich WwTW in order to produce an additional 5 Ml/d of potable water thus resulting in reduced flow in Pearl Brook/the River Douglas which may have residual effects on in-river habitats and local species. Consequently, further analysis (modelling etc.) of scheme operation would be required to confirm effects on the water systems and permitted abstraction volumes. This option has therefore been assessed as having an uncertain though potentially minor negative effect on Objective 1 at this stage.

There would be no operational effects on soils/land use.

The WFD Assessment has reported that there is surface water available for abstraction at all flows in respect to the River Douglas; however, the abstraction of 5 Ml/d could have a widespread or prolonged effect on the hydrological regime of the River Douglas. This option has therefore been assessed as having a negative effect on Objective 3, although uncertainty remains.

The proposed abstraction point and pumping station would be located within Flood Zone 3 and may therefore be liable to flooding; however, operation of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, a minor negative effect has been identified in respect of Objective 4.

There would be no operational effects on air quality.

Operational energy demand would be 790 kWh/Ml, generating 59 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. However, the decrease in flows of the River Douglas may have adverse effects on recreational users such as anglers, although impacts are unlikely to be significant. The increased capacity of 5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would reuse effluent (5 Ml/d) which has been assessed as having a positive effect on Objective 9.

There would be no operational effects on designated cultural heritage assets.

New above ground infrastructure (the abstraction point and pumping station) may be visible from the M61 and residential properties to the south/east. However, as noted above, the development site is not within any landscape designations and is in a semi-urban environment (fringe of Horwich built up area). Further, the infrastructure would have a very small footprint and be located adjacent to Horwich WwTW. Modifications to Rivington WTW, meanwhile, would be contained within the present operational footprint and therefore no landscape impacts are predicted in respect of this component of the scheme. Overall, the option has been assess as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR141: Rossendale WwTW – Final Effluent Reuse	Construction	-	0	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	-/?	-	0	0	+/?	+	++	-	0	0

Construction

This option would involve the development of a new abstraction/intake point on the River Irwell in order to abstract and transfer final effluent from Rossendale WwTW to Townsend Fold WTW via a new 2.2km raw water main and pumping station. Townsend Fold WTW would be modified in order to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water would then be transferred into an existing distribution system. The option would have a design capacity of 10 Ml/d.

Neither the proposed abstraction site nor the pipeline route include or cross statutory or non-statutory nature conservation designations. HRA Screening has concluded that there are no likely significant effects (e.g. no impact pathways) on European designated sites. There are two SSSIs equal to or under 1.5km from the proposed scheme: Hodge Clough (1km downstream from the abstraction point) and West Pennine Moors (1.5km). Taking into account the type/scale of construction activity and distance to these sites, no effects on their interest features are anticipated. Construction of abstraction infrastructure and the pumping station on the River Irwell could introduce pollution/debris into the river ecosystem (although this is likely to be avoided through appropriate mitigation). Sections of the pipeline would also cross fields, and therefore, there is potential for short term disturbance to biodiversity during construction. Overall, this option has been assessed as having a minor negative effect on Objective 1.

The new abstraction infrastructure and pumping station would be situated on a greenfield site within Rossendale WwTW's operational footprint. Modifications to Townsend Fold WTW would be contained within the current operational footprint of the facility whilst any soil displaced due to pipeline works would be reinstated following the completion of construction. On balance, this option has been assessed as having a neutral effect on Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point and the pumping station would be located within Flood Zone 3 whilst pipeline works would either run adjacent to or traverse Flood Zones 2/3. Construction of these components may therefore be liable to flooding depending on the timing of works. Construction is not expected, however, to cause or exacerbate flooding in the area.

There could be traffic congestion during the construction period (particularly on the A682, A681 and local roads such as Holme Lane, Manchester Road, and Irwell Vale Road) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 6,919 vehicle movements during the 1.8 year construction period). However, any impacts would be temporary and a minor negative effect has therefore been identified in respect of Objective 5.

The option would generate 8,131 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. There may be a risk of temporary noise disturbance/air quality impacts associated with construction of the abstraction infrastructure and pumping station on residential receptors situated within Irwell Vale. Additionally, pipeline works and modifications to Townsend Fold WTW may temporarily disturb a small number of residential and other receptors within eastern Haslingden as well those situated along Bury Road and Holmeswood Park. The transportation of equipment/material could further intensify the potential risk of nuisance and disturbance for residential receptors. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a substantial capital expenditure which has been assessed as having a significant positive effect on the local economy associated with supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. However, pipeline works across the A56 in addition to the utilisation of the local road network for pipeline routing and the transportation of material/equipment could result in increased congestion and disruption/driver delay. Overall, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effective on Objective 10.

The development sites and proposed pipeline route do not contain any designated heritage assets. There are five Grade II / II* listed buildings within 150m of the proposed works including two listed buildings under 50m from the proposed pipeline route (Ewood Hall (24m) and Holme Bridge (28m). In consequence, there is the potential for construction activity to have short term, temporary adverse effects on the settings of these assets and a minor negative effect has been identified in respect of Objective 11.

The development sites and proposed pipeline route are not within or in proximity to any landscape designations. Development associated with the abstraction infrastructure/pumping station could affect local landscape character and the visual amenity of residential receptors to the south/south west. However, works would be within the footprint of an existing operational area and would benefit from existing screening (trees). Modifications to Townsend Fold WTW would be contained within the present operational footprint and therefore no significant landscape impacts are predicted in respect of this component of the scheme (although the visual amenity of a small number of residential receptors in close proximity to the site may be affected during construction). Sections of the pipeline would be routed through fields and works may affect the visual amenity of a small number of residential receptors. Overall, the option has been assessed as having a minor negative effect on Objective 12.

Operation

HRA Screening has concluded that operation of the option would have no effects alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.) on any European conservation site. Operation of the scheme would, however, indirectly utilise final effluent from Rossendale WwTW in order to produce an additional 10 Ml/d of potable water which would result in reduced flow in the River Irwell and may have residual effects on in-river habitats and local species. Consequently, further analysis (modelling etc.) of scheme operation would be required to confirm effects on the water systems and permitted abstraction volumes. This option has therefore been assessed as having an uncertain though potentially minor negative effect on Objective 1 at this stage.

There would be no operational effects on soils/land use.

The WFD Assessment has reported that there is surface water available for abstraction at all flows in respect to the River Irwell; however, the abstraction of 10 Ml/d could have a widespread or prolonged effect on the hydrological regime of the River Irwell. This option has therefore been assessed as having a negative effect on Objective 3, although uncertainty remains.

The proposed abstraction point and pumping station would be located within Flood Zone 3 and may therefore be liable to flooding; however, operation of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, a minor negative effect has been identified in respect of Objective 4

There would be no operational effects on air quality.

Operational energy demand would be 314 kWh/Ml, generating 74 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption; however, it may adversely affect fishing (trout) on the River Irwell due to the decreased water level although this is not expected to be a severe impact. The increased capacity of 10 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would reuse effluent (10 Ml/d) which has been assessed as having a significant positive effect on Objective 9.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The abstraction and pumping station would introduce new above ground infrastructure within a semi-rural greenfield setting. However, as noted above, the development would be within the footprint of an existing operational area and would benefit from existing screening (trees). Modifications to Townsend Fold WTW, meanwhile, would be contained within the present operational footprint and therefore no significant landscape impacts are predicted in respect of this component of the scheme during operation. Overall, the option has been assess as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR142: Hyndburn WwTW – Final Effluent Reuse	Construction	-	0	0	-	-	--	0	++/-	0	--	0	0
	Operation	-/?	0	-/?	-	0	0	+/?	+	++	-	0	0

Construction

This option would involve the development of a new abstraction/intake point on the River Calder in order to abstract and transfer final effluent from Hyndburn WwTW to Martholme WTW via a new 2.12km raw water main and pumping station. Martholme WTW would be modified in order to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water would then be transferred into the existing distribution system. The option would have a design capacity of 10Ml/d.

Neither the proposed abstraction site nor pipeline route include or cross statutory or non-statutory nature conservation sites and the HRA has concluded that there are no likely significant effects (e.g. no impact pathways) on European designated sites. Construction of abstraction infrastructure, the pumping station, and pipeline works on/across the River Calder could introduce pollution/debris into the river ecosystem (although this is likely to be avoided through appropriate mitigation). Sections of the pipeline would also cross fields, and therefore, there is potential for short term disturbance to biodiversity during construction. Overall, this option has been assessed as having a minor negative effect on Objective 1.

The new abstraction infrastructure and pumping station would be situated on greenfield land albeit within the operational footprint of Hyndburn WwTW. Modifications to Martholme WTW would be contained within the current operational footprint of the facility whilst any soil displaced due to pipeline works would be reinstated following the completion of construction. On balance, this option has been assessed as having a neutral effect on Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point and the pumping station would be located within Flood Zone 3 whilst pipeline works would either run adjacent to or traverse Flood Zones 2/3. Construction of these components may therefore be liable to flooding depending on the timing of works. Construction is not expected, however, to cause or exacerbate flooding in the area.

There could be traffic congestion during the construction period (particularly on the A680, A678, Martholme Lane and Mill Lane) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 7,270 vehicle movements during the 1.8 year construction period). However, any impacts would be temporary and a minor negative effect has therefore been identified in respect of Objective 5.

The option would generate 8,356 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. Taking into account the rural location of the works and the small number of residential receptors that may experience disturbance during construction, any impact on human health is expected to be negligible and the option has therefore been assessed as having a neutral effect on Objective 7.

Construction would involve a substantial capital expenditure which has been assessed as having a significant positive effect on the local economy associated with supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Pipeline works (where they cross local roads) and HGV movements could cause some minor disruption to the local road network although any impact would be temporary. Overall, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effective on Objective 10.

The development sites and proposed pipeline route do not contain any designated heritage assets. There are three Grade II listed buildings within the general vicinity of the scheme; specifically, Moorside House and associated infrastructure (365m), Clayton Hall Farm (267m), and Martholme Farm (585m). However, taking into account the type/scale of the works and the distance to these assets, no effects on their setting are predicted. Overall, this option has been assessed as having a neutral effect on Objective 11.

The development sites and proposed pipeline route are not within or in proximity to any landscape designations. Development associated with the abstraction infrastructure/pumping station could affect local landscape character; however, works would be within the footprint of an existing operational area and would benefit from existing screening (trees/vegetation). Modifications to Martholme WTW would be contained within the present operational footprint of the facility and therefore no significant landscape impacts are predicted in respect of this component of the scheme. Pipeline works within a semi-rural setting may adversely impact landscape character and the visual amenity of a very small number of residential receptors although any impact is likely to be negligible particularly given the presence of two parallel woodland buffers. On balance, this option has been assessed as having a neutral effect on Objective 12.

Operation

Operation of the scheme would indirectly utilise final effluent from Hyndburn WwTW in order to produce an additional 10 Ml/d of potable water. The option would result in reduced flow in the River Calder, and presumably by extension, the River Ribble and the Ribble and Alt Estuaries SPA / Ramsar. Although it is unlikely that there would be significant / adverse effects based on available information, additional analysis (modelling etc.) of scheme operation and/or identification of acceptable operational mitigation measures would be required to confirm effects on the estuary and permitted abstraction volumes. There may, however, be localised impacts on the River Calder's in-river habitats and native aquatic species due to the reduced flow. Consequently, this option has been assessed as having minor negative effect on Objective 1, although uncertainty remains.

There would be no operational effects on soils/land use.

The WFD Assessment has reported that there is surface water available for abstraction at all flows in respect to the River Calder; however, abstraction of up to 10 Ml/d could have a widespread or prolonged effect on the hydrological regime of the River Calder. This option has therefore been assessed as having a negative effect on Objective 3, although uncertainty remains.

The proposed abstraction point and pumping station would be located within Flood Zone 3 and may therefore be liable to flooding; however, operation of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, a minor negative effect has been identified in respect of Objective 4

There would be no operational effects on air quality.

Operational energy demand would be 353 kWh/Ml, generating 81 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption; however, it may adversely affect fishing on the River Calder due to the decreased water level although this is not expected to be a severe impact. The increased capacity of 10 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would reuse effluent (10 Ml/d) which has been assessed as having a significant positive effect on Objective 9.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The abstraction point and pumping station would introduce new above ground infrastructure within a semi-rural greenfield setting. However, as noted above, this development would be within the footprint of an existing operational area and would benefit from existing screening (trees and vegetation). Modifications to Hyndburn WTW, meanwhile, would be contained within the present operational footprint of the facility and therefore no significant landscape impacts are predicted in respect of this component of the scheme during operation. Overall, the option has been assess as having a neutral effect on Objective 12

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR144: Saddleworth and Mossley Top – Final Effluent Reuse	Construction	-	0	0	-	-	--	-	+	0	--	-	-
	Operation	0	0	0	-	0	0	+	+	+	-	0	0

Construction

This option would involve the development of a new abstraction/intake point on the River Tame in order to abstract and transfer final effluent from Mossley Top WwTW and Saddleworth WwTW to Buckton Castle WTW via a new 2.93km raw water main and pumping station. Buckton Castle WTW would be modified in order to accommodate the increased raw water input as well as to provide new operational processes required to treat raw river water/effluent to potable water quality standards. Treated water would then be transferred into the existing distribution system from Buckton Castle WTW. The option would have a design capacity of 5Ml/d.

Neither the proposed abstraction site nor the pipeline route contain/traverse through any European designated conservation sites.. Huddersfield Narrow Canal SSSI is under 100m from the abstraction point and would be crossed by the pipeline. In consequence, there is the potential for construction activity to affect the aquatic interest features of this site though it is assumed that site level mitigation measures would prevent any significant effect. Castle Clough and Cowbury Dale LNR and Dark Peak SSSI/South Pennine Moors SAC/SPA are 0.3km and 1.9km respectively from the proposed pipeline route although given the scale of works and distance to these sites, adverse impacts on their interest features are not expected (no impact pathways). More generally, the construction of abstraction infrastructure, the pumping station and pipeline works on/across the River Tame and Staly Brook could introduce pollution/debris into the river ecosystems (although this is likely to be avoided through appropriate mitigation). Sections of the pipeline would also cross fields and therefore there is potential for short term disturbance to biodiversity during construction. Overall, the option has been assessed as having a minor negative effect on biodiversity at this stage.

The new abstraction infrastructure and pumping station would be situated on greenfield land albeit within the operational footprint of Mossley Top WwTW. Modifications to Buckton WTW would be contained within the current operational footprint of the facility whilst any soil displaced due to pipeline works would be reinstated following the completion of construction. On balance, this option has been assessed as having a neutral effect on Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point, pumping station and a small section the pipeline would be located within Flood Zone 3. Construction of these components could therefore be liable to flooding depending on the timing of work, although construction is not expected to cause or exacerbate flooding in the area.

There could be traffic congestion during the construction period (particularly on the A635 and B6175) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 1,856 vehicle movements during the 1.5 year construction period). However, any impacts would be temporary and a minor negative effect has therefore been identified in respect of Objective 5.

The option would generate 2,024 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, construction could result in temporary disruption to the users of Stamford Golf Course and Micklehurt Cricket Pitch. Pipeline works may cause temporary noise disturbance/air quality impacts on residential receptors within eastern Mossley and particularly dwellings situated along the B6175. Modifications to Buckton Castle WTW may also disrupt the amenity of educational and community facilities within its vicinity such as the Mossley Hollins High School, although as works would be contained within existing sites, any impacts are expected to be very minor. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a moderate capital expenditure which has been assessed as having a positive effect on the local economy associated with supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. Pipeline works (where they cross local roads) and HGV movements could cause some minor disruption to the local road network although any impact would be temporary and not significant. Overall, this option has been assessed as having a positive effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effective on Objective 10.

The development sites and proposed pipeline route do not include any designated heritage assets. There are seven Grade II listed buildings within 150m of the proposed works including five listed buildings under 100m from the proposed pipeline route (Kershaw Hey Farmhouse (95m), Stamford Arms (41m), Pleasant View House/Barn (91m), Overgreen (95m), and Howard's Farmhouse and adjoining cottage (79m). In consequence, there is the potential for construction activity to have a short term, adverse impact on the settings of these assets. There are also five listed buildings to the east of Buckton Castle WTW, although as the WTW upgrade would be within an existing site, no significant impacts on these assets are predicted. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The development sites and proposed pipeline route are not within or in proximity to any landscape designations. Development associated with the abstraction infrastructure/pumping station could affect local landscape character; however, works would be within the footprint of an existing operational area and would benefit from existing screening (trees/vegetation). Modifications to Buckton WTW would be contained within the present operational footprint of the facility and therefore no significant landscape impacts are predicted in respect of this component of the scheme. Pipeline works may temporarily affect landscape character and the visual amenity of residential and recreational receptors along the proposed route and in consequence, the option has been assessed as having a minor negative effect on Objective 12.

Operation

The operation of the scheme would indirectly utilise final effluent from Mossley Top WwTW and Saddleworth WwWT in order to produce an additional 5 Ml/d of potable water. It should be noted that the HRA did not find any clear operational effects or likely significant effects associated with the option. Huddersfield Narrow Canal (approximately 100m away) is designated as a SSSI due to the presence of aquatic plant communities; however, this is not expected to be affected by this abstraction. Overall, this option has been assessed as having a neutral effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment reports that the ALS (Abstraction Licensing Strategy) indicates that there is water available at all flow regimes from the River Tame such that abstraction and utilisation of discharges from both Mossley Top and Saddleworth WwTWs has been assessed as having a neutral effect on Objective 3.

The proposed abstraction point and pumping station would be located within Flood Zone 3 and may therefore be liable to flooding; however, operation of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, a minor negative effect has been identified in respect of Objective 4

There would be no operational effects on air quality.

Operational energy demand would be 463 kWh/Ml, generating 41 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The increased capacity of 5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would reuse effluent (5 Ml/d) which has been assessed as having a positive effect on Objective 9.

There would be no operational effects on designated cultural heritage assets.

The abstraction point and pumping station would introduce new above ground infrastructure within a semi-rural greenfield setting. However, as noted above, this development would be within the footprint of an existing operational area and would benefit from existing screening (trees and vegetation). Modifications to Buckton WTW, meanwhile, would be contained within the present operational footprint of the facility and therefore no significant landscape impacts are predicted in respect of this component of the scheme during operation. Overall, the option has been assess as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR146: Davyhulme – Final Effluent Reuse	Construction	0	+	0	-	-	--	0	++/-	0	--	0	-
	Operation	?	0	-/?	-	0	--	++	++	++	--	0	0

Construction

This option would involve the development of a new storage tank and pumping station within the vicinity of Davyhulme WwTW in order to abstract and transfer 159 Ml of final effluent to a new WTW and on-site treated water storage via a new 428m raw water main. The new WTW would be required to treat final effluent to potable water quality standards. Treated water (100 Ml/d) would then be transferred into an existing treated water network for Manchester. Additionally, a new access road (4m wide and 350m long) leading to the new WTW would need to be installed prior to operation.

Neither the proposed abstraction infrastructure and WTW sites nor the proposed pipeline route are within any statutory or non-statutory biodiversity designations. The Davyhulme Millennium Nature Reserve is approx. 0.5km from the proposed abstraction infrastructure and 0.7km from the proposed location of the new WTW. Because the proposed works would be located on previously developed land, it is not expected that construction would have significant effects on the habitats and wildlife supported by the Nature Reserve, although works may result in temporary localised impacts such as air pollution (dust), noise disturbance, and disruption of wildlife movement in/out of the site. The proposed excavation route directly traverses the Manchester Ship Canal which poses the risk of introducing pollution/debris into the canal which could have an adverse impact on biota, although site specific mitigation and established best practice should prevent any significant effects. In general, construction would result in the temporary disturbance and restriction of movement to local wildlife situated between the Barton Aerodrome and the Manchester Ship Canal; however, any such impact is expected to be minor if not negligible due to the prior industrialisation of the site. Overall, this option has been assessed as having a neutral effect on Objective 1.

The new abstraction infrastructure and WTW/treated water storage would introduce new above ground infrastructure within an established industrial zone composed of Davyhulme WwTW, Barton Aerodrome, and Salford City Stadium which is expected to support the proposed development despite the permanent intake of urban classified land. Pipeline excavation would be routed through Grade 3b agricultural and urban land, and would subsequently be reinstated following the completion of construction. On balance, this option has been assessed as having a minor positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction infrastructure and WTW/treated water storage would be located within a Flood Zone 2 originating from the Manchester Ship Canal whereas the proposed excavation route traverses through a Flood Zone 2 and 3 of the Manchester Ship Canal. Construction would therefore be liable to flooding depending on the timing of works. Construction is not expected, however, to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts on traffic congestion during the construction period (particularly on the M60, A57, B5215, and local roads such as Bent Lanes and Woodhouse Road/Broadway which lead to Davyhulme WwTW) which would have a negative effect on local air quality (there would be an estimated 40,658 HGV movements during the 1.9-year construction period).

The option would generate 26,402 tCO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, there may be temporary disruption of use and/or loss of amenity to the grounds proximate to construction which may host recreational walking and sport such as Davyhulme Millennium Nature Reserve, Salteye Brook walking path, and the Manchester Ship Canal towpath. Because the scheme is situated within a semi-rural industrialised setting, there is a decreased likelihood that noise/vibration disturbance and air quality deterioration associated with construction would adversely impact residential receptors; however, receptors situated within northeast Calder Bank (Bent Lanes and Ripley Crescent) may be vulnerable to such impacts due to their proximity to Davyhulme WwTW. It should be noted that construction could result in a loss of amenity to the Salford City Stadium regarding increased noise disturbance though this would depend on the timing of the works and use of the stadium. On balance, this option has been assessed as having a neutral effect on Objective 7.

Construction would involve a significant capital expenditure resulting in a positive effect on the local economy associated with supply chain benefits generated by the development together with spend by construction workers and contractors in the local economy. The proposed pipeline route is approx. 302m from the closest access road (Salford City Stadium) which suggests that excavation would have a negligible impact on local ease of access/mobility, however, the transportation of material/equipment on the local road network could still result in increased congestion and disruption/driver delay. Additionally, excavation would traverse the Manchester Ship Canal which may temporarily disrupt movement within this section of the canal system. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significantly negative effective on Objective 10.

Neither the abstraction and WTW/treated water storage nor the proposed excavation route contain any historic designations; specifically, the closest heritage assets to the scheme would be three Grade II Listed Buildings situated 0.5km away from the new WTW and access road: Barton Aerodrome's Main Hangar/Workshops, Control Tower, and Office. The proximity between these heritage assets and the works suggests that there may be a minor temporary loss of visual amenity regarding their settings during construction, however, this would be temporary. Overall, this option has been assessed as having a neutral effect on Objective 11.

Neither the abstraction infrastructure and WTW/treated water storage nor the proposed excavation route would be within or in proximity to any landscape designations. Development of the abstraction infrastructure, WTW/treated water storage, and raw water main would be situated within an industrialised semi-rural setting thus maintaining the existing landscape character. Notwithstanding, the proposed WTW/treated water storage site lacks substantial woodland buffer along its southern and eastern periphery which could temporarily reduce the visual amenity associated with the wider semi-rural setting for passing receptors on the Manchester Ship Canal or users of the Salford City Stadium. Consequently, the option has been assessed as having a minor negative effect on Objective 12.

Operation

The operation of the scheme would utilise the final effluent (159 Ml) from the Davyhulme WwTW in order to produce 100 Ml/d of new potable water. This scheme would presumably reduce flows into the Mersey Estuary SPA / Ramsar via the Manchester Ship Canal; consequently, additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes although it is unlikely that there would be significant / adverse based on available information. There may be localised effects to ecological features within the Manchester Ship Canal, e.g. native and migratory fish species, however, there is an uncertainty regarding magnitude of effect due to the industrial setting of this canal section. Overall, and consistent with HRA Screening conclusions, the option has been assessed as having an uncertain effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The WFD Assessment has reported that there is surface water available at all flows in respect to the Manchester Ship Canal; however, reductions in discharges to the canal could have widespread or prolonged effects on the hydrological regime of the canal. This option has therefore been assessed as having a negative effect on Objective 3, although uncertainty remains.

The new abstraction infrastructure and WTW/treated water storage would be located within a Flood Zone 2 originating from the Manchester Ship Canal and therefore, may be liable to flooding during operation, however, operation of the general scheme is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 3,265 kWh/Ml, generating 4,593 tCO2e/a. This has been assessed as having a significantly negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased capacity of 100 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing. The option would reuse effluent (100 Ml/d) which has been assessed as having a significantly positive effect on Objective 9.

There would be no operational effects on designated cultural heritage assets.

The operational sites are not within or in proximity to any landscape designations. The new abstraction infrastructure and WTW/treated water storage would introduce new above ground structures within an industrialised semi-rural setting which is not expected to adversely impact the local landscape due to their comparatively minor structural footprints and their proximity to Davyhulme WwTW. Consequently, it is expected that these structural components would subsequently become part and parcel to the existing industrial zone. Overall, the option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR153: Simmonds Hill – Increased WTW Capacity	Construction	-	+	0	0	-	--	-	++/-	0	--	-	-
	Operation	?	0	-/?	0	0	0	++	++	0	-	0	0

Construction

This option would involve the reinstatement and refurbishment of the Helsby boreholes in order to abstract and transfer 3 Ml/d to the Foxhill WTW via a new 1.6km raw main between a treated water storage site and the Foxhill facility. Refurbishment of these boreholes would include new borehole pumps, mechanical and electrical fixtures (M&E), and headworks. The Foxhill borehole (1) would also be reinstated to include a new borehole slotted liner, borehole pump, M&E, and headworks to abstract an additional 3 M/l to be blended with the existing 8 Ml/d abstracted on site (11 Ml/d cumulative). The Foxhill WTW's disinfection process would be modified to increase the capacity by 3 Ml/d; subsequently, a cumulative 14 Ml/d would be transferred from Foxhill WTW to Simmonds Hill WTW via an existing treated water main. Additionally, Mouldsworth, Manley Common, Manley Quarry, and Five Crosses boreholes would be refurbished (7 new borehole pumps) to abstract an additional 5 Ml/d of water which would also be transferred to Simmonds Hill WTW via existing water infrastructure. Simmonds Hill WTW would be modified to increase its existing capacity (27Ml/d) by 8 Ml/d which would result in a new maximum capacity of 35 Ml/d. Overall capacity yield has been determined as up to 11 Ml/d.

A number of statutory conservation sites are within proximity of the borehole sites, WTWs, and proposed pipeline route; however, it is expected that the utilisation of established infrastructure sites within the scheme should help mitigate against adverse impacts on local biodiversity due to the contained nature of on-site refurbishment/modification. The Five Crosses BH is within the vicinity of various SSSIs which include Dunsdale Hollow (1.3km), Beechmill Wood and Pasture (870m), and Warburton's Wood and Well Wood (2.5km). Because these sites have been designated primarily due to their flora interest features, it is considered unlikely that the installation of a borehole pump would result in any discernible effect to the local and designated biodiversity within these sites. Five Crosses BH and Foxhill WTW are approx. 4.2km from the Mersey Estuary Ramsar/SSSI/SPA. Simmonds Hill WTW and Manley Common BH are within the proximity to Hatch Mere SSSI (3.3km) and Flaxmere Moss SSSI (3.9km) which compose the Midland Meres and Mosses Phase 1 – 2 Ramsar (West Midland Mosses SAC). Due the relative distance between the works and the conservation areas in addition to the scale of works proposed on site (installation of borehole / modification of treatment process), it is not expected that construction would result in any adverse impacts on their interest features, and if needed any effects on the site's internationally significant wildfowl population can be avoided with established measures such as construction best-practice or timing works to avoid breeding / migration periods. It is assumed that Black Lake Delamere SSSI and Limmer Moss SSSI (2.2km and 3.2km, respectively, from Mosley Common BH) would not be subject to any adverse impact from proposed construction due to their distance from working areas and the scale of works. A small segment of the proposed raw water main is approx. 54m from the Helsby Quarry LNR, which contains a range of habitats that support various species of bird and small terrestrial mammals. Due to the proximity of excavation to the site, works could result in temporary minor noise disturbance, loss of air quality, and a restriction of movement in/out of the site during the construction period. The proposed raw water main route traverses through urban/semi-rural greenfield which may cause short-term disturbance to habitats and species within proximity of excavation such as Foxhill Wood. On balance, this option has been assessed as having a negative effect on Objective 1.

The refurbishment/modification of boreholes and WTWs would be contained within existing operational sites such that new infrastructure should not significantly impact land/soil quality nor require significant additional land-intake. Pipeline excavation would be routed through Grade 3b agricultural land, and would be reinstated following the completion of construction. Overall, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area, nor would the sites be at risk from flooding.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the A56, B5393, B5152 B5393, and the local road network within the vicinities of the proposed components) which would have a negative effect on local air quality (there would be an estimated 3,366 HGV movements during the 1.5-year construction period).

The option would generate 3,456 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, construction may result in a temporary disruption of use or loss of amenity to the grounds within the construction vicinity which host recreational walking and sport such as Helsby Golf Course and Helsby Community Sports Club. Additionally, there may be noise/vibration disturbance and air quality impacts associated with the refurbishment and modification of the boreholes/WTW and the pipeline excavation which could affect residential receptors near Mouldsworth, Manley, southern Helsby, and the scattered residential dwellings and farmsteads within the vicinity of the scheme. Furthermore, educational and community facilities adjacent to construction such as Horn's Mill Primary School may also be vulnerable to noise disturbance and disruption of amenity. Overall, this option has been assessed as having a negative impact on Objective 7.

Construction of the option requires a substantial capital investment that could have a significant positive effect on the local economy and could create a number of local employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, pipeline excavation in addition to the transportation of equipment/material could temporarily increase congestion and disruption/driver delay on the regional and local road network. On balance, this option has been assessed as having a significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

Neither the borehole and WTW sites nor the proposed excavation route contain any historic designations, however, there are several Grade II/II* Listed Buildings and scheduled monuments maintain vantage points to the scheme. There are four scheduled monuments in proximity to the scheme although only the Promontory Fort on Helsby Hill is under .5km from the works (375m) with the other three ranging between 872m – 1km. Due to the Promontory Fort's elevated siting, excavation of the pipeline may result in a temporary loss of visual amenity looking out of the Fort whereas the other three sites' relative distances from the proposed works could make any adverse effect negligible. Additionally, 15 Grade I / II / II* Listed Buildings are within proximity to the proposed works; specifically, there are 3 Listed Buildings under 100m from the excavation route: Birch Cottage (55m), Meadowbank Cottage (74m), and Alvanley House (19m). Although it is expected that mitigation measures will be utilised during construction, the proximity between these heritage assets and the works suggests a moderate risk to the integrity and settings of these heritage assets. The remaining Listed Buildings (>100m) may experience a loss of visual amenity regarding their settings, however, this would be temporary.

Neither the borehole and WTW sites nor the proposed excavation route are within or in proximity to any landscape designations. Refurbishment/modification of the boreholes and the WTW may adversely impact the amenity of the surrounding semi-rural greenfield setting; however, construction would be confined within the existing structural footprints of these components such that any adverse impact on the landscape would be minor. The proposed excavation route enjoys segments of woodland buffer although works could adversely impact the wider semi-rural landscape and the residential visual amenity associated with such when excavation occurs within open greenfield areas. Consequently, the option has been assessed as having a negative effect on Objective 12.

Operation

It is currently unknown whether the abstraction of up to 11 Ml/d of groundwater would have an adverse effect on the statutory/non-statutory conversation sites within the general area. Operation would require increased exploitation of the aquifer, specifically, it is assumed that the option has the potential to reduce flows into the Mersey Estuary Ramsar/SSSI/SPA via (for example) the Hornsmill Brook. Additionally, there are several conservation areas within the proximity of these abstraction sites which support habitats and flora that are dependent upon groundwater: Hatch Mere SSSI and Flaxmere Moss SSSI which compose the Midland Meres and Mosses Phase 1 – 2 Ramsar (West Midland Mosses SAC) as well as Limmer Moss SSSI. Further modelling and analysis will be required to determine whether the increased abstraction will adversely impact water flows feeding into the Mersey Estuary as well as the water tables supporting water dependant features of conservation interest. Overall, this option has been assessed as having an uncertain effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

Although the abstraction licences are already in place, it is unclear how much additional quantity is required. Consequently, there are likely to be moderate effects on water quantity (should the existing licences be increased) as the abstraction licensing strategy (ALS) indicates that there is restricted water available in the groundwater body and limited water availability in the Peckmill Brook and Hoolpool Gutter. Overall, the abstraction of up to 11 Ml/d has been assessed as having a negative effect on Objective 3 but uncertainty remains.

The operation of this option is not expected to cause or exacerbate flooding in the general area or elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 469 kWh/Ml, generating 84 tonnes CO2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased abstraction of 10.7 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The refurbishment/modification of the boreholes and WTWs would be part and parcel to the existing structural footprint established on these sites such that any adverse impact on the surrounding semi-rural landscape would be minor, if not negligible. Additionally, the scheme benefit from moderate to substantial woodland buffer which should help screen any new structural additions to the sites. Overall, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR154: Sandiford – Increased WTW Capacity	Construction	-	+	0	-	0	-	-	+	0	-	0	-
	Operation	0	0	-/?	-	0	-	+	+	0	-	0	0

Construction

This option would involve the refurbishment of the existing Organsdale, Delamere (#3), Delamere (#4), Eddisbury, Cotebrook (#40), Cotebrook (#15), and Sandiford boreholes in order to increase raw water production by a cumulative 10 Ml/d (within existing licence limits). To facilitate this increase of abstraction, new BH pumps would be installed within 7 of these boreholes; notwithstanding, it is considered that the existing raw water infrastructure would allow increased pumping across all sites. Additionally, Delamere WTW would require internal modification to increase its capacity of arsenic removal by 5 Ml/d in order to continue treating Organsdale, Delamere (#3), Delamere (#4), and Eddisbury BHs. Sandiford WTW would also require modification to increase its treatment capacity by 10 Ml/d which would involve a new partial nitrate removal plant to ensure treated water compliance. Output from Sandiford WTW would be transferred to a treated water storage facility for wider distribution. It is assumed that existing pipeline infrastructure would not require upgrading in order to accommodate the increase of 10 Ml/d.

It is expected that the utilisation of the existing/operational BH sites should help mitigate against adverse impacts on local biodiversity due to the contained nature of the refurbishment/modification. Borehole pump replacement at the 7 designated sites would be non-invasive such that works are not expected to adversely impact local habitats or wildlife beyond that of minor noise disturbance. Similarly, the internal modification of Delamere WTW's treatment processes would be contained within the current facility which suggests that the only discernible impact resulting from the works would be minor noise disturbance to wildlife within the WTW's immediate setting. Sandiford WTW is not within any statutory or non-statutory biodiversity designated sites. There are four conservation sites within the general vicinity of the Sandiford WTW: Oak Meres SSSI/SAC – Midland Meres & Mosses Phase 2 Ramsar (857m), Little Budsworth Common SSSI (1.5km), Abbots Moss SSSI – West Midland Mosses SAC (3.1km), and Linmer Moss SSSI (4.4km). Because any modification or refurbishment to Sandiford WTW's treatment process would be confined within its existing footprint including the construction of the partial nitrate removal plant, it is considered highly unlikely that works would disturb or result in any detrimental impacts on these sites' environmental and flora interest features. Notwithstanding, required alteration to the facility could temporarily impact proximate habitats such as Sandy Mere and Oak Mere and local wildlife regarding noise disturbance during the construction period. Overall, significant adverse impacts resulting from construction on these features can be avoided with established project-level mitigation, e.g. construction best-practice, such that this option may have a minor negative effect on Objective 1.

The refurbishment of the 7 BHs, Delamere WTW, and Saniford WTW would be contained within their existing footprints such that any new ancillary infrastructure should not significantly impact land/soil quality. Overall, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The Sandiford WTW is directly adjacent to a Flood Zone 3 originating from the Sandyford Brook which traverses through the site; consequently, modification may be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is not expected that there would be significant impacts on traffic congestion during the construction period beyond a minor increase movement on the B5152 leading to Sandiford WTW such that the option would have a neutral effect on local air quality (there would be an estimated 947 HGV movements during the 1.5-year construction period).

The option would generate 555 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, refurbishment of the BHs and WTWs may result in a temporary loss of amenity to the grounds within proximity to construction which host recreational walking and sport. Additionally, there may be noise/vibration disturbance depending on the scale of Sandiford WTW's new nitrate removal plant which could affect proximate farmsteads such as Fishpool Lane Farm, Ottersbank Farm, Sidebottom Farm, Rosebank Farm, and Forest Farm. Overall, this option has been assessed as having a minor negative impact on Objective 7.

Construction would involve a moderate capital expenditure which could have positive effects on the local economy but would not be of a scale likely to generate significant new employment opportunities although individual spend by contractors and workers could provide some local benefit to business. It is not expected that required works would result in a significant intensification of movement on the local road network. On balance, the option has been assessed as having a positive effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a negative effect on Objective 10.

The Sandiford WTW does not include any historic designations, however, there is a cluster of 5 bowl barrows situated around Fishpool Lane Farm at an average distance of 259m from the site. Construction of the nitrate removal plant could result in a minor loss of visual amenity regarding the settings of these assets although, depending on scale of the infrastructure, effects could be negligible due to the distance. The two closest Listed Buildings to the site are the ancillary structures of Sandybrow House (1.2km) and the Church of St. John (1.2km); consequently, these sites are not expected to experience any discernible effect associated with potential refurbishment works to the facility. Overall, this option has been assessed as having a neutral effect on Objective 11.

It is not expected that the refurbishment and modification of the BHs and Delamere WTW would have any adverse impact on their semi-rural setting or their wider landscape character due to the confined nature of the proposed works. Modification of the Sandiford WTW could, however, temporarily alter its immediate setting and disrupt the visual amenity of surrounding farmsteads depending on the scale of construction associated with the proposed nitrate removal plant though partial woodland buffer along the periphery of the site could reduce any adverse construction impact as negligible. On balance, this option has been assessed as having a minor negative effect on Objective 12.

Operation

The increased cumulative abstraction of 10 Ml/d of groundwater from the Organsdale, Delamere (#3), Delamere (#4), Eddisbury, Cotebrook (#40), Cotebrook (#15), and Sandiford boreholes would remain within current abstraction licence limits thus it is not expected that operation of the option would have an adverse effect on the statutory/non-statutory conversation sites within the general area as the existing licence would have been subject to review under the EA Review of Consents process. For example, Oak Meres SSSI/SAC – Midland Meres & Mosses Phase 2 Ramsar, Little Budworth Common SSSI, Abbots Moss SSSI – West Midland Mosses SAC, and Linmer Moss SSSI sit within the scheme's operational zone; however, the HRA has assessment has concluded that there are no adverse effects or likely significant effects alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.) associated with the increased cumulative abstraction. Overall, this option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

The option would result in the abstraction of an additional 10 Ml/d. The WFD Assessment has concluded that this could have a minor negative effect on groundwater resources, although uncertainty remains.

Sandiford WTW site is adjacent to a Flood Zone 3 originating from the Sandyford Brook and therefore, may be liable to flooding during operation, however, operation of the general scheme is not expected to cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 1,045 kWh/Ml, generating 168 tonnes CO2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, the increased abstraction of 10 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The refurbishment/modification of the BHs and WTWs would be part and parcel to the existing structural footprints established on these sites such that any adverse impact on the surrounding rural landscape would be minor, if not negligible. Sandiford WTW's new nitrate removal plant would be the only significantly new infrastructure introduced within the scheme which could slightly alter the local setting though partial woodland buffer should moderate any adverse impacts to the wider landscape character. Overall, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR159: Group 1 - Improved Reservoir Compensation Release Control	Construction	-	+	0	-	0	-	-	0	0	-	-	-
	Operation	0/?	0	0	0/?	0	+	++	++	++	0	0	0

Construction

This option would involve the construction of new automated penstock arrangements at 76 reservoirs (Group 1) in order to provide compensation control in line with licence requirements. The proposed development scope would also include a new kiosk at each targeted reservoir. It is estimated that operation of the scheme would result in a cumulative design capacity of up to 13.2 Ml/d.

The majority of the proposed reservoir sites (56) are situated within and/or immediately adjacent to a European designated conservation site. Approximately 50 reservoirs are within 5km of South Pennine Moors SAC, 13 are directly adjacent to the SAC and 5 (Readycon Dean, Blackstone Edge, White Holme, Light Hazzles, and Warland) are components of the SAC itself. These 50 reservoirs are also within proximity to and/or are in the Peak District Moors (South Pennine Moors Phase 1) SPA (22 reservoirs in total with 8 directly adjacent) and the South Pennine Moors Phase 2 SPA (28 reservoirs in total with 5 directly adjacent and 5 within the boundary of the SPA). However, construction of new penstock arrangements and kiosks would be small in scale and be within the operational footprints of the reservoirs such that works are unlikely to adversely affect the interest features of these sites.

Duddon Estuary Ramsar/SPA and Morecambe Bay Ramsar/SAC/SPA are within the general vicinity of Poaka Beck (c. 2.6km), Harlock (c. 3km) and Pennington (c. 4km) reservoirs, although it is considered unlikely that there would be any clear impact pathways between the proposed scheme and the features of these sites (estuaries, mudflats/sandflats, salt meadows, inlets/bays, and coastal dunes). It is also considered unlikely that construction at Stocks Reservoir would significantly affect the protected hay meadows of the North Pennine Dale Meadows SAC (c. 1.7km) or the interest features of Bowland Fells SPA (2.3km). Wet Sleddale Reservoir is within proximity of several SACs: Lake District High Fells (directly adjacent); River Eden (c. 123m downstream); North Pennine Dale Meadows SAC (c. 153m); and Naddle Forest SAC (c. 4.8km). Although it is unlikely that Naddle Forest SAC would be adversely affected by the proposed works at West Sleddale Reservoir (due to the lack of clear impact pathways), there is a minor risk of disturbance/nuisance to the other sites and particularly the River Eden SAC associated with the potential introduction of pollution/debris within the River Lowther during the construction period. However, the HRA has concluded that construction of the new penstock arrangements and kiosks would be minor and of low invasiveness thus adverse construction effects are likely to be avoidable with site specific mitigation and established best practice.

There are a number of reservoirs (24) that are either directly adjacent to (19) or situated within (5) SSSIs including: Goyt Valley (Errwood Reservoir); South Pennine Moors SSSI (5 reservoirs situated within and 5 directly adjacent); and West Pennine Moors (5). Wet Sleddale Reservoir, meanwhile, is within proximity to Shap Fells SSSI, Wet Sleddale Meadows SSSI and the River Eden and Tributaries SSSI. Additionally, Walkerwood Reservoir is within proximity to Brushes Valley LNR whereas Jumbles Reservoir is situated on the boundaries of the Upper Bradshaw Valley LNR and Ousel Nest Quarry LNR. However, it is considered unlikely that construction would result in any significant effects on these SSSIs/LNRs beyond very minor (temporary) localised noise disturbance and adverse air quality impacts on, for example, the waterfowl and wading avifauna interest features which utilise these reservoirs as roosting/breeding sites (depending on the timing of the works). There may also be minor, localised adverse

effects on biodiversity associated with the loss of/disturbance to habitats and species, although it is assumed that established scheme-level avoidance and/or mitigation measures will be utilised to help control any adverse impacts in this regard. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Works associated with the construction of the new automated penstock arrangements and ancillary kiosks would be confined within the existing footprints of the 76 reservoirs and no substantial land take would be required. If additional land is required, all of the targeted reservoirs are situated on Grade 4/5 agricultural land/non-agricultural land and therefore significant adverse effects on soil are not expected. Overall, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

There are 36 reservoirs within the scope of this scheme that are situated within Flood Zones 2/3; consequently, construction activity may be liable to flooding depending on the timing of works. It is not anticipated, however, that construction would result in, or exacerbate, flooding elsewhere during the construction period. Overall, this option has been assessed as having a negative effect on Objective 4.

There would be c. 959 vehicle movements associated with this option over the 1.5 year implementation period. The majority of the targeted reservoirs are situated within rural/semi-rural areas which should minimise traffic and air quality impacts. Whilst 8 reservoirs are within urban areas, vehicle movements in these locations would be small and any congestion related impacts temporary. The scale of construction associated with the new penstock systems and kiosks would be minor which should have a negligible effect with respect to plant and machinery emissions. Overall, this option has been assessed as having a neutral effect on Objective 5.

The option would generate 958 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a negative effect on Objectives 6 and 10.

Given the scale of development, construction of the new automated penstock arrangements and control kiosks are not expected to significantly affect opportunities for recreation and physical activity. However, it is unknown whether best practice and safety protocols would permit continued recreational use of a reservoir (if previously available to the public) during the construction period. As previously noted, the majority of the targeted reservoirs are located within rural/semi-rural settings and therefore it is highly unlikely that the proposed construction works and HGV movements would significantly affect human health due to temporary noise disturbance and air quality impacts. Whilst there are 8 reservoirs located within urban areas where works may cause some disturbance to nearby sensitive receptors, any effects would be very minor and temporary. Overall, this option has been assessed as having a minor negative effect on human health.

Construction would involve a relatively modest capital expenditure which is considered insufficient to have a substantive effect on the local economy and local employment creation. Although construction may disrupt access to the reservoirs for recreational use (depending on the timing of the works), it is not considered likely that a reduction of foot traffic within proximate towns will result in adverse effects on local economies due to the short implementation period per reservoir. Due to the minor scale of the construction works and relative settings, it is not expected that associated HGV movements would cause substantial congestion and/or disruption/driver delay on the local road networks. Overall, the option has been assessed as having a neutral effect on economic and social wellbeing (Objective 8).

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have minor negative effects on Objective 10.

The majority of the targeted reservoirs are within the general vicinity of heritage assets. A total of 6 reservoirs (Audenshaw (1,2,3), Torside, Castleshaw (Upper/Lower), Swinden, Pennington, and Levers Water) are under 500m from Scheduled Monuments with Castleshaw Reservoirs being directly adjacent to the Castleshaw Roman Forts and Levers Water Reservoir being adjacent to Conniston Copper Mines. There are also circa 80 Grade II / II* listed buildings within proximity to 30 of the targeted reservoirs with 10 assets under 100m (e.g. Bleak House and ancillary infrastructure (88m from Woodhead), Arnfield Tower (50m from Arnfield), Castle Hill Cote (42m from Castleshaw Lower), and Waterworks Cottage (33m – Springs) whilst Bradshaw Brook Viaduct Grade II Listed Building is situated within the boundary of Wayoh Reservoir. It is not expected that construction works would result in any adverse effects to the structural integrity of these assets although their settings may be temporarily affected. Overall, this option has been assessed as having a negative effect on Objective 11.

The majority of the proposed reservoir sites (49) are situated within, or in proximity to, designated landscapes. A total of 15 reservoirs are within the boundary of the Peak District National Park with a further 18 in proximity. Levers Water and Wet Sleddale Reservoirs, meanwhile, are situated within the Lake District National Park and WHS whilst Wet Sleddale is circa 3.3km from the Yorkshire Dales National Park boundary. A total of 14 reservoirs are also within 10km from the Forest of Bowland AONB with 4 reservoirs being directly situated within this AONB (Stocks, Churn Clough, Upper Ogden, and Lower Ogden). In consequence, there is the potential for substantial landscape impacts associated with new development. However, construction activity would be small in scale and take place within the footprint of existing reservoirs and therefore significant negative effects on landscape are not predicted. Notwithstanding this, recreational users of these reservoirs in addition to proximate residential receptors may perceive the works (plant, machinery, etc.) as impacting the landscape. Overall, this option has been assessed as having a negative effect on Objective 12.

Operation

The operation of the new automated penstock arrangements at the 76 targeted reservoirs within Group 1 would help prevent 'over-compensation' releases by providing increased control of reservoir storage in line with licence requirements. As operation of the reservoirs would remain within licenced limits, it is unlikely the reduction of 'over-compensation' would significantly or adversely affect nearby European designated conservation sites. Notwithstanding this, ecological processes within water networks fed by these reservoirs may have adapted to these larger compensation releases such that a reduction in present volume may adversely affect or disrupt in-river habitats and aquatic species. It is not expected, however, that effects would be significant as reductions would be relatively small with the largest reduction being 3.2 Ml/d from the Longdendale & Audenshaw group (9 reservoirs) (other reductions range from 0.1 Ml/d to 1.5 Ml/d). Overall, operation of this option has been assessed as having a neutral effect on biodiversity, although some uncertainty remains.

There would be no operational effects on soils/land use.

The operation of this option would reduce present 'over-compensation' flows and operation would remain within existing licence limits. In consequence, the option has been assessed as having a neutral effect on Objective 3.

Operation of the new penstock systems are not expected to cause or exacerbate flooding. It should be noted that the reduction of 'over-compensation' releases may help prevent or minimise localised flooding, although this is uncertain.

There would be no operational effects on air quality.

Ongoing energy use and related greenhouse gas emissions associated with the operation of this option would be negligible and neutral effects have therefore been identified in respect of climate change and resource use in this regard. It should be noted that increased efficiency in respect of conserving reservoir storage could increase resilience to climatic driven supply restrictions in the region. On balance, this option has been assessed as having a minor positive effect on climate change (Objective 6) and a significant positive effect on water resources (Objective 8).

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. It is unknown whether reduction of 'over-compensation' releases would adversely affect downstream recreational activities (e.g. angling) though the minor reduction per reservoir suggests that any impact would be negligible. The increased capacity of up to 13.2 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health, as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

There would be no operational effects on designated cultural heritage assets.

As noted above, the majority of the proposed reservoir sites (49) are situated within, or proximate to, a designated landscape and in consequence, there is the potential for substantial landscape impacts. However, the new penstock systems and kiosks would be situated within the previously established footprints of the reservoirs, and furthermore, would be small in scale. Recreational users and proximate residential receptors may perceive the new infrastructure as an adverse intensification of the sites although such effects would be very minor. As the reduction of compensation release per reservoir would be relatively minor, it is also considered unlikely that water networks fed by the reservoirs would significantly alter in respect to water flow. On balance, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR160: Group 2 – Improved Reservoir Compensation Release Control	Construction	-	+	0	-	0	-	-	0	0	-	-	-
	Operation	0/?	0	0	0/?	0	+	+	+	++	0	0	0

Construction

This option would involve the construction of new automated penstock arrangements at 4 reservoirs (Group 2: Lake Vyrnwy, Rivington, Thirlmere and Haweswater) in order to provide compensation control in line with licence requirements. The proposed development scope would also include a new kiosk at each targeted reservoir. It is estimated that operation of the scheme would result in a cumulative design capacity of up to 8.8 Ml/d.

