



United Utilities

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

Environmental Report Supplementary Information: Draft Resilience Options



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Amec Foster Wheeler Environment  
& Infrastructure UK Limited

### Report for

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# 1. Introduction

## 1.1 Overview

- 1.1.1 United Utilities is currently preparing its Water Resources Management 2019 (WRMP19) that 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 is currently consulting on a Draft Water Resources Management Plan (Draft WRMP) in order that regulators, stakeholders and the public can comment on United Utilities' proposed strategy and further contribute to the development of the plan.
- 1.1.2 United Utilities has identified, and included in its Draft WRMP, five potential solutions to address the resilience risks associated with the regional aqueduct system (which transfers water from the Lake District to supply the Manchester and Pennine areas including parts of Lancashire and south Cumbria). At this stage, United Utilities' preferred Manchester and Pennine Resilience solution has not been determined; this work is ongoing and will be informed by consultation responses to the Draft WRMP together with further assessment and appraisal.
- 1.1.3 In this context, and as part of the process of selecting the preferred Manchester and Pennine Resilience solution, Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler, now Wood) has been commissioned to undertake a Strategic Environmental Assessment (SEA) of the five potential solutions identified by United Utilities and their component resilience options. The SEA is being undertaken to assess the likely economic, social and environmental effects of the potential solutions and in doing so, it will help to inform the selection of the preferred Manchester and Pennine Resilience solution.
- 1.1.4 This document presents the assessment of the resilience solutions and supplements the findings of the assessment of the resilience solutions contained in the Environmental Report for the Strategic Environmental Assessment of the Draft Water Resources Management Plan (Draft WRMP) 2019<sup>1</sup> (available via [www.unitedutilities.com/wrmpconsultation](http://www.unitedutilities.com/wrmpconsultation)) in a manner anticipated in the Environmental Report. It should be read in conjunction with the Environmental Report to provide consultees with an understanding of the likely significant effects of the resilience options that will make up the Manchester and Pennine Resilience solutions described in the Draft WRMP.

## 1.2 Context

### United Utilities' Draft Water Resources Management Plan 2019

- 1.2.1 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.
- 1.2.2 The WRMP will present management options by water resource zone (WRZ). WRZs are defined in the Water Resources Planning Guideline<sup>2</sup> 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*

<sup>1</sup> Amec Foster Wheeler (2018) *Strategic Environmental Assessment of the Draft Water Resources Management Plan 2019: Environmental Report*.

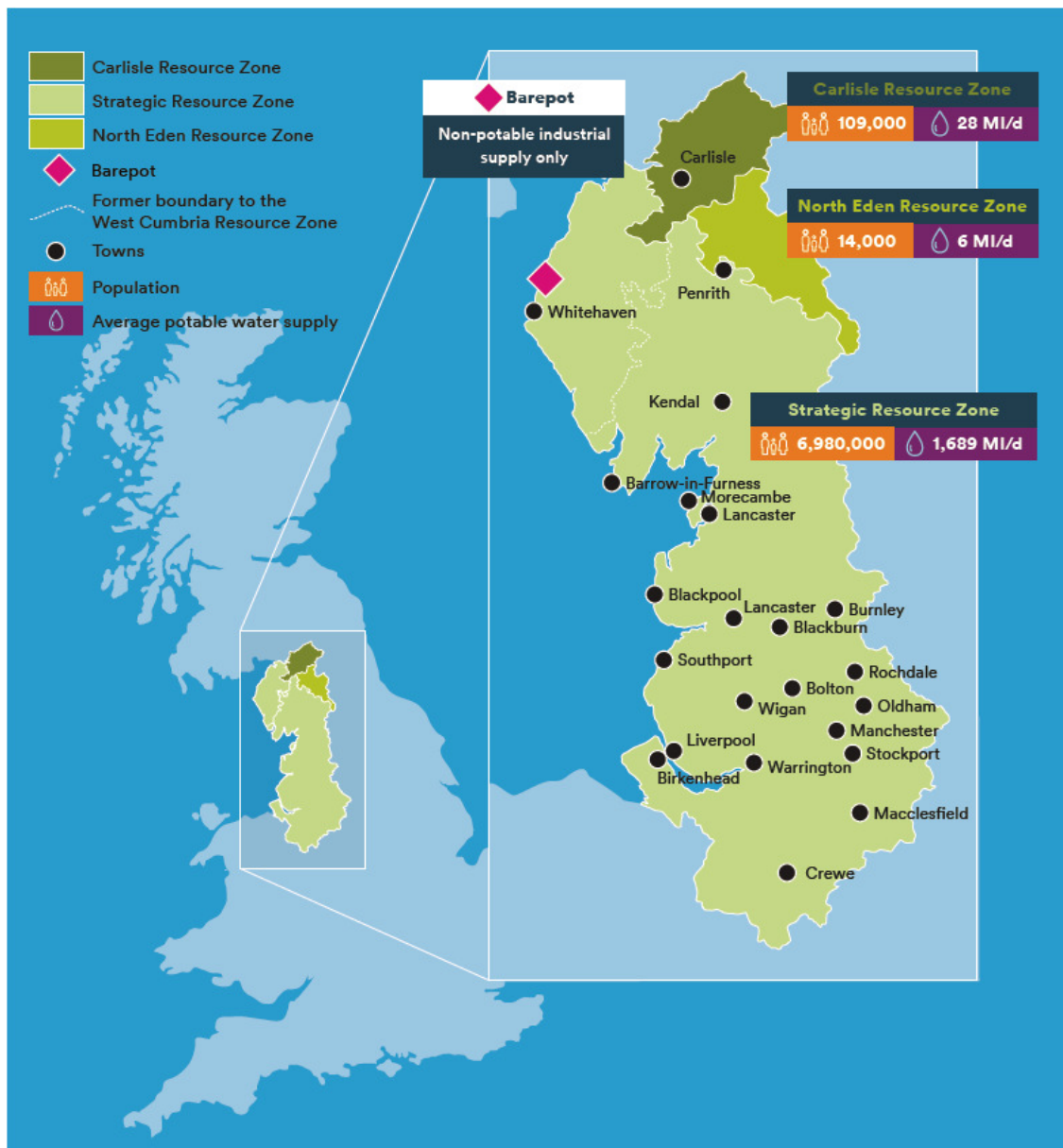
<sup>2</sup> Environment Agency and Natural Resources Wales (2017) *Water Resources Planning Guideline: Interim Update*. Available at: <https://naturalresources.wales/media/681612/interim-wrpg-update-final-april-2017.pdf> [Accessed October 2017].