Three of the reservoir sites (Vyrnwy, Haweswater and Thirlmere) are situated within the vicinity of, and/or are immediately adjacent to, a European designated conservation site. Lake Vyrnwy is adjacent to Berwyn and South Clwyd Mountains SAC and Berwyn SPA/SSSI (an internationally significant site supporting European dry heath and blanket bog environs) whilst Thirlmere is circa 813m from the Lake District High Fells SAC and Haweswater is directly adjacent to Naddle Forest SAC/SSSI, both of which have been designated due to their flora and natural environs (tarns, wet/dry heaths, grasslands, alpine based heaths and grasslands, blanket bogs, and old sessile oak woods). Construction of new penstock arrangements and kiosks would be small in scale and be located within the operational footprints of the reservoirs such that works are unlikely to adversely affect the interest features of these sites. Haweswater Reservoir is immediately upstream of the River Eden SAC (c. 871m) and construction may pose the potential risk of introducing pollution/debris within Haweswater Beck thus affecting in-river habitats and species (including White-clawed crayfish, Atlantic salmon, bullhead, otter, and several species of lamprey). However, the HRA has concluded that effects are likely to be avoidable with site specific mitigation and established best practice at the project stage. There are six other SACs under 10km from Thirlmere and Haweswater Reservoirs: River Derwent and Bassenthwaite Lake (4.5km from Thirlmere); Borrowdale Woodland Complex (3.7km from Thirlmere); North Pennine Dale Meadows (3.1km from Haweswater); River Kent SAC (4.3km from Haweswater); Ullswater Oakwoods (7km from Haweswater); and the Asby Complex (9km from Haweswater), although it is considered unlikely that there would be any clear impact pathways between the works and these SACs.

The four reservoirs are within proximity of circa. 20 SSSIs and are immediately adjacent to 5. Rivington Reservoir sits along the boundary of the West Pennine Moors SSSI and is circa 2km from Red Moss SSSI. Primarily designated for its range of environmental habitats, the West Pennine Moors support a significant population of upland breeding birds (lapwing and curlew) which use reservoir margins as well as nearby pastureland for breeding, foraging, and roosting; construction may result in minor temporary noise disturbance and adverse air quality impacts on these avifauna in addition to breeding avifauna at Red Moss although effects are expected to be managed to an acceptable level. Besides the River Eden and Tributaries SSSI (which is immediately downstream of Haweswater Reservoir) and the Naddle Forest SSSI (along its periphery), there are five SSSIs ranging from 2.9km to 4.3km from Haweswater: Blea Water (1.7km); Swindale Meadows (2.9km); Butterwick Meadows (3km); Shap Fells (3.3km); and Troutbeck (4.3km) whilst Thirlmere Reservoir is directly adjacent to Thirlmere Woods SSSI, within proximity to Armboth Fells SSSI and upstream of the River Derwent and Tributaries SSSI via St. John's Beck. Due to the small scale of construction and the potential for mitigation to minimise impacts at the project level, significant effects on the interest features of these SSSIs are not predicted. Haweswater is within proximity to Helvellyn and Farfield SSSI (2km), Lodore – Troutdale Woods SSSI (3.5km), Stonewaite Woods SSSI (4.5km), and Rosthwaite Fell (5.5km). However, the relative distance

between sites prevents any clear direct impact pathways. Lake Vyrnwy is within the general vicinity of nine SSSIs; however, the closest sites (with the exception of Berwyn SSSI), Fachwen Isaf and Coed Copi'r Graig, are 3.6km and 4km, respectively, from Lake Vyrnwy such that it is highly unlikely that construction would adversely affect any of these sites due to relative distance to the proposed works.

There may be minor, localised adverse effects on biodiversity associated with the loss of/disturbance to habitats and species, although it is assumed that established scheme-level avoidance and/or mitigation measures will be utilised to help control any adverse impacts in this regard. Overall, this option has been assessed as having a minor negative effect on Objective 1.

Works associated with the construction of the new automated penstock arrangements and ancillary kiosks would be confined within the existing footprints of the reservoirs and no substantial land take would be required. Overall, this option has been assessed as having a positive effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The four reservoirs are situated within Flood Zones 2/3; consequently, construction may be liable to flooding depending on the timing of work. It is not anticipated, however, that construction would result in, or exacerbate, flooding elsewhere during the construction period. Overall, this option has been assessed as having a negative effect on Objective 4.

There would be a small number (circa 50) of vehicle movements over the 1.2 year implementation period and the reservoirs are situated within rural/semi-rural sites. In consequence, traffic and associated air quality impacts are expected to be negligible. The scale of construction associated with the new penstock systems and kiosks would be minor which should have a negligible effect with respect to plant and machinery emissions. Overall, this option has been assessed as having a neutral effect on Objective 5.

The construction of this option would generate a small volume of greenhouse gas emissions (approximately 105 tCO_2e) which has been assessed as having a negative effect on Objectives 6 and 10.

Given the scale of development, construction of the new automated penstock arrangements and control kiosks are not expected to significantly affect opportunities for recreation and physical activity. However, it is unknown whether best practice and safety protocols would permit continued recreational use of a reservoir (if previously available to the public) during the construction period. As previously noted, the majority of the targeted reservoirs are located within rural/semi-rural settings and therefore it is highly unlikely that the proposed construction works and HGV movements would significantly affect human health due to temporary noise disturbance and air quality impacts. Thirlmere and Haweswater have hotels along their banks (Dalehead Hall Hotel and Haweswater Hotel, respectively) in addition to Burbank village c. 500m from Haweswater. Additionally, Lake Vyrnwy is within the general proximity of Llandwdynn (c. 300m) whereas Rivington is close to Aldington (c.600m), Rivington County Park (c. 575m), and various farmsteads along the periphery of the reservoir. Consequently, sensitive residential and recreational receptors proximate to the works may experience some minor temporary nuisance and disturbance. Overall, this option has been assessed as having a minor negative effect on human health.

Construction would involve a relatively modest capital expenditure which is considered insufficient to have a substantive effect on the local economy and local employment creation. Although construction may disrupt access to the reservoirs for recreational use (depending on the timing of the works), it is not considered likely that a reduction of foot traffic within proximate towns will result in adverse effects on local economies due to the short implementation period per reservoir. Due to the minor scale of the construction works and relative settings, it is not expected that associated HGV movements would cause substantial congestion and/or disruption/driver delay on the local road networks. Overall, the option has been assessed as having a neutral effect on economic and social wellbeing (Objective 8).

The option would not affect water efficiency.

The four targeted reservoirs are proximate to a range of heritage assets. There are 17 Scheduled Monuments ranging from 212m to 783m from the reservoirs with two monuments directly adjacent to Haweswater (Highhouse Romano-British Farmstead and Haweswater Romano-British Farmstead). There are also 32 Grade I/II Listed Buildings under 500m from the targeted reservoirs with 13 assets under 100m of Rivington (e.g. Rivington Castles, Hamers Cottage, and Church of Holy Trinity and Bell House), Thirlmere (e.g. Wythburn Church and Straining Well & Valve House) and Lake Vyrnwy (e.g. Pont Eunant, Pistyll y Ceunant Bridge, Pont Ty-uchaf, Lake Vyrnwy Dam, Lake Vyrnwy Straining Tower/approach Bridge, Pont Cynon, and the Lake Vyrnwy Dam Memorial). It is not expected that construction works would result in any adverse impacts on the structural integrity of these assets although their settings may be temporarily affected. Overall, this option has been assessed as having a negative effect on Objective 11.

Haweswater and Thirlmere Reservoirs are situated within the Lake District National Park and WHS; Lake Vyrnwy is circa 3km from Snowdonia National Park. In consequence, there is the potential for substantial landscape impacts associated with new development. However, construction activity would be small in scale and take place within the footprint of existing reservoirs and therefore significant negative effects on landscape are not predicted. Notwithstanding this, recreational users of these reservoirs may perceive the works (plant, machinery, etc.) as impacting the landscape. Overall, this option has been assessed as having a negative effect on Objective 12.

Operation

The operation of the new automated penstock arrangements at the 4 targeted reservoirs within Group 2 would help prevent 'over-compensation' releases by providing increased control of reservoir storage in line with licence requirements. As operation of the reservoirs would remain within licenced limits, it is unlikely the reduction of 'over-compensation' would significantly or adversely affect nearby European designated conservation sites. Notwithstanding this, ecological processes within water networks fed by these reservoirs may have adapted to these larger compensation releases such that a reduction in present volume may adversely affect or disrupt in-river habitats and aquatic species. It is not expected, however, that effects would be significant as reductions would be relatively small with the largest reduction being 3.4 Ml/d from Lake Vyrnwy (with other reductions ranging from 1.4 Ml/d to 2.2 Ml/d). Overall, operation of this option has been assessed as having a neutral effect on biodiversity, although some uncertainty remains.

There would be no operational effects on soils/land use.

The operation of this option would reduce present 'over-compensation' flows and operation would remain within existing licence limits. In consequence, the option has been assessed as having a neutral effect on Objective 3.

Operation of the new penstock systems are not expected to cause or exacerbate flooding. It should be noted that the reduction of 'over-compensation' releases may help prevent or minimise localised flooding, although this is uncertain.

There would be no operational effects on air quality.

Ongoing energy use and related greenhouse gas emissions associated with the operation of this option would be negligible and neutral effects have therefore been identified in respect of climate change and resource use in this regard. It should be noted that increased efficiency in respect of conserving reservoir storage could increase resilience to climatic driven supply restrictions in the region. On balance, this option has been assessed as having a minor positive effect on climate change (Objective 6) and a significant positive effect on water resources (Objective 8).

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. It is unknown whether reduction of 'over-compensation' releases would adversely affect downstream recreational activities (e.g. angling) though the minor reduction per reservoir suggests that any impact would be negligible. The increased capacity of up to 8.8 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health, as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

There would be no operational effects on designated cultural heritage assets.

Haweswater and Thirlmere Reservoirs are directly situated within the Lake District National Park/WHS whilst Lake Vyrnwy is within circa 3km from the boundary of Snowdonia National Park; in consequence, there is the potential for substantial landscape impacts. However, the new penstock systems and kiosks would be situated within the previously established footprints of the reservoirs, and furthermore, would be small in scale. Recreational users may perceive the new infrastructure as an adverse intensification of the sites although such effects would be very minor. As the reduction of compensation release per reservoir would be relatively minor, it is also considered unlikely that water networks fed by the reservoirs would significantly alter in respect to water flow. On balance, this option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR800: River Bela to Thirlmere Aqueduct	Construction	-	+	0	-	-	--	-	+/-	0	--	-	-
	Operation	0	0	0	0	0	0	+	+	0	-	0	0

Construction

This option would involve an abstraction trade from an existing non-water industry abstraction licence holder abstracting from the River Bela. It would require the development of a new abstraction/intake point on the River Bela at Bela Mill in order to abstract and transfer 4.5 Ml/d of water to Thirlmere Aqueduct (Lupton North Well) via a new pumping station and 8.5km raw water main.

The proposed abstraction infrastructure would be within 850m of Morecambe Bay SAC/SPA/Ramsar/SSSI (designated for wintering wading birds and wildfowl in addition to being a layover site for migrating birds) and Morecambe Bay Pavements SAC and Farleton Knott SSSI). There is the potential for works to cause disturbance to these features as well as to introduce pollution/debris to the river system; however, given the scale of works associated with this option, it is assumed that significant effects would be avoidable with established scheme-level avoidance or mitigation measures. More generally, the construction of this option could result in the localised loss of/disturbance to habitats and species. Overall, this option has been assessed as having a minor negative effect on biodiversity.

The new abstraction infrastructure and pumping station would be situated within the existing footprint of Bela Mill whilst land excavated during pipeline works would be reinstated. Overall, this option has been therefore assessed as having a minor positive effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point would be situated within Flood Zone 3 whilst sections of the proposed pipeline route would traverse Flood Zones 2/3. Construction could therefore be liable to flooding depending on the timing of works, although it is unlikely that construction of the overall scheme would cause or exacerbate flood risk elsewhere. Overall, a minor negative effect has been identified in respect of Objective 4.

There could be traffic congestion associated with pipeline works (especially along the A6, A65, A590, B6384 and B6385 due to vehicle movements and crossings) which, together with plant and machinery operation, may have a negative effect on local air quality (there would be an estimated 3,254 vehicle movements during the 1.5 year construction period).

The option would generate 4,169 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, the proposed works could result in temporary disruption to users of open space along the pipeline route. Sections of the proposed pipeline would be routed through residential areas (Milnthorpe/Ackenthwaite) and in consequence, there is the potential for noise/vibration disturbance and air quality impacts associated with excavation works on residential receptors, particularly along Beetham Road and Main Street. The remaining route would traverse a semi-rural setting with works and associated HGV movements potentially affecting scattered settlements and farmsteads such as Lupton, Nook, and Milton. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction would involve a relatively small capital expenditure which could have a minor positive effect on the local economy. Pipeline works would be routed along and/or utilise both local and regional road networks (including the A65 and A590) which could increase congestion and cause disruption/driver delay during the construction phase. On balance, this option has been assessed as having a mixed positive and negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

The proposed abstraction site is not within or in proximity to any heritage designations and works in this location would be unlikely to significantly affect the settings of assets within proximity such as Dallam Park Ringwork Scheduled Monument (342m). There are approximately 30 Grade II/II* listed buildings along the proposed pipeline route including 18 assets under 100m (for example, seven buildings along the Main Street of Milnthorpe (8m to 62m), Milton Mill House & Mill (88m), Somnerdale House (68m) and Spout House Farmhouse & Barn (36m). However, any adverse impacts on their settings associated with pipeline works would be temporary. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The proposed abstraction site is adjacent to Arnside and Silverdale AONB. However, works would be of a small scale and would occur within the footprint of Bela Mill which benefits from screening (trees) such that no impacts on the AONB or wider landscape character are predicted. Construction and associated HGV movements could, however, affect the visual amenity of a small number of residential receptors and the setting of Bela Mill itself. Pipeline works may also have a temporary adverse impact on local landscape character and visual amenity. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

This option would involve an abstraction trade from an existing non-water industry abstraction licence holder and would utilise existing licenced volumes. In consequence, hydrological effects would not be anticipated as the licence would have been subject to review under the EA Review of Consents process. Furthermore, it is not expected that the transfer of raw water via the Thirlmere aqueduct would result in any significant effects on proximate European designated conservation sites (River Derwent and Bassenthwaite Lake SAC) as mitigation measures such as INNS screening would be included within treatment processes as proposed by the EA's position on raw water transfers between catchments. Overall, this option has been assessed as having a neutral effect on biodiversity at this stage.

There would be no operational effects on soils/land use.

As noted above, this option would involve an abstraction trade from an existing non-water industry abstraction licence holder and would utilise existing licenced volumes. Overall, the option has been assessed as having a neutral effect on Objective 3.

The abstraction infrastructure would be located within Flood Zone 3 and therefore may be liable to flooding during operation; however, its operation is not expected to cause or exacerbate the risk of flooding elsewhere. Overall, the option has been assessed as having a neutral effect on Objective 4.

There would be no operational effects on air quality.

Operational energy demand would be 651 kWh/Ml, generating 51 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The increased capacity of 4.5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

As noted above, the proposed abstraction infrastructure would be adjacent to Arnside and Silverdale AONB. However, the development would be of a small scale and would occur within the footprint of Bela Mill which benefits from screening (trees) such that no impacts on the AONB or wider landscape character are predicted.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR810: Cow Green IR to Haweswater via Heltondale Aqueduct (Northumbrian Water)	Construction	--	0	0	-	--	--	-	++/--	0	--	-	--
	Operation	--/?	0	0	-	0	-	++/?	++	0	-	0	-

Construction

This option would involve the development of a new abstraction infrastructure and screens at Cow Green Reservoir in order to abstract and transfer 40 Ml/d to the Heltondale Aqueduct via a new pumping station at Cow Green, a new 44.6km raw water main, and 8 new break pressure tanks situated along the route. Abstracted water would then be discharged from the Heltondale Aqueduct into Haweswater Reservoir for use in the SRZ.

The proposed abstraction infrastructure and ancillary equipment as well as approx. 12.7km of pipeline would be directly situated within the Moors House-Upper Teesdale NNR/SAC, Upper Teesdale SSSI, Appleby Fells SSSI, and the North Pennine Moors SPA. These overlapping conservation areas constitute an extensive upland area within the North Pennines which contains a number of nationally rare habitat types as well as a variety of representative habitats and associated plant and animal communities (golden plover, raptors and invertebrate species such as mollusc *Vertigo genesii*). Furthermore, Upper Teesdale NNR has been declared a 'Biosphere Reserve' by UNESCO. Consequently, construction of the abstraction components and excavation poses a significant risk of damaging these protected habitats and associated ecosystems, disturbing protected and local fauna and flora, and temporarily disrupting the wildlife movement within these sites. The proposed pipeline route would also directly cross the River Eden and Tributaries SSSI/SAC at five points: Pow Beck, Lyvennet Beck, Hoff Beck, Hilton Beck, and the River Eden itself. The River Eden and Tributaries have been classified as supporting a wide range of aquatic European Directive species which could be vulnerable to the introduction of pollution/debris. Works would also cross approx. 13 other rivers which suggests a significant risk to the wider water system and biodiversity. The proposed pipeline excavation would also be routed within the general vicinity of three other designated conservation areas: Butterwilk Meadows SSSI (0.8km), Crosby Ravensworth Fell SSSI, and Asby Complex SAC (0.7km). Due to the distance between these sites and the proposed works, it is not expected that the works would result in significantly adverse impacts to their interest features and local wildlife; however, minor noise disturbance and air quality impacts could impact the Crosby Ravensworth Fell's assemblage of moorland breeding birds. Overall, construction would occur within rural to semi-rural greenfield settings such that works may cause short-term disturbance to habitats and species. Consequently, this option has been assessed as having a significant negative effect on Objective 1, although the identification of scheme specific mitigation measures and/or amendments to scheme design at the plan level may help minimise potential effects.

The new abstraction infrastructure and pumping station would be situated within the existing operational footprint of Cow Green Reservoir which suggests a negligible effect on land/soil as the new infrastructure should not require significant land-intake (Grade 5 agricultural land). Similarly, the installation of the new break pressure takes would not require significant land-intake due to their minor scale. The proposed raw water main route utilises a moderate length of existing road network which helps decrease land disruption whereas the other segments would be routed through Grade 3b, 4, and 5 agricultural land. Consequently, this option has been assessed as having a neutral effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources.

The proposed abstraction and ancillary infrastructure (screens and pumping station) would be situated within Flood Zone 3 of Cow Green Reservoir whereas the proposed raw water main would traverse through various Flood Zone3s originating from 8 different river systems. Consequently, construction of the abstraction infrastructure and excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the A6, A66, B6542, B6260, B6277, and the segments of the local road network which overlays and/or leads to the excavation route) which would have a significant negative effect on local air quality (there would be an estimated 73,945 HGV movements during the 2.6 year construction period).

The option would generate 90,665 tCO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

It is expected that large scale of the works may result in temporary disruption of use or loss of amenity to the areas within the construction vicinity which host recreational walking and sport such as angling at Cow Green Reservoir and the various impacted rivers, Appleby Golf Course, and the various walking paths within Dufton and Murton Fell, Bampton Common, and Knipe Moor. Additionally, there may be noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors proximate to the scheme such as Bampton Grange, Rosgil, northern Shap, Crosby Ravensworth, Maulds Meaburn, Burrells, southern Appleby-in-Westmorland, and the scattered agricultural farmsteads along the proposed route. Because the pipeline is routed along various segments of the local road network, the transportation of equipment/material may further intensify these effects on residential, recreational, and institutional receptors such as the Crosby Ravensworth C of E School. Overall, this option has been assessed as having a negative impact on Objective 7.

Construction of the option represents a significant capital investment that could create a number of jobs resulting in a significantly positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding, pipeline excavation would be routed along and/or utilise both local and regional road networks which could result in a significant increase in congestion and disruption/driver delay throughout the construction phase. Additionally, excavation would cross a segment of rail line which could temporary disrupt service. On balance, this option has been assessed as having a mixed significantly positive and negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

There are approx. 16 scheduled monuments along the proposed excavation route that may maintain vantage points on construction; specifically, 8 scheduled monuments are within 100m of the proposed route. The Scorndale Lead Mines, Great Carrath's prehistoric stone hut circle, and the Moulds Meaburn medieval settlement and field system would be directly adjacent of the excavation route which poses a significant risk of excavation damaging the settings these sites in addition to potentially impacting previously unidentified archaeological artefacts and assets. Additionally, there are approx. 36 Grade II/II* Listed Buildings within the vicinity of the proposed construction scheme; specifically, there are 16 Listed Buildings under 100m from the excavation route. Although it is expected that scattered woodland buffer and mitigation measures would help moderate any severe adverse effects to these listed buildings, the proximity between these assets and the works suggests a risk to their settings throughout the construction phase. The remaining assets (>100m) may experience a loss of visual amenity regarding their settings, however, this would be temporary. Overall, this option has been assessed as having a negative effect on Objective 11.

The abstraction and ancillary infrastructure and approx. 13km of the proposed excavation route would be situated within the North Pennines AONB. Additionally, 9.4km of excavation would be situated within the Yorkshire Dales National Park and 8.6km would be within the Lake District National Park and World Heritage Site. The cumulative effect of construction and excavation could significantly alter the wider landscape character of these sites; specifically, the loss of visual amenity of residential and recreational receptors looking in/out of the park. The proposed excavation route outside of these protected settings would enjoy sporadic segments of woodland buffer although works could adversely impact the wider rural landscape and the residential visual amenity associated with such when excavation occurs within proximity of open greenfield areas. Consequently, the option has been assessed as having a significantly negative effect on Objective 12.

Operation

The scheme would require a new abstraction licence such that hydrological effects on downstream sites in Teesdale are currently unknown thus requiring further investigation (modelling etc.). The transfer of raw water to Heltondale Aqueduct poses a risk of introducing water of different chemistry into the Eden SAC, with may result in residual effects on interest features. The water transfer could also change the flow and spill regime in Haweswater Beck (a tributary of Eden SAC). These changes are uncertain and would require detailed modelling of the potential hydrological changes to be undertaken. There is also the potential for Invasive Non-Native Species (INNS) to the River Eden SAC if water is not treated (either at source or before discharge), although it is expected that established treatment standards will be included within scheme level design which would prevent any significant effects in this regard. Overall, significant effects cannot be excluded without additional analysis (modelling etc.) of scheme operation and / or identification of acceptable operational mitigation measures such that this option has been assessed as potentially having a significantly negative effect on biodiversity at this stage, although substantial uncertainty remains.

There would be no operational effects on soils/land use.

It is assumed that Cow Green Reservoir has the capacity to support the new abstraction rate of 40 Ml/d and in this context the WFD Assessment has concluded that it is unlikely that operation would significantly change and/or adversely alter the volume and surface area of the reservoir. Furthermore, it is expected that compensation flows will be maintained to the River Tees throughout operation thus minimising residual effects on downstream hydromorphology. Overall, this option has been assessed as having a neutral effect on Objective 3.

The abstraction site and ancillary infrastructure would be located within a Flood Zone 3 of Cow Green Reservoir, and therefore, would be liable to flooding during operation though general operation of the scheme is not expected to increase the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 1,565 kWh/Ml, generating 711 tCO2e/a. This has been assessed as having a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption although it may potentially impact angling and other recreational activities on Cow Green reservoir as operation would result in increased drawdown of the reservoir, especially during particularly dry years. Overall, the increased capacity of 40 Ml/d would help ensure a continual supply of clean drinking water, generating a significantly positive effect on health as well as supporting economic/population growth which could result in a significantly positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The option would require new above-ground infrastructure (intake equipment/pumping station) within an AONB, although it is expected that these new components would become part and parcel to the existing structural footprint through appropriate screening/landscaping. Additional drawdown of the reservoir may also be perceptible. Overall, the option has been assessed as having a minor negative effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR812: Transfer of raw water from Kielder Water IR (Northumbrian Water) to the SRZ	Construction	--/?	-	0	-	--	--	-	++/--	0	--	-/?	--
	Operation	--/?	0	?	0	0	--	++/?	++	0	--	0	-

Construction

This option comprises the transfer of water from Kielder Water in the Northumbrian Water supply region to the UU supply region. Under this option, a new intake structure and screening equipment would be constructed at Kielder Water. A new 40km raw water main with three pumping stations would be constructed from Kielder to transfer water into Heltondale Aqueduct.

There are a number of major uncertainties around the scheme which will determine the likelihood of significant effects. The proposed abstraction point at Kielder Water is not within any statutory or non-statutory nature conservation sites. Components of Border Mires, Kielder-Butterburn SAC and Kielder Mires SSSI are approximately 1.5km to the south whilst Kielderhead and Emblehope Moors SSSI is circa 5km to the north of the site. Components of North Pennine Dales Meadows SAC and Thorneyburn Meadow SSSI are circa 5km downstream. Construction of a new intake may have short term negative effects on biodiversity due to disturbance/habitat loss, although significant adverse effects on designated sites are not anticipated given distance to the sites, the scale of works and the assumption that appropriate mitigation would be implemented. Effects on biodiversity would depend heavily on the pipeline route selected and location of pumping stations (yet to be determined). Under current proposals, the pipeline from Kielder is assumed to be a straight line across Kielder Forest (and hence across the Border Mires, Kielder – Butterburn SAC) in addition to a large number of SSSIs including Lampert Mosses, River Eden and Tributaries (SAC) and Kielder Mires, amongst others. HRA Screening has concluded that construction phase impacts are uncertain, but would be likely to have significant and almost certainly adverse effects on the SACs on the pipeline route. Additionally, the pipeline may also adversely impact the River Eden SAC as excavation directly crosses several tributaries at non-established crossing points. Should this option be taken forward to the preferred options stage, impacts on those features of designated sites that may be significantly affected would need to be considered in more detail and mitigation measures identified. Further, scheme level investigations would need to be undertaken at the project stage should the option form part of the final Water Resources Management Plan. At this stage, the option has been assessed as having a significant negative effect on biodiversity, although substantial uncertainty remains.

It has been assumed that the new intake structure and pumping stations would be built on greenfield land and in consequence, the option has been assessed as having a minor negative effect on Objective 2.

Construction of this option would not have effects on water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The site of the new intake would be within Flood Zone 3 whilst the proposed pipeline route would cross Flood Zones 2/3 at several points. As a result, construction activity may be affected by flooding (depending on timing) although the option would not cause or significantly exacerbate flooding in the area. Overall, the option has been assessed as having a minor negative effect on Objective 4.

Construction is expected to generate a negative effect on air quality as a result of emissions from plant/machinery and associated HGV movements (there would be an estimated 312,503 vehicle movements during the 2.6 year construction period). This has been assessed as having a significant negative effect on Objective 5.

Construction of the scheme would generate 12,759 tCO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10).

Construction of the option could lead to short term effects on human health due to noise and air quality impacts. Whilst the abstraction point is not located in close proximity to significant numbers of residential receptors, pipeline works may have adverse effects on receptors along the proposed route. Kielder Reservoir is also a regionally/nationally important recreation site and therefore the amenity of visitors may be affected during construction. However, any negative effects on these receptors would be temporary and have therefore been assessed as minor.

Construction of the option would involve a high capital expenditure which is likely to generate employment opportunities and supply chain benefits together with increased spend by construction workers and contractors in the local economy. However, current proposals indicate that whilst the pipeline would largely cross fields/local roads, sections would cross a number of A roads including the A69, A689, A6071, A6, A66 and M6. Together with associated HGV movements, this is likely to cause congestion/driver delay. On balance, the option has been assessed as having a mixed significant positive and significant negative effect on Objective 8.

This option is unlikely to have an effect on water efficiency.

Construction would increase resource use, energy demand and generate waste which has been assessed as having a significant negative effect on Objective 10.

There are a small number of Grade II listed buildings in proximity of the proposed abstraction point; however, in view of the scale of construction activity and distance to these assets, construction works are considered unlikely to affect their settings. There are also several heritage and archaeological sites around the shoreline of Kielder Water (Haw Hill Camp and a Romano-British settlement located on the south shoreline) which would be unaffected by the option. However, a number of heritage features are located along the proposed pipeline route including Hadrians Wall World Heritage Site/Scheduled Monument, although it is possible that these features could be avoided, for example by routing the pipeline along roads etc. Notwithstanding this, the settings of some assets such as listed buildings along roads may be temporarily affected during the works. There is also the potential for unknown archaeology to be encountered on the route due to the number of ancient monuments present in the area and roman roads. Overall, the option has been assessed as having a negative effect on Objective 11 at this stage, although some uncertainty remains.

The proposed abstraction point, a pumping station and a large section of the pipeline route are within/traverse Northumberland National Park in addition to the Lake District National Park and WHS. Development may have short term, adverse landscape impacts and could affect the visual amenity of recreational receptors at Kielder Water and residential receptors along the pipeline route, particularly where it enters south Carlisle. Overall, the option has been assessed as having a significant negative effect on Objective 12.

Operation

The scheme would require an interbasin transfer of raw water between catchments requiring a discharge to Haweswater Reservoir via the Heltondale Aqueduct. Haweswater Beck which flows out of Haweswater is a tributary of the River Eden SAC. Consequently, the additional volume of water within Haweswater Reservoir may result in changes within its hydrological regime (lake levels etc) in addition to changes to Haweswater Beck's flow and spill regime. Furthermore, the discharge of Kielder water in Haweswater Reservoir and Haweswater Beck may alter the water chemistry of these two waterbodies, and subsequently, the River Eden SAC and other downstream sites. In general, further investigation (modelling etc.) will be required to gauge the magnitude of these potential effects. It should be noted, however, that operation of the scheme includes INNS treatment processes, e.g. the treatment of raw water prior to discharge, such that adverse effects from INNS transfer on the SAC as a result of the operation would be avoidable or mitigated. Should this option be taken forward to the preferred options stage, impacts on those features of the SAC that may be significantly affected will be considered in more detail and mitigation measures identified. Further, scheme level investigations would need to be undertaken at the project stage should the option form part of the receiving water company's final Water Resources Management Plan. Taking into account the findings of the HRA Screening, this option has been assessed as having a significant negative effect on biodiversity, although substantial uncertainty remains.

No operational effects on land use/soils are anticipated (initial loss of land assessed at the construction stage).

It is assumed that Kielder Water Reservoir has the capacity to support the new abstraction rate of 100 Ml/d; therefore, the WFD Assessment has concluded that it is unlikely that operation would significantly change and/or adversely alter the volume and surface area of the reservoir. Additionally, all river surface water bodies that intersect Kielder Water have water available across all flows as do all river water bodies directly downstream of the reservoir. Furthermore, it is expected that compensation flows will be maintained to the River North Tyne throughout operation thus minimising residual effects on downstream hydromorphology. There is uncertainty whether the transfer of raw water would result in potential hydrological changes to Haweswater Reservoir and Haweswater Beck (water volume, water chemistry, and etc.). Overall, this option has been assessed as having an uncertain effect on Objective 3 at this stage.

The option is not expected to cause or exacerbate flooding.

Operation of this option would not have an effect on air quality.

Operational energy usage would be 975 KWh/Ml and the option would generate 1,640 tCO_2e/a which has been assessed as having a significant negative effect on Objectives 6 and 10.

The option would have significant positive effects on human health by ensuring a continuity of supply of safe drinking water as well as a significant positive effect on the local economy as increased supply may support population and economic growth. However, there is the potential for impacts on recreational use of Kielder Reservoir due to changes in water levels as a result of abstraction.

The option is not a leakage reduction or water efficiency option and therefore effects on Objective 9 are expected to be neutral. No operational effects on cultural heritage assets during operation are anticipated. The new bankside intake structure and pumping station at Kielder, together with the additional draw on the reservoir, may have adverse effects on landscape character and the visual amenity of recreational users. New above ground infrastructure at the other development sites would have negligible landscape/visual impacts as they would be of relatively small scale. Overall, the option has been assessed as having a negative effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR813: Scammonden IR to Buckton Castle via Huddersfield Narrows Canal	Construction	-	0	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	0	-	0	0	+	+	0	-	0	0

Construction

This option would involve the development of a new abstraction point and pumping station at Scammonden impound reservoir in order to abstract and transfer 5 Ml/d to the Huddersfield Narrow Canal via a new 4.23km raw water main and break pressure tank. A second new abstraction point and pumping station would be installed on the Huddersfield Narrow Canal near Mossley in order to abstract and transfer 5 Ml/d to Buckton Castle WTW via a new 721m raw water main for treatment and distribution.

The Scammonden impound reservoir abstraction point and the proposed pipeline route between the impound reservoir and the Huddersfield Narrow Canal are within 3km of European designated sites (South Pennine Moors SSSI/SAC (2.2km) and the Dark Peak SSSI (2.8km) which together comprise the Peak District Moors SPA). Due to the scale of development associated with installing the abstraction infrastructure and excavation work in combination with the relative distance between the sites, it is unlikely that designated European sites/features would be exposed to adverse or significant effects (no impact pathways). Furthermore, it is expected that established mitigation would help prevent adverse effects beyond minor localised effects (noise disturbance etc.) during the construction period. The proposed pipeline route between the Huddersfield Narrow Canal and Buckton Castle WTW would be within proximity of Castle Clough & Cowbury Dale LNR (1.1km) and Cowbury Dale LNR (1.4km). These nature reserves support a variety of local fauna and woodland avifauna which may be vulnerable to temporary noise disturbance and air quality impacts from excavation; however, any impact is expected to be minor. The Mossley abstraction point would be situated directly on the Huddersfield Narrow Canal SSSI though it is assumed that established construction mitigation measures would prevent potentially adverse construction impacts. Overall, construction would occur within a semi-rural greenfield setting such that works may cause short-term disturbance to proximate habitats and local wildlife such as those dependent upon Scammonden impound reservoir and Slaithwaite Reservoir. Consequently, this option has been assessed as having a negative effect on Objective 1.

The new abstraction infrastructure and pumping station at Scammonden impound reservoir would be situated within the existing footprint of the site which suggests a negligible effect on land/soil as the assumed structural scale of the equipment should not require significant land-intake (Grade 4 agricultural/urban land). The abstraction infrastructure and pumping station on the Huddersfield Narrow Canal would be situated within an undeveloped greenfield site which may result in a minor adverse impact due its small land-intake. The proposed raw water main route, Scammonden impound reservoir to Huddersfield Narrow Canal, utilises a moderate length of existing road network which helps decrease land disruption whereas the other segments would be routed through Grade 4 agricultural land. Notwithstanding, excavated land would be reinstated following the construction period. On balance, this option has been assessed as having a neutral effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources.

The proposed abstraction and pumping station would be situated within Flood Zone 3 of Scammonden Reservoir whereas the proposed raw water main would traverse through a Flood Zone 3 originating from the Bradshaw Clough. Consequently, construction of the abstraction infrastructure and excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

It is expected that there would be impacts from traffic congestion during the construction period (particularly the A640, B6175, and the segments of the local road network which either overlay or lead to the abstraction sites or excavation route) which would have a minor negative effect on local air quality (there would be an estimated 3,817 HGV movements during the 1.5 year construction period).

The option would generate 3,799 tonnes CO2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, the proposed works could result in a temporary disruption of use or loss of amenity to areas that host recreational walking and sport such as Scammonden Reservoir (Brooke Walk), Slaithewaite Reservoir, Hudderfield Narrow Canal towpath, and the Mossley Hollins High School playing fields. Additionally, there may be noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors proximate to the scheme such as eastern Mossley, western Slaithwaite, the scattered agricultural/residential dwellings along the proposed route which compose the western suburbs of Huddersfield. Because the pipeline is routed along various segments of the local road network, the transportation of equipment/material may further intensify these effects on residential, recreational, and institutional receptors such as Wilberlee and Slaithewaite Junior and Infant Schools and Mossley Hollins High School. Overall, this option has been assessed as having a negative impact on Objective 7.

Construction would involve a relatively large capital expenditure which could have significantly positive effect on the local economy which could generate significant new employment opportunities. Notwithstanding, pipeline excavation between Scammonden impound reservoir and the Canal would be moderately routed along and/or utilise the local road networks which could result in a moderate increase in congestion and disruption/driver delay throughout the construction phase. Additionally, excavation would cross a segment of rail line which could temporary disrupt service. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have significantly negative effects on Objective 10.

The option would not affect water efficiency.

Buckton Castle scheduled monument is 876m from the proposed excavation route leading to Buckton Castle WTW; consequently, excavation could temporarily reduce the visual amenity associated with Buckton Castle and its setting in addition to potentially impacting previously unidentified archaeological artefacts and assets. Additionally, there are approx. 36 Grade II/II* Listed Buildings within the vicinity of the proposed construction scheme; specifically, there are 11 Listed Buildings under 100m from the excavation route such as the Sun (5m), Potters (31m), and 3 clusters of residential dwellings within Blake Stones (29m). The proximity between these assets and the works suggests a significant risk to their settings throughout the construction phase. The remaining assets (>100m) may experience a minor loss of visual amenity regarding their settings, however, this would be temporary. Overall, this option has been assessed as having a negative effect on Objective 11.

Neither the abstraction infrastructure nor the proposed pipeline route would be within or in proximity to any landscape designations. The installation of the abstraction infrastructure and pumping station at Scammonden impound reservoir would be situated within the footprint of the reservoir and are expected to be of minor scale such that construction is not expected to significantly alter the local setting or the visual amenity of the reservoir for recreational receptors. Construction of the abstraction and ancillary infrastructure on the bank of Huddersfield Narrow Canal may disrupt the landscape character and the associated visual amenity of recreational receptors utilising the canal, however, significant woodland buffer would confine these potential impacts to the immediate setting. The proposed excavation route would enjoy sporadic segments of woodland buffer although works could adversely impact the wider semi-rural landscape when excavation occurs within proximity of open greenfield areas. Consequently, the option has been assessed as having a negative effect on Objective 12.

Operation

The operation of this option would involve the abstraction of 5Ml/d from Scammonden Reservoir. HRA Screening has not identified any likely significant effects on European designated sites. The transfer of raw water to the Huddersfield Narrow Canal poses a risk to the Huddersfield Narrow Canal SSSI regarding water flow; specifically, increased water flow within certain reaches of the canal could adversely impact both local and designated flora and fauna who are dependent on the canal's present flow variation. Although there may be the potential for introducing Invasive Non-Native Species (INNS) from the Scammonden Reservoir to the Canal, the treatment process would ensure that adverse impacts would be prevented. Overall, this option has been assessed as having a negative effect on Objective 1 although uncertainty remains.

There would be no operational effects on soils/land use.

It is assumed that Scammonden Reservoir has the capacity to support the new abstraction rate of 5 Ml/d; therefore, the WFD Assessment has concluded that it is unlikely that operation would significantly change and/or adversely alter the volume and surface area of the reservoir. It is expected that compensation flows will be maintained to the Black Brook throughout operation thus minimising residual effects on downstream hydromorphology. Furthermore, the WFD Assessment states that the re-abstraction of 5 Ml/d from the Huddersfield Narrow Canal is unlikely to result in significant effects on the hydrological regime or WFD status of the canal as it is assumed that the canal will be managed to maintain flows. Overall, this option has been assessed as having a neutral effect on Objective 3.

The abstraction site and pumping station would be located within a Flood Zone 3 on Scammonden Reservoir, and therefore, would be liable to flooding during operation though general operation of the scheme is not expected to increase the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 685 kWh/Ml, generating 41 tonnes CO2e/a. This has been assessed as having a neutral effect on Objective 6 and a negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health by increased noise, nuisance or disruption though it may potentially impact recreational activities dependent upon Scammonden impound reservoir and Huddersfield Narrow Canal. Scammonden Reservoir is used for both formal and informal recreation activities such as sailing and angling. Although the reservoir would be drawn down more frequently under this option, it is not expected that significant impacts on recreational activities at the reservoir would occur (given the current operational use). The Huddersfield Narrow Canal is also used for both formal and informal recreational activities (angling/boating. It is not considered likely that the discharge of raw water from Scammonden and the subsequent abstraction of the same volume downstream at Mossley would adversely impact on recreation alongside/within the canal. Overall, the increased capacity of 5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The abstraction infrastructure would not be within or in proximity to any landscape designations. The new abstraction equipment and pumping station situated at Scammonden impound reservoir would become part-and-parcel to the existing reservoir operational site such that it is unlikely operation would have an adverse impact on the local setting or the visual amenity associated with such. The abstraction equipment and pumping station on the Canal would be visible to canal users although surrounding woodland buffer would confine any potential impact to the immediate setting which, subsequently, is expected to be minor due to their assumed structural scale. The operation of the option would result in landscape impacts from the increased frequency and magnitude of drawdown of Scammonden Reservoir (variable water levels) though within the context of existing operational practice, this is not considered to be a significant landscape impact. Overall, the option has been assessed as having a neutral effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR814a: Increased abstraction capacity at Heronbridge	Construction	-	-	0	0	-	--	-	++/-	0	--	-	-
	Operation	0/?	0	+/?	0	0	-	++	++	0	-	-	-

Construction

This option would involve a reduction in industrial supply from Heronbridge PS on the River Dee, releasing additional capacity for abstraction and treatment at Huntington WTW. The option would require modifications to/expansion of Huntington WTW. The option would have a design capacity of 24Ml/d.

The existing WTW site and adjacent land at Huntington are within the River Dee and Bala Lake SAC/River Dee SSSI as the expanded WTW would be situated along the banks of the River Dee (SAC). The River Dee supports a diverse range of aquatic flora and fauna including migratory fish populations (Atlantic salmon and trout) and European eel as well as breeding bird species such as king fisher and grey heron which use the river's banks as nesting sites. There is the potential for construction activity to affect these features although the HRA has concluded that significant or significantly adverse effects should be avoidable with established scheme-level avoidance or mitigation measures such as construction best-practice or timing works to avoid breeding / migration periods of fish and avifauna. It is assumed that development would take place on greenfield land adjacent to the existing WTW and in consequence, there is the potential for the localised loss of/disturbance to habitats and species. Overall, this option has been assessed as having a negative effect on Objective 1.

As noted above, it is assumed that the extension to Huntington WTW would take place on greenfield land including that which is of Grade 3 quality. Consequently, this option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The development site is not within Flood Zones 2/3 but would be adjacent to Flood Zone 3 and therefore mitigation may be required to prevent flooding from affecting construction activity. Overall, a neutral effect has been identified in respect of Objective 4.

There could be traffic congestion during the construction period (particularly along the A55, B5130 and the local road network leading to the site) which, together with plant and machinery operation, may have a negative effect on local air quality (there would be an estimated 5,403 vehicle movements during the 1.8-year construction period).

The option would generate 3,894 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. Construction works and HGV movements may affect some receptors including residential properties to the north east and north west of the site and educational facilities such the Chester Catholic High School and Huntington Community Primary School. Overall, this option has been assessed as having a negative effect on Objective 7.

Construction of the option would represent a large capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. The transportation of equipment/material via the local and regional road network may result in increased congestion and disruption/driver delay throughout the construction phase. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

Meadowhouse Farmhouse and Barn Grade II listed buildings are adjacent to the existing WTW site to the north. Additionally, Heronbridge Roman site Scheduled Monument (48m) and Huntington Hall Moated site (64m) would be within proximity to the works. The settings of these assets could be affected during the construction period, although the development would be situated adjacent to an existing facility and the presence of existing screening may help minimise adverse impacts in this regard. Overall, this option has been assessed as having a negative effect on Objective 11.

The development site is not within or in proximity to any landscape designations. Construction associated with the WTW expansion would introduce new development within the present urban greenfield setting and would intensify the use of the existing area. This could affect local landscape character and visual amenity. Recreational users on the River Dee and receptors along the A55 may also be affected. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a negative effect on Objective 12.

Operation

As noted above, this option would involve a reduction in industrial supply from Heronbridge PS on the River Dee, releasing additional capacity for abstraction and treatment at Huntington WTW. The scheme would utilise existing licenced volumes which would have been subject to review under the EA Review of Consents process thus no operational effects on biodiversity would be anticipated; however, licence transfer would need to be confirmed by the EA such that there is some remaining uncertainty.

There would be no operational effects on soils/land use.

The additional licence volume is a result of a proposed licence trade from an existing industrial use abstraction located at Heron Bridge (circa 100 m downstream on River Dee) of 35 Ml/d. The licence trade results in an overall reduction in abstraction quantity from the River Dee of 11 Ml/d which may have a positive benefit on the hydrological regime of the lower reaches of the water body as the Dee AMS indicates there is no new water available for abstraction but it may be possible to trade water with an existing abstractor. Given the short distance between the old and new abstraction locations, no significant change in water body status will occur. Overall, this option has been assessed as having a minor positive effect on Objective 3, although uncertainty remains.

The option would have a neutral effect on surface water resources as the scheme would utilise existing licenced volumes.

The proposed WTW site is not within Flood Zones 2/3 but would be adjacent to Flood Zone 3 and therefore mitigation may be required to ensure that the facility is not at risk of flooding.

There would be no operational effects on air quality.

Operational energy demand would be 127 kWh/Ml, generating 288 tCO_2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would be unlikely to affect human health due to increased noise, nuisance or disruption nor would it affect opportunities for recreation. The increased capacity of 24 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

As noted above, Meadowhouse Farmhouse and Barn Grade II listed buildings are adjacent to the existing WTW site to the north. Additionally, Heronbridge Roman site Scheduled Monument (48m) and Huntington Hall Moated site (64m) would be within proximity to the development. The settings of these assets could be affected by the presence of an enlarged WTW facility, although the development would be situated adjacent to an existing facility and the presence of existing screening may help minimise adverse impacts in this regard. Overall, this option has been assessed as having a negative effect on Objective 11.

The expansion of Huntington WTW would result in the development of new above ground infrastructure on greenfield land which could affect local landscape character and, potentially, the visual amenity of residential and recreational receptors. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR814b: Increased abstraction capacity at Heronbridge	Construction	-	-	0	0	-	--	-	++/-	0	--	-	-
	Operation	?	0	-/?	0	0	0	++/?	++	0	-	-	-

Construction

This option would involve a reduction in industrial supply from Heronbridge PS on the River Dee, releasing additional capacity for abstraction and treatment at Hurleston WTW via Llangollen Canal. Treated output would be transferred to the Mid-Cheshire Main located near Nanney's Bridge via existing infrastructure. The option would require modifications to/expansion of Hurleston WTW. The option would have a design capacity of 24Ml/d.

The existing WTW site and adjacent land are not within any statutory or non-statutory nature conservation sites. The closest European designated conversation site is the River Dee and Bala Lake SAC (River Dee SSSI) at approximately 20km away; consequently, it is not expected that any significant effects would result from construction on protected biodiversity features. Wettenhall and Darnhall Woods SSSI is approximately 6km north of Hurleston WTW, although it is not expected that the scale of construction required to modify/expand the WTW would result in any significant effects on the site. In general, it is assumed that development would be contained within the existing WTW site and/or take place on greenfield land adjacent to the existing WTW depending on the scale of construction required; therefore, there is the potential for the localised loss of/disturbance to habitats and species. Overall, this option has been assessed as having a minor negative effect on Objective 1.

As noted above, it is assumed that the extension to Hurleston WTW would take place on greenfield land including that which is of Grade 2 quality. Consequently, this option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Construction would not cause or exacerbate flooding in the area nor would the site be at risk from flooding.

There could be traffic congestion during the construction period (particularly along the A51) which, together with plant and machinery operation, may have a negative effect on local air quality (there would be an estimated 7,042 vehicle movements during the 1.8-year construction period).

The option would generate 8,051 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. Construction works could affect the amenity of users of Llangollen Canal and there may be noise/vibration disturbance which could affect an Equine Centre, adjacent farms and residential receptors along the A51. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a large capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. The transportation of equipment/material via the local and regional road network may result in increased congestion and disruption/driver delay throughout the construction phase though impacts would be temporary. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

The WTW site does not include any heritage assets; however, it is within close proximity to several Grade II listed buildings including Hurleston Bridge #1 (82m), Llangollen branch of the Shropshire Union Canal Locks 1 – 4 (187m to 459m), and the Bache House Farmhouse and barn (655m). Although it is unlikely that construction would be a direct risk to the integrity of these assets, works may temporarily affect their settings. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The development site is not within or in proximity to any landscape designations. Construction associated with the WTW expansion would introduce new development within the present greenfield setting and would intensify the use of the existing area. This could affect local landscape character and the visual amenity of nearby farmsteads. Recreational users of the Llangollen Canal and Equine Centre and receptors along the A51 may also be affected. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a negative effect on Objective 12.

Operation

As noted above, this option would involve a reduction in industrial supply from Heronbridge PS on the River Dee which would effectively transfer the licenced abstraction volume 'upstream' on the Dee from Heronbridge to a location near the Dee / Llangollen Canal intersection (presumably around the Froncysyllte intake) with transfer of the water to Hurleston via the Llangollen Canal (and presumably the Shropshire Union). The HRA concludes that this shift in abstraction location could have significant effects on the River Dee and Bala Lake SAC which may be adverse such that additional analysis (modelling etc.) of scheme operation and / or identification of acceptable operational mitigation measures would be required should the scheme be taken forward as a preferred option. At this stage, the option has been assessed as having an uncertain effect on biodiversity.

There would be no operational effects on soils/land use.

The licence trade would result in an overall reduction in abstraction quantity from the River Dee of 11 Ml/d but relocates 24 Ml/d of abstraction into the upper reaches of the river in which the Dee AMS indicates there is no new water available for abstraction, although it may be possible to trade water with an existing abstractor. It is currently unclear if 24 Ml/d would be available at Llantisilio, or if flow restrictions would apply; specifically, flows in the River Dee are regulated to allow public water supply abstraction. Consequently, the WFD Assessment notes the increase in abstraction at Llantisilio may be balanced by a reduction in abstraction. Overall, this option has been assessed as having a negative effect on Objective 3, although uncertainty remains.

Operation would not cause or exacerbate flooding in the area nor would the site be at risk from flooding.

There would be no operational effects on air quality.

Operational energy demand would be 133 kWh/Ml, generating 74 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would be unlikely to affect human health due to increased noise, nuisance or disruption. The abstraction may affect recreational receptors (angling) downstream of the abstraction although this is currently uncertain. The increased capacity of 24 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health with some uncertainty regarding future recreational opportunities as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The presence of a new/expanded WTW could affect the settings of Hurleston Bridge #1 and the Llangollen branch of the Shropshire Union Canal locks though this would depend on exact location/design of development. Overall, this option has been assessed as having a negative effect on Objective 11 at this stage.

The expansion of Hurleston WTW would result in the development of new above ground infrastructure on greenfield land which could affect local landscape character and, potentially, the visual amenity of farmsteads and recreational receptors. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR814c: Increased abstraction capacity at Heronbridge	Construction	-	-	0	-	--	--	-	++/--	0	--	--	-
	Operation	-/?	0	-/?	0	0	0	++/?	++	0	-	0	-

Construction

This option would involve a reduction in industrial supply from Heronbridge pumping station on the River Dee, releasing additional capacity for abstraction and treatment at Hurleston WTW. Water would be abstracted from the Dee/Llangollen Canal confluence and transferred via a new circa 44km raw water main to the WTW. Treated output would then be transferred to the Mid-Cheshire Main located near Nanney's Bridge via existing infrastructure. The option would require modifications to/expansion of Hurleston WTW and new pumping infrastructure. The option would have a design capacity of 24Ml/d.

The existing WTW site and adjacent land does not include any statutory or non-statutory nature conservation designations nor are they within proximity to any designated sites. It is assumed that development would take place on greenfield land adjacent to the existing WTW; consequently, there is the potential for the localised loss of/disturbance to habitats and species. The proposed excavation route would require pipe crossings of the River Dee and Bala Lake SAC/River Dee SSSI which supports a diverse range of aquatic flora and fauna with particular emphasis on its migratory fish population (Atlantic salmon and trout) and its wide range of breeding bird species such as kingfisher and grey heron which use the river's banks as nesting sites. HRA Screening has concluded that effects on the interest features of the SAC are likely to be avoidable with established measures, such as construction best-practice or timing works to avoid breeding / migration periods. Works would also either directly cross or be in proximity to five other conservation sites: Bickerton Hill SSSI (1.4km); Chapel Mere SSSI – Midland Meres and Mosses Phase 2 Ramsar (0.7km); Llantysilo Mountains and Minera SSSI – Berwyn and South Clwyd Mountains SAC (direct); Stryt Las A'r Haterd SSSI (1km); and Dinas Bran SSSI (0.05km). It is assumed though that routing/established mitigation would avoid significantly adverse impacts on these sites. Overall, this option has been assessed as having a negative effect on Objective 1.

As noted above, it is assumed that the extension to Hurleston WTW would take place on greenfield land including that which is of Grade 2 quality. Consequently, this option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed pipeline route would traverse through Flood Zones 2/3 and therefore construction activity could be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

There could be traffic congestion during the construction period (particularly along the A51 and in proximity of the pipeline works) which, together with plant and machinery operation, may have a significant negative effect on local air quality (there would be an estimated 69,686 vehicle movements during the 2.6 year construction period).

The option would generate 84,006 tCO_2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, although pipeline works could cause temporary disruption to users of footpaths and open space along the proposed route. Construction works at the WTW site could affect the amenity of users of Llangollen Canal and there may be noise/vibration disturbance which could affect an Equine Centre, adjacent farms and residential receptors along the A51. Pipeline works may also affect receptors at scattered settlements and farmsteads in addition to larger settlements such as Rhiwabon along the proposed route. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a substantial capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Notwithstanding this, the transportation of equipment/material via the local and regional road network and pipeline crossings (including across a number of A roads) may result in increased congestion and disruption/driver delay throughout the construction phase. On balance, this option has been assessed as having a mixed significant positive and significant negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

The WTW site does not contain any heritage assets; however, it is within close proximity of several Grade II listed buildings including Hurleston Bridge #1 (82m), Llangollen branch of the Shropshire Union Canal Locks 1 – 4 (187m to 459m), and Bache House Farmhouse and barn (655m). Although it is unlikely that construction would be a direct risk to the integrity of these assets, works may temporarily affect there settings. Based on current proposals, the pipeline would be directly routed through Offa's Dyke and Wat's Dyke Scheduled Monuments and Pontcysyllte Aqueduct and Canal World Heritage Site. In consequence, works could pose a risk to both the integrity and settings of these assets as well undiscovered archaeological remains. Additionally, there are approximately 50 Grade I /II/ II* listed buildings under circa 500m from the route including 23 assets under 100m, the settings of which could be temporarily affected by construction activity. Overall, this option has been assessed as having a significant negative effect on Objective 11 at this stage.

The WTW site is not within or in proximity to any landscape designations. Construction associated with the WTW expansion at Hurleston would introduce new development within the present greenfield setting and would intensify the use of the existing area. This could affect local landscape character and the visual amenity of nearby farmsteads. Recreational users of the Llangollen Canal and Equine Centre and receptors along the A51 may also be affected. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Approximately 6km of the proposed pipeline would route through Clwydian Range and Dee Valley AONB which could affect the landscape character of the area whilst works may also affect other receptors along the route including recreational and residential receptors. However, any adverse impacts would be temporary. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

This option would involve a reduction in industrial supply from Heronbridge pumping station on the River Dee which would effectively provide additional capacity and treatment 'upstream' on the Dee from Heronbridge to Hurleston WTW via the Llangollen Canal (and presumably the Shropshire Union). HRA Screening has concluded that this shift in abstraction location could have significant effects on the River Dee and Bala Lake SAC which may be adverse such that additional analysis (modelling etc.) of scheme operation and / or identification of acceptable operational mitigation measures would be required should the scheme be taken forward as a preferred option. Furthermore, the shift in abstraction location may result in pronounced localised effects on flow regime of the River Dee (SSSI) and downstream sites which could adversely impact ecological receptors such as in-river habitats and native and migratory species. At this stage, the option has been assessed as having a negative effect on biodiversity though uncertainty remains.

There would be no operational effects on soils/land use.

The proposed licence trade would result in an overall reduction in abstraction quantity (11 Ml/d) from the River Dee at Heronbridge while simultaneously relocating an abstraction licence of 24 Ml/d to Llantisilio, located within the upper reaches of the river. The WFD Assessment has concluded that there is currently no new water available for abstraction within the River Dee; however, the River Dee is

presently regulated to support abstraction and environmental needs thus the increase in abstraction may be balanced by a reduction in other abstractions. In general, it is unclear whether 24 Ml/d would be available at Llantisillio or whether flow restrictions would apply to operation. This option has therefore been assessed as having a negative effect on Objective 3, although uncertainty remains.

Operation would not cause or exacerbate flooding in the area nor would the site be at risk from flooding.

There would be no operational effects on air quality.

Operational energy demand would be 147 kWh/Ml, generating 79 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would be unlikely to affect human health due to increased noise, nuisance or disruption. The abstraction may affect recreational receptors (angling) downstream of the abstraction although this is currently uncertain. The increased capacity of 24 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The presence of a new/expanded WTW could affect the settings of Hurleston Bridge #1 and the Llangollen branch of the Shropshire Union Canal locks though this would depend on exact location/design of development. Overall, this option has been assessed as having a negative effect on Objective 11 at this stage.

The WTW site is not within or in proximity to any landscape designations, although the expansion of Hurleston WTW would result in the development of new above ground infrastructure on greenfield land which could affect local landscape character and, potentially, the visual amenity of farmsteads and recreational receptors. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR816: Manchester Bolton Bury Canal to Strategic Zone	Construction	-	0	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	0	0	0	0	+/?	+	0	-	0	-

Construction

This option would involve the development of a new abstraction/intake point and pumping station at Elton Reservoir in order to abstract and transfer 5.2 Ml/d from Manchester, Bolton, and Bury Canal to a new WTW on-site via a new 263m raw water main. Treated output from the new WTW would then be transferred to a treated water storage facility via a new 4.8km treated water main.

The development sites and proposed pipeline routes do not include and are not adjacent to any statutory or non-statutory designated nature conservation sites. The nearest European designated site is over 10km in distance such that there are no clear impact pathways emerging from construction. Development of the abstraction infrastructure and WTW would take place on greenfield land and in consequence, there is the potential for the localised loss of/disturbance to habitats and species. Construction within the vicinity of Elton Reservoir and the River Irwell may indirectly introduce pollution/debris to these waterbodies, although this is likely to be managed through the adoption of standard mitigation measures. Overall, this option has been assessed as having a minor negative effect on Objective 1.

As noted above, development of the abstraction infrastructure and WTW would result in the loss of greenfield land. However, the land is classified as 'urban' and in consequence, effects on Objective 2 have been assessed as neutral.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

A section of the proposed pipeline route is situated within/adjacent to Flood Zone 3 and consequently, works could be liable to flooding depending timing. It is unlikely that construction of the overall scheme would cause or exacerbate flood risk elsewhere.

There could be traffic congestion during the construction period due to the utilisation of the local road network for pipeline routing and vehicle movements (particularly along the A58 and B6222) which may, together with plant and machinery operation, have a negative effect on local air quality (there would be an estimated 11,469 vehicle movements during the 1.8 year construction period).

The option would generate 11,586 tCO_2e which, together with resource use and waste generation, has been assessed as having a significantly negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, the proposed works could result in temporary disruption to users of Elton Reservoir and allotments at Fern Grove. Construction including pipeline works would be within an urban area and could therefore affect the amenity of a number of residential receptors and community

facilities such as Derby High School, Bury C of E High School, Cygnet Hospital Bury, St. Gabriel's Roman Catholic High School, Bury Grammar School, and Bury Hospice. Overall, this option has been assessed as having a negative effect on Objective 7

Construction of the option would represent a large capital investment that could have a positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. However, the transportation of equipment/material via the local and regional road network and pipeline works within roads may result in increased congestion and disruption/driver delay during the construction phase. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

The development sites including proposed pipeline route do not contain/traverse any designated heritage assets. Bury Castle medieval moated site/fortified manor house Scheduled Monument would be approximately 90m from the pipeline and additionally, there would be circa 15 Grade II listed buildings which may hold vantage points to the route (specifically, four assets would be under 100m from the route, namely Elton House (5m), Bury Transport Museum (57m), Castle Armoury (100m), and the Church Rooms (58m). In consequence, there is the potential for construction activity to temporarily affect the settings of these assets and a minor negative effect has therefore been identified in respect of Objective 11.

The development sites and pipeline routes are not within or in proximity to any landscape designations. The proposed abstraction infrastructure, pumping station and WTW would be situated within an urban greenfield setting and associated construction works may affect the local character of the area as well as the visual amenity of nearby residential and recreational receptors. Pipeline works may also have short term and temporary adverse impacts on the visual amenity of receptors along the proposed route. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

Assuming there is water available for use within the Manchester, Bolton, and Bury Canal, the HRA Screening concluded that the new abstraction of 10 Ml/d of water (the capacity of this option has since been revised) should not result in adverse effects or likely significant effects alone or in combination (e.g. no impact pathways) as there are no designated European conservation sites within 10km from the abstraction point. Abstraction could result in changes to the operating regime of Elton Reservoir resulting in changes to lake level regime and impacts to aquatic ecological features supported by the reservoir, although this is currently uncertain. Overall, this option has been assessed as having an uncertain though potentially minor negative effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment has concluded that abstraction of 6.5 Ml/d from the Manchester, Bolton and Bury Canal is unlikely to result in long term or widespread impacts on the status of the surface water body as it is assumed that the canal will be managed to maintain flows. Specifically, it is expected that Elton Reservoir will match the new abstraction volume with corresponding compensation discharges thus maintaining the canal's hydrological regime. Overall, this option has been assessed as having a neutral effect on Objective 3.

Operation of the option would not be liable for flooding nor cause or exacerbate flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 415 kWh/Ml, generating 91 tCO_2e/a. This has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The abstraction of 6.5 Ml/d from Elton Reservoir could adversely impact recreational activities such as angling (due to the potential impact of changes in drawdown frequency on the fish population) and sailing on the reservoir, although this is uncertain. Overall, the increased capacity of 6.5 Ml/d would help ensure a continual supply of clean drinking water, generating a positive effect on health as well as supporting economic/population growth which could result in a positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

There would be no operational effects on designated cultural heritage assets.

The operational site would not be within or in proximity to any landscape designations. The proposed abstraction infrastructure, pumping station and WTW would introduce new above ground infrastructure within an urban greenfield setting which may have an adverse impact on the local character of the area and affect the visual amenity of users of the reservoir in particular. However, any adverse impacts would be minor.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR817: Carr Mill Dam to Strategic Resource Zone	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	-/?	0	0	-	0	-	++/?	++	0	-	0	-

Construction

This option would involve the development of a new abstraction/intake point and pumping station on Carr Mill Dam in order to abstract and transfer 16 Ml/d of water from St. Helens Canal to a new WTW via a new 886m raw water main (original capacity proposed was 23 Ml/d). Treated output from the new WTW would then be transferred to a treated water storage facility via a new 1km treated water main.

The development sites and proposed pipeline route do not include or cross any statutory or non-statutory nature conservation sites. The nearest European designated site is the Mersey Estuary SPA / Ramsar which is over 10km downstream and there are no clear impact pathways emerging from the construction phase. Clinkham Wood LNR and Stanley Bank LNR/Stanley Bank Meadow SSSI are 1.1km and 0.6km, respectively, from the proposed abstraction point and initial pipeline route; however, the interest features of these sites are not expected to be significantly impacted by construction works. Construction within the vicinity of Carr Mill Dam may indirectly introduce pollution/debris within the dam which could adversely affect local ecosystems, aquatic species, and potentially, downstream habitats, although it is expected that such impacts would be managed by best practice construction mitigation measures. Construction of the scheme components would occur on greenfield land and may result in the localised loss of/disturbance to habitats and species with nearby receptors including Torpen Wood, Hollin Hey Plantation, Goyt Hey Wood, and Car Mill Dam which supports various bird populations. Overall, this option has been assessed as having a minor negative effect on Objective 1.

As noted above, the new abstraction point, pumping station and WTW would be located on greenfield land which is of Grade 3 quality. This has been assessed as having a negative effect on Objective 2.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed abstraction point in addition to a section of the pipeline route would be within Flood Zone 3 and consequently, construction could be liable to flooding depending on the timing of works. It is unlikely that construction of the overall scheme would cause or exacerbate flood risk elsewhere.

There could be traffic congestion during the construction period (particularly along Arch Lane and Garswood Old Road) which may, together with plant and machinery operation, have a minor negative effect on local air quality (there would be an estimated 7,989 vehicle movements during the 1.8 year construction period).

The option would generate 9,020 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, the proposed works could result in temporary disruption/loss of amenity to users of Car Mill (sailing/angling/walking paths). As the scheme is situated within a semi-rural setting, noise/vibration disturbance and air quality impacts on residential receptors are likely to be very minor although Hollin Hey Farm is approximately 125m from the proposed WTW site. Overall, this option has been assessed as having a minor negative effect on Objective 7

Construction of the option would represent a large capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. Whilst the transportation of equipment/material via the local road network may result in a small increase in congestion and disruption/driver delay during the construction phase, on balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on Objective 10.

The option would not affect water efficiency.

There are two Grade II listed buildings within close proximity to the scheme (Hollin Hey House (104m from the pipeline/160m from the WTW) and Hollin Hey Farmhouse (215m from the pipeline/184m from the WTW). Whilst it is expected that measures would be implemented to prevent any significant adverse effects on these assets, their proximity suggests that works may have a temporary adverse impact on their settings. Overall, this option has been assessed as having a minor negative effect on Objective 11.

The development sites and proposed pipeline route are not within or in proximity to any landscape designations. Construction works would take place within a semi-rural greenfield setting composed primarily of fields, agricultural infrastructure and associated residential dwellings and in consequence, there is the potential for adverse impacts on landscape character. Although construction of the abstraction equipment and pumping station is expected to be of minor scale, their proximity to Carr Mill Dam may adversely impact the visual amenity of recreational receptors in the area; however, it is noted that existing screening (trees) may help to minimise these impacts. Construction of the WTW could adversely impact the local setting though a woodland buffer within its vicinity should moderate any effects in this regard. The proposed pipeline route would enjoy sporadic segments of woodland buffer though works could adversely impact the wider semi-rural landscape. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

Assuming there is water available for use within the St. Helen's Canal, the HRA Screening has concluded that the new abstraction of 23 Ml/d of water should not result in adverse effects or likely significant effects alone or in combination (e.g. no impact pathways) on designated European conservation sites including the Mersey Estuary SPA / Ramsar due to relative distance and scale / nature of abstraction. Notwithstanding, abstraction could potentially have an adverse effect on the Carr Mill Dam's ability to support its local populations of aquatic flora and fauna due to changes in water levels although this is currently uncertain. Consequently, this option has been assessed as having an uncertain though potentially minor negative effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment has concluded that abstraction of 23 Ml/d from St. Helen's Canal is unlikely to result in long term or widespread impacts on the status of the surface water body as it is assumed that the canal will be managed to maintain flows. Specifically, it is expected that Carr Mill Dam will match the new abstraction volume with corresponding compensation discharges thus maintaining the canal's hydrological regime. Overall, this option has been assessed as having a neutral effect on Objective 3.

The abstraction infrastructure and pumping station would be located within Flood Zone 3 and, therefore, could be liable to flooding during operation. However, operation of the scheme is not expected to cause or exacerbate the risk of flooding elsewhere.

There would be no operational effects on air quality.

Operational energy demand would be 295 kWh/Ml, generating 135 tCO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption. The abstraction of 23 Ml/d of water from Carr Mill Dam could adversely affect recreational activities such as angling and powerboating, although the magnitude of effect remains uncertain. Overall, the increased capacity of 23 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

It is not expected that the new abstraction point or pumping station would adversely affect proximate heritage assets due to their small scale and presence of screening (trees). The new WTW could, however, affect the setting of Hollin Hey House and Farmhouse although this would depend on the scale/design of the new facility. Overall, this option has been assessed as having a neutral effect on Objective 11.

The operational sites are not within or in proximity to any landscape designations. The proposed abstraction infrastructure, pumping station and WTW would be situated within a semi-rural greenfield setting composed primarily of fields, agricultural infrastructure and associated residential dwellings. The abstraction equipment and pumping station would be of a minor scale though their proximity to Carr Mill Dam may adversely affect the visual amenity of recreational receptors. The new WTW could adversely affect local landscape character although woodland/trees may provide screening. Overall, the option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR820: Shropshire Union Canal to Strategic Resource Zone	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	0	0	0	++	++	0	-	-	-

Construction

This option would involve increased abstraction from the Shropshire Union Canal for treatment to potable standards at Hurleston WTW and transfer to the Mid-Cheshire Main located near Nanney's Bridge. It would require additional abstraction infrastructure, a new/expanded WTW at Hurleston and a 6.9km treated water main.

The existing WTW site, adjacent land and proposed pipeline route do not include or cross any statutory or non-statutory nature conservation sites nor are they within proximity to any designated sites. The nearest European sites (components of the Midlands Meres and Mosses Phase 1 Ramsar) are all located over 8km from the option and are not linked hydrologically. Consequently, HRA Screening has concluded that there are no clear effects or likely significant effects alone or in combination (e.g. no impact pathways) resulting from construction. It is assumed that development of the WTW and some pipeline works would take place on greenfield land and in consequence, there is the potential for the localised loss of/disturbance to habitats and species. Modification to the existing abstraction pumps could indirectly introduce pollution/debris to Shropshire Union Canal which could adversely impact the local canal ecosystem, although these impacts are expected to be managed through the implementation of standard construction practices. The proposed pipeline route, meanwhile, would directly cross three water bodies, the Shropshire Union Canal (main), the Llangollen Canal branch, and two tributaries of the River Weaver, although impacts to these waterbodies are expected to be managed. Overall, this option has been assessed as having a negative effect on Objective 1.

As noted above, it is assumed that the extension to Hurleston WTW would take place on greenfield land including that which is of Grade 2 quality. Consequently, this option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

A section of the proposed pipeline route would be within Flood Zone 3 whilst the new WTW would be adjacent to Flood Zone 3. Consequently, works could be liable to flooding depending on timing. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

There could be traffic congestion during the construction period (particularly along the A51 and local roads such as Poole Hill Road, Wettenhall Road and Dairy Lane) which, together with plant and machinery operation, may have a negative effect on local air quality (there would be an estimated 11,796 vehicle movements during the 1.8 year construction period).

The option would generate 11,479 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. Construction works could affect the amenity of users of the Canal/ Shropshire Union Canal towpath and there may be noise/vibration disturbance which could affect an Equine Centre, adjacent farms and residential receptors along the A51. Pipeline works and HGV movements could also affect the amenity of a small number of receptors along local roads and the proposed pipeline route including scattered settlements and farmsteads. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a large capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. The transportation of equipment/material via the local and regional road network and pipeline works within/across roads may result in increased congestion and disruption/driver delay throughout the construction phase, although any impacts would be temporary. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

The WTW site does not contain any heritage assets; however, it is within proximity of several Grade II listed buildings including Hurleston Bridge #1 (82m), Llangollen branch of the Shropshire Union Canal Locks 1 – 4 (187m to 459m), and the Bache House Farmhouse and barn (655m). There are also three listed buildings under 100m from the pipeline route (Pinfold (39m), Poole Nurseries Cottage (36m) and Lower Hall (50m). Although it is unlikely that construction would be a direct risk to the integrity of these assets, works may temporarily affect their settings. Overall, a negative effect has been identified in respect of Objective 11.

The WTW site and proposed pipeline route are not within or in proximity to any landscape designations. Construction associated with the WTW expansion would introduce new development within the present greenfield setting and would intensify the use of the existing area. This could affect local landscape character and the visual amenity of nearby farmsteads. Recreational users of the canal and Equine Centre and receptors along the A51 may also be affected. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. The proposed pipeline route would enjoy sporadic segments of woodland buffer although works could adversely impact the local rural/semi-rural landscape and the visual amenity of a small number of residential receptors. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

Assuming there is water available for use within the Shropshire Union Canal, the HRA Screening concludes that the new abstraction of 15.5 Ml/d of water (the capacity of this option has since been revised) should not result in adverse effects or likely significant effects alone or in combination (e.g. no impact pathways) on designated European conservation sites such as the components of the Midlands Meres and Mosses Phase 1 Ramsar due to the relative distance and scale / nature of abstraction, and lack of hydrological links between the sites and Shropshire Union Canal . Furthermore, the HRA Screening has concluded that surplus capacity, conjunctively supported by Bradley borehole and Chasewater resource, within the canal should enable abstraction without significant or adverse localised effect on biodiversity. Consequently, this option has been assessed as having a neutral effect on Objective 1.

There would be no operational effects on soils/land use.

The WFD Assessment has concluded that the increased abstraction of 15 Ml/d from the existing pumps on the Shropshire Union Canal is unlikely to result in long term or widespread impacts on the status of the surface water body as it is assumed that flows will be maintained at or above current levels within the canal. Specifically, it is expected that water will be transferred from elsewhere on the canal system to support this abstraction thus maintaining the canal's hydrological regime. Overall, this option has been assessed as having a neutral effect on Objective 3.

Operation would not cause or exacerbate flooding in the area nor would the site be at risk from flooding.

There would be no operational effects on air quality.

Operational energy demand would be 108 kWh/Ml, generating 50 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would be unlikely to affect human health due to increased noise, nuisance or disruption. The increased capacity of 15 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The presence of a new/expanded WTW could affect the settings of Hurleston Bridge #1 and the Llangollen branch of the Shropshire Union Canal locks though this would depend on exact location/design of development. Overall, this option has been assessed as having a negative effect on Objective 11 at this stage.

The operational sites are not within or in proximity to any landscape designations. The expansion of Hurleston WTW would result in the development of new above ground infrastructure on greenfield land which could affect local landscape character and, potentially, the visual amenity of farmsteads and recreational receptors. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
WR821: Shropshire Union Canal	Construction	-	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	0	0	0	++	++	0	-	-	-

Construction

This option would involve increased abstraction from the Shropshire Union Canal for treatment to potable standards at Hurleston WTW and transfer to the Mid-Cheshire Main located near Nanney's Bridge. It would require additional abstraction infrastructure, a new/expanded WTW at Hurleston and a 6.9km treated water main.

The existing WTW site, adjacent land and proposed pipeline route are not within/traverse any statutory or non-statutory nature conservation sites nor are they within proximity to any designated sites. It is assumed that development of the WTW and some pipeline works would take place on greenfield land and in consequence, there is the potential for the localised loss of/disturbance to habitats and species. Modification to the existing abstraction pumps could indirectly introduce pollution/debris to Shropshire Union Canal which could adversely impact the local canal ecosystem, although these impacts are expected to be managed through the implementation of standard construction practices. The proposed pipeline route, meanwhile, would directly cross three water bodies, the Shropshire Union Canal (main), the Llangollen Canal branch, and two tributaries of the River Weaver, although impacts to these waterbodies are expected to be managed. Overall, this option has been assessed as having a negative effect on Objective 1.

As noted above, it is assumed that the extension to Hurleston WTW would take place on greenfield land including that which is of Grade 2 quality. Consequently, this option has been assessed as having a negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

A section of the proposed pipeline route would be within Flood Zone 3 whilst the new WTW would be adjacent to Flood Zone 3. Consequently, works could be liable to flooding depending on timing. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere.

There could be traffic congestion during the construction period (particularly along the A51 and local roads such as Poole Hill Road, Wettenhall Road and Dairy Lane) which, together with plant and machinery operation, may have a negative effect on local air quality (there would be an estimated 14,376 vehicle movements during the 1.9 year construction period).

The option would generate 13,493 tCO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. Construction works could affect the amenity of users of the Canal/ Shropshire Union Canal towpath and there may be noise/vibration disturbance which could affect an Equine Centre, adjacent farms and residential receptors along the A51. Pipeline works and HGV movements could also affect the amenity of a small number of receptors along local roads and the proposed pipeline route including scattered settlements and farmsteads. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a large capital investment that could have a significant positive effect on the local economy associated with employment opportunities and supply chain benefits generated by the development together with spend by construction workers and contractors. The transportation of equipment/material via the local and regional road network and pipeline works within/across roads may result in increased congestion and disruption/driver delay throughout the construction phase, although any impacts would be temporary. On balance, this option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on Objective 10.

The WTW site does not include any heritage assets; however, it is within close proximity of several Grade II listed buildings including Hurleston Bridge #1 (82m), Llangollen branch of the Shropshire Union Canal Locks 1 – 4 (187m to 459m), and the Bache House Farmhouse and barn (655m). There are also three listed buildings under 100m from the pipeline route (Pinfold (39m), Poole Nurseries Cottage (36m) and Lower Hall (50m). Although it is unlikely that construction would be a direct risk to the integrity of these assets, works may temporarily affect their settings. Overall, a negative effect has been identified in respect of Objective 11.

The WTW site and proposed pipeline route are not within or in proximity to any landscape designations. Construction associated with the WTW expansion would introduce new development within the present greenfield setting and would intensify the use of the existing area. This could affect local landscape character and the visual amenity of nearby farmsteads. Recreational users of the canal and Equine Centre and receptors along the A51 may also be affected. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. The proposed pipeline route would enjoy sporadic segments of woodland buffer although works could adversely impact the local rural/semi-rural landscape and the visual amenity of a small number of residential receptors. Overall, the option has been assessed as having a negative effect on Objective 12.

Operation

The operation of this options would involve the abstraction of surplus capacity conjunctively supplemented by additional feed(s) from Belvide Reservoir and/or Llangollen Canal/River Dee which would not require any changes to licence conditions. The increased abstraction may increase fish entrainment from the canal, but other operational effects would not be expected. Overall, the option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on soils/land use.

The option would result in the increased abstraction of 30 Ml/d; however, the WFD Assessment reports that it is likely the abstraction would be supported by water sourced from elsewhere (i.e. the canal is used as a transfer) and flows within the canal managed such that there would only be minor change in the flow regime of the canal. Overall, a neutral effect has therefore been identified in respect of Objective 3.

Operation would not cause or exacerbate flooding in the area nor would the site be at risk from flooding.

There would be no operational effects on air quality.

Operational energy demand would be 136 kWh/Ml, generating 89 tCO_2e/a which has been assessed as having a neutral effect on Objective 6 and a minor negative effect on Objective 10.

The scheme would be unlikely to affect human health due to increased noise, nuisance or disruption. The increased capacity of 30 Ml/d would help ensure a continual supply of clean drinking water, generating a significant positive effect on health as well as supporting economic/population growth which could result in a significant positive effect on the local economy and social-wellbeing.

The option would not affect water efficiency.

The presence of a new/expanded WTW could affect the settings of Hurleston Bridge #1 and the Llangollen branch of the Shropshire Union Canal locks though this would depend on exact location/design of development. Overall, this option has been assessed as having a negative effect on Objective 11 at this stage.

The expansion of Hurleston WTW would result in the development of new above ground infrastructure on greenfield land which could affect local landscape character and, potentially, the visual amenity of farmsteads and recreational receptors. However, the development would be set within the context of an existing operational site and its scale is such that significant adverse impacts are not predicted. Consequently, this option has been assessed as having a negative effect on Objective 12.

The following matrix presents the assessment of the Thames Water Trading Enabling Works Option (B2). It includes the works undertaken by United Utilities in order to maintain supplies to United Utilities' own customers when exporting water from Lake Vyrnwy to the Thames Water region, as well as effects of the Severn Thames transfer which has been assessed as part of Thames Water's draft WRMP. It presents the effects of the works undertaken by Unitied Utilities and Thames Water separately, and then in order to ensure that the cumulative effects have been assessed, presents the separate findings in a combined assessement. Information used to complete the assessment of the Thames Water activities has been taken from the SEA Environmental Report published by Thames Water to accompany the draft WRMP[116].

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
Thames Water Trading Enabling Works Option B2 (United Utilities activities)	C	**-/?**	**+/-**	**0**	**-**	**-**	**--**	**-**	**++/-**	**0**	**--**	**-**	**-**
	O	**0**	**0**	**0**	**0**	**0**	**+/-**	**++**	**++**	**0**	**-**	**0**	**0**

Construction

In order to maintain supplies to United Utilities' own customers when exporting water from Lake Vyrnwy to the Thames Water region, Dee Aqueduct water would be diverted into Vyrnwy Aqueduct using existing aqueduct connections and would then be pumped up Line 3 of the Vyrnwy Aqueduct for additional treatment at Oswestry WTW which would be modified accordingly. Several existing bulk supply points would be switched to supply to receive the Dee Aqueduct water, although this element of the scheme would not require any additional infrastructure. The operation of this scheme would remain within the terms of United Utilities' existing abstraction licence. The option would require 4 booster stations to provide a volume of 58.5 Ml/d. A total of 26 km of pipeline on Line 3 of the Vyrnwy Aqueduct would be replaced with slip lining along a further 21.5km of this line also required. Hydraulic controls would also be improved along Lines 1 and 2. Additionally, there would be 21Ml/d supplied to a treated water storage facility; this would also be within existing licence conditions and there would be no additional infrastructure requirements associated with this element of the scheme. Detailed design is required to confirm these proposals.

[116] Thames Water (2017), Thames Water Draft Water Resources Management Plan 2019 Technical Appendices Appendix B: Strategic Environmental Assessment - Environmental Report, Ricardo Energy & Environment, https://corporate.thameswater.co.uk/-/media/Site-Content/Your-water-future-2018/Appendices/dWRMP19-Appendix-B----Strategic-environmental-assessment---environmental-report-151217.pdf

Oswestry WTW is not located within or in close proximity to any designated nature conservation sites and works would be contained within an existing facility. In consequence, impacts on biodiversity associated with modifications to this WTW would be negligible. Construction of the proposed booster stations is also unlikely to affect any designated nature conservation sites with the nearest designations being Flaxmere Moss SSSI, Hatch Mere SSSI and Midland Meres and Mosses Phase 1 Ramsar Site at between 650m and 800m from the proposed booster station at Brown Moss. Three of the four booster stations would be located on greenfield land and could result in the loss of/disturbance to undesignated habitats and species. Pipeline works along the Vyrnwy Aqueduct between Cotebrook and Brown Moss would be adjacent to Flaxmere Moss SSSI, Hatch Mere SSSI and Midland Meres and Mosses Phase 1 Ramsar Site. Slip lining would also take place between Lake Vyrnwy and Oswestry which could affect Berwyn SPA/SSSI; however, it is anticipated that adverse effects on these sites would be avoided through the implementation of standard project level mitigation. Notwithstanding this, pipeline works across greenfield land may cause some short term disturbance to habitats and species. Overall, this option has been assessed as having a minor negative effect on Objective 1, although some uncertainty remains.

Modifications to Oswestry WTW would be very minor and take place within an existing site and is assessed as an efficient use of land against Objective 2. Development of three of the four proposed booster stations would result in a small loss of greenfield land including Grade 2 and Grade 3 agricultural land (the remaining proposed booster station would be within an existing site). Pipeline excavation would also be routed through Grade 2 and Grade 3 agricultural land which may temporarily disrupt agricultural operations, although land would be reinstated following the completion of construction. Overall, this option has been assessed as having a mixed minor positive and minor negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed WTW and booster station sites are within Flood Zone 1. Some pipeline works would take place within Flood Zones 2 and 3 and in consequence, construction activity may be at risk of flooding (depending on timing); however, the construction of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, this option has been assessed as having a minor negative effect on Objective 4.

It is expected that there would be traffic congestion during the construction period which, together with the operation of plant and machinery, could have a minor negative effect on local air quality (there would be an estimated 70,034 vehicle movements during the construction period).

The option would generate 64,730 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period; however, pipeline works may result in temporary disruption/loss of amenity to users of playing fields at Park Hill, Lake Vyrnwy, Delamere Forest and footpaths including the Shropshire Way. Additionally, there may be noise/vibration disturbance and air quality impacts associated with pipeline works and construction of the booster stations which could temporarily affect residential receptors, farmsteads and community uses in close proximity. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a large capital investment that could create employment opportunities and supply chain benefits together with spend by construction workers and contractors in the local economy. However, pipeline works, in addition to the transportation of equipment/material, could temporarily result in increased congestion and disruption/driver delay including along the A495, A41, A534, A54, A556 and A49. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The nearest designated cultural heritage assets to Oswestry WTW include St Oswald's Well and Headmaster's House, Oswestry School Grade II listed buildings which are circa 400m to the east; beyond these assets is a cluster of listed buildings in Oswestry. Given the distance of these assets from the existing WTW, and taking into account the scale of modifications proposed, this element of the scheme is not expected to have any impacts on cultural heritage. Similarly, the proposed booster stations would all be at least 500m from any heritage assets and in consequence, no adverse impacts are predicted. The exception to this is the proposed booster station which is a Grade II listed building and its setting may be temporarily affected during construction. There are a number of listed buildings and scheduled monuments in close proximity to Line 3 of the Vyrnwy Aqueduct and in consequence, pipeline works may have a temporary adverse impact on their settings. Overall, the option has been assessed as having a minor negative effect on Objective 11.

The development sites are not affected by any landscape designations. As the proposed modifications to Oswestry WTW would be small in scale and contained within an existing site, landscape and visual impacts associated with this element of the scheme are expected to be negligible. The booster stations would be located on greenfield land in rural settings and in consequence, there is the potential for adverse impacts on landscape character as well as on the visual amenity of a small number of residential receptors and farmsteads that would be in close proximity to construction activity. However, as any

works would be of small scale, no significant effects are predicted. Pipeline works could have a temporary adverse effect on local landscape character and the visual amenity of residential and recreational receptors. Overall, this option has been assessed as having a minor negative effect on Objective 12.

Operation

During the operation of this option, there would be no net impacts on the water levels of Lake Vyrnwy. To enable the transfer of water to Thames Water, United Utilities would decrease abstraction from the reservoir by an equivalent volume and there would be no change to the existing abstraction regime. Water would be transferred directly from Lake Vyrnwy via a pipeline and in consequence, there would be no impacts on flows in the Afon Vyrnwy or on associated nature conservation designations and riverine ecology. The release of water into the River Severn and its subsequent abstraction and transfer to the River Thames may have impacts on flows in these rivers and, therefore, the riverine ecology they support. These impacts have been assessed by Thames Water as part of the preparation of the company's WRMP and are outlined in the assessment below. The operation of this option would require additional water from the Dee Aqueduct, although this would remain within the terms of United Utilities' existing licences. Overall, the option has been assessed as having a neutral effect on Objective 1.

No effects on soils or land use are expected during operation (discounting the initial loss of land during construction).

As noted above, the option would not have any impacts on reservoir levels or flows in the Afon Vyrnwy immediately downstream of the reservoir nor would there be an impact on the Dee Aqueduct or Vyrnwy Aqueduct. The operation of the option would require additional water via the Dee Aqueduct from existing licenced abrasctions (principally from the River Dee), that would be diverted through asset modifications to ensure continued supply to United Utilities' customers. Increases in abstraction would be required although these would be within the terms of the existing licences. The release of water into the River Severn (or Afon Vyrnwy further downstream) and its subsequent abstraction and transfer to the River Thames may have impacts on flows in these rivers. These impacts have been assessed by Thames Water as part of the preparation of the company's WRMP and are therefore not considered in this SEA. Overall, the option has been assessed as having a neutral effect on Objective 3.

The operation of the option is not expected to cause or exacerbate flooding.

No operational effects on local air quality are anticipated.

The option would require ongoing energy use of 1,186 kWh/Ml (excluding the operation of any infrastructure related to the abstraction and treatment of water by Thames Water), generating on average 187 tonnes of CO_2e/a which has been assessed as having a minor negative effect on Objectives 6 and 10. By providing additional water to the Thames Water region at times of drought, the option would help ensure climate change resilience and the option has therefore also been assessed as having a positive effect on Objective 6.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect recreational opportunities on Lake Vyrnwy or Afon Vyrnwy. The option would help to maintain water supplies in the Thames Water region during periods of drought which has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No impact on water efficiency or leakage is expected.

As there would be no change in reservoir levels or flows on the Afon Vyrnwy, the transfer of water to the Thames Water region would not have any effects on cultural heritage or landscape. One of the proposed booster station may affect the setting of a Grade II listed building. However, the development would be small in scale and be within the context of an existing operational site such that any effects are expected to be negligible. As noted above, the remaining booster stations would be located on greenfield land in a rural setting and in consequence, there is the potential for adverse impacts on landscape character as well as on the visual amenity of a small number of residential receptors and farmsteads in close proximity. However, as the development would be of small scale, no significant effects are predicted. Overall, the option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
Thames Water Trading Enabling Works Option B2 (Thames Water activities)	C	-/?	-	0	-	-	--	-	++/-	0	--	--	--
	O	-	0	-	0	0	+/--	++	++	0	--	0	-

Construction

This option would involve the transfer of water from Lake Vyrnwy to the Thames Water region. The Thames Water Draft WRMP 2019 identifies that water released from Lake Vyrnwy would be re-abstracted from the Severn at Deerhurst (for subsequent transfer into the River Thames to supply Thames Water). According to Thames Water modelling work, the need for transfers of water from the River Severn into the Thames Water area would occur, on average, 9% of the time. Mythe WTW would provide support to the River Severn to River Thames Transfer by using the 15 Ml/d of the unused part of the existing Severn Trent Water (STW) abstraction licence at its intake; the spare licensed volume would be left in the River Severn for abstraction downstream at Deerhurst by Thames Water. The Mythe intake is located on the River Severn near Tewkesbury, 5km northeast of Deerhurst. STW has advised Thames Water that only minor works would be required at Mythe and elsewhere to release the spare licence volume for abstraction by Thames Water at Deerhurst. The transfer of water would be through a supported conveyance pipeline option that would abstract the water from Deerhurst on the River Severn to the outfall at Culham on the River Thames with a 300 Ml/d capacity and a total length of 88km. As well as the pipeline route, associated works required to transfer the flow to the River Thames would include: a river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station; a raw water low lift pump station and a twin pipeline to the water treatment works; WTW; a treated water high lift pump station; a rising main; a break pressure tank at the high point; a gravity main to discharge; an outfall at Culham with an actuated valve and an aeration cascade; washouts along the route provided with permanent discharge pipework to adjacent watercourses; and a tee off the main pipeline for SWOX supply. This element of the scheme is referred to as the Severn Thames Transfer.

The Thames Water Draft WRMP Environmental Report identifies that the potential for effects on Cothill Fen SAC; Little Wittenham SAC; Bredon Hill SAC; and Dixton Wood SAC during construction of the Severn Thames Transfer were considered in the HRA Screening undertaken in support of the Plan, which concluded no likely significant effect in all cases. With regard to the Severn Estuary SAC, SPA and Ramsar, the HRA screening concluded that the construction (and operation) of the proposed scheme would not have any likely significant effect on the qualifying features of these designated sites. The Environmental Report notes that there are two SSSIs within 1km (Cleeve Common (0.6km) and Chimney Meadows (1km) of the transfer pipelines. However, it states that at these distances from the pipeline construction, the potential for likely significant adverse effects on the grassland habitats and associated features (e.g. wading birds) are assessed as negligible. Works associated with this option may cause some short term disturbance to/loss of habitats and species and overall, this option has therefore been assessed as having a minor negative effect on Objective 1, although some uncertainty remains.

The Thames Water Draft WRMP Environmental Report highlights that the above ground components of the Severn Thames Transfer (e.g. low lift pump station; treatment works; and break pressure tank) would involve permanent landtake, of which approximately 14ha would be greenfield land/agricultural land. Pipeline excavation would also be routed through Grade 2 and Grade 3 agricultural land which

may temporarily disrupt agricultural operations, although land would be reinstated following the completion of construction. Overall, this option has been assessed as having a minor negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Some pipeline works and intake and outfall development associated with the Severn Thames Transfer would take place within Flood Zones 2 and 3 and in consequence, construction activity may be at risk of flooding (depending on timing); however, the construction of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, this option has been assessed as having a minor negative effect on Objective 4.

It is expected that there would be traffic congestion during the construction period which, together with the operation of plant and machinery, could have a minor negative effect on local air quality (there would be over 10,000 movements related to the Severn Thames Transfer).

The option would generate an estimated 219,911 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The Thames Water Draft WRMP Environmental Report identifies that there would likely be adverse effects on health and well-being to local populations from the Deerhurst to Culham element of the Severn Thames Transfer. Issues likely to arise include noise, dust and vibrations during construction associated with construction activities and vehicles (this includes construction of the intake, outfall, treatment works, pumping stations and pipeline). The Environmental Report states that sustained adverse effects would likely be most prominent during construction of the treatment works whilst large parts of the pipeline route could cause disruption to public rights of way during the construction period. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a large capital investment that could create employment opportunities and supply chain benefits together with spend by construction workers and contractors in the local economy. However, pipeline works, in addition to the transportation of equipment/material, could temporarily result in increased congestion and disruption/driver delay. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The Thames Water Draft WRMP Environmental Report highlights that there are a large number of designated assets in proximity to the construction areas associated with the Severn Thames Transfer component of option such that significant adverse effects are on archaeology and cultural heritage are predicted. Overall, the option has therefore been assessed as having a significant negative effect on Objective 11.

The Thames Water Draft WRMP Environmental Report notes that the pipeline route and individual above ground site locations are predominantly within rural locations with at least 45km of the pipeline route being within the Cotswolds AONB. The final part of the route near Culham is 5.5km north of the North Wessex Downs AONB. As a result, significant adverse effects are identified in respect of landscape and visual amenity. Overall, this option has been assessed as having a significant negative effect on Objective 12.

Operation

The Thames Water Draft WRMP Environmental Report states that in operation, the abstraction of water from the River Severn at Deerhurst (up to a maximum daily rate of 300Ml/d) would not reduce flows downstream below a hands-off flow condition of 1,800Ml/d thus, only flows above this level would be affected downstream of the abstraction. The report highlights that abstraction would be limited to a maximum of 275Ml/d if flows at Deerhurst are less than 2,486Ml/d. The volumes would be small in comparison to flows in the estuary (the Severn Estuary has a very large tidal range) such that it is not anticipated that the upstream abstraction would have any significant adverse impact on the qualifying features of the site, which would be well habituated to fluctuating water levels and flows. However, the Environmental Report states that as with the pipeline transfer, supported and phased canal transfers carry a minor risk of temporarily disrupting sea lamprey migration during low flow conditions by causing additional flow to pass over Upper Lode Weir on the River Severn, which may affect the ability of sea lamprey to pass the weir for short infrequent periods. Although there would be some minor modification to the flow regime as a consequence of the abstraction, overall, these flow constraints will provide an acceptable level of protection to the downstream river environment and aquatic ecology, including migratory fish species. Therefore, effects of supported flows on the upstream migration of sea lamprey is considered to be negligible or minor.

The Thames Water Draft WRMP Environmental Report states that detailed studies have identified a number of INNS risks relating to the transfer of INNS present in the lower River Severn to the River Thames, notably: Asian clam; zebra mussel/quagga mussel; killer shrimp/demon shrimp; Caspian mud shrimp and crayfishes. The design of the pipeline therefore includes INNS control measures in the

form of pre-treatment of the River Severn at a water treatment works located near to the abstraction intake on the River Severn; the river water would be treated prior to being transferred to Culham such that invasive species would be removed as far as reasonably practicable before transfer, reducing the risk of accidental release into the River Thames catchment. The Thames Water Draft WRMP Environmental Report highlights that the likely residual adverse effects of the discharge to the River Thames relate to the increases in the low flow to extreme low flow arising from the discharge of 300 Ml/d, in particular risks to the flow regime of the weir pools in the reaches below the discharge point; higher flows and/or more variable changes in flow under low flow conditions may lead to a loss of shallows and increased flow velocities which can reduce habitat availability for the full range of fish, invertebrates and plants living in these reaches. The report notes that detailed studies have identified that flows of 300 Ml/d at Culham may result in some minor adverse effects on aquatic ecology in this reaches. Nevertheless, at times of very low flow conditions, there may be some minor beneficial effects on aquatic ecology by increasing the wetted area and flow velocities downstream of the discharge location.

Overall, the option has been assessed as having a minor negative effect on Objective 1 at this stage.

No effects on soils or land use are expected during operation (discounting the initial loss of land during construction).

The Thames Water Draft WRMP Environmental Report states that the abstraction from the River Severn at Deerhurst would modify the flow regime downstream, reducing some of the flow variability at moderately low flows. However, the report states that this would be ameliorated by river flow support from upstream water sources as flows reduce towards the hands-off flow condition which prevents abstraction at low flows below 1,800Ml/d. The report also highlights that abstraction would be limited to 275Ml/d at river flows below 2,486Ml/d and that these flow constraints on abstraction would protect the low flow regime and flows to the Severn Estuary. Downstream of the discharge to the River Thames at Culham, the greatest proportion change in the flow would be increases in the low flow to extreme low flow and velocities in the reaches immediately downstream, with the greatest effects in the receiving waterbody (Thames (Evenlode to Thame) which would gradually reduce with distance downstream. The Environmental Report states that the River Thames would not be subject to undue flow variability beyond its characteristic flow regime from the elevated baseflow due to the regulated nature of the river. At times of very low flows, the release of water to the River Thames may provide a minor benefit to the hydrological conditions.

The WFD Assessment prepared in support of the Thames Water Draft WRMP notes that there is some uncertainty as to effects on dissolved oxygen and water temperature in the upper reaches of the Afon Vyrnwy downstream of the reservoir. The WFD Assessment states that there may be beneficial effects under some flow conditions, particularly during low flows in hot weather, with higher flows helping to moderate elevated water temperatures and increasing dilution of diffuse pollution pressures. The WFD Assessment highlights that abstracted water would be treated at the nearby treatment works with discharges treated to environmental standards such that there would be a low risk of impacting the physico-chemical quality elements of these River Thames water bodies (which are currently assessed as being at moderate WFD status). Peaks in suspended solids would be monitored and if there was an elevated level of suspended solids, the abstraction from the River Severn would be reduced to just the pipeline 'sweetening' flows, and would be treated prior to the main treatment works. The outfall to the River Thames would involve an aeration cascade structure to oxygenate the discharge water to minimise any adverse impacts on dissolved oxygen concentrations in the river. The assessment notes that there is the potential for some organic pollutants to be in the discharged, such as metaldehyde, as these pollutants are more difficult to treat and remove at the water treatment works.

Overall, the option has been assessed as having a minor negative effect on Objective 3.

The operation of the option is not expected to cause or exacerbate flooding.

No operational effects on local air quality are anticipated.

The option would require ongoing energy use, generating on average 105,031 tonnes of CO_2e/a which has been assessed as having a significant negative effect on Objectives 6 and 10. By providing additional water to the Thames Water region at times of drought, the option would help ensure climate change resilience and the option has therefore also been assessed as having a positive effect on Objective 6.

The option would help to maintain water supplies in the Thames Water region during periods of drought which has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No impact on water efficiency or leakage is expected.

The Thames Water Draft WRMP Environmental Report identifies the potential for adverse landscape and visual impacts associated with above ground infrastructure and the option has been assessed as having a minor negative effect on Objective 12.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
Thames Water Trading Enabling Works Option B2 (Cumulative assessment)	C	-/?	+/-	0	-	-	--	-	++/-	0	--	--	--
	O	-	0	-	0	0	+/--	++	++	0	--	0	-

Construction

This option would involve the transfer of water from Lake Vyrnwy to the Thames Water region. In order to maintain supplies to United Utilities' own customers when exporting water, Dee Aqueduct water would be diverted into the Vyrnwy Aqueduct using existing aqueduct connections and would then be pumped up Line 3 of the Vyrnwy Aqueduct for additional treatment at Oswestry WTW which would be modified accordingly. Several existing bulk supply points would be switched to supply to receive the Dee Aqueduct water, although this element of the scheme would not require any additional infrastructure. The operation of this component of the scheme would remain within the terms of United Utilities' existing abstraction licence and would require 4 booster stations to provide a volume of 58.5 Ml/d. A total of 26 km of pipeline on Line 3 of the Vyrnwy Aqueduct would be replaced with slip lining along a further 21.5km of this line also required. Hydraulic controls would also be improved along Lines 1 and 2. Additionally, there would be 21Ml/d supplied from Duddon Common Booster Station and Sandiford WTW to a treated water storage facility; this would also be within existing licence conditions and there would be no additional infrastructure requirements associated with this element of the scheme. This component of the option is referred to as the enabling works.

The Thames Water Draft WRMP 2019 identifies that water released from Lake Vyrnwy would be re-abstracted from the Severn at Deerhurst (for subsequent transfer into the River Thames to supply Thames Water). According to Thames Water modelling work, the need for transfers of water from the River Severn into the Thames Water area would occur, on average, 9% of the time. Mythe WTW would provide support to the River Severn to River Thames Transfer by using the 15 Ml/d of the unused part of the existing Severn Trent Water (STW) abstraction licence at its intake; the spare licensed volume would be left in the River Severn for abstraction downstream at Deerhurst by Thames Water. The Mythe intake is located on the River Severn near Tewkesbury, 5km northeast of Deerhurst. STW has advised Thames Water that only minor works would be required at Mythe and elsewhere to release the spare licence volume for abstraction by Thames Water at Deerhurst. The transfer of water would be through a supported conveyance pipeline option that would abstract the water from Deerhurst on the River Severn to the outfall at Culham on the River Thames with a 300 Ml/d capacity and a total length of 88km. As well as the pipeline route, associated works required to transfer the flow to the River Thames would include: a river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station; a raw water low lift pump station and a twin pipeline to the water treatment works; WTW; a treated water high lift pump station; a rising main; a break pressure tank at the high point; a gravity main to discharge; an outfall at Culham with an actuated valve and an aeration cascade; washouts along the route provided with permanent discharge pipework to adjacent watercourses; and a tee off the main pipeline for SWOX supply. This element of the scheme is referred to as the Severn Thames Transfer.

Oswestry WTW is not located within or in close proximity to any designated nature conservation sites and works would be contained within an existing facility. In consequence, impacts on biodiversity associated with modifications to this WTW would be negligible. Construction of the proposed booster stations is also unlikely to affect any designated nature conservation sites with the nearest designations being Flaxmere Moss SSSI, Hatch Mere SSSI and Midland Meres and Mosses Phase 1 Ramsar Site at between 650m and 800m from the proposed booster station at Brown Moss. Three of the four booster stations would be located on greenfield land and could result in the loss of/disturbance to undesignated habitats and species. Pipeline works along the Vyrnwy Aqueduct between Cotebrook and

Brown Moss would be adjacent to Flaxmere Moss SSSI, Hatch Mere SSSI and Midland Meres and Mosses Phase 1 Ramsar Site. Slip lining would also take place between Lake Vyrnwy and Oswestry which could affect Berwyn SPA/SSSI; however, it is anticipated that adverse effects on these sites would be avoided through the implementation of standard project level mitigation.