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”.

1.2.3

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 1.1**. These are: the Strategic Resource Zone; the Carlisle Resource Zone; the North Eden Resource Zone; and Barepot non potable industrial supply zone.

Figure 1.1 United Utilities’ Resource Zones (from 2022 onwards)



- 1.2.4 In preparing the 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 surplus in all four of the company's WRZs in a dry year over the planning horizon of WRMP19. As there is forecast to be enough water to meet demand over the period of WRMP19, United Utilities does not need to take any further action in this regard. However, consideration has been given to using the forecast surplus, with possible new source or demand management investment, to explore strategic choices for the WRMP.
- 1.2.5 In this context, United Utilities' Preferred Plan for WRMP19 seeks to deliver the following four 'strategic choices':
- ▶ Enhanced leakage reduction by a total of 80 mega litres per day (Ml/d) over the planning period;
  - ▶ Improved 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);
  - ▶ Increased resilience to others hazards, including through the Manchester and Pennine Resilience solution; and
  - ▶ Commitment to continue to explore national water trading.
- 1.2.6 The Preferred Plan comprises a combination of preferred resource management and demand management (including leakage reduction and network metering) options designed to achieve the four strategic choices outlined above and maintain and enhance the supply-demand balance. These preferred options are presented in the Draft WRMP for public consultation and have been selected following a process of options identification and appraisal. This process initially reviews 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.

### Manchester and Pennine Resilience

- 1.2.7 As part of the Preferred Plan, United Utilities will seek 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 has 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. United Utilities has 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.
- 1.2.8 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'.



## Resilience Solutions

- 1.2.9 As set out in **Section 1.1**, five potential Manchester and Pennine Resilience solutions have been identified by United Utilities. 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 upgrading 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.
- 1.2.10 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 have been subject to Environmental and Social (E&S) Costings, SEA, HRA and WFD Assessment.
- 1.2.11 The outcomes of these assessments, together with consultees' views on the Draft WRMP19, will be used to inform the selection of the preferred Manchester and Pennine Resilience solution.

## Resilience Options

- 1.2.12 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 has identified a total of 34 resilience options, different combinations of which form the five potential Manchester and Pennine Resilience solutions. These options are listed and described in **Table 1.1** together with the respective solution(s) to which they relate.

Table 1.1 Resilience Options

| Ref   | Option  | Description  | Solution(s)  |
|-------|---|--|--|
| 3     | Manchester and Pennine Aqueduct to Raw: 2 Stage filtration (Bury) | <p>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.</p> <p>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.</p> | <ul style="list-style-type: none"> <li>• Solution C</li> </ul> |
| 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.   | <ul style="list-style-type: none"> <li>• Solution B</li> </ul> |

| Ref   | Option   | Description  | Solution(s)  |
|-------|--|--|--|
|       |  | 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.  |  |
| 37-42 | Manchester and Pennine Aqueduct sections T01 to T06                              | <p>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.</p> <p>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.</p>   | <ul style="list-style-type: none"> <li>• Solution D</li> <li>• Solution E</li> </ul> |
| 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.   | <ul style="list-style-type: none"> <li>• Solution A</li> <li>• Solution E</li> </ul> |
| 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.  | <ul style="list-style-type: none"> <li>• Solution B</li> <li>• Solution D</li> </ul> |
| 212   | Manchester and Pennine Aqueduct to Raw (Newton-in-Bowland)                       | <p>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.</p> <p>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.</p> | <ul style="list-style-type: none"> <li>• Solution C</li> </ul>                       |
| 213   | Manchester and Pennine Aqueduct to Raw (Clayton-le-Moors)                        | <p>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.</p> <p>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.</p>  | <ul style="list-style-type: none"> <li>• Solution C</li> </ul>                       |
| 214   | Manchester and Pennine Aqueduct to Raw (Haslingden)                              | <p>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.</p> <p>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.</p>  | <ul style="list-style-type: none"> <li>• Solution C</li> </ul>                       |
| 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,   | <ul style="list-style-type: none"> <li>• Solution E</li> </ul>                       |