The Thames Water Draft WRMP Environmental Report identifies that the potential for effects on Cothill Fen SAC; Little Wittenham SAC; Bredon Hill SAC; and Dixton Wood SAC during construction of the Severn Thames Transfer were considered in the HRA Screening undertaken in support of the Plan, which concluded no likely significant effect in all cases. With regard to the Severn Estuary SAC, SPA and Ramsar, the HRA screening concluded that the construction (and operation) of the proposed scheme would not have any likely significant effect on the qualifying features of these designated sites. The Environmental Report notes that there are two SSSIs within 1km (Cleeve Common (0.6km) and Chimney Meadows (1km) of the transfer pipelines. However, it states that at these distances from the pipeline construction, the potential for likely significant adverse effects on the grassland habitats and associated features (e.g. wading birds) are assessed as negligible.

Works associated with this option may cause some short term disturbance to/loss of habitats and species and overall, this option has therefore been assessed as having a minor negative effect on Objective 1, although some uncertainty remains.

Modifications to Oswestry WTW would be very minor and take place within an existing site which is assessed as an efficient use of land against Objective 2. Development of three of the four proposed booster stations would result in a small loss of greenfield land including Grade 2 and Grade 3 agricultural land (the remaining proposed booster station would be within an existing site). The Thames Water Draft WRMP Environmental Report highlights that the above ground components of the Severn Thames Transfer (e.g. low lift pump station; treatment works; and break pressure tank) would involve permanent landtake, of which approximately 14ha would be greenfield land/agricultural land. Pipeline excavation would also be routed through Grade 2 and Grade 3 agricultural land which may temporarily disrupt agricultural operations, although land would be reinstated following the completion of construction. Overall, this option has been assessed as having a mixed minor positive and minor negative effect on Objective 2.

It is not expected that construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed WTW and booster station sites in respect of the enabling works are within Flood Zone 1. Some pipeline works and intake and outfall development associated with the Severn Thames Transfer would take place within Flood Zones 2 and 3 and in consequence, construction activity may be at risk of flooding (depending on timing); however, the construction of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, this option has been assessed as having a minor negative effect on Objective 4.

It is expected that there would be traffic congestion during the construction period which, together with the operation of plant and machinery, could have a minor negative effect on local air quality (there would be an estimated 70,034 vehicle movements during the construction period associated with the enabling works together with over 10,000 movements related to the Severn Thames Transfer).

The option would generate 284,641 tonnes CO_2e which, together with resource use and waste generation, has been assessed as having a significant negative effect on Objectives 6 and 10.

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period. However, pipeline works associated with the enabling works may result in temporary disruption/loss of amenity to users of playing fields at Park Hill, Lake Vyrnwy, Delamere Forest and footpaths including the Shropshire Way. Additionally, there may be noise/vibration disturbance and air quality impacts associated with pipeline works and construction of other scheme components which could temporarily affect residential receptors, farmsteads and community uses in close proximity. The Thames Water Draft WRMP Environmental Report identifies that there would likely be adverse effects on health and well-being to local populations from the Deerhurst to Culham element of the Severn Thames Transfer. Issues likely to arise include noise, dust and vibrations during construction associated with construction activities and vehicles (this includes construction of the intake, outfall, treatment works, pumping stations and pipeline). The Environmental Report states that sustained adverse effects would likely be most prominent during construction of the treatment works whilst large parts of the pipeline route could cause disruption to public rights of way during the construction period. Overall, this option has been assessed as having a minor negative effect on Objective 7.

Construction of the option would represent a large capital investment that could create employment opportunities and supply chain benefits together with spend by construction workers and contractors in the local economy. However, pipeline works, in addition to the transportation of equipment/material, could temporarily result in increased congestion and disruption/driver delay including along the A495, A41, A534, A54, A556 and A49. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8.

The option would not affect water efficiency.

The infrastructure required to construct this option, in addition to energy demand, would have significant negative effects on Objective 10.

The nearest designated cultural heritage assets to Oswestry WTW include St Oswald's Well and Headmaster's House, Oswestry School Grade II listed buildings which are circa 400m to the east; beyond these assets is a cluster of listed buildings in Oswestry. Given the distance of these assets from the existing WTW, and taking into account the scale of modifications proposed, this element of the scheme is

not expected to have any impacts on cultural heritage. Similarly, the proposed booster stations required as part of the enabling works would all be at least 500m from any heritage assets and in consequence, no adverse impacts are predicted. The exception to this is the proposed booster station which is a Grade II listed building and its setting may be temporarily affected during construction. There are a number of listed buildings and scheduled monuments in close proximity to Line 3 of the Vyrnwy Aqueduct and in consequence, pipeline works may have a temporary adverse impact on their settings. The Thames Water Draft WRMP Environmental Report highlights that there are a large number of designated assets in proximity to the construction areas associated with the Severn Thames Transfer component of option such that significant adverse effects are on archaeology and cultural heritage are predicted. Overall, the option has therefore been assessed as having a significant negative effect on Objective 11.

The development sites associated with the enabling works are not affected by any landscape designations. As the proposed modifications to Oswestry WTW would be small in scale and contained within an existing site, landscape and visual impacts associated with this element of the scheme are expected to be negligible. With the exception of the booster stations would be located on greenfield land in rural settings and in consequence, there is the potential for adverse impacts on landscape character as well as on the visual amenity of a small number of residential receptors and farmsteads that would be in close proximity to construction activity. However, as any works would be of small scale, no significant effects are predicted. Pipeline works could have a temporary adverse effect on local landscape character and the visual amenity of residential and recreational receptors. With regard to the Severn Thames Transfer element of the option, the Thames Water Draft WRMP Environmental Report notes that the pipeline route and individual above ground site locations are predominantly within rural locations with at least 45km of the pipeline route being within the Cotswolds AONB. The final part of the route near Culham is 5.5km north of the North Wessex Downs AONB. As a result, significant adverse effects are identified in respect of landscape and visual amenity. Overall, this option has been assessed as having a significant negative effect on Objective 12.

Operation

During the operation of this option, there would be no net impacts on the water levels of Lake Vyrnwy. To enable the transfer of water to Thames Water, United Utilities would decrease abstraction from the reservoir by an equivalent volume and there would be no change to the existing abstraction regime. Water would be transferred directly from Lake Vyrnwy via a pipeline and in consequence, there would be no impacts on flows in the Afon Vyrnwy or on associated nature conservation designations and riverine ecology. The Thames Water Draft WRMP Environmental Report states that in operation, the abstraction of water from the River Severn at Deerhurst (up to a maximum daily rate of 300Ml/d) would not reduce flows downstream below a hands-off flow condition of 1,800Ml/d thus, only flows above this level would be affected downstream of the abstraction. The report highlights that abstraction would be limited to a maximum of 275Ml/d if flows at Deerhurst are less than 2,486Ml/d. The volumes would be small in comparison to flows in the estuary (the Severn Estuary has a very large tidal range) such that it is not anticipated that the upstream abstraction would have any significant adverse impact on the qualifying features of the site, which would be well habituated to fluctuating water levels and flows. However, the Environmental Report states that as with the pipeline transfer, supported and phased canal transfers carry a minor risk of temporarily disrupting sea lamprey migration during low flow conditions by causing additional flow to pass over Upper Lode Weir on the River Severn, which may affect the ability of sea lamprey to pass the weir for short infrequent periods. Although there would be some minor modification to the flow regime as a consequence of the abstraction, overall, these flow constraints will provide an acceptable level of protection to the downstream river environment and aquatic ecology, including migratory fish species. Therefore, effects of supported flows on the upstream migration of sea lamprey is considered to be negligible or minor. The operation of this option would require additional water from the Dee Aqueduct, although this would remain within the terms of United Utilities' existing licences.

The Thames Water Draft WRMP Environmental Report states that detailed studies have identified a number of INNS risks relating to the transfer of INNS present in the lower River Severn to the River Thames, notably: Asian clam; zebra mussel/quagga mussel; killer shrimp/demon shrimp; Caspian mud shrimp and crayfishes. The design of the pipeline therefore includes INNS control measures in the form of pre-treatment of the River Severn at a water treatment works located near to the abstraction intake on the River Severn; the river water would be treated prior to being transferred to Culham such that invasive species would be removed as far as reasonably practicable before transfer, reducing the risk of accidental release into the River Thames catchment. The Thames Water Draft WRMP Environmental Report highlights that the likely residual adverse effects of the discharge to the River Thames relate to the increases in the low flow to extreme low flow arising from the discharge of 300 Ml/d, in particular risks to the flow regime of the weir pools in the reaches below the discharge point; higher flows and/or more variable changes in flow under low flow conditions may lead to a loss of shallows and increased flow velocities which can reduce habitat availability for the full range of fish, invertebrates and plants living in these reaches. The report notes that detailed studies have identified that flows of 300 Ml/d at Culham may result in some minor adverse effects on aquatic ecology in this reaches. Nevertheless, at times of very low flow conditions, there may be some minor beneficial effects on aquatic ecology by increasing the wetted area and flow velocities downstream of the discharge location.

Overall, the option has been assessed as having a minor negative effect on Objective 1 at this stage.

No effects on soils or land use are expected during operation (discounting the initial loss of land during construction).

As noted above, the option would not have any impacts on reservoir levels or flows in the Afon Vyrnwy immediately downstream of the reservoir nor would there be an impact on the Dee Aqueduct or Vyrnwy Aqueduct. The operation of the option would require additional water via the Dee Aqueduct from existing licenced abrasctions (principally from the River Dee), that would be diverted through asset modifications to ensure continued supply to United Utilities' customers. Increases in abstraction would be required although these would be within the terms of the existing licences.

The Thames Water Draft WRMP Environmental Report states that the abstraction from the River Severn at Deerhurst would modify the flow regime downstream, reducing some of the flow variability at moderately low flows. However, the report states that this would be ameliorated by river flow support from upstream water sources as flows reduce towards the hands-off flow condition which prevents abstraction at low flows below 1,800Ml/d. The report also highlights that abstraction would be limited to 275Ml/d at river flows below 2,486Ml/d and that these flow constraints on abstraction would protect the low flow regime and flows to the Severn Estuary. Downstream of the discharge to the River Thames at Culham, the greatest proportion change in the flow would be increases in the low flow to extreme low flow and velocities in the reaches immediately downstream, with the greatest effects in the receiving waterbody (Thames (Evenlode to Thame) which would gradually reduce with distance downstream. The Environmental Report states that the River Thames would not be subject to undue flow variability beyond its characteristic flow regime from the elevated baseflow due to the regulated nature of the river. At times of very low flows, the release of water to the River Thames may provide a minor benefit to the hydrological conditions.

The additional releases of water from Lake Vyrnwy would be not likely to have a significant adverse impact on the WFD physico-chemical or chemical classifications sufficient to result in a change of WFD status in the Afon Vyrnwy or River Severn. However, the WFD Assessment prepared in support of the Thames Water Draft WRMP notes that there is some uncertainty as to effects on dissolved oxygen and water temperature in the upper reaches of the Afon Vyrnwy downstream of the reservoir. The WFD Assessment states that there may be beneficial effects under some flow conditions, particularly during low flows in hot weather, with higher flows helping to moderate elevated water temperatures and increasing dilution of diffuse pollution pressures. The WFD Assessment highlights that abstracted water would be treated at the nearby treatment works with discharges treated to environmental standards such that there would be a low risk of impacting the physico-chemical quality elements of these River Thames water bodies (which are currently assessed as being at moderate WFD status). Peaks in suspended solids would be monitored and if there was an elevated level of suspended solids, the abstraction from the River Severn would be reduced to just the pipeline 'sweetening' flows, and would be treated prior to the main treatment works. The outfall to the River Thames would involve an aeration cascade structure to oxygenate the discharge water to minimise any adverse impacts on dissolved oxygen concentrations in the river. The assessment notes that there is the potential for some organic pollutants to be in the discharged, such as metaldehyde, as these pollutants are more difficult to treat and remove at the water treatment works.

Overall, the option has been assessed as having a minor negative effect on Objective 3.

The operation of the option is not expected to cause or exacerbate flooding.

No operational effects on local air quality are anticipated.

The option would require ongoing energy use, generating on average 105,138 tonnes of CO_2e/a which has been assessed as having a significant negative effect on Objectives 6 and 10. By providing additional water to the Thames Water region at times of drought, the option would help ensure climate change resilience and the option has therefore also been assessed as having a positive effect on Objective 6.

The scheme would not adversely affect human health due to increased noise, nuisance or disruption nor would it affect recreational opportunities on Lake Vyrnwy or Afon Vyrnwy. The option would help to maintain water supplies in the Thames Water region during periods of drought which has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

No impact on water efficiency or leakage is expected.

As there would be no change in reservoir levels or flows on the Afon Vyrnwy, the enabling works element of Option B2 would not have any effects on cultural heritage or landscape. One of the proposed booster stations may affect the setting of a Grade II listed building. However, the development would be small in scale and be within the context of an existing operational site such that any effects are expected to be negligible. As noted above, the remaining booster stations would be located on greenfield land in a rural setting and in consequence, there is the potential for adverse impacts on landscape character as well as on the visual amenity of a small number of residential receptors and farmsteads in close proximity. However, as the development would be of small scale, no significant effects are predicted. With regard to the Severn Thames Transfer element of the option, the Thames Water Draft WRMP Environmental Report identifies the potential for adverse landscape and visual impacts associated with above ground infrastructure. Overall, the option has been assessed as having a minor negative effect on Objective 12.

Manchester and Pennine Resilience Options

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
3: Manchester and Pennine Aqueduct to Raw: 2 Stage filtration (Bury)	Construction	-	-	0	0	--	--	--	++/--	0	--	0	-
	Operation	0	0	0	0	-	-	++	++	0	-	0	-

Construction

This option would involve the development of a new 2 stage filtration Water Treatment Works (WTW) at an existing site in the Bury area in order to provide increased resilience. In conjunction with Options 212, 213, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. In addition to the new WTW, the scheme would require new abstraction/ pumping from a Bulk Supply Point (BSP) to the new WTW, pumping from the new WTW to an existing treated water storage facility, and the demolition of the existing connection mains.

The works involved in the option would not affect any European conservation sites due to the lack of impact pathways; the closest designated conservation area is the South Pennine Moors (Phase 2) SPA (over 10km). Similarly, Lower Red Lees Pasture SSSI (circa 6km) and Rochdale Canal SSSI (circa 6km) are also located at a considerable distance from the existing WTW/treated water storage site such that it is highly unlikely construction and implementation of ancillary works would generate adverse effects. Although there is a possibility that demolition of the existing pipeline connections between the Manchester and Pennine Aqueduct and treated water storage site may be within proximity to these SSSIs and other ecological receptors (route currently unknown), it is expected that site-level mitigation and best practice would be enforced due to the required scale of the works. The development of the new WTW (6 ha) and new on-site pipelines would require a considerable scale of construction within greenfield land which could result in localised disturbances to proximate habitats and associated wildlife including a nearby LNR. It is not expected that the uncertainty regarding the finalised location of the WTW will exacerbate potential effects given that construction would remain within the general of area of the existing reservoir site and taking into account the anticipated utilisation of mitigation measures, irrespective of definitive siting. Overall, the development of the new WTW and implementation of ancillary works are expected to have temporary localised impacts of proximate habitats and species, resulting in a minor negative effect on biodiversity (SEA Objective 1).

The development of the new WTW would require land take (6 ha) including Grade 3 agricultural land. In consequence, this option has been assessed as having a minor negative effect on land use and soils (SEA Objective 2).

Works are expected to be in close proximity to two watercourses. It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented to avoid contamination of nearby watercourses (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3) during construction.

The existing WTW/treated water storage site is situated within Flood Zone 1 thus it is highly unlikely that the development of the new WTW would be liable to flooding whereas the implementation of ancillary works is expected to avoid any potential flood risks through scheduling and timing of required works. The overall construction of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future. Overall, the option has been assessed as having a neutral effect on flood risk (SEA Objective 4).

The option would require 48,447 HGV movements over a 1.9 year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movements and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network (particularly the nearby motorway and B roads) which could increase associated emissions. It is also noted that the scheme is in close proximity to the Greater Manchester AQMA. Overall, the option has been assessed as having a significant negative effect on air quality (SEA Objective 5).

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option is estimated to generate 45,937 tonnes CO_2e during construction. Similarly, this option would comprise several infrastructure components including a new water treatment works, new pipelines, and new ancillary equipment, e.g. abstraction points and pumping stations, which would require a large volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase (45,937 tCO_2e) as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which may include excavation waste, demolition debris, and infrastructural waste (original water treatment work equipment). Consequently, this option has been assessed as having a significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity; however, individual components may result in the temporary disruption of use and amenity of recreation within the general vicinity of the scheme. As previously noted, the general site of the new WTW would be close to residential areas which, depending on the finalised location, could generate adverse effects (noise/vibration and adverse air quality impacts) on human health across the two year construction period, depending on the sensitivity of proximate residential receptors. Construction of the new WTW could particularly affect a nearby care facility due to the vulnerability/sensitivity of its patients. The use of residential roads would also be required for access to the site from the motorway which is within an AQMA. Ancillary works, e.g. demolition together with the transportation of material/equipment on the local road network, may result in personal discomfort (stress) to receptors from noise disturbance and/or decreases in mobility associated with vehicle movements. Notwithstanding this, works would be temporary and associated effects are expected to be felt in the short term only. Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a significant negative effect on human health (SEA Objective 7) at this stage.

The construction of the option would represent a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as a transportation corridor for HGV movements (48,447) during the implementation period in addition to ancillary works may result in disruption to the road network with associated detrimental effects on the well-being of the local community; this is particularly pertinent given the relatively poor accessibility of the site. Overall, the option has been assessed as having a mixed significant positive and significant negative effect on economic and social wellbeing (SEA Objective 8) at this stage.

The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There are several designated cultural heritage assets within the general area of the WTW/treated water storage site; a Scheduled Monument at around 3km and four Grade II listed buildings within 500-800m. It is considered unlikely that development of the new WTW would result in any adverse effects on the Scheduled Monument's or the listed buildings' structural integrity or settings due to the relative distance together with the confined nature of construction with the established operational site. Although it is currently unknown whether the proposed works would be in proximity to other heritage assets, it is expected that mitigation measures would help prevent any significantly adverse effects on the structural integrity of those assets under 100m whereas the remaining assets (>100m) may experience a minor temporary loss of visual amenity regarding their settings. In general, a natural buffer (woodland) and the surrounding urban form are expected to mitigate the majority of potential adverse effects from construction which, on balance, have been assessed as having a neutral effect on historic and cultural assets (SEA Objective 11).

The proposed scheme is not within or proximate to any designated landscape areas; the Peak District National Park is circa 20km from the existing site. Construction of the new WTW within an urban greenfield setting may be perceived by proximate residential receptors as resulting in a loss of landscape character and visual amenity. The scale of construction associated with ancillary works is expected to be minor thus implementation is not expected to generate any adverse impacts on the setting/landscape beyond temporary intensification of material storage/equipment at designated sites. It should also be noted that the predicted increase in vehicle movements during the implementation period may result in minor temporary residual effects on the visual amenity of receptors situated along transport corridors. Overall, this option has been assessed as having a minor negative effect on landscape (SEA Objective 12) during construction.

Operation

It is assumed that the operation of the scheme, the direct abstraction of raw water, would remain within the licensed abstraction limit. Consequently, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites (South Pennine Moors Phase 2 SPA) or associated biodiversity, e.g. rivers and any SSSI tributaries. Because the transfer and treatment of raw water would occur within a closed regulatory network incorporating an existing reservoir, the Manchester and Pennine Aqueduct, and the new WTW, it is considered highly unlikely that there would be any impact pathways to conservation sites (SSSIs) or local habitats and wildlife. There would be an operational loss of greenfield land due to the newly constructed WTW; however, it is expected that a combination of mitigation measures within the construction/operational stages will minimise any potentially adverse effects whereas disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife due to habitat loss in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil have been assessed as neutral (SEA Objective 2).

Any impacts on the status of the surface water bodies (an existing reservoir) are likely to be temporary, if not negligible, due to the presumed availability of water as operation would not increase abstraction beyond the existing licence. Consequently, the continued abstraction and treatment of a maximum 450 Ml/d would have a neutral effect on SEA Objective 3.

The new WTW would be situated within Flood Zone 1 thus it is highly unlikely that operation would be liable to flooding nor would the utilisation of ancillary equipment within the proposed scheme. The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be notable, and in this respect, the option would generate 9,100 HGV movement per year. In consequence, the option has been assessed as having a minor negative effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 103 kWh/Ml) and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements (9,100) would also contribute to emissions. Operational emissions would subsequently be 789 tonnes CO_2e/a. Notwithstanding this, increased operation at the site would occur in tandem with decreased operation at another WTW which may counter-balance carbon emissions. Overall, net operational greenhouse gas emissions are expected to be notable and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts. The abstraction and treatment of 450 Ml/d from the existing reservoir would continue to be supported as it is assumed that there would be no deviation from the present operational licence. Because significant reductions in flow are unlikely, impacts on surface water (the reservoir) would be negligible. Consequently, it is considered highly unlikely that operation would adversely affect recreational activities. As stated, the option has a design capacity of 450 Ml/d, serving to increase resilience and maintaining supplies to customers. The option has therefore been assessed as having a significant positive effect on health (SEA Objective 7).

As noted above (under SEA Objective 7), the abstraction and treatment of 450 Ml/d from the existing reservoir would continue to be supported as it is assumed that there is no deviation from the present operational licence. Because significant reductions in flow are unlikely, impacts on surface water (reservoir) would be negligible. Consequently, it is considered highly unlikely that operation would adversely affect recreational activities. The option has a design capacity of 450 Ml/d serving to increase resilience which may support economic and population growth in the region. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as significantly positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

The operation of this option would require additional resources such as chemicals used in the treatment of raw water. The treatment and pumping of water would also result in a long-term increase in energy use (operation energy usage is estimated to be approximately 103 KWh/Ml) though operation would occur in tandem with decreased resource expenditure at a separate WTW which may offset increased resource use. The treatment of water would generate waste (e.g. sludge), although quantities are uncertain at this stage. Overall, the operation of this option has been assessed as having a negative effect on resource use (SEA Objective 10).

It is considered highly unlikely that operation of the new WTW and ancillary infrastructure would adversely impact heritage assets within their general vicinity. The closest Scheduled Monument is located at a distance of approximately 3km whereas the four most proximate Grade II listed buildings are circa 500-800m. In general, a natural buffer (woodland) and the surrounding urban form are expected to offset the majority of intervening vantage points looking on to the new development which, on balance, has been assessed as having a neutral effect on historic and cultural assets (SEA Objective 11).

The new WTW is not within or proximate to any designated landscape area (the Peak District National Park is at circa 20km). The substantial size of the new facility within an urban greenfield setting in addition to intensifying the use of the site may be perceived by proximate residential receptors as generating a loss of landscape character and visual amenity. It should also be noted that the predicted

vehicle movements during the operational period may result in minor residual effects on the visual amenity of receptors situated along transport corridors. Overall, this option has been assessed as having a minor negative effect on landscape (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
037-038: Manchester and Pennine Aqueduct section T05 to T06	Construction	-	0	-/?	-	--	--	-	++/-	0	--	0	0
	Operation	0	0	-/?	0	0	0	++	++	0	0	0	0

Construction

This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 19.3km, and new connection chambers and isolating penstocks.

The proposed tunnel route will not affect any European conservation sites and does not traverse any statutory or non-statutory nature conservation designations. The route lies approximately 5km from a number of national and local designated sites: West Pennine Moors SSSI, Hodge Clough SSSI, Lower Red Lees Pasture SSSI, and is close to an LNR. The scale of excavation and ancillary works could generate adverse effects on the designated ecological receptors; however impact pathways are limited and if best practice and mitigation measures are used during construction e.g. pipeline re-routing to minimise or prevent adverse effects/timing of development to protect ecological features, the disturbance to habitats and species is likely to be minor and short-term and consequently, this option has been assessed as having a minor negative effect on SEA Objective 1.

In general, the proposed scheme would be situated within Grades 3/4/5 agricultural land such that development should not significantly affect agricultural potential. This option would not require permanent land take with excavated land being reinstated following the construction phase. Overall, this option has been assessed as having a neutral effect on land and soil (SEA Objective 2).

The WFD assessment notes that there is potential from dewatering arising from the construction of the tunnel and shafts which may affect groundwater levels and flows, which could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, the WFD assessment highlights that a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) may protect surface water bodies from impacts arising from changes in the groundwater regime. During construction, the proposed pipeline route (pipe bridge and conduit section) would cross a number of surface water bodies which poses the risk of direct or residual pollution/debris entering the water network. It is assumed, however, that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). Overall, the option has been assessed as having a negative effect on water quality and quantity (SEA Objective 3) at this stage, although some uncertainty remains.

The scheme would involve waterbody crossings (Flood Zone 2/3) and in consequence, construction activity may be liable to flooding (depending on timing); however, the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, the option has been assessed as having a negative effect on (SEA Objective 4).

The option would require some 105,000 HGV movements over a 2.6-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movement and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network (motorways, A roads and connecting lower classifications of road) which could increase associated emissions. Overall, the option is considered as likely to have a significant negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 213,391 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new pipelines and new ancillary equipment which would require a very substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris (soil/rock) and infrastructural waste (although this would be reused/recycled). Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed tunnel would be located in a predominantly rural area. The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity, however, individual components may result in the temporary disruption of use and amenity of recreation within the general vicinity of the scheme. As previously noted, the excavation would also cross surface water bodies which could adversely impact recreational river users. There may also be temporary noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors in the vicinity of the proposed route. An outage of the Manchester and Pennine Aqueduct will be required in order to facilitate development. Notwithstanding this, works would be temporary and associated effects are expected to be felt in the short term only. Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as a transportation corridor for HGV movements (approximately 105,000) during the implementation period, in addition to road crossings, may result in congestion and localised travel disruption, although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There are a number of grade II listed buildings within 200m of the proposed route of the tunnel route. It is assumed that a combination of scheme specific mitigation measures and established best practice will prevent adverse structural effects and because the option will be for below ground infrastructure, it is considered construction of the tunnel would not adversely affect these heritage assets. Overall, this option has been assessed as having a neutral effect on historic and cultural assets (SEA Objective 11).

The tunnel route does not traverse any designated landscapes, the nearest being the Forest of Bowland AONB which lies over 5km distant. The landscape and visual impacts associated with construction of the tunnel route would be minor and temporary and consequently, this option has been assessed as having a neutral effect on SEA Objective 12.

Operation

It is assumed that the operation of the scheme, which includes the direct abstraction of raw water from a reservoir, would remain within the licensed abstraction limit. Consequently, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

There will not be any impacts on the status of the surface water bodies (reservoir) due to the presumed availability of water, and because operation would not involve increased abstraction beyond any or all relevant licences. The WFD assessment notes that as the tunnel will be constructed within the saturated zone of the aquifer, the presence of a low permeability linear structure may alter groundwater flows and levels, particularly where the tunnel is shallower and within the zone of active groundwater flow which may affect surface water. However, as noted above, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further studies may indicate that lower permeability strata

(e.g. mudstones) and superficial deposits (e.g. glacial till) may protect surface water bodies from impacts arising from changes in the groundwater regime. Overall, this option has been assessed as having a negative effect on SEA Objective 3 at this stage, although some uncertainty remains.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would not generate any HGV movements once operational. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation this option would not involve the additional pumping of water and it is not anticipated that there would be any effects on energy use. As already noted, it is not anticipated that there would be any operational vehicle movements, and so operational carbon emissions are anticipated to be negligible. Consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option would serve to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as a significant positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

No additional storing and pumping of water is associated with this option and so there is no change in current operational energy use which has been assessed as having a neutral effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

Operation of the new tunnel would not impact on the local landscape or visual amenity (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
037-042: Manchester and Pennine Aqueduct sections T01 to T06	Construction	-	-	-/?	-	--	--	-	++/-	0	--	0	-
	Operation	0	0	-/?	0	0	0	++	++	0	0	0	0

Construction

This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.

The proposed route for the six tunnels would cross an SPA/SSSI for a distance of approximately 6.6km. However, it is understood that this section would be completed with non-invasive tunnelling or drilling techniques, with any receptor pits (etc.) sited outside the SPA/SSSI boundary, and so effects on the SPA/SSSI as a result of construction are unlikely (assuming all normal best-practice). The HRA highlights that there is a theoretical risk of groundwater bodies being affected by the pipeline, which may then have indirect effects on any groundwater dependent ecosystems that may be associated with European sites, although provisional geological investigations have indicated that this risk is minimal due to the dominance of low-permeability geological formations and the depth of the pipeline. In addition, any potential effects can be avoided through pipeline design to prevent water ingress. A SAC is also circa 600m from the proposed works, although the HRA notes that effects are likely to be avoidable with normal best-practice. There is a potential for construction work to impact further designated sites as the tunnels would be within approximately 5km of the Burns Beck Moss SSSI, Fair Holme Meadow SSSI, Roeburndale Woods SSSI, Myttons Meadows SSSI, Bell Sykes Meadows SSSI, West Pennine Moors SSSI, Hodge Clough SSSI, Lower Red Lees Pasture SSSI, Langcliff Cross Meadow SSSI and close to an LNR and SAC and several Local Wildlife Sites and ancient woodlands. The scale of excavation and ancillary works could generate adverse effects on the designated ecological receptors, however, impact pathways are limited for these sites and if best practice and mitigation measures are used during construction, the disturbance to habitats and species is likely to be minor and short-term. Overall, this option has been assessed as having a negative effect on SEA Objective 1.

This option would not require permanent land take with excavated land being reinstated following the construction phase. In general, the proposed scheme would be situated within Grades 3/4/5 agricultural land such that development should not significantly affect agricultural potential; however, the proposed overall tunnel length is substantial. Overall, given the length of the tunnels, this option has been assessed as having a minor negative effect on land and soil (SEA Objective 2).

The WFD assessment notes that there is potential from dewatering arising from the construction of the tunnel and shafts which may affect groundwater levels and flows, which could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, the WFD assessment highlights that a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) may protect surface water bodies from impacts arising from changes in the groundwater regime. During construction, the proposed pipeline routes would cross a number of surface water bodies. A pipe bridge would be required to cross two brooks and one conduit section would cross a larger water body which poses the risk of direct or residual pollution/debris entering the water network. It is assumed, however, that construction activities would be undertaken in accordance

with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). Overall, the option has been assessed as having a negative effect on water quality and quantity (SEA Objective 3) at this stage, although some uncertainty remains.

The scheme would involve waterbody crossings (Flood Zone /3) and in consequence, construction activity may be liable to flooding (depending on timing); however, the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, the option has been assessed as having a negative effect on (SEA Objective 4).

The option would require some 496,000 HGV movements over a 6-year construction period (albeit over a large area) which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movements and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network (motorways, A roads and connecting lower classifications of road) which could increase associated emissions. Overall, given the scale and duration of the option, it is considered as likely to have a significant negative effect on local air quality, SEA Objective 5, although it is recognised that works would take place over a large area.

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 954,011 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new pipelines and new ancillary equipment which would require a very substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris (soil/rock) and infrastructural waste, although this would be reused/recycled. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The six proposed tunnels would be located within rural and urban areas. The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity, however, individual components may result in the temporary disruption of use and amenity of recreation within the general vicinity of the scheme. As previously noted, the excavation would also cross surface water bodies, which could adversely impact recreational river users. There may also be temporary noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors in the vicinity of the proposed route. An outage of the Manchester and Pennine Aqueduct will be required in order to facilitate development. Notwithstanding this, works would be temporary, dispersed over a large area and associated effects are expected to be felt in the short term only. Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as a transportation corridor for HGV movements (approximately 496,000) during the implementation period, in addition to road crossings, may result in congestion and localised travel disruption within the road network although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There are approximately six grade II listed buildings within the vicinity of the tunnels. The tunnels will also be located approximately 500m from a Scheduled Monument. Given the distance from these features and because the option will be for below ground infrastructure, it is considered construction of the tunnels would not adversely affect these heritage assets.

The route of the tunnels would traverse part of the Yorkshire Dales National Park and the Forest of Bowland AONB. However, as such works would be largely at depth, the landscape and visual impacts associated with tunnel works would be minor and temporary, this option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

It is assumed that the operation of the scheme, which includes the direct abstraction of raw water from an existing reservoir, would remain within the licensed abstraction limit. Consequently, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impacts on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The WFD assessment notes that as the tunnel will be constructed within the saturated zone of the aquifer, the presence of a low permeability linear structure may alter groundwater flows and levels, particularly where the tunnel is shallower and within the zone of active groundwater flow which may affect surface water. However, as noted above, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g.

mudstones) and superficial deposits (e.g. glacial till) may protect surface water bodies from impacts arising from changes in the groundwater regime. Overall, this option has been assessed as having a negative effect on SEA Objective 3 at this stage, although some uncertainty remains.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would not generate any HGV movements once operational. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 350,223 KWh/a) and associated emissions. Operational emissions would, however, be negligible (12.3 tonnes CO_2e/a). Overall, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option would increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as a significant positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

Operation of the new tunnels would not impact on the local landscape or visual amenity (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
046: WELM Uprate to 150Ml/day	Construction	0	0	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	0

Construction

This option would provide additional connectivity for treated water. It would involve the construction of a 3.1Ml break tank and intermediate pumping facilities to enable the transfer of 150 Ml/d.

The proposed infrastructure and ancillary components would not be directly situated within any sites designated for nature conservation. The closest designated sites are three LNR's all of which are within approximately 2km of the site. There are no SPAs or SACs within vicinity of the site. Due to the nature of the construction works proposed, the option may generate temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) though the magnitude of effect would be minor. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The site is limited in scale and is classified as Grade 4 agricultural land, which is not best and most versatile land. As such this option has been assessed as having a negligible effect on SEA Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes no impacts during construction on water bodies. In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3) during construction.

The construction site would be within land categorised as Flood Zone 1 and in consequence the construction of the scheme is not expected to be at risk of flooding or to cause or exacerbate flooding elsewhere now or into the future, thus having a neutral effect on flood risk (SEA Objective 4).

The option would require some 1,700 HGV movements over a 1.5-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Increased vehicle movements and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion. This may adversely affect a nearby residential area, however it should be noted that there access is available to A roads close to the site. Overall, given the scale and duration of the option, it is considered as likely to have a negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 1,296 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new treatment works, pipelines and new ancillary equipment which would require a substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy,

material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed works may result in a temporary disruption of use or loss of amenity of a footpath close to the site. The cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material may adversely affect the amenity of occupiers of dwellings to the south and east of the site. They may experience minor temporary effects due to their proximity to the proposed construction scheme, although it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 1,700) during the implementation period in addition to ancillary works may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. The magnitude of any localised effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a significant positive effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There are no historic assets in the area that would be affected by this option and as such a negligible effect on SEA Objective 11.

The site is approximately 500m from any motorways and A roads. In the vicinity of the site are; an area of open space, residential dwellings, light industrial areas, an existing WTW and a major A road. The site is not considered to be in a sensitive landscape. However, views from local footpaths may be adversely affected, as well as views from residential properties. Overall, the option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

The operation of this option would not result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impacts on land use/soils are expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The operation of the option is not anticipated to affect the qualitative and quantitative water status of water bodies. In consequence, the effects of the option have been assessed as being neutral on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would generate no HGV movements per year. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

This option would not involve any treatment of water, and additional pumping would only be required infrequently when the Manchester and Pennine Aqueduct is out of service or has failed; consequently, it is not expected that operation would result in a notable increase in energy use. No operational vehicle movements or ongoing emissions of CO_2e/a are anticipated. Overall, this option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option serves to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).
As noted above, there is no treatment of water or ongoing additional pumping associated with this option (additional pumping would only be required when the Manchester and Pennine Aqueduct is out of service or has failed) and so there is no increase in current operational energy use which has been assessed as having a neutral effect on resource use (SEA Objective 10).
There would be no operational effects on designated cultural heritage assets (SEA Objective 11).
There would be no operational effects of the option on designated landscapes, although it is noted that there would be some above ground infrastructure. However, overall, given its scale, the existing urban form and the use of screening as appropriate, it is considered that overall there will be a neutral effect on the local landscape or visual amenity (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
112: Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	Operation	0	0	0	0	0	-	+	+	0	-	0	0

Construction

This option would involve implementing Manchester and Pennine Aqueduct outage for a period of 4 weeks to facilitate the installation of connections. There would be no new development associated with the option.

Operation

The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, effects on SEA Objectives 1, 2, 3, 4, 5, 9, 11 and 12 are not anticipated.

During outage, there would be a reduction in energy and resource use required to treat water at an existing WTW but an increase in energy use at 39 other WTWs due to an increased production requirement to meet the flow deficit caused by the Manchester and Pennine Aqueduct outage. This would generate carbon emissions of 1,518 tCO_2e. Overall, this option has been assessed as having a minor negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

As part of Solutions B and D, this option would support the construction of new tunnel sections along the Manchester and Pennine Aqueduct, enhancing its resilience. This would help to ensure a continual supply of clean drinking water, generating a positive effect on health. The option would also contribute towards supporting economic/population growth which could result in a positive effect on the local economy and social wellbeing.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
212: Manchester and Pennine Aqueduct to Raw (Newton-in-Bowland)	Construction	-	-	0	0/?	-	--	0	++	0	--	0	--
	Operation	0	0	0	0/?	-	-	++	++	0	-	0	--

Construction

Under this option, raw water would be taken directly from the Manchester and Pennine Aqueduct (without treatment) for treatment at a new WTW in the Newton-in-Bowland area. In conjunction with Options 3, 213, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.

The option would involve the construction of a new 2 stage filtration WTW together with a new connection from the Aqueduct to the WTW and pumped supply to an existing aqueduct. The new WTW is expected to treat an average of 41 Ml/d, with a maximum treatment capacity of 60 Ml/d.

The option is not located within or near any statutory or non-statutory sites designated for nature conservation. While the exact location of the new WTW is yet to be determined, there is a river approximately 200m distant from the development site so construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.). However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. There is an area of Ancient and Semi-Natural Woodland approximately 500m from the site; however, this is not expected to be affected by construction. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land of approximately 2 hectares. A short distance (460m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The option is located in Flood Zone 1 (low risk of flooding); however, the extent of the proposed site may enter areas of Flood Zones 2 and 3, which may be at risk of flooding depending on the final location and layout of the WTW and associated pipework. Construction activity would be unlikely to result in increased flood risk elsewhere. The option has been assessed as having a neutral effect on SEA Objective 4, with some uncertainty depending on final infrastructure location.

The 9,175 vehicle movements during the 1.8-year construction period, together with emissions associated with the use of plant and machinery, are expected to cause minor deterioration of air quality. The option is in a rural location and access through small villages and minor roads may also generate traffic congestion with effects on local air quality. This has been assessed as a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of on-site plant would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 8,275 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activities could result in temporary noise/vibration disturbance and air quality impacts, however, the area surrounding the development site is very sparsely populated with few nearby receptors. The closest receptors are circa 100m-200m from the site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve substantial capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 9,175) during the implementation period in addition to ancillary works may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. The magnitude of any localised effects are likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are 17 Grade II and II* listed buildings within 1km of the development site. The closest assets to the proposed site are two Grade II listed buildings located within 700m of the site. No effects on these heritage assets or their settings are predicted and a neutral effect has therefore been identified for SEA Objective 11.

The development site is located within the Forest of Bowland AONB. Construction could therefore have a temporary but significant adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors may be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Operation

The operation of this option would involve the transfer of water from the Manchester and Pennine Aqueduct to an existing aqueduct, with water treatment at a new WTW. This process would require the discharge of treated waste water to a nearby river. It is expected that risks would be controlled through standard environmental permitting processes, such that the discharge would not affect local ecology. Further, there would be no new/additional abstraction associated with this option. Overall, the option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on land use/soils.

The treated water would be transferred to an existing aqueduct, while waste water would be discharged to a nearby river. The waste water would be treated prior to discharge and controlled under the environmental permitting regime. Further, there would be no new/additional abstraction associated with this option. Overall, effects on water quantity/quality are not anticipated.

The option is located in Flood Zone 1 (low risk of flooding); however, the final extent of the WTW infrastructure is not yet certain and may enter the adjacent Flood Zones 2 and 3, which would be at risk of flooding. The option has been assessed as having a neutral effect on SEA Objective 4 at this stage, with some uncertainty depending on final infrastructure location.

Operational emissions to air are expected to be notable, and in this respect, the option would generate 9,100 HGV movement per year. In consequence, the option has been assessed as having a minor negative effect on air quality (SEA Objective 5).

It is estimated that 325 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 145 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be notable and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

The treatment capacity of this option would be up to 60 Ml/d (with an average treatment of 41 Ml/d) and in conjunction with Options 3, 213, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. This would help ensure a continual supply of clean drinking water, generating a

significant positive effect on health. The option would also contribute towards supporting economic/population growth which could result in a significant positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would result in new above-ground infrastructure located in the Forest of Bowland AONB. This has the potential for significant adverse effects on local landscape character and visual amenity which has been assessed as a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
213: Manchester and Pennine Aqueduct to Raw (Clayton-le-Moors)	Construction	-	-	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	-	++	++	0	-	0	-

Construction

Under this option, raw water would be taken directly from the Manchester and Pennine Aqueduct (without treatment) for treatment at a new WTW in the Clayton-le-Moors area. In conjunction with Options 3, 212, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.

The option would involve the construction of a new 2 stage filtration WTW together with a new connection from the Manchester and Pennine Aqueduct to the WTW inlet, a pumping station and circa 2.8km pipeline from the WTW to two BSPs.

The option is not located within any statutory or non-statutory sites designated for nature conservation. A canal is located circa 500m from the proposed WTW site and there are areas of Ancient and Semi-Natural Woodland/Local Wildlife Sites over 700m from the site, which are not expected to be significantly affected by construction. Approximately 2.5km of new pipeline would be required to connect the WTW to a BSP. This would not affect any designated sites. The pipeline route crosses the canal in the same location as the existing Manchester and Pennine Aqueduct, and it is assumed that the new pipeline would cross above the canal in the same manner as the Manchester and Pennine Aqueduct, although this is not certain. Construction activities adjacent to the canal have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species. However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. The new WTW would be located on greenfield land adjacent to an existing site, and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has been identified with respect to SEA Objective 1.

Most of the pipeline route would cross areas of open land, while short sections would pass through industrial and suburban areas. It is expected that this would not require permanent land take with excavated land being reinstated following the construction phase. The WTW would be located adjacent to an existing site and would require of approximately 2 hectares of greenfield land. A minor negative effect on SEA Objective 2 has therefore been determined.

Construction of the pipeline crossing the canal (assumed to be over the canal) has the potential for detrimental effects on water quality if pollutants are released into surface waters. As construction is not expected to take place within the canal itself, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. Construction of this option is therefore not expected to affect water quality or river flows/groundwater levels (SEA Objective 3).

The development site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The development site is situated close to a motorway and main A road, and impacts on air quality associated with traffic congestion are therefore expected to be limited due to good access from the main road network. Receptors adjacent to the WTW site and pipeline route may, however, be exposed to minor deterioration of air quality due to the estimated 11,391 vehicle movements during the 1.9-year construction period, together with emissions associated with the use of plant and machinery. This has been assessed as a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 10,779 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts. The area surrounding the proposed WTW is sparsely populated with very few nearby receptors; however, for the nearby properties the works could cause notable increased nuisance. A section of the proposed pipeline route runs through a residential area and works may therefore cause nuisance during construction. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve substantial capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 11,391) during the implementation period in addition to ancillary works may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. A short section of the proposed pipeline route passes through a residential area; however, the short distance involved means that any traffic impacts are expected to be extremely minor and temporary. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

The option would predominantly require new infrastructure. It is possible that the existing UV treatment at a nearby site may be used, but this is not currently certain and a new UV treatment facility may be required. Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are four Grade II listed buildings within 1km of the WTW site the two closest of which are within 150m. A further seven listed buildings are located between 500m and 1km of the pipeline route. No effects on these heritage assets or their settings are predicted and a neutral effect has therefore been identified for SEA Objective 11.

This option would not be located within a designated landscape. The WTW site is located in a predominantly rural area with a small number of receptors adjacent to the site, and construction may therefore have short term, temporary negative landscape and visual impacts. This option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

Operation of the option would involve the transfer of water from the Manchester and Pennine Aqueduct to two BSPs, with water treatment at a new/upgraded WTW. This process would require the discharge of treated waste water to nearby foul sewer and water would not be returned to local waterbodies. No new/additional abstraction would be required. As a result, effects on biodiversity are not anticipated.

There would be no operational effects on land use/soils.

The treated water would not enter waterbodies as it would be transferred to two BSPs, while waste water would be discharged to foul sewers. Further, no new/additional abstraction would be required. A neutral effect on water quantity/quality, SEA Objective 3, has therefore been determined.

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality, with operational vehicle movements of 780 vehicles per year (SEA Objective 5).

It is estimated that 184 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 317 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be notable and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

The treatment capacity associated with this option would be up to 50 Ml/d (with an average treatment of 33.5 Ml/d) and in conjunction with Options 3, 212, 214, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. This would help ensure a continual supply of clean drinking water, generating a significant positive effect on health. The option would also contribute towards supporting economic/population growth which could result in a significant positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The operational aboveground infrastructure includes a new WTW, which is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
214: Manchester and Pennine Aqueduct to Raw (Haslingden)	Construction	-	-	0	0/?	-	--	-	++	0	--	0	-
	Operation	0	0	0	0/?	0	0	++	++	0	0	0	-

Construction

Under this option, raw water would be taken directly from the Manchester and Pennine Aqueduct (without treatment) for treatment at a new WTW in the Haslingden area. In conjunction with Options 3, 212, 213, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.

The option would involve the construction of a new 2 stage filtration WTW together with new connections from the Manchester and Pennine Aqueduct to the WTW inlet and from the WTW to an existing pumping station.

The option is not located within or near any statutory or non-statutory sites designated for nature conservation. There is a river close to the proposed site, so construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.). However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of greenfield land. A short distance (230m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). (SEA Objective 3).

The option is located in Flood Zone 1 (low risk of flooding); however, the proposed site is adjacent to areas of Flood Zones 2 and 3, and works may therefore be at risk of flooding depending on the final location and layout of the WTW and associated pipework. Construction activity would be unlikely to result in increased flood risk elsewhere. The option has been assessed as having a neutral effect on SEA Objective 4 at this stage, with some uncertainty depending on final infrastructure location.

The proposed development site is situated close to two A roads, and impacts on air quality associated with traffic congestion are therefore expected to be limited due to good access from the main road network. Residential receptors may, however, be exposed to minor deterioration of air quality due to the estimated 8,865 vehicle movements during the 1.8-year construction period, together with emissions associated with the use of plant and machinery. This has been assessed as a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 6,137 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts on residential receptors close to the proposed WTW site; however, the number of receptors is likely to be small. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve a significant capital expenditure resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 8,865) during the implementation period in addition to ancillary works may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. The magnitude of any localised effects is likely to be lessened by the adoption of mitigation measures at the project level. The option has therefore been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

The option would predominantly require new infrastructure. It is possible that the existing UV treatment at a nearby site may be used, but this is not currently certain and a new UV treatment facility may be required. Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

The proposed WTW site is located approximately 200m from a Grade II listed structure, while pipework connecting to the pumping station would be 80m from the heritage asset. However, the works would be screened by trees/hedges and partially separated from the structure by an industrial unit. As a result, effects on the setting of the structure are not expected. A total of 11 further Grade II listed buildings are located within 1km of the site but are not expected to be affected by the works. Overall, the option has been assessed as having a neutral effect on SEA Objective 11.

This option would not be located within a designated landscape. The WTW site is located in a predominantly rural area with a small number of receptors adjacent to the site, and construction may therefore have short term, temporary negative landscape and visual impacts. This option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

The operation of the option would involve the transfer of water from the Manchester and Pennine Aqueduct to existing pumping stations, with water treatment at a new WTW. This process would require the discharge of treated waste water into a river. It is expected that risks would be controlled through standard environmental permitting processes, such that the discharge would not affect local ecology. Further, there would be no new/additional abstraction associated with this option. Overall, the option has been assessed as having a neutral effect on biodiversity.

There would be no operational effects on land use/soils.

Under this option, the treated water would be transferred to existing pumping stations, while waste water would be discharged to a river. The waste water would be treated prior to discharge and controlled under the environmental permitting regime such that effects on water quality are not anticipated. Further, there would be no new/additional abstraction associated with this option.

The option is located in Flood Zone 1 (low risk of flooding); however, the final extent of the WTW infrastructure is not yet certain and may enter the adjacent Flood Zones 2 and 3, which would be at risk of flooding. The option has been assessed as having a neutral effect on SEA Objective 4 at this stage, with some uncertainty depending on final infrastructure location.

There would be no operational effects on air quality.

It is estimated that 35 tonnes of CO_2e would be emitted per year during operation. The operational energy demand would be 105 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, emissions would be negligible and this option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

This option would deliver treatment capacity of up to 20 Ml/d (with an average treatment of 9 Ml/d) and in conjunction with Options 3, 212, 213, 301, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. This would help to ensure a continual supply of clean drinking water, generating a significant positive effect on health. The option would also contribute towards supporting economic/population growth which could result in a significant positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

The site is located in close proximity to a Grade II listed structure. However, as the new WTW is located on an existing site and is screened from the structure by trees/hedges there are not expected to be operational effects on this designated heritage asset. The operational above ground infrastructure includes a new WTW, which is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
215: Alternative Supply: Raw water transfer and WTW (Clayton-le-Moors)	Construction	0	-	0	-	-	--	-	++/-	0	--	-	-
	Operation	0/?	0	-	0	0	-	++/-	++	0	-	0	-

Construction

This option would provide additional raw water from the River Ribble (under a new abstraction licence) and additional water treatment capacity in the Clayton-le-Moors area. The option, in conjunction with Options 216, 217 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a new abstraction point, circa 9.1km of 800m main to a new 3 stage WTW and a pumping station.

The proposed infrastructure and ancillary components would not be directly situated within any sites designated for nature conservation. The pipeline passes near to a SSSI designated for its geological interest and as such the risk to the site is considered to be negligible. The site is not within 5km of a SPA or SAC with the nearest SPA being 12km from the proposed scheme. Due to the nature of the construction works proposed, the option may generate temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) though the magnitude of effect would be minor. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The proposed excavation routes would traverse through Grade 3 agricultural land to the north west and Grade 4 agricultural land to the south east with all excavated land reinstated following the construction period. The new WTW will be located adjacent to the existing BSP site, however, this is Grade 4 agricultural land. In general, it is anticipated that the proposed scheme would be situated such that development would not significantly affect agricultural potential; however, given the length of the main and the loss of Grade 3 land, this option has been assessed as having a minor negative effect on land and soil (SEA Objective 2).

It is not expected that the construction of this option would affect water quality or water resources, provided best practice is adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes no impacts during construction on water bodies. In consequence, the option has been assessed as having a neutral effect on water quality and quantity during construction (SEA Objective 3).

Segments of the proposed excavation route would be situated within Flood Zone 3; consequently, excavation would be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere. In consequence, the option has been assessed as having a negative effect on SEA Objective 4.

The option would require some 23,300 HGV movements over a 1.9-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movements and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion. This would be most noticeable on local access roads; however, it should

be noted that there is ready access to the A road network along the majority of the pipeline (particularly on segments of a nearby B road and residential roads overlaying or adjacent to the proposed pipeline route). Overall, given the scale and duration of the option, it is considered as likely to have a negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 28,406 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including treatment works modifications, pipelines and new ancillary equipment which would require a substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructure waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The option is not expected to significantly affect opportunities for recreation and physical activity during the construction period, however, the proposed works could result in a temporary disruption of use or loss of amenity for the various footpaths that cross the path of the proposed pipeline. Due to the rural setting of scheme, the cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material should not significantly affect the amenity of various dwellings, farmsteads and local residential settlements along the route. They may experience minor temporary effects due to their proximity to the proposed construction scheme. Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 23,300) during the implementation period in addition to ancillary works may result in congestion and localised travel disruption within the road network although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

There are 5 Scheduled Monuments and 34 listed buildings within 400m of the pipeline. This includes four Grade II* listed buildings and 5 Grade I listed buildings. A cluster of listed buildings, and 3 of the 5 Scheduled Monuments, are close by. There is one Scheduled Monument, 5 Grade II listed buildings and one Grade I listed building within 100m of the site. Although it is expected that mitigation measures during construction would help prevent any significantly adverse effect on the structural integrity of these assets, the proximity of construction to these buildings suggests that the temporary loss of visual amenity would remain a risk. The remaining listed buildings and Scheduled Monuments (>100m) may experience a minor loss of visual amenity regarding their settings though the route does benefit from scattered woodland and urban development which may screen visual impacts to heritage settings. Overall, this option has been assessed as having a minor negative effect on SEA Objective 11.

The pipeline is within 1km of the Forest of Bowland AONB. The construction of the new WTW would be adjacent to an existing site; however, the effect of construction could temporarily alter the landscape character of the local area. Consequently, works may be perceived by residents and recreational receptors as having an adverse effect on visual and landscape amenity of the area. Overall, the option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

The abstraction of up to 41 Ml/d from a river is not anticipated to result in any significant effects on European sites. The HRA identifies that the abstraction is over 30km upstream of two SPAs, and that significant effects would not be expected due to distance and natural attenuation. The river passes through a SAC 40km upstream of the proposed abstraction point which is too distant to be affected. Impacts on any other ecological receptors within the scheme's general vicinity are expected to be negligible. The option would include a new surface water abstraction from the river of a maximum of 41 Ml/d which could affect river flow and ecology. However, the ALS water is identified as available at all flows (Q30, Q50, Q70 and Q95). Consequently, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1) with some uncertainty.

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The option would include a new surface water abstraction from a river of a maximum of 41 Ml/d. In the ALS water is identified as available at all flows (Q30, Q50, Q70 and Q95); however, the abstraction is relatively large in size and could have a prolonged and/or widespread impact on the hydrological regime of the river. A new abstraction licence would be required to be issued by the Environment Agency. The effects of abstraction have been assessed as having a minor negative effect on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would generate a small number (780) of HGV movements per year. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 216 kWh/Ml) and associated emissions. There would also be embodied carbon in chemicals used to treat water. Operational vehicle movements (780) would also contribute to emissions. Operational emissions would subsequently be 153 tonnes CO_2e/a. Overall, operational greenhouse gas emissions are expected to be minor and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts. Abstraction of the scale proposed could affect recreational fishing at the river with consequential impacts on the health and wellbeing of associated receptors. The option has a design capacity of 41 Ml/d and would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. Taking into account the benefits of the option in terms of improved resilience and the potential for adverse impacts on recreation (fishing), the option has been assessed as having a mixed significant positive and minor negative effect on health (SEA Objective 7).

The option has a design capacity of 41 Ml/d serving to increase regional resilience which may support economic and population growth. Operation will also help to ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as a significant positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

As noted above, there is additional pumping and treatment of water associated with this option and so there is an increase in current operational energy use which has been assessed as having a negative effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

The operational aboveground infrastructure includes a new WTW, which is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
216: Alternative Supply: Raw water abstraction and WTW (Haslingden)	Construction	**0**	**0**	**0**	**0**	**-**	**--**	**-**	**++**	**0**	**--**	**-**	**-**
	Operation	**0/?**	**0**	**0/?**	**0**	**0**	**0**	**+**	**+**	**0**	**0**	**0**	**-**

Construction

This option would provide additional raw water from the River Irwell (under a new abstraction licence) and additional water treatment capacity in the Haslingden area. The option, in conjunction with Options 215, 217 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a new abstraction point and pumping station, circa 1.0km of 450mm main to a new 3 stage WTW and a new connection from the WTW to an existing BSP.

The proposed infrastructure and ancillary components would not be directly situated within any sites designated for nature conservation. The closest designated site is Hodge Clough SSSI over 3km to the distant and the closest SPA / SAC is more than 5km from the site with the South Pennine Moors SPA/SAC 14km from the proposed scheme. Due to the nature of the proposed construction works, the option may generate temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) though the magnitude of effect would be minor. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The site is limited in scale and classified as Grade 4 agricultural land, which is not 'best and most versatile land'. In general, it is anticipated that the proposed scheme would be situated such that development would not significantly affect agricultural potential. As such this option has been assessed as having a negligible effect on SEA Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes no impacts on water bodies during construction. In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3).

The site would be within land categorised as Flood Zone 1 and, in consequence, the construction of the scheme is not expected to be at risk of flooding or to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

The option would require some 6,500 HGV movements over a 1.8-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movement and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion. This may adversely affect a nearby road which is in a residential area,

however, it should be noted that there is ready access to main A road 830m from the site. Overall, given the scale and duration of the option, it is considered as likely to have a negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 6,137 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new treatment works, pipelines and new ancillary equipment which would require a substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed works are expected to result in a temporary disruption of use or loss of amenity for the various designated and undesignated footpaths that cross site, and reduce the site's amenity value as an area of open space. The cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material may adversely affect the amenity of the dwellings to the immediate south east of the site. It is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 6,500) during the implementation period, in addition to ancillary works, may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. The magnitude of any localised effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a significant positive effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

There are 4 listed buildings within 250m with the potential to be adversely affected by development of the site. These listed buildings may experience a minor loss of visual amenity regarding their settings as the site is currently open space. Overall, this option has been assessed as having a minor negative effect on SEA Objective 11.

The site is close to a heritage railway line and an existing WTW. There is also a main A road and a light industrial unit in the vicinity of the site. Therefore, the site is not considered to be in an area of high landscape sensitivity. However, views from local footpaths may be adversely affected. The construction of the new WTW would be adjacent to an existing site; however, construction may be perceived by residents and recreational receptors as disrupting views across the site and reducing amenity of the area. Overall, the option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

The abstraction of up to 5.1 Ml/d from the river is not expected to result in an adverse effect on any European designated site. The option would involve a new surface water abstraction of a maximum of 5.1 Ml/d which could affect river flow and ecology. In the ALS water is identified as available at all flows (Q30, Q50, Q70 and Q95). As the size of the abstraction is relatively small and there is water available, any impact on the hydrological regime of the river would be localised. Impacts on any other ecological receptors within the scheme's general vicinity are expected to be negligible. Consequently, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1) with some uncertainty.

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The option would include a new surface water abstraction from the nearby river of a maximum of 5.1 Ml/d, although in the ALS water is identified as available at all flows (Q30, Q50, Q70 and Q95). A new abstraction licence would be required to be issued by the Environment Agency. Overall, this option has been assessed as having a neutral effect on SEA Objective 3 at this stage, although some uncertainty remains.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would generate a small number (520) HGV movement per year. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 63 kWh/Ml) and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements (520) would also contribute to emissions. Operational emissions would subsequently be 16.5 tonnes CO_2e/a. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option has a design capacity of 5.1Ml/d and would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option has a design capacity of 5.1 Ml/d serving to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

As noted above, there is additional pumping and treatment of water associated with this option and so there is an increase in current operational energy use; however, is of a scale considered which has been assessed as having a neutral effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

The operational aboveground infrastructure includes a new WTW, which is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
217 Alternative Supply: Raw water transfer and WTW (Newton-in-Bowland)	Construction	-	0	0	-	-	--	-	++/-	0	--	-	--
	Operation	0	0	0	0	0	0	+	+	0	0	0	--

Construction

This option would provide additional raw water from an aqueduct and additional water treatment capacity in the Newton-in-Bowland area. The option, in conjunction with Options 215, 216 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a new connection to the raw water aqueduct, circa 5.3km of 700mm diameter pipeline to transfer water from the connection point and a new 3 stage WTW and pumping station.

The proposed infrastructure and ancillary components would not be directly situated within any sites designated for nature conservation. The closest designated site is the Bowland Fells SPA/SSSI, which is circa 350m distant. The North Pennine Dales Meadows SAC is approximately 3.5km from the treatment works. The HRA identifies that disturbance from construction may occur, although this can be mitigated with normal measures (e.g. avoiding construction near the Bowland Fells SPA during the bird breeding season). Due to the nature of the construction works proposed, the option may generate temporary localised effects on proximate habitats and wildlife due to noise disturbance and air quality impacts (dust), although the magnitude of effect would be minor. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts. Overall, this option has been assessed as having a negative effect on biodiversity (SEA Objective 1).

The site is limited in scale and classified as Grade 4 agricultural land, which is not categorised as 'best and most versatile land'. In general, it is anticipated that the proposed scheme would be situated such that development would not significantly affect agricultural potential. As such this option has been assessed as having a negligible effect on SEA Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes no impacts on water bodies during construction. In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3).

Sections of the proposed excavation route would be situated within Flood Zone 3; consequently, excavation could be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere. In consequence, it is assessed as having a negative effect on flood risk (SEA Objective 4).

The option would require some 16,000 HGV movements over a 1.9-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movements and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion. This may adversely affect the local road network. Overall, given the scale and duration of the option, it is considered as likely to have a negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 17,741 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new treatment works, pipelines and new ancillary equipment which would require a substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructure waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed works are expected to result in a temporary disruption of use or loss of amenity to two bridleways that the route of the pipeline would cross. The cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material may adversely affect the amenity of the dwellings along the route of the pipeline, however, as it is a rural area the total number of dwellings affected would be limited. It is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

Construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 16,000) during the implementation period in addition to ancillary works may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9).

There is one Grade II listed building in the immediate vicinity of the route of the pipeline which may experience a loss of visual amenity regarding its setting. There are two additional Grade II listed buildings, however, these heritage assets are over 300m from the proposed route and due to intervening built development and tree screening no effects are anticipated. Overall, this option has been assessed as having a minor negative effect on SEA Objective 11.

The option is within the Forest of Bowland AONB and construction of the new WTW would be on a greenfield site. The effect of construction works could temporarily affect the local landscape. Consequently, works may be perceived by residents and recreational receptors as having an adverse effect on visual and landscape amenity of the area. Overall, the option has been assessed as having a significant negative effect on SEA Objective 12 due to the construction activity within a designated landscape.

Operation

There is no additional abstraction associated with this option (although it does make use of water from an existing licensed abstraction. Focusing on the effects of this option, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The operation of the option is not anticipated to affect the qualitative and quantitative water status of water bodies. In consequence, the effects of the option have been assessed as being neutral on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would generate a small number (780) HGV movement per year. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 68 kWh/Ml) and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements (780) would also contribute to emissions. Operational emissions would subsequently be 43.3 tonnes CO_2e/a.

Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option serves to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

Operation of the option would involve new above ground infrastructure located in the Forest of Bowland AONB which has overall been assessed as having a significant negative effect on the local landscape or visual amenity of the area (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
218: Alternative Supply: Raw water transfer and WTW (Preston)	Construction	0	-/?	0	-	-	--	-	++/-	0	--	-	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	0

Construction

This option would redirect raw water from the River Wyre to additional water treatment capacity in the Preston area. The option, in conjunction with Options 215, 216 and 217, would provide additional abstraction/treatment facilities to facilitate Solution E. The option would require a connection to the raw water feed from the River Wyre and pumping from the connection point via circa 8.5km of 800mm main to a new 3 stage WTW. A new pumping station would also be constructed at the WTW site to feed water from the WTW into an existing aqueduct via circa 4.4km of 700mm pipeline.

The proposed infrastructure and ancillary components would not be directly situated within any sites designated for nature conservation. The closest designated site is Rough Hey Wood SSSI, over 1km from the pipeline at its closest point. The site is not within 5km of a SPA or SAC with Bowland Fells SPA being the closest European site at 7km from the proposed scheme. Due to the nature of the construction works proposed, the option may generate temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) though the magnitude of effect would be minor. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The option is within an area of grade 3 agricultural land. If assessed to be in the grade 3a agricultural land category it would be categorised as 'best and most versatile land'. As such this option has been assessed as having a minor negative/uncertain effect on SEA Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes no impacts during construction on water bodies. In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3) during construction.

Sections of the proposed excavation route would be situated within Flood Zone 3; consequently, excavation could be liable to flooding depending on the timing of works. The overall construction of the scheme, however, is not expected to cause or exacerbate flooding elsewhere. In consequence, it is assessed as having a negative effect on flood risk (SEA Objective 4).

The option would require some 23,460 HGV movements over a 1.9-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. The WTW have close access to A and B roads, which in turn have good access to the motorway. Increased vehicle movement and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion. Overall, given the scale and duration of the option, it is considered as likely to have a negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 27,756 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new treatment works, pipelines and new ancillary equipment which would require a substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed works are expected to result in a temporary disruption of use or loss of amenity for a number of footpaths and one bridleway that the route of the pipeline would cross. The cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material may adversely affect the amenity of the dwellings along the route of the pipeline, although it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

Construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 23,460) during the implementation period in addition to ancillary works may result in disruption of mobility within the road network although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There are five Scheduled Monuments and 10 Grade II listed buildings within 400m of the pipeline. However, it is not anticipated that these historic assets would be adversely affected. One listed building lies within 100m of the pipeline. Although it is expected that mitigation measures during construction would help prevent any significantly adverse effect on these assets, the proximity of construction to the structure suggests that the temporary loss of visual amenity would remain a risk. Overall, this option has been assessed as having a minor negative effect on SEA Objective 11.

The central area of the pipeline is approximately 3.5km from the Forest of Bowland AONB. The two WTW are existing sites outside of the AONB (both circa 3km from the AONB). Construction works could temporarily affect the local landscape; consequently, works may be perceived by residents and recreational receptors as having an adverse effect on visual and landscape amenity of the area. Overall, the option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

There is no additional abstraction associated with this option (although it does make use of water from an existing licensed abstraction). Focusing on the effects of this option, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The operation of the option is not anticipated to affect the qualitative and quantitative water status of water bodies. In consequence, the effects of the option have been assessed as being neutral on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would generate a small number (780) HGV movement per year. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 249kWh/Ml) and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements (780) would also contribute to emissions. Operational emissions would subsequently be 176 tonnes CO_2e/a. Overall, operational greenhouse gas emissions are expected to be minor and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option serves to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

As noted above, there is additional pumping and treatment of water associated with this option and so there is an increase in current operational energy use which has been assessed as having a negative effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

The operational aboveground infrastructure includes a new WTW, which is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
238: Metals & UV treatment of BSPs: Bury	Construction	**0**	**-/?**	**0**	**0**	**-**	**--**	**-**	**++**	**0**	**--**	**0**	**-**
	Operation	**0**	**0**	**0**	**0**	**-**	**-**	**+**	**+**	**0**	**-**	**0**	**-**

Construction

This option seeks to provide treatment of metals, cryptosporidium and/or E.Coli to the treated water which is being siphoned off the Manchester and Pennine Aqueduct. The option would require the construction of a new 2 stage WTW in the Bury area.

The proposed WTW would not be directly situated within any sites designated for nature conservation. The closest site designated for nature conservation is a LNR circa 300m from the site. There are no SPAs or SACs within 5km of the site with the South Pennine Moors SPA/SAC 18km from the proposed scheme. Due to the nature of the construction works proposed, the option may generate temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) though the magnitude of effect would be minor. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The option is expected to require an extension beyond the current WTW boundary at the site. This would be within an area of grade 3 agricultural land. If assessed to be grade 3a agricultural land this would be categorised as 'best and most versatile land'. As such this option has been assessed as having a minor negative/uncertain effect on SEA Objective 2.

It is not expected that the construction of this option would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes no impacts during construction on water bodies. In consequence, the option has been assessed as having a neutral effect on water quality and quantity during construction (SEA Objective 3).

The construction site would be within land categorised as Flood Zone 1 and in consequence the construction of the scheme is not expected to be at risk of flooding or to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

The option would require some 9,610 HGV movements over a 1.9-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Increased vehicle movement and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion. This may adversely affect traffic on local roads some of which are in residential areas, however, it should be noted that there is good access to the motorway from the site. Overall, given the scale and duration of the option, it is considered as likely to have a negative effect on local air quality, SEA Objective 5.

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 11,431 tCO_2e during construction. Similarly, this option would comprise a new treatment works which would require a substantial volume of raw

materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The cumulative impacts of noise/vibration disturbance and air quality impacts resulting from construction and the transportation of equipment/material may adversely affect the amenity of dwellings near to the site. They may experience minor temporary effects due to their proximity to the proposed construction scheme, although it is likely that impacts would be managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 9,610) during the implementation period in addition to ancillary works may result in congestion and localised travel disruption within the road network although any effects would be temporary and felt in the short term only. The magnitude of any effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a significant positive effect on economic and social wellbeing (SEA Objective 8).

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

There are no historic assets in the area that would be affected by this option and as such this is assessed as a neutral effect on SEA Objective 11.

The site is circa 250m from a motorway and residential properties, with further properties and open countryside beyond. The site itself is an existing WTW with covered reservoirs to the north; however, the upgrade works may require construction activity beyond the current operational boundary. Overall, a minor negative effect on SEA Objective 12 has been identified.

Operation

The operation of this option would not result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation of site in advance of the WTW construction would either be permanently lost or reinstated and thus it is highly unlikely that there would be any ongoing disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

The operation of the option is not anticipated to affect the qualitative and quantitative water status of water bodies. It relates to the treatment of water siphoned from the Manchester and Pennine Aqueduct, and sourced from a reservoir. This water body is assumed to be unaffected as operation would not increase abstraction beyond the existing licence. In consequence, the effects of the option have been assessed as being neutral on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be notable, and in this respect, the option would generate 9,100 HGV movement per year. In consequence, the option has been assessed as having a minor negative effect on air quality (SEA Objective 5).

During operation, this option would involve the treatment and pumping of water which would result in a long-term increase in energy use (approximately 134 KWh/Ml) and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements (9,100) would also contribute to emissions. Operational emissions would subsequently be 956.3 tonnes CO_2e/a. Overall, operational greenhouse gas emissions are expected to be notable and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option serves to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

As noted above, there is additional pumping and treatment of water associated with this option and so there is an increase in current operational energy use which has been assessed as having a negative effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

As noted above, the existing WTW site is circa 250m from a motorway and residential properties, with further properties and open countryside beyond. Whilst it is expected that some development under this option would be contained within the existing WTW site, new aboveground infrastructure may be required beyond the current operational boundary (although this is currently uncertain). In consequence, there is the potential for adverse impacts on the local landscape character and the visual amenity of nearby residential receptors. The option has therefore been assessed as having a negative effect on landscape (SEA Objective 12) at this stage, although some uncertainty remains.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
260: Ribblesdale South Well Isolation	Construction	-	-	0	0	0	--	-	0	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	0

Construction

This option would enable the isolation of the downstream section T05 for rehabilitation. It would require a new valve chamber constructed around existing siphon pipes in the Clitheroe area and a new valve house over the chamber. The option would also require a new access road.

This option will not affect any European conservation sites and does not traverse any statutory designations but does lie within an Ecological Network. Assuming best practice and mitigation measures are used during construction disturbance to habitats and species is likely to be minor and short-term and consequently, this option has been assessed as having a minor negative effect on SEA Objective 1.

Additional land would be required for the compound, car park, access track and valve house on an open semi-rural greenfield site. Consequently, this has been assessed as having a minor negative affect on SEA Objective 2.

Given the location of the proposed site, it is not expected that the option will affect any surface water bodies or water quality due to absence of pollutant pathways. Furthermore, it is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3) during construction.

The overall construction of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

The option would require an estimated 411 HGV movements over a 1.5-year construction period which, together with emissions to air from plant, given their scale will not have an effect on local air quality. Overall, given the scale and duration of the option, it is considered as likely to have a neutral effect on local air quality, SEA Objective 5.

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 4,522 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new pipelines, building materials and fencing and new ancillary equipment which would require a moderate volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed option would be located in an area used for recreation and physical activity, although the actually works will be concentrated on a small area. Access to the site is close to an existing track. Works would not directly affect the adjacent recreation areas but there may be temporary noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors in the vicinity of the proposed route. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve a moderate capital expenditure but this would not be significant in terms of the effect on the local economy. The number of vehicle movements are not expected to cause significant disruption or delay. Overall, the option has been assessed as having a neutral effect on SEA Objective 8.

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

There is one listed building located approximately 200m from the site. Due to the nature of the works and distance from this building no effects on cultural or historic assets are expected.

The site is not located within any protected landscape designations but is a semi-rural area. There may be minor and temporary adverse effects on the local landscape during construction. This option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

Once operational, this option would not have any effects on biodiversity and so is assessed as a neutral effect against SEA Objective 1.

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

There will not be any impacts on the status of the surface water bodies from the operation of the option and in consequently, the operation of the option would have a neutral effect on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, there are no vehicle movement expected once the option is operation. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

This option would not involve any additional pumping or treatment of water; consequently, it is not expected that operation would result in an increase in energy use. No operational vehicle movements are anticipated and so no additional CO_2e are anticipated. This option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or adverse air quality impacts nor should it have any discernible impacts on proximate recreational activities. Increasing resilience of supply has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option will also increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

The option would not have any effects on operational energy usage or waste arisings. Consequently, this option has been assessed as having a neutral effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

The operational above ground infrastructure, which includes a valve house building with gantry overhead, fencing and car parking, is anticipated to lead to a minor change in the very localised landscape. Overall, operation of the option would not impact on the local landscape or visual amenity (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
261: Haslingden Well Isolation	Construction	-	-	0	0	0	--	-	0	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	0

Construction

This option would enable the isolation of the downstream section T06 for rehabilitation. It would require a new 12.5mID shaft on an existing 2.59mID conduit in the Haslingden area with two isolating penstocks and provision for downstream tunnel access. The option would also require a new control kiosk and access road.

This option will not affect any European conservation sites and does not traverse any statutory designations but will be within 5km of Hodge Clough (SSSI) and West Pennine Moors (SSSI). The works will be located on a greenfield site on the urban fringes of the town. Assuming best practice and site based mitigation measures are used during construction, any disturbance to habitats and species is likely to be minor and short-term and consequently, this option has been assessed as having a minor negative effect on SEA Objective 1.

Whilst the major infrastructure will be constructed underground and will connect to existing underground assets, additional land would be required for an access track, control building and compound (enclosed with security fencing). Due to the location of the works, on a greenfield site, this has been assessed as having a minor negative affect on SEA Objective 2.

Given the location of the proposed site, it is not expected, that the option will affect any surface water bodies or water quality due to absence of pollutant pathways. Furthermore, it is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3) during construction.

The overall construction of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

The option would require an estimated 570 HGV movements over a 1.2-year construction period. The site has good links to the local road network but vehicles would need to travel through a residential area to reach the site. Given the volume of vehicle movements, localised traffic disruption is unlikely. Additional vehicle emissions are anticipated to be low which, together with emissions to air from plant, given their scale will not have an effect on local air quality. Overall, given the scale and duration of the option, it is considered as likely to have a neutral effect on local air quality, SEA Objective 5.

During the construction phase, the use of plant on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 2,045 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new building materials and fencing and new ancillary equipment which would require a moderate volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy,

material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The proposed option would be located on a greenfield site. There may be temporary noise/vibration disturbance and air quality impacts associated with excavation which could affect nearby residential receptors in the vicinity of the proposed route. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve a moderate capital expenditure but this would not be significant in terms of the effect on the local economy. The number of vehicle movements are not expected to cause significant disruption or delay. However, access to the site is proposed across a heritage railway. Disruption to the operation of this attraction during construction could be mitigated against by measures agreed in consultation with the heritage railway members. Overall, the option has been assessed as having a neutral effect on SEA Objective 8.

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There is a grade II listed structure within 200m of the site. Due to the nature of the works and distance to this structure, no effects on cultural or historic assets are expected (SEA Objective 11).

The site is not located within any protected landscape areas but is on a greenfield site. There may be minor and temporary adverse effects on the local landscape during construction. This option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

Once operational, this option would not have any effects on biodiversity and so is assessed as a neutral effect against SEA Objective 1.

Once construction activity is complete, no ongoing impacts on land use/soils is expected; consequently, operational effects on land use/soil have been assessed as neutral (SEA Objective 2).

There will be no impacts on the status of surface water bodies from the operation of the option and in consequence, the operation of the option would have a neutral effect on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, there are no vehicle movement expected once the option is operational. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

This option would not involve any additional pumping or treatment of water; consequently, it is not expected that operation would result in an increase in energy use. No operational vehicle movements are anticipated and so no additional CO_2e are anticipated. This option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or adverse air quality impacts nor should it have any discernible impacts on proximate recreational activities. Increasing resilience of supply has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option will also increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing have been assessed as positive (SEA Objective 8).

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

The option would not have any effects on operational energy usage or waste arisings. Consequently, this option has been assessed as having a neutral effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets (SEA Objective 11).

The operational above ground infrastructure, which includes a control kiosk, fencing and car parking, is anticipated to lead to a minor change in the very localised landscape. Overall, operation of the option would not impact on the local landscape or visual amenity (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
296: T05 targeted repair 2025	Construction	**0**	**0**	**-/?**	**0**	**-**	**--**	**0**	**++/-**	**0**	**--**	**0**	**0**
	Operation	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**+**	**0**	**0**	**0**	**0**

Construction

This option would target section T05 for remedial works (tunnel lining) in order to provide greater structural support to the wider water distribution network. Under the option, approximately 100m of section T05 would undergo tunnel lining which would involve the installation of steel liner. The installation of two new access shafts (5m diameter/110m deep) would be required to facilitate the proposed works. It should be noted that the installation of tunnel liners would subsequently decrease the diameter of the Manchester and Pennine Aqueduct, e.g. reduced water flow, thus further hydraulic analysis is required to confirm the minimum acceptable diameter to support/maintain present operation.

The implementation of tunnel lining within Section T05 would be of low invasiveness, and furthermore, confined within the subterranean interior of the tunnel. Consequently, it is considered highly unlikely that the proposed works would have any direct or indirect impacts on either European designated conservation sites (South Pennine Moors SAC/South Pennine Moors (Phase 2) SPA circa 11km) or national statutory conservation areas, e.g. West Pennine Moors SSSI (circa 2km) thus having no discernible effect on protected/designated ecological features. Due to the minor structural scale of the proposed shaft/manhole access points, construction may generate temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) though the magnitude of effect would be minor, if not indiscernible. It is expected that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts resulting from the remedial tunnel work including the construction of the access points. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The tunnel lining procedures would target the interior walls of an existing tunnel and the installation of the new shaft/manhole access points would directly alter existing infrastructure; consequently, the proposed works would be confined to the existing operational footprint of the water distribution network which would prevent the need to disturb or introduce new infrastructure on undeveloped greenfield land. The proposed works could potentially introduce pollution/debris into the environment which could result in soil contamination though scheme-specific mitigation and best practice should prevent any potentially adverse impacts resulting from the works. Overall, this option has been assessed as having a neutral effect on land and soil (SEA Objective 2).

During construction, there is little potential for contaminants to pollute watercourses, as the proposed construction and ancillary works would be contained within existing operational sites and tunnels. Furthermore, it is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes that dewatering of the shafts may affect groundwater levels and flows and the quantitative water balance of the groundwater body. Impacts would be temporary, limited to the construction phase and localised as only two shafts are included in the option. In consequence, the option has been assessed as having a negative effect on water quality and quantity (SEA Objective 3) at this stage, although some uncertainty remains.

The proposed development scheme would be predominantly situated within the subterranean interior of the existing tunnel which should prevent any liability to flooding during the duration of the works. The installation of the two new shaft/manhole access points would be situated within Flood Zone 1 thus construction is unlikely to be liable to flooding. Overall, the implementation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future; therefore, this option has been assessed as having a neutral effect on flood risk (SEA Objective 4).

The option would require an estimated 9,114 HGV movements over a 1.8-year construction period which, together with emissions to air from equipment and machinery, is not expected to have a significant effect on local air quality. Vehicle movements may also result in minor disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network. Consequently, the moderate volume of vehicle movement has been assessed as having a minor negative effect on air quality (SEA Objective 5).

During the construction phase, the use of machinery on-site and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction, e.g. steel and concrete lining material, would contain embodied carbon. This option would subsequently generate an estimated 20,322 tCO_2e during construction. Furthermore, installation of the lining and construction of the new shaft/manhole access points would require a significant volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. The option would also generate construction wastes, e.g. excess lining material and debris from the shaft excavation and construction. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity; the proposed remedial works would be confined to the interior of the existing tunnel whereas the minor structural scale of the two new shaft/manhole access points should not disrupt recreational walking in respect of the proximate paths/trails. Similarly, it is considered highly unlikely that tunnel lining would result in adverse effects on human health due to these same reasons; however, the two proposed access points would be situated within suburban semi-rural settings such that works may temporarily affect human health (noise/vibration), albeit minor, depending on the sensitivity of proximate residential receptors. Due to the relatively minor length of the targeted tunnel section (100m), it is considered unlikely that other access points would be used throughout the duration of the works such that vehicle movements on the local road network should not result in significant personal discomfort (stress) to receptors situated along the proposed routes regarding noise and disruption of mobility. It should be noted that most impacts would be managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a neutral effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a large number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (9,114) during the implementation period may result in congestion and localised travel disruption within the road network although any effects would be temporary and felt in the short term only. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

The remedial tunnel lining procedure would be confined to the subterranean interior of the existing tunnel which should prevent any potentially adverse construction impacts on historic and cultural assets in respect of structural integrity and the visual amenity of their settings. Installation of the two new shaft/manhole access points would be within proximity to approximately 5 Grade II listed buildings (approximately 50-300m distant). It is assumed that the minor scale of construction together with a combination of scheme specific mitigation measures and established best practice will prevent adverse effects, though temporary impacts on the visual amenity of settings may occur for those assets situated circa 100m from the proposed works. Overall, this option has been assessed as having a neutral effect on historic and cultural assets (SEA Objective 11).

The proposed development scheme is not situated within or immediately proximate to any designated landscape area; the Forest of Bowland AONB is c. 5km from the tunnel and the two proposed access sites. Due to the relative distance, the scale of construction required for the shaft/manhole access points, and confined nature of the tunnel lining below ground, it is unlikely that construction would have any discernible effect on the visual amenity associated with the designated landscape and/or its wider setting. Furthermore, any potential impacts resulting from the installation of the access points are expected to be minor temporary effects such that works are not expected to adversely impact the local character or amenity of the surrounding setting. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Operation

The provision of greater structural support to the Manchester and Pennine Aqueduct would not incorporate or involve operational abstraction, treatment, or distribution of water. Consequently, it is considered highly unlikely that subsequent operation of the Manchester and Pennine Aqueduct would result in any adverse and/or significant effects on European designated conservation sites (South Pennine Moors SAC/South Pennine Moors (Phase 2) SPA). Because the continued transfer and distribution of water via Manchester and Pennine Aqueduct would occur within a closed regulatory network, it is also considered unlikely that there would be any impact pathways on local ecological receptors. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impacts on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

It is not expected that there would be any impacts on the qualitative and quantitative water status of Manchester and Pennine Aqueduct following the necessary hydraulic analysis required to confirm the minimum acceptable diameter to support/maintain present operation. This option has therefore been assessed as having a neutral effect on SEA Objective 3.

The presence of new lining within the tunnel within the wider context of a structurally improved Manchester and Pennine Aqueduct would be situated belowground therefore flood risk would be negligible to the overall operation of the scheme. In general, operation of the newly modified Manchester and Pennine Aqueduct is not expected to cause or exacerbate flooding elsewhere now or into the future which has been assessed as having a neutral effect on SEA Objective 4.

Operational emissions to air are expected to be negligible; the option would not generate HGV movements. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

This option would not involve any additional pumping or treatment of water; consequently, it is not expected that operation of the structurally improved Manchester and Pennine Aqueduct would result in an increase in energy use. No operational vehicle movements are anticipated and so no additional CO_2e are anticipated. This option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or adverse air quality impacts nor should it have any discernible impacts on proximate recreational activities. Because the scheme is targeting the structural integrity of the existing tunnel rather than facilitating and/or improving abstraction, treatment, and distribution processes, operation will not increase supply; however, it will afford greater certainty of supply and risk reduction. Increasing resilience of supply has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option will also increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

The provision of improved structural support to Manchester and Pennine Aqueduct would not require a long-term increase in energy use in order to maintain present operation (operation energy usage is estimated to be unchanged). Consequently, this option has been assessed as having a neutral effect on resource use (SEA Objective 10).

It is considered highly unlikely that the structurally improved Manchester and Pennine Aqueduct would adversely impact heritage assets within the general vicinity as general operation would be indiscernible to both setting and structure of proximate assets. Consequently, this option has been assessed as having a neutral effect on SEA Objective 11.

The proposed scheme would not introduce any new above ground infrastructure as remedial and ancillary works would target the subterranean interior of the tunnel in addition to providing ground-level shaft/manhole access points. Consequently, the continued operation of Manchester and Pennine Aqueduct is not expected to have any discernible effects on the visual amenity and/or landscape character of either the proximate suburban semi-rural setting or designated landscapes, e.g. Forest of Bowland AONB (circa 5.5km), within the general area. It should also be noted that required vehicle movements during the operational period are not expected to generate any adverse impacts on the visual amenity of receptors situated along transport corridors. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
297: T06 targeted repair 2025	Construction	0	+	-/?	0	-	--	0	++/-	0	--	0	0
	Operation	0	0	0	0	0	0	+	+	0	0	0	0

Construction

This option would target section T06 for remedial works (tunnel lining and conduit lining) in order to provide greater structural support to the wider water distribution network. It is proposed that an approximate 200m of section T06 would undergo conduit lining which would involve the installation of steel reinforcement cages sprayed with concrete lining whilst 200m of the tunnel would receive tunnel lining. The installation of four new access shaft/chambers (5m diameter/110m deep) would be required. Additionally, there is a risk that it may be necessary to rebuild a cracked conduit bridge (approx. 30m) in addition to implementing a new settled conduit configuration as additional ancillary works. It should be noted that the installation of conduit/tunnel liners would subsequently decrease the diameter of the Manchester and Pennine Aqueduct, e.g. reduced water flow, thus further hydraulic analysis is required to confirm the minimum acceptable diameter to support/maintain present operation.

The implementation of conduit and tunnel lining within Section T06 in addition to potential ancillary works would be of low invasiveness, and furthermore, confined within the subterranean interior of the tunnel. Consequently, it is considered highly unlikely that the proposed works would have any direct or indirect impacts on either European designated conservation sites (South Pennine Moors SAC/South Pennine Moors (Phase 2) SPA (circa 11km) and/or Rochdale Canal SAC – circa 6km) or national statutory conservation areas, e.g. West Pennine Moors SSSI (circa 3km) and Lower Red Lees Pasture SSSI (circa 3km), thus having no discernible effect on protected/designated ecological features. Due to the minor structural scale and short duration of construction regarding the proposed shaft/manhole access points, construction may generate temporary localised effects to proximate wildlife and habitats, e.g. the nearby LNR, regarding noise disturbance and air quality impacts (dust) though effects are expected to be minor. It is expected, however, that established best practice and on-site mitigation measures should fully control and prevent any potentially adverse impacts resulting from the remedial work and shaft construction. On balance, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The proposed works would be confined to the existing operational footprint of the water distribution network which would prevent the need to disturb or introduce new infrastructure on undeveloped greenfield land. Overall, this option has been assessed as having a positive effect on land and soil (SEA Objective 2).

During construction, there would be little potential for contaminants to pollute watercourses, as the proposed construction and ancillary works would be contained within existing operational sites and tunnels. Furthermore, it is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). The WFD assessment notes that dewatering of the shafts and new access chambers may affect groundwater levels and flows and the quantitative water balance of the groundwater body. Overall impacts would be temporary, limited to the construction phase, and localised to the four shaft/chamber locations. In consequence, the option has been assessed as having a negative effect on water quality and quantity (SEA Objective 3) during construction (with some uncertainty remaining).

The proposed development scheme would be predominantly situated within the subterranean interior of the existing tunnel which should prevent any liability to flooding during the duration of the works. The installation of the four new shaft/manhole assess points would be situated within Flood Zones 1 thus construction is unlikely to be liable to flooding. Overall, the implementation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future; therefore, this option has been assessed as having a neutral effect on flood risk (SEA Objective 4).

The option would require an estimated 17,323 HGV movements over a 2-year construction period which, together with emissions to air from equipment and machinery, is not expected to have a significant effect on local air quality. Vehicle movements may result in minor disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network. Consequently, the moderate volume of vehicle movement has been assessed as having a minor negative effect on air quality (SEA Objective 5).

During the construction phase, the use of on-site machinery and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction, e.g. steel and concrete lining material, would contain embodied carbon. This option would subsequently generate 38,625 tCO_2e during construction. Furthermore, installation of the lining, construction of the new shaft/manhole access points, and the potential implementation of ancillary works would require a significant volume of raw materials and energy to execute. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. The option would also generate construction wastes such as excess lining material and debris. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity; the proposed remedial works and potential ancillary conduit bridge refurbishment would be contained within the subterranean interior of the tunnel, whereas the minor structural scale of the four new shaft/manhole access points should not disrupt and/or adversely impact the amenity of proximate recreational activities, e.g. nearby golf clubs or hiking trails. Similarly, it is considered highly unlikely that the proposed works targeting the tunnel would result in adverse effects on human health due to these same reasons. Notwithstanding this, the four proposed access points would be situated within suburban semi-rural settings such that works may temporarily affect human health (noise/vibration), albeit minor, depending on the sensitivity of proximate residential receptors and scattered residential farmsteads within the vicinity. Due to the relatively minor length of the individual tunnel sections targeted for lining/refurbishment, it is unlikely that vehicle movements on the local road network would result in notable personal discomfort (stress) to receptors situated along the proposed routes regarding noise and disruption of mobility. Furthermore, impacts would likely be managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a neutral effect on human health (SEA Objective 7).

The construction of the option represents a significant capital investment which is expected to generate a large number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (17,323) during the implementation period may result in minor disruption of mobility within the road network although any effects would be temporary and felt in the short term only. Furthermore, the magnitude of effect is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing (SEA Objective 8).

The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

The remedial conduit/tunnel lining procedures and ancillary refurbishment works would be confined to the subterranean interior of the tunnel which should prevent any adverse impacts from construction on historic and cultural assets regarding their structural integrity and the visual amenity of their settings. Installation of the four new shaft/manhole access points would be within proximity to approximately 13 Grade II listed buildings ranging from around 60-450m distant. It is assumed that the minor scale of construction together with a combination of scheme specific mitigation measures and established best practice will prevent adverse structural effects from the installation of the access points though temporary impacts on the visual amenity of settings may occur for those assets situated around 100m from the proposed works. Notwithstanding this, a natural buffer (woodland) is expected to help offset potentially adverse visual impacts during the construction stage. Overall, this option has been assessed as having a neutral effect on historic and cultural assets (SEA Objective 11).

The proposed developmental scheme is not situated within or immediately proximate to any designated landscape area (the Peak District National Park is circa 19km from the tunnel and the four proposed access sites). Due to the relative distance, the scale of construction required for the shaft/manhole access points, and the confined nature of the conduit/tunnel lining and potential ancillary works below ground, it is unlikely that construction would have any discernible effect on the visual amenity associated with the designated landscape and/or its wider setting. Furthermore, any potential impacts resulting from the installation of the access points are expected to be minor temporary effects such that works are not expected to adversely impact the local character or amenity of the surrounding setting. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Operation

The provision of greater structural support to the Manchester and Pennine Aqueduct would not incorporate new or altered abstraction, treatment, or distribution processes. Consequently, it is considered unlikely that subsequent operation of the Manchester and Pennine Aqueduct would result in any adverse or significant effects on European designated conservation sites (South Pennine Moors SAC/South

Pennine Moors (Phase 2) SPA or Rochdale Canal SAC). Because the continued distribution of water via Manchester and Pennine Aqueduct would occur within a closed regulatory network, it is also considered unlikely that there would be any impact pathways on local ecological receptors. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

It is not expected that there would be any impacts on the qualitative and quantitative water status of Manchester and Pennine Aqueduct following the necessary hydraulic analysis required to confirm the minimum acceptable diameter to support/maintain present operation. This option has therefore been assessed as having a neutral effect on SEA Objective 3.

The newly refurbished tunnel within the wider context of a structurally improved Manchester and Pennine Aqueduct would be situated belowground such that flood risk would be negligible to the overall operation of the scheme. In general, the continued operation of Manchester and Pennine Aqueduct is not expected to cause or exacerbate flooding elsewhere now or into the future which has been assessed as having a neutral effect on SEA Objective 4.

Operational emissions to air are expected to be negligible and in this respect, the option would not generate any HGV movements. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

This option would not involve any additional pumping or treatment of water; consequently, it is not expected that operation of the refurbished Manchester and Pennine Aqueduct would result in an increase in energy use. No operational vehicle movements are anticipated and so no additional CO_2e is anticipated. This option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or adverse air quality impacts nor should it have any discernible impacts on proximate recreational activities. Because the scheme is targeting the structural integrity of the existing tunnel rather than facilitating and/or improving abstraction, treatment, and distribution processes, operation will not increase supply; however, it will afford greater certainty of supply and reduction of risks. Increasing resilience of supply has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option will also increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

The provision of improved structural support to Manchester and Pennine Aqueduct would not require a long-term increase in energy use in order to maintain present operation (operation energy usage is estimated to be unchanged). Consequently, this option has been assessed as having a neutral effect on resource use (SEA Objective 10).

It is considered highly unlikely that the structurally improved Manchester and Pennine Aqueduct would adversely impact heritage assets within the general vicinity as general operation would be indiscernible to both setting and structure of proximate assets. Consequently, this option has been assessed as having a neutral effect on SEA Objective 11.

The proposed scheme would not introduce any new aboveground infrastructure as remedial and ancillary works would target the subterranean interior of the existing tunnel in addition to providing ground-level shaft/manhole access points. Consequently, the continued operation of Manchester and Pennine Aqueduct is not expected to have any discernible effects on the visual amenity and/or landscape character of either the proximate suburban semi-rural setting or designated landscapes, e.g. the Peak District National Park (circa 19km), within the general area. It should also be noted that required vehicle movements during the operational period are not expected to generate any adverse impacts on the visual amenity of receptors situated along transport corridors. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
301: Lunesdale Siphon BSPs North	Construction	-	0	0	-	-	--	-	+	0	--	-	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	0

Construction

This option seeks to provide additional connectivity for treated water via existing pipework to a treated water storage site in the Kendal area and onwards to the north end of the Lunesdale Siphon where it would be intercepted by a proposed new pipeline connecting to existing BSPs. In conjunction with Options 3, 212, 213, 214, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option would require pipelines from the treated water storage facility to the Manchester and Pennine Aqueduct in the vicinity of the BSPs in the Kirkby Lonsdale area in addition to increased storage provision at the existing treated water storage site (from 0.75Ml to 9.0Ml).

The HRA identifies that the works involved in the option are not expected to affect any European conservation sites. The scheme would be in the general vicinity of the Morecambe Bay Pavements SAC (circa 4km), Ingleborough Complex (circa 6km), Morecambe Bay Ramsar/SAC (circa 11km), and Leighton Moss Ramsar/SPA (circa 13km) though due to the distance to the sites and the absence of specific pollutant pathways, excavation of the proposed pipeline and modification of the existing treated water storage site are not considered likely to have any adverse effects on the European sites. The proposed pipeline route will cross four watercourses two of which feed into Morecambe Bay; however, site level mitigation and established best practice should prevent any adverse impacts resulting from pollution/debris within the waterways. Under current proposals, the pipeline would also cross a Local Wildlife Site; however, site level mitigation and established best practice should prevent any adverse impacts on this site from occurring. Burns Beck Moss SSSI, (circa 3km), Hutton Roof LNR/SSSI (circa 4km), and Leck Beck Head Catchment Area SSSI (circa 6km) are also located at a moderate distance from the existing scheme such that it is highly unlikely that the scale of excavation and ancillary works would generate adverse effects on their designated ecological receptors. Notwithstanding this, it is expected that excavation and modification of the treated water storage will result in temporary localised effects to proximate habitats and wildlife regarding noise disturbance and air quality impacts (dust) which should be controlled for through established best practice and on-site mitigation measures. Overall, the development of the new pipeline route and expansion of the treated water storage is expected to have minor negative effect on biodiversity (SEA Objective 1).

The modification of the treated water storage site would be contained within the operational footprint of existing site such that the new enlarged reservoir should not impact on land use/soil quality, and would be making best use of existing developed land. Similarly, the proposed pipeline route is expected to be similar to the Manchester and Pennine Aqueduct which would also further minimise the need to disturb undeveloped greenfield land. In general, the proposed scheme would be situated within Grades 3/4/5 agricultural land such that development should not significantly affect agricultural potential, and furthermore, all excavated land would be reinstated following construction. Overall this option has been assessed as having a neutral effect on land and soil (SEA Objective 2).

During construction, the proposed pipeline route would cross four watercourses, in addition to various unnamed waterbodies which poses the risk of direct or residual pollution/debris entering the water network. It is assumed, however, that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be

implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3) during construction.

The proposed pipeline route would traverse Flood Zones 2 and 3 (originating from three watercourses) which suggests that construction could be liable to flooding depending on the timing of the works. Because excavation and installation of new piping does not require a significant scale of construction nor introduce new above ground infrastructure, it is expected that scheduling of works could be utilised to avoid any potential flood risks. The overall construction of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a minor negative effect on flood risk (SEA Objective 4).

The option would require 4,080 HGV movements over a 1.5-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movement and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network which could increase associated emissions. In general, the option has been assessed as having a negative effect on air quality (SEA Objective 5).

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 3,903 tCO_2e during construction. Similarly, this option would comprise several infrastructure components including new pipelines and new ancillary equipment, e.g. reservoir infrastructure, which would require a moderate volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructure waste. Consequently, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity, however, individual components may result in the temporary disruption of use and amenity of recreation within the general vicinity of the scheme. Modification of the treated water storage site would be confined within the existing operational footprint of the site such that expansion works would have a neutral effect on any proximate recreational activities, e.g. trail hiking. The proposed pipeline route, in general, would traverse through greenfield sites which may encompass hiking trails, walking paths, and designated woodland though disruption of activity would be temporary. The route would, however, traverse through school playing fields which may adversely impact sport and recreational activity. As previously noted, the excavation would also cross surface water bodies, which could adversely impact proximate angling sites and kayaking routes though this remains uncertain. Excavation may also temporarily affect human health (noise/vibration and adverse air quality impacts) depending on the sensitivity of proximate residential receptors. The transportation of material/equipment on the local road network may result in personal discomfort (stress) to receptors from noise disturbance and/or decreases in mobility regarding vehicle movement to scattered settlements and farmsteads situated along the proposed routes. Notwithstanding this, works would be temporary and associated effects are expected to be felt in the short term only. Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option represents a moderate capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network as transportation corridors regarding HGV movements (4,080) during the implementation period in addition to excavation may result in congestion and localised travel disruption within the road network although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a positive effect on economic and social wellbeing (SEA Objective 8).

The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources (SEA Objective 9) during construction.

There are nine Scheduled Monuments within the vicinity of the scheme; however, only one of these assets is directly adjacent to the proposed pipeline route whereas the remaining eight monuments are at a distance greater than 500m. The proximity of the works to the closest Scheduled Monument may adversely impact the visual amenity of its setting though appropriate site-specific mitigation should prevent any damage to the structural integrity of the monument. It should be noted that there is an additional risk of damage to unknown/undiscovered archaeological assets within the vicinity of the Scheduled Monument due to the proximity of excavation though it is expected screening or possible route alteration would occur prior to the commencement of the works. The proposed scheme would also be within proximity to 23 Grade II listed buildings around 30-450m from the site; four listed buildings would be situated under 100m of the proposed route. It is assumed that a combination of scheme specific mitigation measures and established best practice will prevent adverse structural effects on all and any asset though temporary impacts on the visual amenity of their settings may occur for those assets situated under 100m from the proposed works. Notwithstanding this, a natural buffer (woodland) is expected to help offset potentially adverse visual impacts during the construction stage. Overall, this option has been assessed as having a minor negative effect on historic and cultural assets (SEA Objective 11).

The proposed excavation route would traverse approximately 4.5km of the Yorkshire Dales National Park which may be perceived by residential and recreational receptors as adversely impacting the amenity associated with the designated landscape and its setting. It should be noted, however, that excavation works would be temporary and of a relatively minor scale such that impacts on either the Yorkshire Dales or the wider semi-rural landscape would be confined to the immediate vicinity of the route. Two other designated landscapes, Forest of Bowland AONB (circa 6km) and Arnside and

Silverdale AONB (circa 11km), would also be in the general vicinity of the scheme though the intervening distance between the sites and the proposed works is expected to prevent any discernible effects on the amenity and natural character of these parks. The modification of the treated water storage site would be contained within the operational footprint of the existing site such that significant localised landscape effects are not expected beyond the temporary intensification of material storage/equipment on-site. It should also be noted that the predicted increase in vehicle movements during the implementation period may result in minor temporary residual effects on the visual amenity of receptors situated along transport corridors. Overall, this option has been assessed as having a minor negative effect on landscape (SEA Objective 12) during construction.

Operation

It is assumed that the increased connectivity between the existing link main, treated water storage site and BSPs together with enhanced storage capacity of a further existing treated water storage site would operate under existing licence which should not subsequently generate any effects in respect of the Environment Agency Habitats Regulations Review of Consents process. Consequently, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites (Morecambe Bay Pavements SAC, Morecambe Bay Ramsar/SAC, Leighton Moss Ramsar/SPA, and Ingleborough Complex SAC). Because the transfer and storage of raw water would occur within a closed network, it is considered highly unlikely that there would be any impact pathways that would lead to effects on national nature conservation sites (Hutton Roof Crags LNR/SSSI, Burns Beck Moss SSSI, and Leck Beck Head Catchment Area SSSI) or local habitats and wildlife. There would be a minor operational loss of greenfield land due to the expanded treated water storage site, however, this is not considered to affect wildlife or habitats as the land is within the operational footprint of the existing treated water storage facility. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

Any impacts on the status of the surface water bodies (reservoir) are likely to be temporary, if not negligible, due to the presumed availability of water as operation would not involve increased abstraction beyond any or all relevant licences. Consequently, the storage and transfer of up to 7.7 Ml/d would have a neutral effect on SEA Objective 3.

The enlarged treated water storage site would be situated within a Flood Zone 1 thus it is highly unlikely that operation would be liable to flooding nor would the new pipeline be at risk due to its installation belowground. The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

Operational emissions to air are expected to be negligible, and in this respect, the option would not generate any HGV movements once operational. In consequence, the option has been assessed as having a neutral effect on air quality (SEA Objective 5).

During operation, this option would not involve the additional pumping of water and it is not anticipated that there would be any effects on energy use. As already noted, it is not anticipated that there would be any operational vehicle movements, and so operational carbon emissions are anticipated to be negligible. Consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option has a design capacity of 7.7 Ml/d and in conjunction with Options 3, 212, 213, 214, 303, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

The option has a design capacity of 7.7 Ml/d serving to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

There is no additional storing and pumping of water associated with this option and so there is no change in current operational energy use which has been assessed as having a neutral effect on resource use (SEA Objective 10).

It is considered highly unlikely that operation would adversely impact heritage assets within the general vicinity as the storage and distribution of water would be indiscernible to both setting and structure of proximate assets. Furthermore, the only aboveground infrastructure included within this scheme, the modified treated water storage, would be contained within the site's existing operational footprint such that any potentially adverse visual impacts would most likely be prevented by either relative distance from assets or natural intervening buffer (woodland). Consequently, this option has been assessed as having a neutral effect on historic and cultural assets (SEA Objective 11).

The newly modified treated water storage site is not within or immediately adjacent to any designated landscape areas; the Yorkshire Dales National Park (circa 2km), Arnside and Silverdale AONB (circa 9km), and the Forest of Bowland AONB (circa 15km) are situated at a distance in which the enlarged treated water storage site would be indiscernible to their character and wider protected settings.

Furthermore, it is highly unlikely that the modification of the treated water storage site would be perceived by residential and/or passing recreational receptors as having an adverse impact on the local semi-rural setting due to its siting within a previously established operational site. It should also be noted that required vehicle movements during the operational period are not expected to generate any adverse impacts on the visual amenity of receptors situated along transport corridors. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
303: Lunesdale Siphon BSPs South	Construction	-	0	0	-	-	--	0	+	0	--	-	-
	Operation	0	0	0	-	0	0	++	++	0	0	0	0

Construction

This option would increase connectivity for treated water through Manchester and Pennine Aqueduct outage on a permanent basis. In conjunction with Options 3, 212, 213, 214, 301, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.

The options would require new sections of pipeline between BSPs in the Bentham area. The option would also require: a new pumping station in the Bentham area; additional 9Ml storage at an existing treated water storage site near Lancaster; modification to a pumping station in the Morecambe area to accommodate permanent usage; and the abandonment of existing facilities.

It is not expected that the works associated with this option would affect any European designated conservation sites. The scheme would be in the general vicinity of Bowland Fells SPA (circa 2.5km), Calf Hill and Cragg Woods SAC (circa 4km), Morecambe Bay Ramsar/SAC (circa 4km), Ingleborough Complex SAC (circa 10km), Morecambe Pavements SAC (circa 11km), and Leighton Moss Ramsar/SPA (circa 15km). However, the scale of construction together with the intervening distance suggests that there would not be any adverse effects on these European sites. It should be noted that the proposed pipeline route would cross a river which feeds into Morecambe Bay; however, the HRA notes that site level mitigation and established best practice should prevent any adverse impacts resulting from pollution/debris within the waterway. The proposed development scheme would also be within the general vicinity of a range of SSSIs which include Clear Beck Meadows (circa 500m), Far Holme Meadows (circa 1km), Robert Hall Moor (circa 1km), Roeburndale Woods (circa 1.5km), Calf Hill and Cragg Woods SSSI (circa 4km), and Bowland Fells SSSI (circa 2.5km). Excluding Clear Beck Meadows SSSI, these sites are also located at a moderate distance from the scheme such that it is highly unlikely that development would generate adverse effects on their interest features. Classified as one of the best examples of species-rich meadow grassland in Lancashire, Clear Beck Meadows may support a wide range of native terrestrial wildlife which could be vulnerable to adverse impacts arising from pipeline works although such effects would be temporary and minor. In general, construction activity within a rural greenfield setting is expected to result in some temporary, localised effects on proximate habitats and species associated with noise disturbance and air quality impacts (dust), although this should be controlled through established best practice and on-site mitigation measures. Overall, this option has been assessed as having a minor negative effect on biodiversity (SEA Objective 1).

New above ground infrastructure associated with this option would be contained within the operational footprints of existing sites and should not, therefore, affect land use/soil quality. The proposed pipeline route between two existing BSPs is expected to closely follow Manchester and Pennine Aqueduct which would also further minimise the need to disturb undeveloped greenfield land. In general, the proposed scheme, particularly the proposed pipeline route, would be situated within Grades 3/4 agricultural land which would be reinstated following the completion of construction. Overall, this option has been assessed as having a neutral effect on land and soil (SEA Objective 2).

During construction, the proposed pipeline route would cross the a river which poses the risk of pollution/debris entering the water body. It is assumed, however, that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3).

Pipeline works together with the construction of the new pumping station would traverse and/or be situated within Flood Zones 2 and 3 which suggests that construction could be liable to flooding (depending on the timing of the works). The remaining infrastructure components included within the scheme are situated in Flood Zone 1, and are thus unlikely to be liable to flooding. In general, construction of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, the option has been assessed as having a minor negative effect on flood risk (SEA Objective 4).

The option would require 2,246 vehicle movements over a 1.6-year construction period which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movements and the transportation of equipment/material may also result in disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network, although the rural setting of the scheme should inherently lessen any associated impacts. Overall, the option has been assessed as having a minor negative effect on air quality (SEA Objective 5).

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 1,897 tonnes CO_2e during construction which has been assessed as having a significant negative effect on climate change (SEA Objective 6).

The implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity and new above ground infrastructure would predominantly be confined to existing operational footprints which should help prevent any adverse effects on proximate recreational activities. The proposed pipeline routes, in general, would traverse through greenfield land which may temporarily affect walking routes. As previously noted, the routes would cross a river which could adversely impact proximate angling sites and kayaking, although this remains uncertain. The proposed development scheme would be situated within a rural setting characterised by sparsely distributed residential farmsteads; consequently, the minor scale of the proposed works is not expected to adversely impact human health. Pipeline works (1.8km in total) could temporarily disturb proximate residential receptors in terms of noise/vibration and adverse air quality impacts depending on sensitivity, although impacts would be very minor, if not indiscernible. Similarly, the transportation of material/equipment on the local road network may result in some noise disturbance, although the rural setting of this scheme should minimise this risk. Furthermore, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a neutral effect on human health (SEA Objective 7).

The construction of the option would represent a moderate capital investment which is expected to generate a small number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Utilisation of the local road network during the implementation period in addition to pipeline works may result in minor traffic disruption, although any effects would be temporary. Overall, the option has been assessed as having a positive effect on economic and social wellbeing (SEA Objective 8).

The implementation of the option would not lead to a reduction in losses from the supply network nor would construction affect water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

The infrastructure required to construct this option, in addition to energy demand, would have a significant negative effect on SEA Objective 10.

There are three Scheduled Monuments within the general vicinity of the scheme; the closest being approximately 1km from the works). Consequently, it is considered unlikely that development would adversely impact the settings of these assets. The proposed scheme would be within proximity to 9 Grade II listed buildings ranging up to 500m from the site; two listed buildings would be situated under 100m of the proposed pipeline route. It is assumed that a combination of scheme specific mitigation measures and established best practice would prevent adverse structural effects on these assets, although temporary impacts on their settings may occur. Overall, this option has been assessed as having a minor negative effect on cultural heritage (SEA Objective 11).

The proposed scheme, with the exception of the implementation of the increased 9Ml storage at an existing treated water storage site, would be situated within the Forest of Bowland AONB. Although the scale of construction associated with the individual scheme components would be minor, works may collectively be perceived by residential and recreational receptors as adversely impacting the amenity associated with the designated landscape and its rural setting. It should be noted, however, that any potential effects associated with the individual components would be temporary and minor, and more so, confined to existing operational sites. The Yorkshire Dales National Park (circa 8km) is also in the general vicinity of the scheme, although the intervening distance between the site and the proposed works is expected to prevent any discernible effects on this landscape. Overall, this option has been assessed as having a minor negative effect on landscape (SEA Objective 12) during construction.

Operation

It is assumed that increased treated water connectivity through Manchester and Pennine Aqueduct outage enabling works, e.g. an improved water distribution network regarding greater pipeline coverage, increased pumping and storage infrastructure, and the cessation of unnecessary resource expenditure, would maintain operation under the existing licence associated with the existing WTWs. It is therefore unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites (Bowland Fells SPA, Calf Hill and Cragg Woods SAC, Morecambe Bay Ramsar/SAC, Ingleborough Complex SAC, Morecambe Pavements SAC, and Leighton Moss Ramsar/SPA). As the storage and distribution of treated water would occur within a closed regulatory network, it is also considered unlikely that there would be any impact pathways on external conservation sites such as proximate SSSIs or local habitats and wildlife. There would be minor operational losses of greenfield land

due to the installation of the 9Ml storage unit at an existing treated water storage site and existing pumping station though it is expected that a combination of mitigative measures during the construction/operational stages would minimise any potentially adverse effects. Furthermore, excavated land would be reinstated following the construction period thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility. Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

Any impacts on the status of the associated surface water bodies (reservoir, river and raw water sources) are likely to be temporary, if not negligible, as operation does not involve alteration to existing pumping station would be situated within Flood Zones 2 and 3 and thus operation may be liable to flooding. The remaining components would either be situated within Flood Zone 1 or be belowground (e.g. new pipelines) such that flood risk would be negligible. The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere. On balance, the option has been assessed as having an overall minor negative effect on SEA Objective 4.

There would be no operational effects on air quality.

During operation, this option would involve the additional storage and pumping of water which may result in a long-term increase in energy use (approximately 113 KWh/Ml). Notwithstanding this, the permanent provision of potable water to the existing DMA through Manchester and Pennine Aqueduct outage enabling works would occur in tandem with the disuse/abandonment of four existing BSP/PSs which may help offset carbon emissions. Overall, net operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health, as a result of noise or air quality impacts, or on recreational activities. The option has a design capacity of up to 58.2 Ml/d and in conjunction with Options 3, 212, 213, 214, 301, 306 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. This would increase regional resilience and would help to ensure that a continual supply of clean drinking water is available. Overall, the option has been assessed as having a significant positive effect on health (SEA Objective 7).

As noted above (under SEA Objective 7), the option has a design capacity of up to 58.2 Ml/d serving to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as significantly positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on SEA Objective 9.

The additional storage and distribution of water would result in a long-term increase in energy use (operation energy usage is estimated to be approximately 113 KWh/Ml), although operation would occur in tandem with the disuse/abandonment of existing BSP/PSs which may help offset the increased resource use. Overall, the operation of this option has been assessed as having a neutral effect on resource use (SEA Objective 10).

It is considered highly unlikely that operation would adversely impact heritage assets within the general vicinity of the scheme. Consequently, this option has been assessed as having a neutral effect on SEA Objective 11.

The new PS would be directly situated within the Forest of Bowland AONB whereas the 9Ml storage unit at the existing treated water storage site would be approximately 0.5km from the boundary of the AONB. Due to the minor structural scale of these scheme components in addition to the relative distance between treated water storage site and the Forest of Bowland, it is considered unlikely that their operation would adversely affect the AONB. Furthermore, it is not expected that residential and/or passing recreational receptors would perceive the new aboveground infrastructure as having an adverse impact on the local rural setting due to their confined nature within previously established operational sites. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
306: Ribblesdale Siphon BSPs North	Construction	**0**	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**
	Operation	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**+**	**0**	**0**	**0**	**0**

Construction

This option would adapt the connectivity of the treated water network with BSPs in the Clitheroe area being permanently supplied via an existing aqueduct and pumping stations using existing network infrastructure. In conjunction with Options 3, 212, 213, 214, 301, 303 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.

The option would require a new circa 2.9km reinforcing pipe (250mm diameter) to support the new configuration between the BSPs and the aqueduct. Some existing pipelines would be abandoned.

It is not expected that the pipeline works would affect any European designated conservation sites. The scheme would be in the general vicinity of the South Pennine Moors SAC/South Pennine Moors (Phase 2) SPA (circa 19km), Bowland Fells SPA (circa 13km), and the North Pennine Dales Meadows (circa 15km); however, the minor scale of construction associated with the scheme together with the intervening distance suggests that there would be no effects on these designated sites. It should be noted that works would traverse a river in addition to being immediately adjacent to a smaller watercourse of which both ultimately feed into a Ramsar/SPA site; however, site level mitigation and established best practice should prevent any adverse impacts resulting from pollution/debris entering the waterbodies. In general, the proposed pipeline route would closely follow/underlie an existing road within the wider semi-rural greenfield such that it is unlikely that construction would generate adverse ecological impacts beyond temporary, localised effects to proximate habitats and species associated with noise disturbance and air quality impacts (dust) (there are several Local Wildlife Sites and ancient woodlands in close proximity to the scheme). Overall, construction impacts within the context of the proposed scheme should be fully controlled through established best practice and on-site mitigation measures thus this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

The proposed pipeline route is expected to closely follow/underlie an existing road which would assist in minimising the need to disturb undeveloped greenfield land. Furthermore, all excavated land would be reinstated following construction. Overall, this option has been assessed as having a neutral effect on land use and soils (SEA Objective 2).

During construction, the proposed pipeline route would cross a river in addition to being within the immediate vicinity of a smaller watercourse which poses the risk of direct or residual pollution/debris entering the waterbodies. It is assumed, however, that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3).

The proposed pipeline route would traverse and/or be situated within Flood Zones 2 and 3 originating from a river and brook which suggests that works could be liable to flooding (depending on the timing). Because the installation of the new pipeline does not require a significant scale of construction, it is expected that scheduling could be utilised to help avoid potential flood risks in this regard. Implementation of the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, this option has been assessed as having a neutral effect on flood risk (SEA Objective 4).

This option would require 800 vehicle movements over a 1.3-year construction period which may result in minor disruption to traffic (e.g. lengthened driver-delay and congestion) and associated emissions to air (alongside the use of plant). However, any effects in this regard are likely to be very minor and a neutral effect on air quality (SEA Objective 5) is therefore predicted.

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction, e.g. new pipes, would contain embodied carbon. This option would generate 822 tCO_2e during construction which has been assessed as having a neutral effect on climate change (SEA Objective 6).

The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity. Notwithstanding this, the existing road where the pipeline would be laid is the only access route to a football academy and playing fields thus works could disrupt accessibility to the facilities, although this would be temporary. As previously noted, pipeline works would cross surface water bodies which could adversely impact proximate angling sites and kayaking routes, although this remains uncertain. The proposed development scheme would be situated within a semi-rural setting (village and sparsely distributed residential farmsteads) consequently, works may temporarily affect human health (noise/vibration and adverse air quality impacts) depending on the sensitivity of proximate residential receptors. Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

The construction of the option would represent a minor capital investment which is not expected to generate a large number of employment opportunities or supply chain benefits. Utilisation of the local road network during the implementation period may result in minor disruption to traffic although any effects would be temporary and felt in the short term only. Overall, this option has been assessed as having a neutral effect on economic and social wellbeing (SEA Objective 8).

The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

The resources required to construct this option would be minor and a neutral effect has therefore been identified in respect of SEA Objective 10.

The closest Scheduled Monument within the general vicinity of the scheme is approximately 500m. Consequently, it is considered unlikely that the proposed works would adversely impact the setting of this asset. The proposed scheme would be within proximity to approximately 5 Grade I and II listed buildings ranging from approximately 25m to 500m including. It is assumed that a combination of scheme specific mitigation measures and established best practice would prevent adverse structural effects on these assets, although temporary impacts on their settings may occur. Overall, this option has been assessed as having a minor negative effect on cultural heritage (SEA Objective 11).

The proposed scheme is not situated within or immediately proximate to any designated landscape area with the Forest of Bowland AONB being circa 2.5km from the proposed pipeline route. Due to the relative distance from/to the AONB and the scale of construction associated with this option, it is unlikely that construction would have any discernible effect on this designated landscape. Furthermore, any potential impacts resulting from excavation are expected to be minor temporary effects such that works are not expected to adversely impact the local landscape character or visual amenity. Overall, this option has been assessed as having a neutral effect on landscape (SEA Objective 12).

Operation

The permanent provision of treated water to two existing BSPs via an existing aqueduct and PSs through the alteration of the existing potable water network would distribute up to 8 Ml/d under existing licences which are assumed to have been reviewed by the EA under the Review of Consents process. Consequently, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on land use/soil (SEA Objective 2) have been assessed as neutral.

No operational effects on water quality or quantity (SEA Objective 3) are predicted.

The option is not expected to cause or exacerbate flooding.

No effects on local air quality are anticipated.

Operational carbon emissions would be negligible and the option has therefore been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

Once operational, the option is not expected to have any adverse effects on health, as a result of noise or adverse air quality impacts, nor should it have any impacts on recreation. The option has a design capacity of 8 Ml/d and in conjunction with Options 3, 212, 213, 214, 301, 303 and 382, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct, serving to increase regional resilience. The option has therefore been assessed as having a positive effect on health (SEA Objective 7).

As noted above, the option has a design capacity of up to 8 Ml/d serving to increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Overall, effects on social and economic wellbeing (SEA Objective 8) have been assessed as positive.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

No effects on cultural heritage (SEA Objective 11) during operation are predicted.

This option would not require any new aboveground infrastructure and in consequence, no operational effects on landscape (SEA Objective 12) are predicted.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
348: Metals & UV Treatment of BSPs: Lunesdale Siphon (1)	Construction	-	-	0	0	-	--	0	+	0	--	0	--
	Operation	0	0	0	0	0	0	+	+	0	0	0	--

Construction

This option would involve the construction of a new WTW with second stage rapid gravity filters (RGF) for metals removal and UV treatment in the Kirkby Lonsdale area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 2.48 Ml/d..

The proposed WTW site is not located within or near any statutory or non-statutory sites designated for nature conservation. A small stream is located approximately 40m from the site but separated by a single track road and walled field boundaries such that contamination of surface waters by site-derived pollutants is not expected. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels, provided best practices are adhered to and mitigation implemented (such as dust suppression and emergency response procedures).

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

There are a limited number of receptors on minor roads which connect the site to A roads and the motorway; however, these may be exposed to minor deterioration of air quality due to the estimated 1,290 vehicle movements during the 1.5 year construction period, together with emissions associated with the use of plant and machinery. Minor traffic congestion may also arise with associated effects on local air quality. This has been assessed as a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,161 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors, the closest being 150m from the proposed WTW site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve a moderate capital expenditure resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities are not anticipated. Overall, the option has been assessed as having a minor positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are five Grade II listed buildings within approximately 500m of the site, with the closest being within approximately 230m. No effects on the setting of theses heritage assets are predicted and a neutral effect has therefore been identified for SEA Objective 11.

The site is located within the Yorkshire Dales National Park and construction could therefore have a temporary but significant adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors may be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Operation

The operation of the option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quality has therefore been determined on SEA Objective 3.

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 24 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 274 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of 2.48 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would result in new aboveground infrastructure located in the Yorkshire Dales National Park. This has the potential for significant adverse effects on local landscape character, the special qualities of the National Park and visual amenity. This has been assessed as a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
349: Metals & UV Treatment of BSPs: Lunesdale Siphon (2)	Construction	-	-	0	0	-	--	0	+	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	-

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Kirkby Lonsdale area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 2.9 Ml/d.

The proposed WTW site is not located within any statutory or non-statutory sites designated for nature conservation. A river lies approximately 300m from the proposed site while two Sites of Biological Importance are around 200m to the north; however, these sites are not expected to be significantly affected by the works. The proposed WTW would be located on greenfield land adjacent to an existing pumping station and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The proposed development site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The WTW site is situated close to an A road with access to the motorway, and impacts on air quality associated with traffic congestion are therefore expected to be limited due to good access from the main road. Residential receptors (primarily along a local B road) may, however, be exposed to minor deterioration of air quality due to the estimated 1,361 vehicle movements during the 1.5-year construction period, in addition to the release of emissions associated with the use of plant and machinery. This has been assessed as a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,209 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors, the closest being 200m from the site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve a moderate capital expenditure resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a minor positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are three Grade II listed buildings within 500m of the proposed WTW site, with the closest located around 250m to the north-east. There are a further 50 listed buildings within 1km of the WTW site, predominately in a nearby town. There are two Scheduled Monuments located approximately 700m from the site. No effects on these heritage assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

Landscape and visual impacts associated with construction would be minor and temporary, with works taking place adjacent to an existing site. The proposed works would not be located within a designated landscape; however, the WTW site is approximately 500m from the boundary of the Yorkshire Dales National Park. Given the scale of works involved, effects on the setting of the National Park are not anticipated, although there could be localised landscape effects from the introduction of above ground infrastructure. Overall, this option has been assessed as having a negative effect on SEA Objective 12.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined. (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 25 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 1,283 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of 2.9 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The operational above ground works include a new WTW, which is anticipated to have a minor negative effect on the local landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
350: Metals & UV Treatment of BSPs: Lunesdale Siphon (3)	Construction	-	-	0	0	0	--	0	+	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	-

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Kirkby Lonsdale area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 0.36 Ml/d, with a maximum treatment capacity of 0.57 Ml/d.

The proposed WTW site is not located within or near any statutory or non-statutory sites designated for nature conservation. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has therefore been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The proposed site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The development site would require access via various minor roads connecting to A roads. However, the number of vehicle movements associated with the option is limited (an estimated 701 vehicle movements during the 1.5-year construction period) such that impacts on air quality associated with traffic congestion are not expected. The site is in a rural location with few receptors likely to be exposed to emissions associated with the use of plant and machinery. Overall, the option has been assessed as having a neutral effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 1,866 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors (a farm lies 50m north-west of the site, while the next closest receptors are 0.5km from the site). Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve a moderate capital expenditure resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a minor positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

A Scheduled Monument is located approximately 350m from the WTW site. There are 10 Grade I, II* and II listed buildings within 1km of the site, the closest of which is 600m from the site. No effects on these assets or their settings are predicted and a neutral effect has therefore been identified for SEA Objective 11.

Works would take place in a rural area and construction may have short term, temporary negative landscape and visual impacts. This option would not be located within protected/designated landscapes. The site is located 1.8km from the boundary of the Yorkshire Dales National Park; however, given the scale of works and distance involved, effects on the setting of the National Park are not anticipated. Overall, this option has been assessed as having a minor negative effect on landscape (SEA Objective 12).

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 19 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 922 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of 0.57 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The operational aboveground works include a new WTW, which is anticipated to have a minor negative effect on the local landscape, depending on final design, location and mitigation (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
351: Metals & UV Treatment of BSPs: Lunesdale Siphon (4)	Construction	-	-	0	0	-	--	-	++	0	--	0	--
	Operation	0	0	0	0	0	0	+	+	0	0	0	--

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Wrayton area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 5.59 Ml/d, with a maximum treatment capacity of 6.04 Ml/d.

The proposed WTW site is situated less than 50m from Robert Hall Moor SSSI and in consequence, mitigation measures would need to be implemented to ensure that construction activities and any resulting disturbance do not have an adverse effect on this habitat and any associated species. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. The option is not located within, or near to, any other statutory or non-statutory sites designated for nature conservation. Overall, a minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (600m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been determined.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The 1,826 vehicle movements during the 1.5-year construction period, together with emissions associated with the use of plant and machinery, are expected to cause a minor deterioration of air quality. The option is in a rural location and access through small villages and minor roads may also generate traffic congestion with effects on local air quality. This has been assessed as having a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of on-site plant would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,717 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts. The surrounding area is sparsely populated with very few nearby receptors; however, for the adjacent residential properties the works could cause notable increased nuisance. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve a large capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities are not anticipated, although it is possible that minor and temporary traffic congestion may arise. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are eight Grade II and II* listed buildings within 1km of the site, the closest of which lies 700m to the south-west. A Scheduled Monument is also located 700m from the site. No effects on these assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

The site is located within the Forest of Bowland AONB. Construction could therefore have a temporary but significant adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors would likely be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 35 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 251 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of 6.04 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would constitute new aboveground infrastructure located in the Forest of Bowland AONB and in consequence, there is the potential for adverse effects on this designated landscape. This has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
352: Metals & UV Treatment of BSPs: Lunesdale Siphon (5)	Construction	-	-	0	0	0	--	0	0	0	--	0	--
	Operation	0	0	0	0	0	0	+	+	0	0	0	--

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Bentham area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 0.01 Ml/d.

The proposed WTW site is not located within or near any statutory or non-statutory sites designated for nature conservation. A minor watercourse is approximately 130m from the proposed site and therefore construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.). However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. Areas of ancient woodland are located approximately 600m from the site, although these are not expected to be affected by the works. The proposed WTW is located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has therefore been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The site is in a rural location with access via minor roads. However, the number of vehicle movements associated with the option is limited (an estimated 393 vehicle movements during the 1.5-year construction period) such that impacts on air quality associated with traffic congestion are not expected. There are very few nearby receptors which may be exposed to emissions associated with the use of plant and machinery. Overall, this option has been assessed as having a neutral effect on SEA Objective 5.

During the construction phase, transportation and the use of on-site plant would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 1,662 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors, the closest of which is 200m from the WTW site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Capital expenditure associated with this option is likely to be small and would not have a substantive effect on the local economy or local employment creation. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a neutral effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are five Grade II listed buildings within 1km of the WTW site, the closest of which lies 350m to the north. No effects on these assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

The site is located within the Forest of Bowland AONB. Construction may therefore, have a temporary but adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors would likely be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 17 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 23,305 kWh/Ml, and there is also an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of 0.01 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would constitute new aboveground infrastructure located in the Forest of Bowland AONB and in consequence, there is the potential for adverse effects on this designated landscape. This has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
353: Metals & UV Treatment of BSPs: Lunesdale Siphon (6)	Construction	-	-	0	0	0	--	0	0	0	--	-	--
	Operation	0	0	0	0	0	0	+	+	0	0	-	--

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Bentham area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat 0.01 Ml/d.

The proposed WTW site is not located within any statutory or non-statutory sites designated for nature conservation. A small watercourse lies approximately 150m from the proposed site, which feeds into a river. Construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.); however, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. Areas of ancient woodland (Ancient & Semi-Natural Woodland) and Sites of Biological Importance are located approximately 100m from the WTW site but are not expected to be significantly affected by the works associated with this option. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has therefore been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The site is in a rural location with access via minor roads only. However, the number of vehicle movements associated with the option is limited (an estimated 397 vehicle movements during the 1.5-year construction period) such that impacts on air quality associated with traffic congestion are not expected. A farm lies adjacent to the site, although overall, there are very few nearby receptors which may be exposed to emissions associated with the use of plant and machinery and vehicle movements. On balance, the option has been assessed as having a neutral effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 1,662 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors (a farm lies adjacent to the site but the next closest residential receptor would be over 300m from the works). Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Capital expenditure associated with this option is likely to be small and would not have a substantive effect on the local economy or local employment creation. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a neutral effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

The adjacent farm is a Grade II listed building, which comprises of a farmhouse and adjoining barns dating to the 17th Century. Construction work may result in temporary effects on the setting of the farm, although direct effects on this asset are not expected (assuming appropriate mitigation is in place). Effects are not anticipated on the six further Grade II listed buildings located within 1km of the proposed site. Overall, this option has been assessed as having a minor negative effect on SEA Objective 11.

The proposed WTW site is located within the Forest of Bowland AONB. Construction could therefore have a temporary but adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors would likely be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 17 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 23,305 kWh/Ml, and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of 0.01 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

As noted above, the adjacent farm is a Grade II listed building and new above ground infrastructure may result in adverse effects on the setting of this asset. Overall, this option has been assessed as having a minor negative effect on SEA Objective 11 at this stage.

The new WTW would constitute new above ground infrastructure located in the Forest of Bowland AONB and in consequence, there is the potential for adverse effects on this designated landscape. This has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
354: Metals & UV Treatment of BSPs: Hodder Siphon	Construction	-	-	0	0/?	-	--	0	++	0	--	0	--
	Operation	0	0	0	0/?	0	-	++	++	0	-	0	--

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Newton-in-Bowland area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 40.86 Ml/d, with a maximum treatment capacity of 45.28 Ml/d.

The proposed WTW site is not located within any statutory or non-statutory sites designated for nature conservation. A river lies adjacent to the proposed works and therefore construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.). However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. There is an area of Ancient and Semi-Natural Woodland approximately 700m from the site; however, this is not expected to be affected by construction. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has therefore been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (600m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The proposed WTW site is located in Flood Zone 1 (low risk of flooding), although it is adjacent to areas of Flood Zones 2 and 3 and therefore works may be at risk of flooding depending on the final location and layout of the WTW and associated pipework. Construction activity would be unlikely to result in increased flood risk elsewhere. Overall, the option has been assessed as having a neutral effect on SEA Objective 4 at this stage, with some uncertainty depending on final infrastructure location.

The 4,653 vehicle movements during the 1.8-year construction period, together with emissions associated with the use of plant and machinery, are expected to cause minor deterioration of air quality. The option is in a rural location and access through small villages and minor roads may also generate traffic congestion with effects on local air quality. Overall, the option has been assessed as having a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 5,324 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors. The closest receptors are barns 80m from the proposed WTW site, and farm buildings beyond this, at 350m from the site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve a substantial capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Utilisation of the local road network as transportation corridors regarding HGV movements (approximately 4,653) during the implementation period in addition to ancillary works may result in congestion and localised travel disruption within the road network although any effects would be temporary and felt in the short term only. The magnitude of any localised effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are 20 Grade II and II* listed buildings within 1km of the proposed WTW site, predominantly in a nearby village. The closest to the proposed site is located 650m to the north-east. No effects on these assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

The proposed development site is located within the Forest of Bowland AONB. Construction could therefore have a temporary but adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors would likely be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The proposed WTW site is located in Flood Zone 1 (low risk of flooding); however, the final extent of the WTW infrastructure is not yet certain and may enter the adjacent Flood Zones 2 and 3, which would be at risk of flooding. Overall, the option has been assessed as having a neutral effect on SEA Objective 4 at this stage, with some uncertainty depending on final infrastructure location.

There would be no operational effects on air quality.

It is estimated that 153 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 209 kWh/Ml and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be notable and consequently, this option has been assessed as having a negative effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 45.28 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a significant positive effect on health. This would also contribute towards supporting economic/population growth which could result in a significant positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would constitute new aboveground infrastructure located in the Forest of Bowland AONB and in consequence, there is the potential for adverse effects on this designated landscape. This has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
355: Metals & UV Treatment of BSPs: Ribblesdale Siphon (1)	Construction	-	-	0	0	0	--	0	0	0	--	0	--
	Operation	0	0	0	0	0	0	+	+	0	0	0	--

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clitheroe area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 0.02 Ml/d, with a maximum treatment capacity of 0.03 Ml/d.

The proposed WTW site is not located within or near any statutory or non-statutory sites designated for nature conservation. A minor watercourse lies approximately 250m from the proposed site, and areas of Ancient and Semi-Natural Woodland are located at a distance of approximately 900m. These are not expected to be affected by the works. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land adjacent to an existing pumping station. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The proposed WTW site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The WTW site is in a rural location with access via minor roads. However, the number of vehicle movements associated with the option is limited (an estimated 400 vehicle movements during the 1.5-year construction period) such that impacts on air quality associated with traffic are not expected. There are very few nearby receptors which may be exposed to emissions associated with the use of plant and machinery. Overall, the option has been assessed as having a neutral effect on SEA Objective 5.

During the construction phase, transportation and the use of on-site plant would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 1,672 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors, the closest of which is 250m from the WTW site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Capital expenditure associated with this option would be small and unlikely to have a substantive effect on the local economy and local employment creation. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a neutral effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are three Grade II listed buildings within 1km of the proposed site, the closest of which lies 450m to the south-east. No effects on these assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

The proposed WTW site is located within the Forest of Bowland AONB. Whilst the works would be adjacent to an existing pumping station, the potential for construction to have a temporary but adverse effect on this designated landscape remains. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme, the number of receptors likely to be affected would be small. Overall, this option has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 17 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 11,739 kWh/Ml, and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 0.03 Ml/d associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a minor positive effect on health. This would also contribute towards supporting economic/population growth which could result in a minor positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would constitute new aboveground infrastructure located in the Forest of Bowland AONB and in consequence, there is the potential for adverse effects on this designated landscape. This has been assessed as having a significant negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
356: Metals & UV Treatment of BSPs: Ribblesdale Siphon (2)	Construction	-	-	0	0	-	--	0	++	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	-

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clitheroe area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 4.09 Ml/d, with a maximum treatment capacity of 5.05 Ml/d.

The proposed WTW site is not located within or near any statutory or non-statutory sites designated for nature conservation. The proposed WTW would be located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (600m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The 1,734 vehicle movements during the 1.5-year construction period, together with emissions associated with the use of plant and machinery, are expected to cause a minor deterioration in air quality. The option is in a rural location and access through small villages and minor roads may also generate traffic congestion with effects on local air quality. Overall, this option has been assessed as having a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,624 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the surrounding area is very sparsely populated with few nearby receptors, the closest of which is 350m from the WTW site. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve substantial capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities are not anticipated, although it is possible that minor and temporary traffic congestion may arise. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are nine Grade II and II* listed buildings within 1km of the proposed WTW site, the closest of which are seven assets approximately 350m from the site. No effects on these assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

Works would take place in a rural area and construction may have short term, temporary negative landscape and visual impacts. This option would not be located within a designated landscape; however, it would be 100m outside the boundary of the Forest of Bowland AONB. While construction would take place adjacent to an existing operational site, the potential for an adverse effect on the setting of the AONB remains, depending on final design and screening. Overall, this option has been assessed as having a minor negative effect on SEA Objective 12 at this stage.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 33 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 408 kWh/Ml, and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 5.05 Ml/d (with an average treatment of 4.09 Ml/d) associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a positive effect on health. This would also contribute towards supporting economic/population growth which could result in a positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

During operation, the presence of a new WTW in a rural area may affect the local landscape character. While the WTW would be located adjacent to an existing site, there is the potential for an adverse effect on the setting of the Forest of Bowland AONB due to the close proximity of the scheme to this designated landscape, depending on final design, location and mitigation. Overall, the option has been assessed as having a minor negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
357: Metals & UV Treatment of BSPs: Ribblesdale Siphon (3)	Construction	-	-	0	0	0/-	--	0	+	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	-

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clitheroe area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 2.10 Ml/d, with a maximum treatment capacity of 2.17 Ml/d.

This option is not located within any statutory or non-statutory sites designated for nature conservation. The site is adjacent to an Ancient & Semi-Natural Woodland and within 500m of other Ancient Woodland and Local Wildlife Sites, consequently, construction activities have the potential to cause disturbance to associated habitats and species (e.g. from site lighting, noise, vibration, etc.). However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. The proposed WTW is located on greenfield land and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has been identified with respect to SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The WTW site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The site is situated close to an A road but is expected to require access through a nearby village. Residential receptors may be exposed to very localised and short term minor deterioration of air quality due to the estimated 1,056 vehicle movements during the 1.5-year construction period (averaged at 3 HGVs per day, if work restricted to weekdays but likely to be higher when associated with specific aspects of the proposed scheme). This has been assessed as a neutral/minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,119 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts; however, the closest receptors in the nearby village would be approximately 300m from the works and are not expected to experience substantial health impacts. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a neutral effect on SEA Objective 7.

Construction would involve a moderate capital expenditure resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities are not anticipated, although it is possible that minor and temporary traffic congestion may arise. Overall, the option has been assessed as having a minor positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are four Scheduled Monuments within 1km of the proposed WTW site the closest of which is over 700m from the site. There are also numerous Grade I, II* and II listed buildings within the nearby village all of which are more than 0.5km from the site. However, no effects on these assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

This option would not be located within any designated landscapes. Construction would require new, aboveground works which may have short term, temporary negative impacts on local landscape character and the visual amenity of receptors in the nearby village. Overall, this option has been assessed as having a minor negative effect on landscape at this stage (SEA Objective 12).

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quantity/quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 23 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 302 kWh/Ml. There would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 2.17 Ml/d (with an average treatment of 2.10 Ml/d) associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a positive effect on health. This would also contribute towards supporting economic/population growth which could result in a positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

During operation, the presence of a new WTW may affect the local landscape character and the visual amenity of a small number of nearby receptors. Overall, the option has therefore been assessed as having a minor negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
358: Metals & UV Treatment of BSPs: Ribblesdale Siphon (4)	Construction	-	+/-/?	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	0	++	++	0	0	0	-

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Clayton-le-Moors area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 33.51 Ml/d, with a maximum treatment capacity of 43.05 Ml/d.

This option is not located within or near any statutory or non-statutory sites designated for nature conservation. The a canal is located circa 500m from the proposed WTW site and there are areas of Ancient and Semi-Natural Woodland over 700m from the site, although these are not expected to be affected by construction. The new WTW would be located on an existing site; however, the extent of the new WTW is not currently known and it is assumed that some greenfield land would be required, the development of which could result in the localised loss of/disturbance to habitats and species. Overall, the option has been assessed as having a minor negative effect on SEA Objective 1 at this stage.

As noted above, this option is expected to make use of an existing site; however, it is assumed that greenfield land would also be required. A short distance (600m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Overall, a mixed minor positive and minor negative effect on SEA Objective 2 has been determined.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The proposed WTW site is situated close to an A road and motorway and impacts on air quality associated with traffic congestion are therefore expected to be limited due to good access from the main road. Receptors adjacent to the site may, however, be exposed to minor deterioration of air quality due to the estimated 2,866 vehicle movements during the 1.5-year construction period, together with emissions associated with the use of plant and machinery. This has been assessed as having a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 3,469 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts. The surrounding area is sparsely populated with very few nearby receptors; however, for the adjacent properties the works could cause notable increased nuisance. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve substantial capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

The option would utilise some existing equipment already in operation at the site; however, the option would predominantly require new infrastructure. Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are four Grade II listed buildings within 1km of the proposed WTW site, the closest of which is located 430m south of the site. No effects on these heritage assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

This option would not be located within a designated landscape. The proposed WTW site is situated in a predominantly rural area with a small number of adjacent residential receptors; construction may therefore have short term, temporary negative landscape and visual impacts. Overall, this option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 76 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 107 kWh/Ml and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 43.05 Ml/d (with an average treatment of 33.51 Ml/d) associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a significant positive effect on health. This would also contribute towards supporting economic/population growth which could result in a significant positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

During operation, the presence of a new WTW may affect the local landscape character and the visual amenity of a small number of nearby receptors. Overall, the option has therefore been assessed as having a minor negative effect on SEA Objective 12 at this stage.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
359: Metals & UV Treatment of BSPs: Ribblesdale Siphon (5)	Construction	-	-	0	0	-	--	-	++	0	--	0	-
	Operation	0	0	0	0	0	0	+	+	0	0	0	-

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Accrington area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 5.23 Ml/d, with a maximum treatment capacity of 6.83 Ml/d.

This option is not located within or near any statutory or non-statutory sites designated for nature conservation. A small, unnamed stream is located approximately 50m from the site and therefore construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species. However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. The proposed WTW would be located on greenfield land adjacent to an existing pumping station, and construction may therefore result in the localised loss of/disturbance to habitats and species. Overall, a minor negative effect has been identified in respect of SEA Objective 1.

Construction of the WTW would result in the loss of a small area of greenfield land. A short distance (500m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a greenfield site, a minor negative effect on SEA Objective 2 has been determined.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels.

The site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The 1,743 vehicle movements during the 1.5-year construction period, together with emissions associated with the use of plant and machinery, are expected to cause a minor deterioration of air quality. The proposed development site is located close to and A road but works are expected to require access through a nearby village, which may result in temporary, localised congestion with resulting effects on air quality. Overall, the option has been assessed as having a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,588 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts on receptors in the surrounding residential areas. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve substantial capital expenditure resulting in a significant positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities are not anticipated, although it is possible that minor and temporary traffic congestion may arise. Overall, the option has been assessed as having a significant positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

There are six Grade II listed buildings within 1km of the proposed WTW site, the closest of which is approximately 250m to the south. No effects on these heritage assets or their settings are predicted and a neutral effect has therefore been identified in respect of SEA Objective 11.

Landscape and visual impacts associated with construction would be minor and temporary. The proposed works would not be located within an area designated for landscape. The WTW site is adjacent to an existing site and approximately 150m from industrial uses, although there is the potential for adverse impacts on the visual amenity of a small number of residential and recreational receptors to the south east. Overall, this option has been assessed as having a minor negative effect on SEA Objective 12.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of this option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 36 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 271 kWh/Ml and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 6.83 Ml/d (with an average treatment of 5.23 Ml/d) associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a positive effect on health. This would also contribute towards supporting economic/population growth which could result in a positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

There would be no operational effects on designated cultural heritage assets.

The new WTW would be located adjacent to an existing site and would not be within any designated landscape areas. Further, the WTW would be approximately 150m from industrial uses including a railway line and an industrial estate. In consequence, effects on local landscape character and visual amenity are expected to be minor (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
360: Metals & UV Treatment of BSPs: Haslingden	Construction	0	+	0	0	-	--	-	+	0	--	0	0
	Operation	0	0	0	0	0	0	+	+	0	0	0	0

Construction

This option would involve the construction of a new WTW with second stage RGF for metals removal and UV treatment in the Haslingden area in order to treat water siphoned off the Manchester and Pennine Aqueduct. This would also involve associated works including pumping, chemical dosing/storage, mixers and analysers. The new WTW is expected to treat an average of 8.97 Ml/d, with a maximum treatment capacity of 9.96 Ml/d.

This option is not located within or near any statutory or non-statutory sites designated for nature conservation. A river is adjacent to the proposed WTW site and therefore construction activities have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.). However, these risks are expected to be avoided or controlled through the normal project planning process and standard best-practice measures. The works would be located on an existing site and therefore disturbance to species or loss of habitat would likely be negligible. Overall, this option has been assessed as having a neutral effect on SEA Objective 1.

As noted above, the proposed scheme would be located on an existing site. A short distance (600m) of pipeline would be required; however, this would not require permanent land take with excavated land being reinstated following the construction phase. Due to the location of the proposed WTW on a brownfield site, a minor positive effect on SEA Objective 2 has been identified.

It is not expected that construction of this option would affect water quality or river flows/groundwater levels, provided that best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The proposed WTW site is located in Flood Zone 1 (low risk of flooding) and works would be unlikely to result in increased flood risk elsewhere. The option has therefore been assessed as having a neutral effect on SEA Objective 4.

The WTW site is situated close to two A roads and impacts on air quality associated with traffic congestion are therefore expected to be limited due to good access from the main road. Residential receptors may, however, be exposed to minor deterioration of air quality due to the estimated 1,427 vehicle movements during the 1.5-year construction period, together with emissions associated with the use of plant and machinery. This has been assessed as having a minor negative effect on SEA Objective 5.

During the construction phase, transportation and the use of plant on-site would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. Carbon emissions associated with this option would be 2,207 tonnes CO_2e which has been assessed as having a significant negative effect on SEA Objective 6.

Construction activity could result in temporary noise/vibration disturbance and air quality impacts on residential receptors to the immediate east of the proposed development site; however, the number of receptors that would be affected is likely to be small. Local opportunities for recreation and physical activity are not expected to be affected. Overall, this option has been assessed as having a minor negative effect on SEA Objective 7.

Construction would involve a moderate capital expenditure resulting in a positive effect on the local economy associated with employment opportunities and supply chain benefits. Effects on local facilities and traffic congestion are not anticipated. Overall, the option has been assessed as having a minor positive effect on SEA Objective 8.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on SEA Objective 9 during construction.

The option would utilise some existing equipment already in operation at the site; however, the scheme would predominantly require new infrastructure. Construction would increase resource use, energy usage and generate waste which has been assessed as having a significant negative effect on SEA Objective 10.

The proposed WTW site is located less than 50m from a Grade II listed structure, although the WTW would be screened by trees/hedges and is partially separated from the structure by an industrial unit. As a result, effects on the setting of the listed building are not expected. Nine further Grade II listed buildings are located between 400m and 1km from the site; however, the settings of these assets are not expected to be affected by the works. Overall, the option has been assessed as having a neutral effect on SEA Objective 11.

Any landscape and visual impacts associated with construction would be minor and temporary, with works taking place within an existing site (the visual amenity of a very small number of residential receptors to the east could be temporarily affected). The proposed development site is not located within an area designated for landscape. Overall, this option has been assessed as having a neutral effect on SEA Objective 12.

Operation

The operation of this option is expected to be within the limits of the existing abstraction licence and therefore would not affect local ecology through changes in flows. The treated water would be used directly for human consumption, and not returned to local waterbodies. As a result, effects on biodiversity are not anticipated (SEA Objective 1).

There would be no operational effects on land use/soils.

Operation of the option is expected to take place within the existing abstraction licence limits so effects on river flows/groundwater levels are not expected. The treated water would not be returned to waterbodies as it would be used as drinking water. A neutral effect on water quality has therefore been determined (SEA Objective 3).

The option is not expected to cause or exacerbate flooding, and is not located within an area at risk of flooding.

There would be no operational effects on air quality.

It is estimated that 30 tonnes CO_2e would be emitted per year during operation. The operational energy demand would be 114 kWh/Ml, and there would also be an ongoing requirement for chemical usage. Overall, operational greenhouse gas emissions are expected to be negligible and consequently, this option has been assessed as having a neutral effect on climate change (SEA Objective 6) and resource use (SEA Objectives 10).

As part of Solution B, the increased treatment capacity of up to 9.96 Ml/d (with an average treatment of 8.97 Ml/d) associated with this option would help to ensure that any metals and crypto/E-coli ingress along the Manchester and Pennine Aqueduct can be dealt with at each BSP, helping to ensure a continual supply of clean drinking water and generating a positive effect on health. This would also contribute towards supporting economic/population growth which could result in a positive effect on the local economy and social wellbeing.

The option would not affect water efficiency or leakage.

The WTW site is located in close proximity to a Grade II listed structure. However, as the new WTW would be located on an existing site and is screened from the structure by trees/hedges, there are not expected to be operational effects on this, or other more distant, assets (SEA Objective 11).

The new WTW would be located on an existing site and adjacent to industrial units; once works are complete, any landscape and visual impacts are therefore expected to be negligible. As a result, effects on the local landscape or visual amenity are not expected (SEA Objective 12).

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
382: Manchester and Pennine Aqueduct to Raw: WTW reduced flow	Construction	-	-	0	-	-	--	-	++/-	0	--	0	-
	Operation	0	0	0	0	0	-	+	+	0	-	0	-

Construction

This option would reduce the flow of a WTW in the Kendal area from 570 Ml/d to 80 Ml/d whilst continuing to provide treated water to existing BSPs. In conjunction with Options 3, 212, 213, 214, 301, 303 and 306, it would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct.

The option would require: modifications and refurbishment of the existing WTW to maintain the existing process but at a reduced flow of 80 Ml/d; new connections to a new inlet tank (total length circa 8km); new UV disinfection process; new final water chemical dosing and storage in bunded area – replaced existing due to new outlet position; sodium bisulphite dosing and storage for de-chlorination of start up to waste line and pre UV disinfection (prevention of fouling); dual process streaming of works to minimise plant shut-downs and ensure 50% of max flow can be maintained at all times; and a new valve chamber and new twin outlet pipelines from the WTW to supply existing BSPs.

The WTW site is not located within any statutory or non-statutory sites designated for nature conservation, although it is in relative close proximity (approximately 700m) to the River Kent SAC/SSSI. Modifications to the WTW would be within or adjacent to an existing site and no effects on the SAC/SSSI are expected. The proposed pipeline would cross a SAC/SSSI although it is expected that significant or significant adverse effects could be avoided with established mitigation measures. More generally, some WTW development and pipeline works would take place on greenfield land and in consequence, construction activity may result in the localised loss of/disturbance to habitats and species. Overall, the implementation of this option is expected to have a temporary, localised impact biodiversity and a minor negative effect has therefore been identified in respect of SEA Objective 1.

Works associated with modifications to an existing WTW would be undertaken within the existing WTW site but the scheme would additionally require some adjacent greenfield land, albeit of Grade 4 quality. Pipeline works associated with this option would be both under the existing WTW site and greenfield land, although all excavated land would be reinstated following construction. Overall, this option has been assessed as having a minor negative effect on land use and soil (SEA Objective 2).

During construction, there is the potential for contaminants to pollute watercourses including where the proposed pipeline crosses a river. However, it is assumed that construction activities would be undertaken in accordance with relevant best practice and pollution prevention guidance, and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). Consequently, the option has been assessed as having a neutral effect on water quality and quantity (SEA Objective 3).

Construction would not cause or exacerbate flooding in the area, although it should be noted that a section of pipeline would be routed across Flood Zone 2 and therefore works may be liable to flooding (depending on timing). In consequence, the option has been assessed as having a minor negative effect on SEA Objective 4 at this stage.

This option would require in the region of 24,787 vehicle movements over a 1.9-year construction period which, together with emissions from associated plant, are likely to have an adverse effect on local air quality. The number of vehicle movements associated with the transportation of equipment and materials, together with road crossings associated with pipeline works, may also result in delays and disruption, e.g. lengthened driver-delay and congestion. These impacts may be particularly significant along the connecting road network from the motorway and A roads, which traverse the north side of a nearby town. Consequently, this option has been assessed as having a minor negative effect on air quality (SEA Objective 5).

During the construction phase, the use of on-site plant and transportation of equipment/materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 10,720tCO_2e during construction. This option would comprise several infrastructure components which would require a moderate volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial. Furthermore, this option would generate construction wastes which would include excavation debris and infrastructural waste. Overall, this option has been assessed as having significant negative effects on climate change (SEA Objective 6) and resource use (SEA Objective 10).

The implementation of the scheme is not expected to affect opportunities for recreation and physical activity. Construction activity, together with the transportation of materials and equipment on the local road network, may result in temporary noise and disturbance during construction, although the number of receptors likely to be affected is small and it is anticipated that potential adverse impacts would managed and mitigated where possible using best practice procedures. Overall, this option has been assessed as having a minor negative effect on human health (SEA Objective 7).

Construction would involve a large capital expenditure which is expected to generate a number of employment opportunities and supply chain benefits. There would be no impact on existing recreational facilities. Construction is likely to cause some congestion and delay on the local road network, although any effects would be temporary. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on SEA Objective 8.

This is a resilience option against structural failure of the Manchester and Pennine Aqueduct and would not affect water efficiency. The implementation of the option would not lead to a reduction in losses from the supply network nor would construction improve water efficiency. In consequence, the option has been assessed as having a neutral effect on water resources during construction (SEA Objective 9).

There is a listed structure approximately 450m from the WTW site and the closest Scheduled Monuments are at approximately 3km. Due to the distance of the scheme from these assets, it is considered that construction would not impact on these designated heritage features or their settings and a neutral effect has therefore been identified in respect of SEA Objective 11.

Modifications to the WTW would be approximately 650m from the boundary of the Lake District National Park and World Heritage Site. However, the scheme would be set within the context of a large existing site (with extension beyond the site boundary) such that landscape and visual impacts are not expected to be significant. However, there remains the potential for impacts on local landscape character and visual amenity including along the proposed pipeline route, in addition to an adverse effect on the setting of the National Park, depending on final design and screening. Overall, the option has been assessed as having a negative effect on landscape (SEA Objective 12) during construction.

Operation

It is assumed that the direct abstraction of raw water from an existing reservoir would remain within the existing licenced limit and consequently, it is considered unlikely that the operation of this option would result in any adverse effects on biodiversity (including River Kent SAC/SSSI). Overall, this option has been assessed as having a neutral effect on biodiversity (SEA Objective 1).

Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on SEA Objective 2 have been assessed as neutral.

There would be no impacts on the status of the surface water bodies from the operation of the option and consequently, the operation of the option would have a neutral effect on SEA Objective 3.

The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on flood risk (SEA Objective 4).

There would be no operational effects on air quality (SEA Objective 5).

The operation of this option would result in a very small long-term increase in energy use and emissions associated with the treatment and pumping of water. Operational vehicle movements (estimated at 9,100) would also contribute to emissions. Operational emissions would be 240 tonnes CO_2e/a. Overall, this option has been assessed as having a negative effect on climate change (SEA Objective 6).

Once operational, the option is not expected to have any adverse effects on health as a result of noise or adverse air quality impacts nor should it have any discernible impacts on recreational activities. In conjunction with Options 3, 212, 213, 214, 301, 303 and 306, this option would form part of the overall solution which covers the requirements for the Manchester and Pennine Aqueduct becoming a raw water aqueduct. This would help to ensure a continual supply of clean drinking water, generating a positive effect on health. The option would also contribute towards supporting economic/population growth which could result in a positive effect on the local economy and social wellbeing.

The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during operation (SEA Objective 9).

The treatment and pumping of water associated with this option would result in a very small long-term increase in energy use (operation energy usage is estimated to be approximately 9 KWh/Ml). Overall, the operation of this option has been assessed as having a negative effect on resource use (SEA Objective 10).

There would be no operational effects on designated cultural heritage assets.

Once construction is complete, the proposed scheme would be approximately 650m from the boundary of the Lake District National Park and World Heritage Site. However, the scheme would be set within the context of a large existing site (with extension beyond the existing boundary) such that landscape and visual impacts are not expected to be significant, although there remains the potential for impacts on local landscape character and the setting of the National Park. This has been assessed as having a negative effect on landscape (SEA Objective 12).

Appendix E
Preferred Options Assessment Matrices

Preferred Manchester and Pennine Resilience Options

Option WR037-042: Manchester and Pennine Aqueduct sections T01 to T06

Option Summary

This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	-	0	**Effects of Construction** The proposed route for the six tunnels under Option 37-42 would cross the Bowland Fells SPA/ SSSI for a distance of approximately 7km. This site as a result of construction-related disturbance are unlikely (assuming all normal best-practice). The HRA highlights that there is a theoretical risk of groundwater bodies beneath the SPA being affected by the aqueduct, which may then have indirect effects on any groundwater dependent ecosystems within the European sites that have hydrological connectivity. This could, in theory, result affect the integrity of the SPA by affecting the habitats that support the interest features. However, this risk is considered to be negligible due to • the dominance of low-permeability geological formations; • the nature of the upland habitats (predominantly ombrotrophic mires (etc.) maintained by rainfall and shallow subsurface flows rather than deep groundwater) and the absence of any evidence of significant connectivity with groundwater; • the depth of the pipeline (at least 50m below the surface at the boundary of the SPA, and more typically in excess of 200m below the surface); • the absence of any evidence that the existing aqueduct, which also runs beneath the fells, is having any effect on surface habitats. The River Kent SAC is also within close proximity of the tunnel works whilst short sections of open-cut pipeline either cross, or are within the catchment of, minor

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				tributaries of Morecambe Bay (and hence its associated European sites). The effects on the River Kent SAC and Morecambe Bay suite of sites are likely to be avoidable with normal best-practice. There is a potential for construction work to impact further designated sites as the tunnels would be within approximately 5km of the Burns Beck Moss SSSI, Fair Holme Meadow SSSI, Roeburndale Woods SSSI, Myttons Meadows SSSI, Bell Sykes Meadows SSSI, West Pennine Moors SSSI, Hodge Clough SSSI, Lower Red Lees Pasture SSSI, Langcliff Cross Meadow SSSI and close to an LNR and SAC and several Local Wildlife Sites and ancient woodlands. The scale of excavation and ancillary works could generate adverse effects on the designated ecological receptors; however, impact pathways are limited for these sites and if best practice and mitigation measures are used during construction, the disturbance to habitats and species is likely to be minor and short-term. Overall, this option has been assessed as having a negative effect on Objective 1. **Effects of Operation** It is assumed that the operation of the scheme, which includes the direct abstraction of raw water from an existing reservoir, would remain within the licensed abstraction limit. Consequently, it is considered unlikely that operation would result in any adverse and/or significant effects on European designated conservation sites. Any disturbed land from excavation/demolition would be reinstated thus it is highly unlikely that there would be any disturbance to terrestrial wildlife regarding habitat loss or mobility in the longer term during operation of the scheme. Overall, this option has been assessed as having a neutral effect on biodiversity Objective 1. **Mitigation** • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant and/or adverse construction effects on both local wildlife features and designated conservation areas. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• Operational mitigation would be actively implemented as required by abstraction licence constraints in order to prevent adverse effects under resource constrained conditions. **Uncertainty** • None identified.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	-	0	**Effects of Construction** This option would not require permanent land take with excavated land being reinstated following the construction phase. In general, the proposed scheme would be situated within Grades 3/4/5 agricultural land such that development should not significantly affect agricultural potential; however, the proposed overall tunnel length is substantial. It is not expected that geologically protected sites would be adversely affected by the implementation of the scheme. Overall, given the length of the tunnels, this option has been assessed as having a minor negative effect on Objective 2. **Effects of Operation** Once construction activity is complete, no ongoing impact on land use/soils is expected; consequently, operational effects on this objective have been assessed as neutral. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions** • It has been assumed that development sites are not contaminated. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows?	-/?	-/?	**Effects of Construction** The WFD assessment notes that there is potential from dewatering arising from the construction of the tunnel and shafts which may affect groundwater levels and flows, which could in turn impact on baseflows to nearby water courses. There may also be water quality impacts from drilling shafts through mine workings, or spillages from construction machinery in the subsurface environment. However, the WFD assessment highlights that a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?			lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) may protect surface water bodies from impacts arising from changes in the groundwater regime. During construction, the proposed tunnel routes would cross a number of surface water bodies. A pipe bridge would be required to cross two brooks and one conduit section would cross a larger water body which poses the risk of direct or residual pollution/debris entering the water network. It is assumed, however, that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). Overall, the option has been assessed as having a negative effect on Objective 3, although some uncertainty remains. **Effects of Operation** The WFD assessment notes that as the tunnel would be constructed within the saturated zone of the aquifer, the presence of a low permeability linear structure may alter groundwater flows and levels, particularly where the tunnel is shallower and within the zone of active groundwater flow which may affect surface water. However, a detailed study of the geology of the tunnel route has not been undertaken at this time, and good connections between the groundwater and surface water environment have been assumed. Further study may indicate that lower permeability strata (e.g. mudstones) and superficial deposits (e.g. glacial till) may protect surface water bodies from impacts arising from changes in the groundwater regime. Overall, this option has been assessed as having a negative effect on Objective 3 at this stage, although some uncertainty remains. **Mitigation** • Further detailed WFD assessment should be undertaken at the project stage. Further assessment should include consideration of more detailed design information, detailed geological study and investigation of the water environment (in particular links between the groundwater and surface water environments), detailed impact assessment, and more detailed review of WFD objectives to ensure that the effects highlighted in this report are appropriately accounted for. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). • Good connections between the groundwater and surface water environment have been assumed

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The likelihood of operational effects on groundwater is uncertain.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	-	0	**Effects of Construction** The scheme would involve waterbody crossings, which inherently involves crossing Flood Zone 3. In consequence, construction activity may be liable to flooding depending on timing. However, the scheme is not expected to cause or exacerbate flooding elsewhere. Overall, this option has been assessed as having a minor negative effect on Objective 4. **Effects of Operation** The overall operation of the scheme is not expected to cause or exacerbate flooding elsewhere now or into the future thus having a neutral effect on Objective 4. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?	--	0	**Effects of Construction** The option would generate some 496,000 HGV movements over a 6-year construction period (albeit over a large area) which, together with emissions to air from plant, may have an adverse effect on local air quality. Vehicle movements and the transportation of equipment/material may result in disruption, e.g. lengthened driver-delay and congestion, due to the utilisation of the local road network (motorways, A roads and connecting lower classifications of road) which could increase associated emissions.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option reduce the need to travel or encourage sustainable modes of transport?			The proposed scheme would not be within designated Air Quality Management Areas (AQMAs). Overall, given the scale and duration of the option, it has been assessed as having a significant negative effect on air quality, although it is recognised that works would take place over a large area. **Effects of Operation** Operational emissions to air are expected to be negligible, and in this respect, the option would not generate any vehicle movements during operation. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process (if/as required). **Assumptions** • None identified. **Uncertainty** • None identified.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	--	0	**Effects of Construction** During the construction phase, the use of plant on-site and transportation of materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 954,011 tCO_2e during construction (comprising both embodied carbon in construction materials and emissions from vehicle movements) which has been assessed as having a significant negative effect on Objective 6. **Effects of Operation** During operation, this option would involve the treatment and pumping of water which would result in an increase in emissions. Operational emissions would, however, be negligible (12.3 tonnes CO_2e/a). This option has therefore been assessed as having a neutral effect on Objective 6.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate, if appropriate, renewable energy provision. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-	++	**Effects of Construction** The six proposed tunnels would be located within rural and urban areas. The overall implementation of the scheme is not expected to significantly affect opportunities for recreation and physical activity; however, individual components may result in the temporary disruption of use and amenity of recreation within the general vicinity of the scheme. As previously noted, tunnel works would cross surface water bodies which could adversely impact recreational river users. There may also be temporary noise/vibration disturbance and air quality impacts associated with excavation which could affect residential receptors in the vicinity of the proposed route. An outage of the Manchester and Pennine Aqueduct would be required in order to facilitate development. Notwithstanding this, works would be temporary, dispersed over a large area and associated effects are expected to be felt in the short term only. It is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Overall, this option has been assessed as having a minor negative effect on Objective 7. **Effects of Operation** Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts and it is considered highly unlikely that operation would adversely affect recreational activities. The option would form part of the overall solution that would provide significant resilience of supply to over two million customers in the event of the failure of the Manchester and Pennine Aqueduct. The option has therefore been assessed as having a significant positive effect on Objective 7.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • None identified. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**++/-**	**++**	**Effects of Construction** The construction of this option would represent a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Whilst the degree to which this would benefit the local labour market and local businesses would depend, to an extent, on the recruitment practices of contractors appointed to undertake the works, existing skills within the local labour market, and the procurement policies of both United Utilities and any sub-contractors, benefits are expected to be substantial. Utilisation of the local road network as a transportation corridor for HGV movements (approximately 496,000 movements) during the implementation period, in addition to road crossings, may result in congestion and localised travel disruption although any effects would be temporary and felt in the short term only. Nonetheless, the magnitude of effects is likely to be lessened by the adoption of mitigation measures at the project level. Overall, the option has been assessed as having a mixed significant positive and minor negative effect on Objective 8. **Effects of Operation** This option would not require significant levels of additional resource (financial or human) during operation, and in consequence, it is likely to be resilient to any future changes in these resources. The option would increase regional resilience which may support economic and population growth. Operation may also ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. Therefore, this option has been assessed as having a significant positive effect on economic and social wellbeing (Objective 8). **Mitigation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. • A detailed transport assessment should be undertaken as part of the EIA process (if/as required). **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**0**	**Effects of Construction and Operation** The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**--**	**0**	**Effects of Construction** This option would require a very substantial volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase as a proxy (954,011 tCO_2e), material use and energy requirements are considered to be substantial. This option would generate construction wastes which would include excavation debris (soil/rock) and infrastructural waste, although this would be reused/recycled. Overall, this option has been assessed as having significant negative effect on Objective 10. **Effects of Operation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				The operation of this option may require additional resources such as chemicals used in the treatment of raw water alongside materials used for the long term maintenance. However, overall it is considered that operational resource use would be negligible. **Mitigation** • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques. **Assumptions** • None identified. **Uncertainty** • Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. • The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. • The volume of waste generated under operation of this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction** There are approximately six grade II listed buildings within the vicinity of the proposed tunnels. The tunnels would also be located approximately 500m from a Scheduled Monument. Given the distance from these features and because the option involves below ground infrastructure, it is considered that construction would not adversely affect these heritage assets. Overall, this option has been assessed as having a neutral effect on Objective 11. **Effects of Operation** The operation of the new tunnels would not impact on cultural heritage assets (Objective 11). **Mitigation** • None identified. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	-	0	**Effects of Construction** The route of the proposed tunnels would traverse part of the Yorkshire Dales National Park and the Forest of Bowland AONB. However, as works would be largely at depth, the landscape and visual impacts associated with the construction of this option would be minor and temporary. Overall, this option has been assessed as having a minor negative effect on Objective 12. **Effects of Operation** The operation of the new tunnels would not impact on the local landscape or affect visual amenity (Objective 12). **Mitigation** • Construction activity should be screened where possible as to avoid/minimise adverse landscape/visual impacts. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR112: Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections

Option Summary

This option would involve implementing Manchester and Pennine Aqueduct outage for a period of 4 weeks to facilitate the installation of connections. There would be no new development associated with this option.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on biodiversity is not anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?			assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on soil quality and geodiversity is not anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on water quality and/or quantity is not anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on flood risk is not anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on air quality is not anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**-**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** During the 4-week outage periods, there would be a reduction in energy and resource use required to treat water at an existing WTW. However, there would also be an increase in energy use at 39 other WTWs due to an increased production requirement to meet the flow deficit caused by the Manchester and Pennine Aqueduct outage. This would generate carbon emissions of 1,518 tCO_2e. Overall, this option has been assessed as having a minor negative effect on climate change. **Mitigation** • Maximise the use of renewable energy sources, including alternative fuel sources. • Consider opportunities to minimise CO_2 emissions associated with staff travel, including provision of alternative modes of transport **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**+**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** As part of Solution D, this option would support the construction of new tunnel sections along the Manchester and Pennine Aqueduct, enhancing its resilience and helping to ensure the continuity of a safe and secure drinking water supply. Ensuring a resilient supply of clean drinking water would, in turn, have an ongoing positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** As part of Solution D, this option would support the construction of new tunnel sections along the Manchester and Pennine Aqueduct, enhancing its resilience. In turn, this would support economic and population growth generating a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, no effects on this objective are predicted. **Mitigation** • None identified. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**-**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** During the 4-week outage periods, there would be a reduction in energy and resource use required to treat water at an existing WTW. However, there would also be an increase in energy use at 39 other WTWs due to an increased production requirement to meet the flow deficit caused by the Manchester and Pennine Aqueduct outage. Overall, this has been assessed as having a negative effect on this objective. **Mitigation** • Maximise the use of renewable energy sources, including alternative fuel sources. **Assumptions** • None identified. **Uncertainty** • None identified.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeo environmental deposits?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on cultural heritage is not anticipated. **Mitigation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option affect public access to, or enjoyment of, features of cultural heritage?			• None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction** There would be no new development associated with the option. **Effects of Operation** The operation of this option would involve taking sections of the Manchester and Pennine Aqueduct out of use for a period of 4 weeks to enable the installation of connections. Alternative water sources would be used during this period and it is assumed that no new/additional abstraction would be required to compensate for the outage. In consequence, an effect on landscape is not anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Preferred Demand Management - Leakage Reduction and Network Metering Options

Option WR500a: Leakage Reduction Stage 1

Option Summary

This option would involve an increase in leakage detection and repair activity over a 3 year period. It is anticipated that 276 leakage surveys, 510 pipeline repairs and 10 pressure management valve (PMV) installations would be undertaken per annum.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of PMVs may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option prevent the spread/introduction of invasive non-native species?			Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?			**Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of PMVs may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of PMVs would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 4,250 vehicle movements over the 3 year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of PMVs would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and PMVs), the operation of plant and vehicle movements throughout the investigative and construction period. However, emissions associated with this option would be very small (16 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 199 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**+**	**Effects of Construction** The repair of pipelines and installation of PMVs would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 10 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 10 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 10 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and PMVs, for example) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of PMVs may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500b: Leakage Reduction Stage 2

Option Summary

This option would involve an increase in leakage detection and repair activity. It is anticipated that 615 leakage surveys, 1,020 pipeline repairs and 23 pressure management valve (PMV) installations would be undertaken per annum (including Leakage Reduction Stage 1).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of PMVs may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of PMVs may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of PMVs would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 8,999 vehicle movements over the implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of PMVs would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and PMVs), the operation of plant and vehicle movements throughout the investigative and construction period. However, emissions associated with this option would be very small (33 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 364 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**++**	**Effects of Construction** The repair of pipelines and installation of PMVs would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 20 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	+	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a minor positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 20 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 20 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and PMVs, for example) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of PMVs may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500c: Leakage Reduction Stage 3

Option Summary

This option would involve an increase in leakage detection and repair activity. It is anticipated that 947 leakage surveys, 1,428 pipeline repairs and 35 pressure management valve (PMV) installations would be undertaken per annum (including Leakage Reduction Stages 1 and 2).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of PMVs may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of PMVs may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of PMVs would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 13,283 vehicle movements over the implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of PMVs would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and PMVs), the operation of plant and vehicle movements throughout the investigative and construction period. However, emissions associated with this option would be very small (48 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 421 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**++**	**Effects of Construction** The repair of pipelines and installation of PMVs would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 28 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	+	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a minor positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 28 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 28 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and PMVs, for example) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of PMVs may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500d: Leakage Reduction Stage 4

Option Summary

This option would involve an increase in leakage detection and repair activity. It is anticipated that 1,467 leakage surveys, 1,938 pipeline repairs and 54 pressure management valve (PMV) installations would be undertaken per annum (including Leakage Reduction Stages 1, 2 and 3).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of PMVs may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of PMVs may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of PMVs would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 19,484 vehicle movements over the implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of PMVs would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and PMVs), the operation of plant and vehicle movements throughout the investigative and construction period. However, emissions associated with this option would be very small (71 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 459 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**++**	**Effects of Construction** The repair of pipelines and installation of PMVs would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 38 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a significant positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 38 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 38 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and PMVs, for example) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of PMVs may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500e: Leakage Reduction Stage 5

Option Summary

This option would involve an increase in leakage detection and repair activity. It is anticipated that 2,159 leakage surveys, 2,448 pipeline repairs and 80 pressure management valve (PMV) installations would be undertaken per annum (including Leakage Reduction Stages 1, 2, 3 and 4).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of PMVs may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of PMVs may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of PMVs would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 27,059 vehicle movements over the implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of PMVs would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and PMVs), the operation of plant and vehicle movements throughout the investigative and construction period. However, emissions associated with this option would be very small (98 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 457 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**++**	**Effects of Construction** The repair of pipelines and installation of PMVs would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 38 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a significant positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 48 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of PMVs would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 48 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and PMVs, for example) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of PMVs may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of PMVs, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500f: Leakage Reduction Stage 6

Option Summary

This option would involve an increase in leakage detection and repair activity over a 1 year period. It is anticipated that 85 leakage surveys, 511 pipeline repairs and 4,424 noise lgger installations would be undertaken per annum.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of noise loggers may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of noise loggers may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of noise lggers would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 2,277 vehicle movements over the one year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	-	+	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of noise loggers would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and noise loggers), the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 601 tCO_2e and in consequence, the option has been assessed as having a minor negative effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 110 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**+**	**Effects of Construction** The repair of pipelines and installation of noise loggers would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 4.99 Ml/d which has been assessed as having a positive effect on health.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 4.99 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 4.99 Ml/d which has been assessed as having a positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**-**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and noise loggers, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be minor. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a negative effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of noise loggers may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500g: Leakage Reduction Stage 7

Option Summary

This option would involve an increase in leakage detection and repair activity over a 2 year period. It is anticipated that 189 leakage surveys, 1,136 pipeline repairs and 12,572 noise lgger installations would be undertaken per annum (including Leakage Reduction Stage 6).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of noise loggers may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of noise loggers may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of noise lggers would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 5,512 vehicle movements over the two year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	--	+	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of noise loggers would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and noise loggers), the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 1,702 tCO_2e (including Option WR500f) and in consequence, the option has been assessed as having a significant negative effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 204 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**-/?**	**+**	**Effects of Construction** The repair of pipelines and installation of noise loggers would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 9.81 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 9.81 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 9.81 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**--**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and noise loggers, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be significant. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a significant negative effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of noise loggers may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500h: Leakage Reduction Stage 8

Option Summary

This option would involve an increase in leakage detection and repair activity over a 3 year period. It is anticipated that 414 leakage surveys, 2,486 pipeline repairs and 32,655 noise lgger installations would be undertaken per annum (including Leakage Reduction Stages 6 and 7).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of noise loggers may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of noise loggers may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of noise lggers would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 11,447 vehicle movements over the three year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	--	+	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of noise loggers would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and noise loggers), the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 4,411 tCO_2e (including Options WR500f-g) and in consequence, the option has been assessed as having a significant negative effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 387 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-/?	++	**Effects of Construction** The repair of pipelines and installation of noise loggers would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 19.81 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	+	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a minor positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 19.81 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	0	++	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 19.81 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	--	+	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and noise loggers, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be significant. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a significant negative effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of noise loggers may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500i: Leakage Reduction Stage 9

Option Summary

This option would involve an increase in leakage detection and repair activity over a 5 year period. It is anticipated that 645 leakage surveys,3,874 pipeline repairs and 58,230 noise lgger installations would be undertaken per annum (including Leakage Reduction Stages 7 and 8).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of noise loggers may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of noise loggers may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of noise lggers would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 18,084 vehicle movements over the five year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	--	+	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of noise loggers would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and noise loggers), the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 10,719 tCO_2e (including Options WR500f-h) and in consequence, the option has been assessed as having a significant negative effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 544 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-/?	++	**Effects of Construction** The repair of pipelines and installation of noise loggers would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 29.95 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	+	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 29.95 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	0	++	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 29.95 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	--	+	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and noise loggers, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be significant. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a significant negative effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of noise loggers may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500j: Leakage Reduction Stage 10

Option Summary

This option would involve an increase in leakage detection and repair activity over a 6 year period. It is anticipated that 902 leakage surveys,5,416 pipeline repairs and 87,465 noise lgger installations would be undertaken per annum (including Leakage Reduction Stages 7, 8 and 9).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of noise loggers may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of noise loggers may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of noise lggers would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 25,483 vehicle movements over the six year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	--	+	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of noise loggers would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and noise loggers), the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 17,929 tCO_2e (including Options WR500f-i) and in consequence, the option has been assessed as having a significant negative effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 677 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-/?	++	**Effects of Construction** The repair of pipelines and installation of noise loggers would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 39.90 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a significant positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 39.90 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	0	++	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 39.90 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	--	+	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and noise loggers, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be significant. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a significant negative effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of noise loggers may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR500k: Leakage Reduction Stage 11

Option Summary

This option would involve an increase in leakage detection and repair activity over a 7 year period. It is anticipated that 1,014 leakage surveys, 6,087 pipeline repairs and 104,554 noise lgger installations would be undertaken per annum (including Leakage Reduction Stages 7, 8, 9 and 10).

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Construction activity associated with leakage repair and the installation of noise loggers may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. Investigative procedures are not predicted to be intensive, although accessing the pipeline network may result in minor temporary adverse effects on local ecology. Neither the locations of the pipelines requiring repair nor the scale of the proposed works are currently known although it is expected that works are likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once pipeline repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with pipeline repair and the installation of noise loggers may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of repair activity is currently unknown, it is assumed that works could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**-/?**	**0**	**Effects of Construction** Leakage investigation and subsequent pipeline repair and installation of noise lggers would generate vehicle movements associated with the transportation of material, equipment and personnel. It is estimated that there would be up to 28,849 vehicle movements over the seven year implementation period which would result in increased emissions to air. This scale of vehicle movements and associated emissions are not expected to cause significantly adverse effects on air quality, given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. However, if emissions were concentrated in localised areas, particularly if they included designated air quality management areas (AQMAs), they could contribute to the exceedance of air quality thresholds and could be considered adverse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once pipeline repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	--	+	**Effects of Construction** Leakage investigation and the repair of pipelines/installation of noise loggers would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair and noise loggers), the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 20,226 tCO_2e (including Options WR500f-j) and in consequence, the option has been assessed as having a significant negative effect on climate change. **Effects of Operation** Once the identification and repair of network leakages is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 633 tCO_2e per year (on average over the first

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-/?	++	**Effects of Construction** The repair of pipelines and installation of noise loggers would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, although as the locations of pipelines to be repaired are not known, some uncertainty remains. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair, there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a negative effect on health, although some uncertainty remains. **Effects of Operation** Once the identification and repair of network leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				an estimated water saving of up to 45.23 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be generated during the implementation phase of this option. Pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having a significant positive effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 45.23 Ml/d which has been assessed as having a significant positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	0	++	**Effects of Construction** It is not expected that leakage investigation and pipeline repair/installation of noise loggers would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The identification and repair pipelines would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 45.23 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	--	+	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair and noise loggers, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be significant. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a significant negative effect on resource use. **Effects of Operation** Any additional resource use once pipeline works have been completed would be negligible.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Pipelines targeted for investigation and subsequent repair could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**-/?**	**0**	**Effects of Construction** Pipeline investigation and repair including the installation of noise loggers may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be temporary and following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of pipeline repairs/installation of noise loggers, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the pipelines requiring repair and the scale of the proposed works are not currently known.

Option WR503: Monitoring of Household Meters to Identify and Fix Supply Pipe Leaks

Option Summary

This option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5 year period.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** Works associated with the repair of supply pipe leaks would be undertaken within the curtilage of customer properties and in consequence, works would not be expected to have a discernible effect on designated nature conservation sites (e.g. SACs, SPAs, Ramsar and SSSIs), the ecological quality of habitats and associated groundwater/river water bodies, habitat fragmentation, management of natural habitats and ecosystems, habitat restoration and creation, or the prevention of invasive non-native species transfer. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Once supply pipe repair works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target existing supply pipes within the curtilages of customer properties and would not require any new land take. In consequence, there would be no effects on land use, geodiversity or soils during construction and operation and the option has therefore been assessed as having a neutral effect on SEA Objective 2. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the repair of supply pipes would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted. Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Supply pipe repair would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with supply pipe repair would take place within the curtilages of customer properties and are unlikely to be significantly affected by flood risk. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** Supply pipe repair would generate vehicle movements associated with the transportation of material, equipment and personnel which would generate emissions to air. However, the number of vehicle movements associated with this option would be very small. There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors including occupants of related properties. However, any effects in this regard would be temporary and are unlikely to be significant. Once supply pipe repairs are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**0**	**Effects of Construction** The repair of supply pipes would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair), the operation of machinery and vehicle movements. However, emissions associated with this option would be very small and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the repair of supply pipes is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, reductions in greenhouse gas emissions associated with this option would be very small (58 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time). Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. However, in view of the level of estimated water savings associated with this option (3.81 Ml/d), any effects in this regard are likely to be negligible. Overall, this option has been assessed as having a neutral effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**+**	**Effects of Construction** The repair of supply pipes would generate some noise and emissions to air; however, whilst activity would take place within the curtilages of customer properties (and, therefore, in close proximity to sensitive receptors), any effects are expected to be negligible reflecting the small scale of works and their temporary nature. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes, although the volume of movements associated with this option would be very small and any impacts would be temporary.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				During the period of pipeline repair, there may be temporary disruption to the water supplies of the affected customer. Overall, this option has been assessed as having a neutral effect on health. **Effects of Operation** Once the identification and repair of supply pipe leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 3.81 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of any contractors to undertake pipeline works) may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small and it is likely that the majority of work would be accommodated in existing employees' or contractors'/partners' workloads. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 3.81 Ml/d which has been assessed as having a positive effect on wellbeing. The repair of supply pipe leaks could also help reduce water bills for metered customers. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that supply pipe repair would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The repair of supply pipes would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 3.81 Ml/d which has been assessed as having a positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**0**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair, for example) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Works may generate waste which could include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Any additional resource use once pipeline works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. However, using carbon emissions savings associated with this option as a proxy for energy use, any effects are likely to be negligible. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Supply pipes targeted for repair could be within, or in close proximity to, heritage assets including, in particular, listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the supply pipes and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. Further, works would be small in scale and temporary. In consequence, significant effects are not expected. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Assumptions • None identified. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would take place within the curtilages of existing customer properties, would be small in scale and temporary. In consequence, no significant landscape or visual impacts are predicted. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on landscape would be anticipated. Overall, this option has been assessed as having a neutral effect on landscape during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR514: Logging of Large Customers

Option Summary

This option would involve the logging of large customers over a 5 year period (it is assumed that 10% of those temporarily logged would become permanent). This would require the installation of loggers to all customers identified as having high consumption (above 500 l/hr) in either District Metering Areas (DMAs) with poor operability or DMAs with good operability in order to assess which customers have the largest impact on the operability within DMAs. Logged customers would be setup in Netbase and their night use allowances would be updated to reflect the percentage of night use to daily consumption which should have a positive impact on operability and leakage.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** Under this option, loggers would be installed within the curtilages of existing premises/properties and construction works would not be required. In consequence, there would be no impacts on biodiversity and the option has therefore been assessed as having a neutral effect on this objective. **Effects of Operation** The logging of large customers would improve leak detection and operability, reducing demand for water in the Strategic Resource Zone. This may in-turn benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Loggers would be installed within the footprint of existing premises and properties and there would be no additional land-take. The option has therefore been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** Under this option, loggers would be installed within the curtilages of existing premises/properties and construction works would not be required. In consequence, there would be no impacts on water quantity or quality and the option has therefore been assessed as having a neutral effect on this objective. **Effects of Operation** The logging of large customers would improve leak detection and operability, reducing demand for water in the Strategic Resource Zone. This may in-turn benefit the water environment and the option has therefore been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Under this option, loggers would be installed within the curtilages of existing premises/properties and construction works would not be required. In consequence, there would be no impacts on flood risk and the option has therefore been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** The installation of loggers would involve vehicle movements associated with the transport of personnel and equipment and which would generate emissions to air. However, the number of vehicle movements associated with this option would be very small (up to 1,080 vehicle movements over the 5 year implementation period) and in consequence, any air quality impacts are expected to be negligible. Operational emissions to air are also expected to be negligible. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	-	0	**Effects of Construction** As noted above, the installation of loggers would generate vehicle movements with associated greenhouse gas emissions. There may also be embodied carbon in the logging equipment. In this regard, this option would generate up to 324 tCO_2e during the implementation phase which has been assessed as having a negative effect on climate change. **Effects of Operation** The logging of large customers would improve leak detection and operability, reducing demand for water in the Strategic Resource Zone. Lower levels of leakage may in-turn reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, emissions reductions associated with this option would be very small (16 tCO_2e per year on average over the first ten years of operation, although savings would gradually decline over time). In consequence, the option has been assessed as having a neutral effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	0	+	**Effects of Construction** Under this option, loggers would be installed within the curtilages of existing premises/properties and construction works would not be required. In consequence, there would be no substantial impacts on health and the option has therefore been assessed as having a neutral effect on this objective. **Effects of Operation** Leakage reduction associated with this option would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 1.07 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small and it is likely that the majority of work would be accommodated in existing employees' or contractors'/partners' workloads. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction associated with this option would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 1.07 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. **Assumptions** • None identified. **Uncertainty** • None identified.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that the installation of loggers would affect the sustainable use of water resources. The option has therefore been assessed as having a neutral effect on this objective. **Effects of Operation** The logging of large customers would improve leak detection and operability, reducing demand for water in the Strategic Resource Zone. In this context, this

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				option would generate an estimated water saving of up to 1.07 Ml/d which has been assessed as having a positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	-	0	**Effects of Construction** The installation of loggers would require a small volume of raw materials (for example, in the manufacture of loggers) and energy (for example, fuel consumption associated with vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, the option has been assessed as having a negative effect on this objective. **Effects of Operation** This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. However, any energy savings in this regard would be small and in consequence, the option has been assessed as having a neutral effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains?	0	0	**Effects of Construction and Operation** Under this option, loggers would be installed within the curtilages of existing premises/properties and construction works would not be required. In consequence, there would be no impacts on cultural heritage and the option has therefore been assessed as having a neutral effect on this objective during both construction and operation.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?			**Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** Under this option, loggers would be installed within the curtilages of existing premises/properties and construction works would not be required. In consequence, there would be no impacts on landscape and the option has therefore been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR515: Splitting District Metering Areas

Option Summary

This option includes a study of non-operable DMAs over a 5 year period to determine the reason(s) why a DMA is not currently operable, and subsequently, to carry out appropriate actions to remedy any identified issues and/or constraints. The option scope includes office design, hydraulic modelling and site investigation in addition to the construction of chambers, installation of meters and the repair of pipework and ancillary equipment.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**-/?**	**0**	**Effects of Construction** Works associated with the construction of chambers, installation of metres and pipeline repair may impact on biodiversity including priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. Effects may be direct (for example, the loss of habitats or species) or indirect (for example, disturbance to habitats and species caused by emissions to air and noise and the fragmentation of habitats). If this is the case, these areas would have been previously disturbed during pipeline laying but are assumed now to have been restored and through this option may be subject to extensive excavation and disruption along the route of the affected water main. The location of the works to be undertaken is currently unknown although it is expected that construction activity is likely to focus on areas where the distribution network is most dense (under roads, tracks, and/or footpaths) which should limit impact pathways to sensitive ecological receptors. Further, impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Overall, this option has been assessed as having a minor negative effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once the works associated with this option have been completed, there would be no adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England/Natural Resources Wales. • Bio-security measures should be implemented during construction phase. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths. • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects on both local wildlife features and designated conservation areas. **Uncertainty** • The location of works are not currently known.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions** • It is assumed that leakage repair would primarily target the densest areas of the water distribution network, e.g. under roads, tracks, and/or footpaths.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the works associated with this option would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** Pipeline repair and the installation of meters would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with the construction of chambers, installation of metres and pipeline repair may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of the works to be undertaken is currently unknown, it is assumed that they could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?			be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once pipeline works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction** Site investigation, the construction of chambers, installation of meters and the repair of pipework and ancillary equipment would generate vehicle movements associated with the transportation of material, equipment and personnel. However, the number of vehicle movements would be small and is not expected to have noticeable air quality impacts, particularly given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once the works associated with this option are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The location of works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** Site investigation, the construction of chambers, installation of meters and the repair of pipework and ancillary equipment would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair), the operation of plant and vehicle movements throughout the investigative and construction period. However, emissions associated with this option would be very small (59 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the works associated with this option are complete, any carbon emissions would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 150 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**+**	**Effects of Construction** Site investigations and construction activity associated with this option would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, particularly given the volume of vehicle movements associated with this option. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. During the period of pipeline repair (if required), there may be temporary disruption to water supplies to customers depending on the severity of leakage and associated repair works required. Overall, this option has been assessed as having a neutral effect on health. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 2.15 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • Where possible, pipeline works should be routed to avoid open space and recreational facilities/suitable diversions should be put in place. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The location of works are not currently known.
8. To maintain and enhance the economic and social	Will the option ensure sufficient infrastructure is in place for predicted population increases?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake pipeline works) may be

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
well-being of the local community	Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?			generated during the implementation phase of this option. However, the level of investment would be small and in consequence, benefits in this regard are expected to be negligible. Works including pipeline repair may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 2.15 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that works associated with this option would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Pipeline repair and network metering would result in less water being lost due to leakage and therefore lower demand for water abstraction. In this context, this option would generate an estimated water saving of up to 2.15 Ml/d which has been assessed as having a positive effect on water resources. **Mitigation** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Assumptions • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with, for example, materials for pipeline repair) and the use of fuel (related to the operation of plant and vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Pipeline excavation would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. Using carbon emissions savings associated with this option as a proxy for energy use, this has been assessed as having a positive effect on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of works, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?	**-/?**	**0**	**Effects of Construction** Works associated with the construction of chambers, installation of metres and pipeline repair may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?			on landscape character. However, landscape impacts associated with this option would be temporary and following the completion, excavated land would be reinstated such that long term significant effects are unlikely. Nonetheless, as the location of works is unknown at this stage, some uncertainty remains. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a negative effect on landscape, although some uncertainty remains. **Effects of Operation** Following the completion of works associated with this option, excavated land would be reinstated and no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the works are not currently known.

Option WR517: Upstream Tiles Enhancements

Option Summary

This option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** The repair of existing/installation of new meters and probes is generally not expected to affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, it would be expected that adverse effects would be mitigated where possible using best practice construction techniques. Overall, this option has been assessed as having a neutral effect on SEA Objective 1, although uncertainty remains. **Effects of Operation** Once the works associated with this option have been completed, there would be no adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The location of works are not currently known.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target the existing pipeline network and would not require any new land take. Further, all excavated land would be reinstated following the construction period such that any disruption to land use would be temporary. There is the potential for works to affect sites designated for their geological interest. However, any impacts would be felt in the short term only and it is expected that site-specific mitigation measures and established best practice would prevent any significant adverse effects from occurring. Works may disturb contaminated land or result in contamination (for example, through the accidental release of fuels or oils). However, this is expected to be managed through appropriate pollution prevention control techniques. Overall, the option has been assessed as having a neutral effect on this objective during construction and operation. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions** • The utilisation of scheme specific mitigation measures and established best practice throughout the implementation period is expected to minimise and/or prevent significant construction effects geological sites. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels?	**0**	**+**	**Effects of Construction** It is not expected that the works associated with this option would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** This option would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?			**Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, whilst the location of the works to be undertaken is currently unknown, it is assumed that they could be scheduled to avoid periods of flooding. It is also assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to works occurring with appropriate mitigation measures identified to ensure that flood risk is minimised. Once works have been completed, no effects on flood risk would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate FRA would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction** Site visits and the replacement of existing/installation of new full bore meters and probes would generate vehicle movements associated with the transportation of material, equipment and personnel. However, the number of vehicle movements would be small and is not expected to have noticeable air quality impacts, particularly given the geographic extent of the Strategic Resource Zone and the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region. There may be emissions to air associated with the use of plant and machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Overall, this option has been assessed as having a minor negative effect on air quality, although some uncertainty remains. **Effects of Operation** Once the works associated with this option are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. **Assumptions** • None identified. **Uncertainty** • The location of works are not currently known.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?	**-**	**0**	**Effects of Construction** The replacement of existing/installation of new full bore meters and probes would generate carbon emissions associated with embodied carbon, the operation of plant and vehicle movements throughout the investigative and construction period. Emissions associated with this option would be 270 tCO_2e which has been assessed as having a minor negative effect on climate change. **Effects of Operation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?			Once the works associated with this option are complete, any carbon emissions would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, reductions in greenhouse gas emissions associated with this option would be small (60 tCO_2e per year, on average over the first ten years of operation) which has been assessed as having a neutral effect on this objective. Overall, this option has been assessed as having a neutral effect on SEA Objective 6. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**+**	**Effects of Construction** Site visits and construction activity associated with this option would generate noise and emissions to air including dust which could have adverse impacts on human health, depending on the scale, duration and proximity of the works to sensitive receptors such as residential properties. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes. However, any impacts would be temporary and are not expected to be significant, particularly given the volume of vehicle movements associated with this option. Where works affect pipelines that cross open space, footpaths and other recreational uses, there may be temporary disruption/loss of amenity to users of these facilities. However, any impacts would be temporary and are not expected to be significant. Overall, this option has been assessed as having a neutral effect on health. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 3.57 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • Where possible, works should be planned to avoid open space and recreational facilities/suitable diversions should be put in place.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Assumptions • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • The location of works are not currently known.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake works) may be generated during the implementation phase of this option. However, the level of investment would be small and in consequence, benefits in this regard are expected to be negligible. Works including may take place within and/or utilise road networks which, together with associated vehicle movements, could result in increases in localised congestion and disruption/driver delay throughout the implementation phase. However, any effects in this regard would be temporary and small in scale. Overall, this option has been assessed as having neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 3.57 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that works associated with this option would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** This option would result in less water being lost due to leakage and therefore lower demand for water abstraction. In this context, this option would generate an estimated water saving of up to 3.57 Ml/d which has been assessed as having a positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**-**	**0**	**Effects of Construction** This option would result in the consumption of raw materials (associated with, for example, probes) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be minor. Works would generate waste which may include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a minor negative effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. However, using carbon emissions savings associated with this option as a proxy for energy use, effects in this regard are expected to be negligible. **Mitigation**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option could be within, or in close proximity to, heritage assets including, for example, scheduled monuments and listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage including archaeological remains during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the pipelines and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. In consequence, significant effects are not expected. Following the completion of works, excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce potentially adverse impacts to cultural and historic assets if rerouting is not possible in the context of the given setting. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction** Works associated with this option may have an impact on landscape character associated with the introduction of plant and machinery into landscapes. Where works are located in rural, greenfield settings, these effects may be more pronounced. There is also the potential for works to take place in designated landscapes such as National Parks and AONBs which may affect their special qualities and result in substantial impacts on landscape character. However, landscape impacts associated with this option would be very temporary and following the completion, any excavated land would be reinstated such that long term significant effects are unlikely. Works associated with this option may affect the visual amenity of receptors in close proximity to construction sites for a very short period. The probability of adverse effects occurring and their magnitude would likely be increased where works take place in close proximity to large numbers of sensitive receptors such as in urban areas. Overall, this option has been assessed as having a neutral effect on landscape. **Effects of Operation** Following the completion of works associated with this option, no further effects on landscape would be anticipated. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • The locations of the works are not currently known.

Option WR907d: Third party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage

Option Summary

This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** Works associated with the repair of supply pipe leaks and plumbing leaks would be undertaken within the curtilage of (and inside) customer properties and in consequence, works would not be expected to have a discernible effect on designated nature conservation sites (e.g. SACs, SPAs, Ramsar and SSSIs), the ecological quality of habitats and associated groundwater/river water bodies, habitat fragmentation, management of natural habitats and ecosystems, habitat restoration and creation, or the prevention of invasive non-native species transfer. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Once works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target existing supply pipes and plumbing leaks within the curtilages of (and within) customer properties and would not require any new land take. In consequence, there would be no effects on land use, geodiversity or soils during construction and operation and the option has therefore been assessed as having a neutral effect on SEA Objective 2. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted. Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** The repair of supply pipes and plumbing leaks would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with the repair of supply pipes and plumbing leaks would take place within the curtilages of (and inside) customer properties and are unlikely to be significantly affected by flood risk. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** The repair of supply pipes and plumbing leaks would generate vehicle movements associated with the transportation of material, equipment and personnel which would generate emissions to air. However, the number of vehicle movements associated with this option would be very small. There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors including occupants of related properties. However, any effects in this regard would be temporary and are unlikely to be significant. Once works are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	-	+	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair), the operation of machinery and vehicle movements. Emissions associated with this option would be circa 295 tCO_2 which has been assessed as having a minor negative effect on climate change. **Effects of Operation** Once the repair of supply pipes and plumbing leaks is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. Reductions in greenhouse gas emissions associated with this option would be 915 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time). Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	0	++	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate some noise and emissions to air; however, whilst activity would take place within the curtilages of customer properties (and, therefore, in close proximity to sensitive receptors), any effects are expected to be negligible reflecting the small scale of works and their temporary nature. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes, although the volume of movements associated with this option would be very small and any impacts would be temporary. During the period of pipeline repair, there may be temporary disruption to the water supplies of the affected customer. Overall, this option has been assessed as having a neutral effect on health.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Effects of Operation Once the identification and repair of supply pipe and plumbing leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 2.12 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**++**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works) may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 54.0 Ml/d which has been assessed as having a significant positive effect on wellbeing. The repair of supply pipe and plumbing leaks could also help reduce water bills for metered customers. **Mitigation** • Where possible, contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The repair of supply pipes and plumbing leaks would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 54.0 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**-**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, negative effects in this regard have been identified. Works may generate waste which could include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a negative effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, effects in this regard have been assessed as positive. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Supply pipes targeted for repair could be within, or in close proximity to, heritage assets including, in particular, listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the supply pipes and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. Further, works would be small in scale and temporary. In consequence, significant effects are not expected. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would take place within the curtilages of (and inside) existing customer properties, would be small in scale and temporary. In consequence, no significant landscape or visual impacts are predicted. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on landscape would be anticipated. Overall, this option has been assessed as having a neutral effect on landscape during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR907e: Third party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage

Option Summary

This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** Works associated with the repair of supply pipe leaks and plumbing leaks would be undertaken within the curtilage of (and inside) customer properties and in consequence, works would not be expected to have a discernible effect on designated nature conservation sites (e.g. SACs, SPAs, Ramsar and SSSIs), the ecological quality of habitats and associated groundwater/river water bodies, habitat fragmentation, management of natural habitats and ecosystems, habitat restoration and creation, or the prevention of invasive non-native species transfer. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Once works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target existing supply pipes and plumbing leaks within the curtilages of (and within) customer properties and would not require any new land take. In consequence, there would be no effects on land use, geodiversity or soils during construction and operation and the option has therefore been assessed as having a neutral effect on SEA Objective 2. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted. Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** The repair of supply pipes and plumbing leaks would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with the repair of supply pipes and plumbing leaks would take place within the curtilages of (and inside) customer properties and are unlikely to be significantly affected by flood risk. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** The repair of supply pipes and plumbing leaks would generate vehicle movements associated with the transportation of material, equipment and personnel which would generate emissions to air. However, the number of vehicle movements associated with this option would be very small. There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors including occupants of related properties. However, any effects in this regard would be temporary and are unlikely to be significant. Once works are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	-	0	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair), the operation of machinery and vehicle movements. Emissions associated with this option would be 165 tCO_2 which has been assessed as having a minor negative effect on climate change. **Effects of Operation** Once the repair of supply pipes and plumbing leaks is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, reductions in greenhouse gas emissions associated with this option would be very small (36 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time). Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. However, in view of the level of estimated water savings associated with this option (2.12 Ml/d), any effects in this regard are likely to be negligible. Overall, this option has been assessed as having a neutral effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards?	0	+	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate some noise and emissions to air; however, whilst activity would take place within the curtilages of customer properties (and, therefore, in close proximity to sensitive receptors), any effects are expected to be negligible reflecting the small scale of works and their temporary nature. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes, although the volume of movements associated with this option would be very small and any impacts would be temporary.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?			During the period of pipeline repair, there may be temporary disruption to the water supplies of the affected customer. Overall, this option has been assessed as having a neutral effect on health. **Effects of Operation** Once the identification and repair of supply pipe and plumbing leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 2.12 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works) may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 2.12 Ml/d which has been assessed as having a positive effect on wellbeing. The repair of supply pipe and plumbing leaks could also help reduce water bills for metered customers. **Mitigation** • Where possible, contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The repair of supply pipes and plumbing leaks would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 2.12 Ml/d which has been assessed as having a positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**-**	**0**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, negative effects in this regard have been identified. Works may generate waste which could include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a negative effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. However, using carbon emissions savings associated with this option as a proxy for energy use, any effects are likely to be negligible. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Supply pipes targeted for repair could be within, or in close proximity to, heritage assets including, in particular, listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the supply pipes and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. Further, works would be small in scale and temporary. In consequence, significant effects are not expected. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would take place within the curtilages of (and inside) existing customer properties, would be small in scale and temporary. In consequence, no significant landscape or visual impacts are predicted. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on landscape would be anticipated. Overall, this option has been assessed as having a neutral effect on landscape during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR907f: Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage

Option Summary

This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** Works associated with the repair of supply pipe leaks and plumbing leaks would be undertaken within the curtilage of (and inside) customer properties and in consequence, works would not be expected to have a discernible effect on designated nature conservation sites (e.g. SACs, SPAs, Ramsar and SSSIs), the ecological quality of habitats and associated groundwater/river water bodies, habitat fragmentation, management of natural habitats and ecosystems, habitat restoration and creation, or the prevention of invasive non-native species transfer. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Once works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target existing supply pipes and plumbing leaks within the curtilages of (and within) customer properties and would not require any new land take. In consequence, there would be no effects on land use, geodiversity or soils during construction and operation and the option has therefore been assessed as having a neutral effect on SEA Objective 2. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted. Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** The repair of supply pipes and plumbing leaks would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with the repair of supply pipes and plumbing leaks would take place within the curtilages of (and inside) customer properties and are unlikely to be significantly affected by flood risk. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** The repair of supply pipes and plumbing leaks would generate vehicle movements associated with the transportation of material, equipment and personnel which would generate emissions to air. However, the number of vehicle movements associated with this option would be small (2,925 movements over a 5 year period). There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors including occupants of related properties. However, any effects in this regard would be temporary and are unlikely to be significant. Once works are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	-	+	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair), the operation of machinery and vehicle movements. Emissions associated with this option would be 178 tCO_2 which has been assessed as having a minor negative effect on climate change. **Effects of Operation** Once the repair of supply pipes and plumbing leaks is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. In this context, reductions in greenhouse gas emissions associated with this option would be 179 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	0	++	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate some noise and emissions to air; however, whilst activity would take place within the curtilages of customer properties (and, therefore, in close proximity to sensitive receptors), any effects are expected to be negligible reflecting the small scale of works and their temporary nature. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes, although the volume of movements associated with this option would be very small and any impacts would be temporary. During the period of pipeline repair, there may be temporary disruption to the water supplies of the affected customer.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Overall, this option has been assessed as having a neutral effect on health. **Effects of Operation** Once the identification and repair of supply pipe and plumbing leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 10.53 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	+	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works) may be generated during the implementation phase of this option. In this regard, the level of investment associated with this option has been assessed as having a minor positive effect on this objective. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 10.53 Ml/d which has been assessed as having a significant positive effect on wellbeing. The repair of supply pipe and plumbing leaks could also help reduce water bills for metered customers. **Mitigation** • Where possible, contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The repair of supply pipes and plumbing leaks would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 10.53 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**-**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, negative effects in this regard have been identified. Works may generate waste which could include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a negative effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this option has been assessed as having a positive on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Supply pipes targeted for repair could be within, or in close proximity to, heritage assets including, in particular, listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the supply pipes and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. Further, works would be small in scale and temporary. In consequence, significant effects are not expected. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would take place within the curtilages of (and inside) existing customer properties, would be small in scale and temporary. In consequence, no significant landscape or visual impacts are predicted. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on landscape would be anticipated. Overall, this option has been assessed as having a neutral effect on landscape during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR907g: Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage

Option Summary

This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a five year period.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** Works associated with the repair of supply pipe leaks and plumbing leaks would be undertaken within the curtilage of (and inside) customer properties and in consequence, works would not be expected to have a discernible effect on designated nature conservation sites (e.g. SACs, SPAs, Ramsar and SSSIs), the ecological quality of habitats and associated groundwater/river water bodies, habitat fragmentation, management of natural habitats and ecosystems, habitat restoration and creation, or the prevention of invasive non-native species transfer. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Once works have been completed, this option would not have any adverse effects on biodiversity. The reduction in leakage would reduce demand for water in the Strategic Resource Zone which could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would target existing supply pipes and plumbing leaks within the curtilages of (and within) customer properties and would not require any new land take. In consequence, there would be no effects on land use, geodiversity or soils during construction and operation and the option has therefore been assessed as having a neutral effect on SEA Objective 2. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect river flows and/or groundwater levels. Similarly, no effects on water quality are predicted. Overall, this option has been assessed as having a neutral effect in respect of Objective 3. **Effects of Operation** The repair of supply pipes and plumbing leaks would result in less water being lost due to leakage and therefore lower demand for water abstraction. This is likely to have benefits in respect of water quantity and, potentially, quality and in consequence, the option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Works associated with the repair of supply pipes and plumbing leaks would take place within the curtilages of (and inside) customer properties and are unlikely to be significantly affected by flood risk. Overall, this option has been assessed as having a neutral effect on Objective 4 during both construction and operation. **Mitigation** • None identified. **Assumptions** • It is assumed that works could be scheduled to avoid periods of flooding. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** The repair of supply pipes and plumbing leaks would generate vehicle movements associated with the transportation of material, equipment and personnel which would generate emissions to air. However, the number of vehicle movements associated with this option would be small (2,925 movements over a 5 year period). There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors including occupants of related properties. However, any effects in this regard would be temporary and are unlikely to be significant. Once works are complete, there would be no/very few further vehicle movements or works that may result in emissions to air. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**+**	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate carbon emissions associated with embodied carbon (in, for example, materials for pipeline repair), the operation of machinery and vehicle movements. However, emissions associated with this option would be very small (38 tCO_2). Overall, this option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the repair of supply pipes and plumbing leaks is complete, any carbon emissions associated with this option would be negligible. Lower levels of leakage may, however, reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. In this context, reductions in greenhouse gas emissions associated with this option would be 179 tCO_2e per year (on average over the first ten years of operation, although savings would gradually decline over time) which has been assessed as having a positive effect on this objective. Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. Overall, this option has been assessed as having a positive effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**++**	**Effects of Construction** The repair of supply pipes and plumbing leaks would generate some noise and emissions to air; however, whilst activity would take place within the curtilages of customer properties (and, therefore, in close proximity to sensitive receptors), any effects are expected to be negligible reflecting the small scale of works and their temporary nature. Vehicle movements associated with the transportation of equipment, material and personnel may also have adverse impacts on receptors along transport routes, although the volume of movements associated with this option would be very small and any impacts would be temporary. During the period of pipeline repair, there may be temporary disruption to the water supplies of the affected customer.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Overall, this option has been assessed as having a neutral effect on health. **Effects of Operation** Once the identification and repair of supply pipe and plumbing leakages is complete, there would be no further adverse effects on health associated with this option. Leakage reduction would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 10.53 Ml/d which has been assessed as having a significant positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	+	++	**Effects of Construction** Employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works) may be generated during the implementation phase of this option. In this regard, the level of investment associated with this option has been assessed as having a minor positive effect on this objective. **Effects of Operation** Leakage reduction would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 10.53 Ml/d which has been assessed as having a significant positive effect on wellbeing. The repair of supply pipe and plumbing leaks could also help reduce water bills for metered customers. **Mitigation** • Where possible, contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**++**	**Effects of Construction** It is not expected that the repair of supply pipes and plumbing leaks would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The repair of supply pipes and plumbing leaks would assist in minimising water loss within the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 10.53 Ml/d which has been assessed as having a significant positive effect on water resources. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**+**	**Effects of Construction** This option would result in the consumption of raw materials (associated with materials for pipeline repair, for example) and the use of fuel (related to the operation of plant and vehicle movements). Using the estimated carbon emissions associated with this option as a proxy for resource use, however, effects in this regard are expected to be negligible. Works may generate waste which could include excavation waste and infrastructural waste (original water equipment), although it would be expected that any soils displaced during the works would be reused during the reinstatement of land. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				water. Using carbon emissions savings associated with this option as a proxy for energy use, this option has been assessed as having a positive on this objective. **Mitigation** • Opportunities to utilise reused/recycled materials should be considered where appropriate. • Construction wastes should be reused/recycled where possible. • Measures to reduce energy usage during implementation should be considered including, for example, the use of low energy plant. **Assumptions** • None identified. **Uncertainty** • The exact resource requirements (e.g. volumes of specific materials) associated with the construction of this option are unknown at this stage. • The volume of waste that would be generated under this option is uncertain at this stage.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** Supply pipes targeted for repair could be within, or in close proximity to, heritage assets including, in particular, listed buildings. In consequence, there is the potential for both direct (e.g. loss of, or damage to, an asset) and indirect (e.g. effects on the settings of assets) impacts on cultural heritage during the implementation phase of this option. However, construction sites would have been previously disturbed during the initial installation of the supply pipes and it is expected that site-specific mitigation measures would manage any adverse impacts in this regard. Further, works would be small in scale and temporary. In consequence, significant effects are not expected. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on cultural heritage would be anticipated. Overall, this option has been assessed as having a neutral effect on Objective 11 during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** Works associated with this option would take place within the curtilages of (and inside) existing customer properties, would be small in scale and temporary. In consequence, no significant landscape or visual impacts are predicted. Following the completion of pipeline repairs, any excavated land would be reinstated and no further effects on landscape would be anticipated. Overall, this option has been assessed as having a neutral effect on landscape during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR912: Third Party 2 - Proposal to Reduce Customer Water Demand for UU by 5 Ml/day Across AMP

Option Summary

This option would involve the reduction of customer side leakage at non-household properties.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** This option would not be expected to involve large scale construction works and in consequence, this option would not have any discernible impacts on biodiversity. Overall, the option has been assessed as having a neutral effect on this objective. **Effects of Operation** This option would reduce the risk of leakage. Associated reductions in demand for water in the Strategic Resource Zone could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?	**0**	**0**	**Effects of Construction and Operation** This option would not involve any land take. The option has therefore been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?			• None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that this option would affect river flows or groundwater levels. The option has therefore been assessed as having a neutral effect in respect of Objective 3 **Effects of Operation** This option is likely to increase/ensure continuity of water supply through leakage reduction. Increased water efficiency may protect and slightly enhance the quality and quantity of the surface water environment and the groundwater resource. Overall, this option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Activity associated with this option may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, it is assumed that works could be scheduled to avoid periods of flooding should there be a risk. Overall, this option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** This option would generate vehicle movements and associated emissions to air. However, the number of vehicle movements associated with this option would be very small and given the geographic extent of the Strategic Resource Zone, the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region, any air quality impacts are expected to be negligible. There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Once works are complete, vehicle movements associated with ongoing maintenance would be very small and therefore emissions to air would be negligible. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?	**0**	**0**	**Effects of Construction** This option would generate carbon emissions associated with embodied carbon, the use of plant and vehicle movements. However, emissions associated with this option would be very small (3 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, reductions in

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	Will the option increase environmental resilience to the effects of climate change?			greenhouse gas emissions associated with this option would be very small (85 tCO_2e per year on average over the first ten years of operation, although savings would gradually decline over time). Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. However, taking into account the relatively small volume of savings associated with this option, effects in this regard are likely to be negligible. Overall, this option has been assessed as having a neutral effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**+**	**Effects of Construction** Works associated with this option would not be expected to involve large scale construction activity and in consequence, this option would not have any discernible impacts on health. Overall, the option has been assessed as having a neutral effect on this objective. **Effects of Operation** Leakage reduction associated with this option would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 5.0 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small and it is likely that the majority of work would be accommodated in existing employees' or contractors'/partners' workloads. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction associated with this option would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 5.0 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that works associated with this option would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** Leakage reduction associated with this option has been assessed as having a positive effect on SEA Objective 9. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**0**	**Effects of Construction** This option would result in the consumption of raw materials (in pipeline materials) and the use of fuel (related to vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. However, using carbon emissions savings associated with this option as a proxy for energy use, effects in this regard are expected to be negligible. Overall, this option has been assessed as having a neutral effect on resource use. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** As noted above, this option would not involve substantive construction activity and would not, therefore, have a discernible impact on cultural heritage. Overall, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** This option would not involve substantive construction activity and in consequence, it would not have any discernible impacts on landscape. Overall, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Option WR914: Third Party - Cello 4S and Regulo

Option Summary

This option would involve surveys and the installation of pressure management devices by a Third Party over a 5 year period together with ongoing maintenance to be undertaken by United Utilities.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread/introduction of invasive non-native species?	**0**	**0**	**Effects of Construction** The installation of Cello 4s and Regulo PRV controllers would not be expected to involve large scale construction works and in consequence, this option would not have any discernible impacts on biodiversity. Overall, the option has been assessed as having a neutral effect on this objective. **Effects of Operation** Increased water efficiency through the regulation and/or reduction of high pressure variations within the water distribution network would reduce the risk of leakage in addition to water breakout should leakage occur within the network. Associated reductions in demand for water in the Strategic Resource Zone could benefit the water environment and the ecology it supports. However, effects are unlikely to be significant. Overall, this option has been assessed as having a neutral effect on biodiversity. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile agricultural land? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination? Will the option affect geomorphology?	**0**	**0**	**Effects of Construction and Operation** This option would not involve any land take and should meters require replacement, this would be significantly low impacts. The option has therefore been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)? Will the option support the achievement of protected area objectives? Will the option support the achievement of environmental objectives set out in River Basin Management Plans? Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?	**0**	**+**	**Effects of Construction** It is not expected that the installation of Cello 4s and Regulo PRV Controllers would affect river flows or groundwater levels, or water quality, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). This option has therefore been assessed as having a neutral effect in respect of Objective 3 **Effects of Operation** This option is likely to increase/ensure continuity of water supply through the regulation and/or reduction of high pressure variations within the water distribution network which would reduce the risk of leakage in addition to water breakout should leakage occur within the network. Overall, increased water efficiency may protect and slightly enhance the quality and quantity of the surface water environment and the groundwater resource. Overall, this option has been assessed as having a positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures).

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	**0**	**0**	**Effects of Construction and Operation** Activity associated with this option may take place in areas of flood risk and in consequence, could be vulnerable to flooding. However, it is assumed that works could be scheduled to avoid periods of flooding should there be a risk. Overall, this option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	**0**	**0**	**Effects of Construction and Operation** The installation of Cello 4s and Regulo PRV Controllers in addition to investigative surveys would generate vehicle movements and associated emissions to air. However, the number of vehicle movements associated with this option would be very small and given the geographic extent of the Strategic Resource Zone, the associated extended road network of principal and secondary highways, and assuming that the vehicle movements are dispersed across the region, any air quality impacts are expected to be negligible. There may be emissions to air associated with the use of machinery on site which could affect nearby sensitive receptors. However, any effects in this regard would be temporary and are unlikely to be significant. Once works are complete, vehicle movements associated with ongoing maintenance would be very small and therefore emissions to air would be negligible. Overall, this option has been assessed as having a neutral effect on air quality during both construction and operation. **Mitigation** • None identified. **Assumptions**

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				• None identified. **Uncertainty** • None identified.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option reduce vulnerability to the effects of climate change by appropriate adaptation? Will the option increase environmental resilience to the effects of climate change?	**0**	**0**	**Effects of Construction** The installation of Cello 4s and Regulo PRV Controllers in addition to investigative surveys would generate carbon emissions associated with embodied carbon (in, for example, PRV Controllers) and vehicle movements. However, emissions associated with this option would be very small (74 tCO_2e) and in consequence, the option has been assessed as having a neutral effect on climate change. **Effects of Operation** Once the installation of Cello 4s and Regulo PRV Controllers is complete, any carbon emissions associated with this option (e.g. emissions related to ongoing maintenance) would be negligible. Lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. However, reductions in greenhouse gas emissions associated with this option would be very small (68 tCO_2e per year on average over the first ten years of operation, although savings would gradually decline over time). Reduced leakage may improve the resilience of the water supply network to the effects of climate change (drought) by increasing water availability. However, taking into account the relatively small volume of savings associated with this option, effects in this regard are likely to be negligible. Overall, this option has been assessed as having a neutral effect on SEA Objective 6. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	**0**	**+**	**Effects of Construction** The installation of Cello 4s and Regulo PRV controllers would not be expected to involve large scale construction works and in consequence, this option would not have any discernible impacts on health. Overall, the option has been assessed as having a neutral effect on this objective. **Effects of Operation** Leakage reduction associated with this option would lower demand for water abstraction and could help to ensure the continuity of water supplies. In this context, this option would generate an estimated water saving of up to 4.0 Ml/d which has been assessed as having a positive effect on health. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	**0**	**+**	**Effects of Construction** Employment opportunities and supply chain benefits may be generated during the implementation phase of this option. However, the level of investment associated with this option is expected to be small and it is likely that the majority of work would be accommodated in existing employees' or contractors'/partners' workloads. Overall, this option has been assessed as having a neutral effect on wellbeing. **Effects of Operation** Leakage reduction associated with this option would lower demand for water abstraction and could help to ensure the continuity/availability of water supplies and support population and economic growth in the Strategic Resource Zone. In this context, this option would generate an estimated water saving of up to 4.0 Ml/d which has been assessed as having a positive effect on wellbeing. **Mitigation** • None identified. **Assumptions** • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**+**	**Effects of Construction** It is not expected that the provision/installation of Cello 4s and Regulo PRV Controllers nor investigative surveys would affect the sustainable use of water resources. A neutral effect has therefore been identified in respect of this objective. **Effects of Operation** The regulation and/or reduction of high pressure variations within the water distribution network would reduce the risk of leakage in addition to water breakout during leakages in the Strategic Resource Zone. This has been assessed as having a positive effect on SEA Objective 9. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**0**	**0**	**Effects of Construction** This option would result in the consumption of raw materials (associated with PRVs, for example) and the use of fuel (related to vehicle movements). However, using the estimated carbon emissions associated with this option as a proxy for resource use, it is anticipated that effects in this regard would be negligible. Overall, this option has been assessed as having a neutral effect on resource use. **Effects of Operation** Any additional resource use once works have been completed would be negligible. This option would be expected to reduce the demand for water which in-turn would result in a reduction in energy use associated with the treatment and pumping of water. However, using carbon emissions savings associated with this option as a proxy for energy use, effects in this regard are expected to be negligible. Overall, this option has been assessed as having a neutral effect on resource use.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Mitigation • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
11. To conserve and enhance cultural and historic assets	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings Will the option conserve or enhance archaeologically important sites and/or remains? Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits? Will the option affect public access to, or enjoyment of, features of cultural heritage?	**0**	**0**	**Effects of Construction and Operation** As noted above, this option would not involve substantive construction activity and would not, therefore, have a discernible impact on cultural heritage. Overall, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
12. To conserve and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	**0**	**0**	**Effects of Construction and Operation** This option would not involve substantive construction activity and in consequence, it would not have any discernible impacts on landscape. Overall, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Appendix F
Assessment of Alternative Trading Portfolios

As set out in **Section 6.3**, in preparing the Revised Draft WRMP United Utilities identified two alternative combinations of preferred options (portfolios) for water trading. Both alternatives included Manchester and Pennine Resilience Solution D and the leakage reduction and network metering options that comprise the Preferred Plan, alongside different portfolios of feasible resource and demand management options to facilitate the export of up to 180 Ml/d of water to the Thames Water region during periods of drought.

An assessment of the cumulative effects of the two trading portfolios identified by United Utilities against the 12 SEA objectives that comprise the assessment framework (based on the findings of the feasible options assessment) is presented in the tables below.

The assessment includes the Thames Water Trading Enabling Works Option (B2). It includes the works undertaken by United Utilities in order to maintain supplies to United Utilities' own customers when exporting water from Lake Vyrnwy to the Thames Water region, as well as effects of the Severn Thames transfer which has been assessed as part of Thames Water's draft WRMP. To complete the cumulative assessment of the option, information has been taken from the SEA Environmental Report published by Thames Water to accompany the draft WRMP[117] (see Appendix D, D213 – D222 for more information).

This assessment demonstrates that the effects associated with both trading portfolios would be very similar with significant positive effects identified across several of the SEA objectives including water quality and quantity (SEA Objective 3), climate change (SEA Objective 6), health (SEA Objective 7), wellbeing (SEA Objective 8), water resources (SEA Objective 9) and resource use (SEA Objective 10). This reflects the operational benefits of the alternatives including increased water supply resilience, climate change adaptation and mitigation, reduced demand for water and, in terms of construction, capital investment.

Adverse effects associated with the construction/implementation of water management measures would be short term and temporary and it is expected that best practice construction techniques and methods could be implemented at the project stage to help reduce the likelihood of such effects occurring and their magnitude. Similarly, it is expected that negative operational effects could be managed to an acceptable level at the project stage, with appropriate mitigation identified through further detailed assessment of environmental impacts. The exception to this is in respect of climate change (SEA Objective 6) and resource use (SEA Objective 10) where cumulative significant negative effects have been identified during construction and operation for both trading portfolios. However, these effects reflect the energy and resource use associated with the implementation of the water management measures which is to a large extent unavoidable (although effects may be reduced at the project stage through, for example, the use of renewable energy and sustainably sourced construction materials). Reflecting the scale of vehicle movements associated with the implementation of Manchester and Pennine Resilience Option 37-42 (which features in both portfolios), overall significant negative effects on air quality (SEA Objective 5) have also been identified whilst the Severn Thames Transfer component of Option B2 required for both alternatives could have significant negative effects on cultural heritage (SEA Objective 11) and landscape (SEA Objective 12) during construction.

As noted in **Section 6.3**, a water trade from the North West is not included in the preferred plans of other water companies at this stage and whilst water trading remains United Utilities' preference for future WRMP planning rounds, the trading portfolios have not been taken forward as part of the Preferred Plan for WRMP19.

[117] Thames Water (2017), Thames Water Draft Water Resources Management Plan 2019 Technical Appendices Appendix B: Strategic Environmental Assessment - Environmental Report, Ricardo Energy & Environment, https://corporate.thameswater.co.uk/-/media/Site-Content/Your-water-future-2018/Appendices/dWRMP19-Appendix-B----Strategic-environmental-assessment---environmental-report-151217.pdf

Assessment of Trading Portfolio 1

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR062b	Worthington WTW (Rivington)	C	-	0	0	-	-	--	-	++/-	0	--	-	0
		O	-	0	0	0	0	0	++/?	++	0	-	0	0
WR099b	Worsthorne Borehole (Hurstwood IR)	C	-	+	0	0	0	-	0	0	0	-	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR101	Franklaw Z Site Plus Increased Franklaw WTW Treatment Capacity	C	0	+	0	-	-	--	-	++/-	0	--	0	0
		O	0	0	-/?	-	0	-	++	++	0	-	0	0
WR102d	Eccleston Hill Borehole to Prescot WTW	C	-	+	0	0	-	--	0	0	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR102e	Bold Heath Boreholes to Prescot WTW	C	-	+	0	0	-	--	-	+/-	0	--	-	-
		O	0	0	0	0	0	-	+	+	0	-	0	0
WR105a	Lymm Boreholes (Abandonment of existing WTW facility; new WTW at Sow Brook	C	-	-	0	0	-	--	-	++	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	-
WR107b	Randles Bridge, Knowsley, Primrose Hill	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	-/?	-	0	-	++	++	0	-	0	0
WR113	Tytherington Boreholes	C	0	+	0	0	-	--	-	0	0	--	-	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR159		C	-	+	0	-	0	-	-	0	0	-	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Group 1 - Improved Reservoir Compensation Release Control	O	0/?	0	0	0/?	0	+	++	++	++	0	0	0
WR160	Group 2 – Improved Reservoir Compensation Release Control	C	-	+	0	-	0	-	-	0	0	-	-	-
		O	0/?	0	0	0/?	0	+	+	+	++	0	0	0
B2	Thames Water Trading Enabling Works including Severn Thames Transfer (Cumulative assessment)	C	-/?	+/-	0	-	-	--	-	++/-	0	--	--	--
		O	-	0	-	-	0	+/--	++	++	0	--	0	-
37-42	Manchester and Pennine Aqueduct sections T01 to T06	C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR610b	Education programme	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR620b	Provision of free water efficiency goods and advice to all newly metered customers	C	**0**	**0**	**0**	**0**	**-/?**	**--**	**0**	**0**	**0**	**--**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**++**	**++**	**++**	**++**	**++**	**0**	**0**
WR500a	Leakage reduction stage 1	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**++**	**+**	**0**	**0**
WR500b	Leakage reduction stage 2	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**+**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500c	Leakage reduction stage 3	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**+**	**0**	**0**	**0**	**-/?**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500d	Leakage reduction stage 4	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500e	Leakage reduction stage 5	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500f	Leakage reduction stage 6	C	-/?	0	0	0	-/?	-	-/?	0	0	-	0	-/?
		O	0	0	+	0	0	+	+	+	+	+	0	0
WR500g	Leakage reduction stage 7	C	-/?	0	0	0	-/?	--	-/?	0	0	--	0	-/?
		O	0	0	+	0	0	+	+	+	++	+	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR500h	Leakage reduction stage 8	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500i	Leakage reduction stage 9	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500j	Leakage reduction stage 10	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**++**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500k	Leakage reduction stage 11	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**++**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR503		C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Monitoring of household meters to identify and fix supply pipe leaks	O	0	0	+	0	0	0	+	+	+	0	0	0
WR511	Network metering enhancements	C	0	0	0	0	-/?	--	0	0	0	--	0	0
		O	0	0	+	0	0	+	+	+	++	+	0	0
WR514	Logging of large customers	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR515	Splitting District Metering Areas	C	-/?	0	0	0	0	0	0	0	0	0	0	-/?
		O	0	0	+	0	0	+	+	+	+	+	0	0
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	C	0	0	0	0	0	-	0	0	0	-	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**+**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR914	Third Party - Cello 4S and Regulo	C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
Cumulative Effects of Trading Portfolio 1		C	**-/?**	**+/-**	**-/?**	**-**	**--**	**--**	**-**	**++/-**	**0**	**--**	**--**	**--**
		O	**-**	**0**	**+/-/?**	**-**	**0**	**++/--**	**++**	**++**	**++**	**++/--**	**0**	**-**

Assessment of Trading Portfolio 2

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR062b	Worthington WTW (Rivington)	C	-	0	0	-	-	--	-	++/-	0	--	-	0
		O	-	0	0	0	0	0	++/?	++	0	-	0	0
WR099b	Worsthorne Borehole (Hurstwood IR)	C	-	+	0	0	0	-	0	0	0	-	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR102d	Eccleston Hill Borehole to Prescot WTW	C	-	+	0	0	-	--	0	0	0	--	0	-
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR102e	Bold Heath Boreholes to Prescot WTW	C	-	+	0	0	-	--	-	+/-	0	--	-	-
		O	0	0	0	0	0	-	+	+	0	-	0	0
WR113	Tytherington Boreholes	C	0	+	0	0	-	--	-	0	0	--	-	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	0	0	0	0	+	+	0	-	0	0
WR159	Group 1 - Improved Reservoir Compensation Release Control	C	-	+	0	-	0	-	-	0	0	-	-	-
		O	0/?	0	0	0/?	0	+	++	++	++	0	0	0
WR160	Group 2 – Improved Reservoir Compensation Release Control	C	-	+	0	-	0	-	-	0	0	-	-	-
		O	0/?	0	0	0/?	0	+	+	+	++	0	0	0
WR821	Shropshire Union Canal	C	-	-	0	-	-	--	-	++/-	0	--	-	-
		O	0	0	0	0	0	0	++	++	0	-	-	-
B2	Thames Water Trading Enabling Works including Severn Thames Transfer (Cumulative assessment)	C	-/?	+/-	0	-	-	--	-	++/-	0	--	--	--
		O	-	0	-	-	0	+/--	++	++	0	--	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
37-42	Manchester and Pennine Aqueduct sections T01 to T06	C	-	-	-/?	-	--	--	-	++/-	0	--	0	-
		O	0	0	-/?	0	0	0	++	++	0	0	0	0
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0
WR610b	Education programme	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR620b	Provision of free water efficiency goods and advice to all newly metered customers	C	0	0	0	0	-/?	--	0	0	0	--	0	0
		O	0	0	+	0	0	++	++	++	++	++	0	0
WR623b		C	0	0	0	0	-/?	--	0	0	0	--	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Offering water efficiency home checks when installing a meter at a customer's property	O	0	0	+	0	0	++	++	++	++	++	0	0
WR500a	Leakage reduction stage 1	C	-/?	0	0	0	-/?	0	-/?	0	0	0	0	-/?
		O	0	0	+	0	0	+	+	+	++	+	0	0
WR500b	Leakage reduction stage 2	C	-/?	0	0	0	-/?	0	-/?	+	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500c	Leakage reduction stage 3	C	-/?	0	0	0	-/?	0	-/?	+	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500d	Leakage reduction stage 4	C	-/?	0	0	0	-/?	0	-/?	++	0	0	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR500e	Leakage reduction stage 5	C	**-/?**	**0**	**0**	**0**	**-/?**	**0**	**-/?**	**++**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500f	Leakage reduction stage 6	C	**-/?**	**0**	**0**	**0**	**-/?**	**-**	**-/?**	**0**	**0**	**-**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**+**	**+**	**0**	**0**
WR500g	Leakage reduction stage 7	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**0**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**++**	**+**	**0**	**0**
WR500h	Leakage reduction stage 8	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR500i	Leakage reduction stage 9	C	**-/?**	**0**	**0**	**0**	**-/?**	**--**	**-/?**	**+**	**0**	**--**	**0**	**-/?**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500j	Leakage reduction stage 10	C	-/?	0	0	0	-/?	--	-/?	++	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR500k	Leakage reduction stage 11	C	-/?	0	0	0	-/?	--	-/?	++	0	--	0	-/?
		O	0	0	+	0	0	+	++	++	++	+	0	0
WR503	Monitoring of household meters to identify and fix supply pipe leaks	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
WR511	Network metering enhancements	C	0	0	0	0	-/?	--	0	0	0	--	0	0
		O	0	0	+	0	0	+	+	+	++	+	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WR514	Logging of large customers	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR515	Splitting District Metering Areas	C	**-/?**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-/?**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**+**	**+**	**+**	**+**	**0**	**0**
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**0**	**+**	**+**	**+**	**0**	**0**	**0**
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	C	**0**	**0**	**0**	**0**	**0**	**-**	**0**	**+**	**0**	**-**	**0**	**0**
		O	**0**	**0**	**+**	**0**	**0**	**+**	**++**	**++**	**++**	**+**	**0**	**0**
WR907g		C	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+**	**0**	**0**	**0**	**0**

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity and Quality	4. Flood Risk	5. Air Quality	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	O	0	0	+	0	0	+	++	++	++	+	0	0
WR914	Third Party - Cello 4S and Regulo	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	+	+	+	0	0	0
Cumulative Effects of Trading Portfolio 2		C	-/?	++	-/?	-	--	--	-	++/-	0	--	--	--
		O	-	0	+/-/?	-	0	++/--	++	++	++	++/--	0	-

Appendix G
Schedule of Consultation Responses

Scoping Report

United Utilities published a Strategic Environmental Assessment (SEA) Scoping Report as part of the initial stage of the SEA of the Draft Water Resources Management Plan (Draft WRMP) for a consultation period of five weeks ending 12th December 2016. Responses were received to the consultation from the following organisations:

- Environment Agency;
- Natural England;
- Natural Resources Wales; and
- Cadw.

In support of the consultation, a meeting attended by the Environment Agency, Natural England and Natural Resource Wales was also held on 16th November 2016. The purpose of this meeting was to seek initial feedback on the content of the SEA Scoping Report and to inform consultation responses.

The following sections provide a summary of the comments received from the statutory consultees together with responses and actions taken in this Environmental Report.

The SEA assessment framework was amended as a result of this consultation. The changes to the assessment framework are shown in **Table G1.5**

SEA Scoping Report Response Summary and Actions

The comments received from those organisations who responded to the SEA Scoping Report consultation are shown in Tables G1.1-G1.5 below, together with the corresponding responses and actions taken.

Table G1.1 Environment Agency

Consultation Question	Section	Consultee Response	Response/Action
Q1. Do you think that this Scoping Report sets out sufficient information to establish the context for the SEA of the draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?	General	Yes.	Comment noted.
	Section 1.5	Section 5.2 – second to last bullet eludes to options also being considered as alternatives. This needs to be explained earlier in the report in Chapter 1. It mentions alternatives, but doesn't explain that each option can also be considered as an alternative.	Comment noted. Section 4.5 makes clear that both alternative plans and water management options are considered alternatives for the purposes of the SEA. This is also set out in the NTS.
	Section 3/Appendix B	The Scoping Report does not make reference to any environmental targets. These are often used to help compare options and give an understanding of the desired outcome e.g. Option 1 will help contribute 5% of the land required to meet the BAP. Relevant targets can be identified from the review of plans and programmes and incorporated into the WRMP.	Comment noted. The review of plans and programmes contained in Appendix B and the baseline presented in Section 3 identify targets where relevant and available. No change.
	Appendix B	Appendix B does not reference the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. There are no third sector reports from the Canal & River Trust, RSPB, Wildlife Trusts etc.	Agreed. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 has been included in Appendix B/Table 2.1 together with relevant plans and programmes prepared by the third sector including: Living Waterways transform places & enrich lives;

Consultation Question	Section	Consultee Response	Response/Action
			North West Waterway Fisheries & Angling Action Plan Cheshire Wildlife Trust Strategy
	General	As the two are closely linked please consider the feedback we recently made on the Drought Plan SEA Scoping Report as well which was to include: Information on how the SEA has influenced production of the plan Information on compliance with WFD and Common Standards Monitoring Guidance, where standards may be more stringent than WFD requirements in order to bring designated sites back into favourable status.	Agreed. Information on how the SEA has influenced the development of the WRMP is included in Section 1 of the Environmental Report. A WFD Assessment has been undertaken alongside the SEA and this has informed the assessment of options in terms of effects on water quality. Impacts on designated sites have also been considered through the consideration of effects on biodiversity.
Q2. Do you agree that the main economic, social and environmental issues identified are relevant to the SEA of the draft WRMP? If not, which issues do you think need to be included or excluded?	Section 3.10	Yes.	Comment noted.
Q3. Do you agree with the proposed approach to the SEA of the draft WRMP? Do the SEA objectives and guide questions that comprise the assessment framework cover a sufficient range of environmental, social and economic topics? If not, which objectives/guide questions should be amended and which other objectives/guide questions do you believe should be included?		Figure 1.3 – It would be useful to have shown the outputs of the WFD/HRA on this process flow chart as well.	Comment noted. This response was considered; however, it was considered that inclusion of further outputs would over complicate the figure.
	Section 4.3	Material assets, Table 4.2 – refers to reduce/recycle waste produced and also sustainable use of raw materials in construction, but perhaps should explicitly say source and use recycled aggregates/materials in construction, ahead of using 'new' materials.	Agreed. The following additional guide question has been included under SEA Objective 10:

Consultation Question	Section	Consultee Response	Response/Action
			"*Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials*?"

Table G1.2 Natural England

Consultation Question	Section	Consultee Response	Response/Action
Q1. Do you think that this Scoping Report sets out sufficient information to establish the context for the SEA of the draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?	General	Yes.	Comment noted.
	Section 3.2	P21. Third arrow point – use of the term "protected area" may be confusing as there is under the Water Framework Directive an understanding that these are those areas which enjoy European designation whether as biodiversity sites or otherwise as, for example, Bathing Waters and Drinking Water Protected Areas.	Agreed. Reference to protected area has been revised to read 'designated area'.
	Section 3.2	Table 3.1 and text for 3.2. Add reference to Marine Conservation Zones.	Agreed. Reference to Marine Conservation Zones has been included in Section 3.2.
	Section 3.2	P21. Clarify the reference to "a total of 42% of freshwater SSSIs are in unfavourable condition" to say whether this means they are either in a no change or deteriorating condition, i.e. that there is no current remedy in place to address the reason for unfavourable condition.	Agreed. The text has been revised to clarify the condition of the SSSIs referred to in this response.
	Section 3.2	SPAs in the UU Supply Area - Figure 3.2 Note that there are two current consultations to extend SPAs in the Area – Solway Firth and Liverpool Bay.	Agreed. Text has been included in Section 3.2 referring to the proposed SPA extensions.
	Section 3.2	P28. International sites, the current wording of this section should be amended to reflect amendments to the Conservation of Habitats and Species Regulations, 2010 which came into force on the 16th August 2012. These amendments are referred to as the Conservation of Habitats and Species (Amendment) Regulations 2012. Though most amendments are related to marine sites and species, Regulation 9 is slightly amended. In particular we refer you to the competent and appropriate authority duty to exercise their functions so as to secure compliance with the directive in relation to, amongst other things, the Water Resources Act 1991.	Agreed. Reference to the Habitats Regulations has been revised to reflect the amendments noted in this response.
Q2. Do you agree that the main economic, social and environmental issues identified are relevant to	General	Yes.	Comment noted.

Consultation Question	Section	Consultee Response	Response/Action
the SEA of the draft WRMP? If not, which issues do you think need to be included or excluded?			
	Section 3.10	Biodiversity – 3rd bullet point: We wonder why the reference to fragmentation is specifically to "the lowlands of the NW Region, especially in the south", and we suggest it would be better to omit this specific reference and simply say "fragmentation of biodiversity in the NW region".	Agreed. The key issue has been revised as per this response.
Q3. Do you agree with the proposed approach to the SEA of the draft WRMP? Do the SEA objectives and guide questions that comprise the assessment framework cover a sufficient range of environmental, social and economic topics? If not, which objectives/guide questions should be amended and which other objectives/guide questions do you believe should be included?	General	Yes.	Comment noted.

Table G1.3 Natural Resources Wales

Consultation Question	Section	Consultee Response	Response/Action
Q1. Do you think that this Scoping Report sets out sufficient information to establish the context for the SEA of the draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?	General	The Scoping Report sets out sufficient information to establish the context for the SEA of the draft WRMP in terms of review of plans and programmes. We have noticed that the Dee General Directions (2016) have been missed from the list in the Table 2.1 and Appendix B.	Comment noted. Reference to the Dee General Direction (2016) has been included Appendix B (in respect of WRMPs),
Q2. Do you agree that the main economic, social and environmental issues identified are relevant to the SEA of the draft WRMP? If not, which issues do you think need to be included or excluded?	General	Geomorpholoy is also an important element of the environment as the change of geomorphology by water supply options might impact on habitats and species as well as water quality due to sedimentation. The Scoping Report has not provided baseline information, analysis and assessment for this element. It may be considered in United Utilities' separate WFD Assessment. The WFD Assessment should be linked with the SEA process.	Comment noted. The following additional guide question has been included under SEA Objective 2: "*Will the option affect geomorphology*?" The WFD Assessment has considered the morphological status of waterbodies where appropriate. The assessment findings have been used to inform the SEA, particularly in respect of effects on water quality and quantity.
Q3. Do you agree with the proposed approach to the SEA of the draft WRMP? Do the SEA objectives and guide questions that comprise the assessment framework cover a sufficient range of environmental, social and economic topics? If not, which objectives/guide questions should be amended and which other objectives/guide questions do you believe should be included?	General	The SEA process and assessment should inform the selection of options in the WRMP.	Agreed. The findings of the SEA have helped to inform the selection of the preferred options for the WRMP (see Section 1 of the Environmental Report).

Table G1.4 Cadw

Consultation Question	Section	Consultee Response	Response/Action
Q1. Do you think that this Scoping Report sets out sufficient information to establish the context for the SEA of the draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?	General	We note that the report appears to include all of the current legislation, including the Historic Environment (Wales) Act 2016.	Comment noted.
	Section 3.8	There is a need for a small amendment to the third paragraph on page 67 in regard to Historic Environment Records. The final sentence should be amended to read "Historic Environment Records (HERs) held by local authorities and Welsh Archaeological Trusts include both designated and undesignated assets."	Agreed. The text has been amended as per this response.
Q2. Do you agree that the main economic, social and environmental issues identified are relevant to the SEA of the draft WRMP? If not, which issues do you think need to be included or excluded?	General	Cultural Heritage is identified as a key sustainability issue and is fully considered as a topic in the plan.	Comment noted.

Revised SEA Assessment Framework

Amendments to the SEA assessment framework made as a result of the consultation process are shown in **Table G1.5** below. Amendments to the assessment framework are shown in red text.

Table G1.5 Amendments to the SEA Assessment Framework following Consultation on the Scoping Report

Topic Area	SEA Objective	Guide Questions
Biodiversity	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.	*Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?*
		Will the option protect and enhance non-designated sites and local biodiversity?
		Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?
		Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?
		Will the option protect, and enhance where appropriate, coastal and marine habitats and species?
		Will the option prevent the spread/introduction of invasive non-native species?
Geology and Soils	2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	*Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?*
		Will the option utilise previously developed land?
		Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?
		Will the option minimise the loss of best and most versatile agricultural land?
		Will the option minimise conflict with existing land use patterns?
		Will the option minimise land contamination?
		Will the option affect geomorphology?
Water – Quantity and Quality	3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies.	*Will the option minimise the demand for water resources?*
		Will the option protect and improve surface, groundwater, estuarine and coastal water quality?
		Will the option result in changes to river flows?
		Will the option result in changes to groundwater levels?
		Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?
		Will the option support the achievement of protected area objectives?
		Will the option support the achievement of environmental objectives set out in River Basin Management Plans?
		Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?

Topic Area	SEA Objective	Guide Questions
Water – Flood Risk	4. To reduce the risk of flooding.	*Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?*
		Will the option have the potential to help alleviate flooding in the catchment area now or in the future?
		Will the option be at risk of flooding now or in the future?
Air Quality	5. To minimise emissions of pollutant gases and particulates and enhance air quality.	*Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates?*
		Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)?
		Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?
		Will the option reduce the need to travel or encourage sustainable modes of transport?
Climate Change	6. To limit the causes and potential consequences of climate change.	*Will the option reduce or minimise greenhouse gas emissions?*
		Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?
		Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?
		Will the option increase environmental resilience to the effects of climate change?
Human Environment - Health	7. To ensure the protection and enhancement of human health.	*Will the option ensure the continuity of a safe and secure drinking water supply?*
		Will the option affect opportunities for recreation and physical activity?
		Will the option maintain surface water and bathing water quality within statutory standards?
		Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?
Human Environment - Social and Economic Well-Being	8. To maintain and enhance the economic and social well-being of the local community.	*Will the option ensure sufficient infrastructure is in place for predicted population increases?*
		Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?
		Will the option help to meet the employment needs of local people?
		Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?
		Will the option improve access to local services and facilities (e.g. sport and recreation)?
		Will the option contribute to sustaining and growing the local and regional economy?
		Will the option avoid disruption through effects on the transport network?
		Will the option be resilient to future changes in resources (both financial and human)?
		Will the option lead to reduced leakage from the supply network?

Topic Area	SEA Objective	Guide Questions
Material Assets and Resource Use - Water Resources	9. To ensure the sustainable and efficient use of water resources.	*Will the option improve efficiency in water consumption?*
Material Assets and Resource Use – Waste and Resource Use	10. To promote the efficient use of resources.	*Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials?*
		~~*Will the option seek to minimise the demand for raw materials?*~~
		Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?
		Will the option encourage the use of sustainable design and materials?
		Will the option reduce or minimise energy use?
Cultural Heritage	11. To conserve and enhance cultural and historic assets.	*Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings*
		Will the option avoid or minimise damage to archaeologically important sites?
		Will the option avoid damage to important wetland areas with potential for palaeo-environmental deposits?
		Will the option affect public access to, or enjoyment of, features of cultural heritage?
Landscape	12. To conserve and enhance landscape character.	*Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?*
		Will the option protect and enhance landscape character, townscape and seascape?
		Will the option affect public access to existing landscape features?
		Will the option minimise adverse visual impacts?

Draft WRMP Environmental Report

United Utilities published an Environmental Report alongside the Draft WRMP for consultation between 2nd March and 25th May 2018, following submission to Defra in December 2017. Responses were received to the consultation from the following organisations:

- Environment Agency;
- Natural England;
- Lake District National Park Authority; and
- Natural Resources Wales.

The following schedule provide a summary of the comments received from the consultees together with responses and actions taken in this updated Environmental Report.

Consultee	Report Section/ Option/ Consultation Question	Consultee Response Summary	Response/Action
Environment Agency	Section 6/ Option B2: Thames Water Trading Enabling Works	States that the Environmental Report should include a cumulative assessment of the water trading proposals.	Comment noted. As set out in Section 6.3 of the Draft WRMP Environmental Report, United Utilities had agreed with Thames Water that any environmental impacts downstream of Lake Vyrnwy in the Severn and Thames catchments associated with a possible transfer would be assessed in Thames Water's Water Resources Management Plan. Whilst water trading remains United Utilities' preference, a bulk transfer does not currently feature in Thames Water's (or any other water company's) emerging WRMP and therefore water trading is no longer being pursued as part of the Preferred Plan for WRMP19. Notwithstanding this, the assessment of Option B2 has been revised to reflect the findings of the Thames Water Draft WRMP Environmental Report (which considered the downstream effects of a transfer). This revised assessment is presented in Appendix D and Appendix F to this report.
	Option WR101: Franklaw Z site plus increased Franklaw WTW treatment capacity and Option WR099b: Worsthorne Borehole (Hurstwood IR)	States that it does not appear that impacts on priority species and habitats have been considered within the SEA. Considers that the potential impacts on fish, especially Atlantic salmon, should be considered for options that may also impact surface water such as Franklaw and Worsthorne. Highlights that salmon stocks in the River Wyre catchment are classified as being 'At Risk' and a considerable amount of work has been done to improve access for salmonid fish into the River Brun in recent years.	Comment noted. For the avoidance of doubt, the SEA has considered effects on priority species and habitats such as Atlantic salmon and this is reflected in the appraisal matrices (under SEA Objective 1) contained in Appendix D and Appendix E to the Environmental Report. With specific regard to Options WR099b and WR101, the Environment Agency's comments are noted. However, for the reasons set out above, the options no longer form part of United Utilities' Preferred Plan for WRMP19. No change.
	Sections 1.3 and 1.4	Considers that it is unclear how the feasible options appraised were identified as the preferred options. States that this is particularly relevant where more than one feasible option was provided for the same asset. For example, three feasible options are provided for the Worsthorne Borehole (WR099a, b and c). WR099b is listed in the preferred options even though it has the greatest number of negative effects of the three Worsthorne	Comment noted. The options identification and appraisal process is detailed in Sections 1.3 and 1.4 of the Draft WRMP Environmental Report and further information in relation to the selection of the preferred WRMP options is contained in supporting technical

Consultee	Report Section/ Option/ Consultation Question	Consultee Response Summary	Response/Action
		Borehole options (a, b and c) presented in the plan.	documentation[118]. In consequence, it is not considered necessary to include further information in the Environmental Report. No change.
	Manchester and Pennine Resilience	Notes that two of the five potential solutions proposed to improve the resilience of customer supplies include new abstractions. States that the Environment Agency is concerned that this new abstraction (particularly from the lower River Ribble) has the potential to limit the opportunity for other potential abstractors to get an abstraction licence in the catchments upstream and that this risk should be reflected in the SEA under Objective 8 (as it could limit local economic growth).	Comment noted. United Utilities has identified Solution D as the preferred Manchester and Pennine Resilience solution. This solution comprises Manchester and Pennine Aqueduct sections T01 to T06, which would involve the construction of new tunnels, and Option 112, that would involve implementing Manchester and Pennine Aqueduct outage. In consequence, there would be no new abstractions required under this solution and therefore there is no potential for impacts on existing or future abstractors. No change.
	Section 6	Notes that the SEA associated with the Manchester and Pennine Resilience solutions does not consider the cumulative effects of these solutions with the effects of the options proposed as the preferred plan in the wider WRMP.	Comment noted. Section 6.2 of the Draft WRMP Environmental Report includes a high level assessment of plan alternatives. This includes Plan Alternative 4 which comprises of continued demand management, a programme of leakage reduction, water trading and the Manchester and Pennine Resilience programme. However, as highlighted in the Environmental Report, as United Utilities' preferred Manchester and Pennine Resilience solution had not been determined at that stage, the assessment of this element of the WRMP was necessarily undertaken at a high level, commensurate with the level of information/detail available at this time. Subsequently, an SEA of alternative solutions was undertaken to help inform the selection of the preferred Manchester and Pennine Resilience solution. The accompanying report set out that, once the preferred

[118] United Utilities (2017) *Draft Water Resources Management Plan 2019: Technical Report – Options Identification* and United Utilities (2017) *Draft Water Resources Management Plan 2019: Technical Report – Options Appraisal*.

Consultee	Report Section/ Option/ Consultation Question	Consultee Response Summary	Response/Action
			solution had been identified, it would be subject to further detailed assessment if required. In this context, a detailed assessment of the preferred Manchester and Pennine Resilience solution (Solution D) is contained in Appendix E of this Environmental Report and the cumulative effects of the WRMP including Solution D are assessed in Section 6.
	Manchester and Pennine Resilience	Considers that the cumulative assessment of minor positive effects appears to be treated differently to minor negative effects. For example, for Solution A, minor positive health effects resulting from the operational phase have been accumulated to a significant positive effect overall. In contrast, minor negative effects on air quality or landscape (from construction) are accumulated to be minor negative overall. This similarly applies to the negative health effects of Solution E.	Disagree. The significant positive effects identified in respect of health reflect the potential for a Manchester and Pennine Resilience solution to significantly enhance the resilience of supply to over two million customers, ensuring the long term continuity of a clean and safe water supply at a regional scale. In contrast, adverse effects on air quality and landscape would be largely localised and temporary such that they would not be significant. However, where a solution is considered likely to result in substantial emissions to air, and/or involve extensive works within nationally designated landscapes (e.g. Solutions B, C and E), the potential for significant negative effects on these air quality and landscape has been identified. No change.
	Manchester and Pennine Resilience	States that some of the construction effects appear to be concluded to be minor on the basis of their temporary and short-term nature (for example, biodiversity and traffic disruption). However, when it comes to the wellbeing effects of the capital investment and the construction jobs created (presumably equally temporary and short term), this is considered to be a significant positive effect.	Disagree. Whilst works would be temporary, the scale of investment associated with the construction of the Manchester and Pennine Resilience solutions would be regionally, if not nationally, significant. In contrast, effects on biodiversity and transport would be localised and would therefore not be considered significant. No change.
	Manchester and Pennine Resilience	Considers there to be an inconsistency in the treatment of geology in the assessment of Solution D. In the context of biodiversity effects, the potential effects on groundwater are discounted on the basis of geological investigations. However, in the context of impacts on the water environment, the document states that a detailed study of the geology of the route has not been undertaken and	Comment noted. The findings of the SEA in respect of biodiversity reflect those of the HRA which states that geological investigations have indicated that the risk of works affecting groundwater bodies is minimal due to the dominance of low-permeability geological

Consultee	Report Section/ Option/ Consultation Question	Consultee Response Summary	Response/Action
		the relationship between ground and surface waters are based on assumptions.	formations and the depth of the pipeline. In contrast, the effects in respect of water (SEA Objective 3) reflect the WFD Assessment which highlights that a *detailed* study of the geology of the tunnel route has not been undertaken at this stage such that in the context of that assessment, its methodology and regulatory requirements, some uncertainty remains. In this context, it is fully anticipated that a detailed geological study in support of Solution D would be undertaken at the project stage. No change.
Natural England	Manchester and Pennine Resilience	Welcomes the SEA of the five solutions but states that their presentation is confusing.	Comment noted. Without further information from Natual England, it is unclear how the solutions could be presented in a different manner. Sections 5.5 and 6.3 of the revised Environmental Report does however contain the summary of the assessment of all five solutions, along with the assessment of the preferred solution fo Manchester and Pennine Resilience. No change.
	Manchester and Pennine Resilience	Considers that the SEA does provide "pointers" to which of the solutions and their constituent options provide the greatest resilience benefit and which are most harmful to the environment.	Comment noted. No change.
	Option B2: Thames Water Trading Enabling Works	States that it would be helpful if the WRMP included an assessment of the effect of a potential transfer to Thames Water in terms of the effects outside United Utilities' supply area (e.g. from new pipeline construction and transfer of water to the River Severn).	Comment noted. As set out in Section 6.3 of the Draft WRMP Environmental Report, United Utilities had agreed with Thames Water that any environmental impacts downstream of Lake Vyrnwy in the Severn and Thames catchments associated with a possible transfer would be assessed in Thames Water's Water Resources Management Plan. Whilst water trading remains United Utilities' preference, a bulk transfer does not currently feature in Thames Water's (or any other water company's) emerging WRMP and therefore water trading is no longer being pursued as part of the Preferred Plan for WRMP19.

Consultee	Report Section/ Option/ Consultation Question	Consultee Response Summary	Response/Action
			Notwithstanding this, the assessment of Option B2 has been revised to reflect the findings of the Thames Water Draft WRMP Environmental Report (which considered the downstream effects of a transfer). This revised assessment is presented in Appendix D and Appendix F to this report.
Lake District National Park Authority (LDNPA)	Do you think that the Environmental Report has correctly identified the likely significant effects of the draft Water Resources management Plan? If not, what other significant effects do you think we have missed, and why?	Yes, although the LDNPA would be keen to work with United Utilities in the future to understand in more detail the impact upon the World Heritage Site's Outstanding Universal Value.	Comment noted. The assessment of both feasible and preferred WRMP options, as well as the Manchester and Pennine Resilience solutions, has identified where there is the potential for effects on the Lake District National Park World Heritage Site. No change is therefore proposed at this stage. United Utilities welcomes the opportunity to work with the LDNPA on future WRMPs. No change.
	Do you agree with the conclusions of the Environmental Report and the recommendations for avoiding, reducing or off-setting significant effects associated with the implementation of the draft Water Resources Management Plan? If not, what do you think should be the key recommendations and why?	Yes.	Comment noted. No change.
	Do you agree with the proposed arrangements for monitoring the significant effects of the implementation of the Water Resources Management Plan? If not, what measures do you propose?	Yes. The LDNPA would be willing to work with United Utilities to develop indicators in relation to monitoring the impact of the WRMP on the Lake District National Park World Heritage Site and supports any approaches to using natural capital the company may take in the future to assess change in the natural assets of the Lake District.	Comment noted. United Utilities welcomes the opportunity to work with the LDNPA in finalising the monitoring framework for the WRMP.
Natural Resources Wales (NRW)	Section 6.5	Notes that the SEA has considered how the WRMP, in relation to United Utilities' operations in Wales, contributes to the objectives and goals of the Well-being of Future Generations (Wales) Act	Comment noted. As per this response, the information requested will be included in the final WRMP.

Consultee	Report Section/ Option/ Consultation Question	Consultee Response Summary	Response/Action
		2015 and Environment (Wales) Act 2016. States that for clarity, the company should summarise this information within the final plan.	
	Section 6.5	States that United Utilities should consider working with Thames Water and Severn Trent Water and other interested stakeholders to jointly investigate opportunities to improve the environment and contribute to the Welsh Government's wellbeing goals around Llyn Vyrnwy.	Comment noted. United Utilities would welcome the opportunity to work with other stakeholders in respect of Lake Vyrnwy.
	Section 6/ Option B2: Thames Water Trading Enabling Works	Notes that United Utilities' preferred plan includes supply schemes that could affect Wales including a trade to export water from Llyn Vyrnwy and a 30 Ml/d third party supply at Hurleston. States that if these options, or any other option, that could affect Wales are progressed further for the final plan, NRW would expect the company to consult NRW on any revised SEA Environmental Report.	Comment noted. Whilst water trading remains United Utilities' preference, a bulk transfer does not feature in Thames Water's (or any other water company's) emerging WRMP and therefore water trading is no longer being pursued as part of the preferred plan for WRMP19. No change.