| Ref | Option   | Description  | Solution(s)  |
|-----|--|--|--|
|     |  | <p>in conjunction with Options 216, 217 and 218, would provide additional abstraction/treatment facilities to facilitate Solution E.</p> <p>The option would require a new abstraction point, circa 9.1km of 800mm main to a new 3 stage WTW and a pumping station.</p>  |  |
| 216 | Alternative Supply: Raw water abstraction and WTW (Haslingden)     | <p>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.</p> <p>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.</p>  | <ul style="list-style-type: none"> <li>• Solution A</li> <li>• Solution E</li> </ul> |
| 217 | Alternative Supply: Raw water transfer and WTW (Newton-in-Bowland) | <p>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.</p> <p>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.</p>  | <ul style="list-style-type: none"> <li>• Solution E</li> </ul>                       |
| 218 | Alternative Supply: Raw water transfer and WTW (Preston)           | <p>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.</p> <p>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.</p> | <ul style="list-style-type: none"> <li>• Solution E</li> </ul>                       |
| 238 | Metals & UV treatment of BSPs: Bury                                | <p>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.</p>  | <ul style="list-style-type: none"> <li>• Solution B</li> </ul>                       |
| 260 | Ribblesdale South Well Isolation                                   | <p>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.</p>   | <ul style="list-style-type: none"> <li>• Solution A</li> </ul>                       |
| 261 | Haslingden Well Isolation  | <p>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.</p>   | <ul style="list-style-type: none"> <li>• Solution A</li> </ul>                       |
| 296 | T05 targeted repair 2025   | <p>This option would target section T05 for remedial works (tunnel lining) in order to provide greater structural support to the wider water distribution network.</p> <p>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</p>   | <ul style="list-style-type: none"> <li>• Solution A</li> </ul>                       |

| Ref | Option                        | Description   | Solution(s)  |
|-----|-------------------------------|---|--|
|     |                               | 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.   |  |
| 297 | T06 targeted repair 2025      | <p>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.</p> <p>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.</p> | <ul style="list-style-type: none"> <li>• Solution A</li> </ul> |
| 301 | Lunesdale Siphon BSPs North   | <p>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.</p> <p>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 0.75MI to 9.0MI).</p>  | <ul style="list-style-type: none"> <li>• Solution C</li> </ul> |
| 303 | Lunesdale Siphon BSPs South   | <p>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.</p> <p>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 9MI 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.</p>  | <ul style="list-style-type: none"> <li>• Solution C</li> </ul> |
| 306 | Ribblesdale Siphon BSPs North | <p>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.</p> <p>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.</p>  | <ul style="list-style-type: none"> <li>• Solution C</li> </ul> |

| Ref | Option  | Description  | Solution(s)  |
|-----|---|--|--------------|
| 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 MI/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 MI/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 MI/d, with a maximum treatment capacity of 0.57 MI/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 MI/d, with a maximum treatment capacity of 6.04 MI/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 MI/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 MI/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 expected to treat an average of 40.86 MI/d, with a maximum treatment capacity of 45.28 MI/d. | • Solution B |
| 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 MI/d, with a maximum treatment capacity of 0.03 MI/d.           | • Solution B |

| Ref | Option   | Description  | Solution(s)  |
|-----|--|--|--|
| 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 MI/d, with a maximum treatment capacity of 5.05 MI/d.   | <ul style="list-style-type: none"> <li>• Solution B</li> </ul> |
| 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 MI/d, with a maximum treatment capacity of 2.17 MI/d.   | <ul style="list-style-type: none"> <li>• Solution B</li> </ul> |
| 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 MI/d, with a maximum treatment capacity of 43.05 MI/d.  | <ul style="list-style-type: none"> <li>• Solution B</li> </ul> |
| 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 MI/d, with a maximum treatment capacity of 6.83 MI/d.  | <ul style="list-style-type: none"> <li>• Solution B</li> </ul> |
| 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 MI/d, with a maximum treatment capacity of 9.96 MI/d.  | <ul style="list-style-type: none"> <li>• Solution B</li> </ul> |
| 382 | Manchester and Pennine Aqueduct to Raw: WTW reduced flow | <p>This option would reduce the flow of a WTW in the Kendal area from 570 MI/d to 80 MI/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.</p> <p>The option would require: modifications and refurbishment of the existing WTW to maintain the existing process but at a reduced flow of 80 MI/d; new connections to a new inlet tank (total length circa 8km); new UV disinfection process; new final water chemical dosing and storage in banded 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.</p> | <ul style="list-style-type: none"> <li>• Solution C</li> </ul> |

**Abbreviations:**

BSP: Bulk Supply Point  
 DMA: District Metered Area  
 RGF: Rapid Gravity Filters  
 WTW: Water Treatment Works

## 1.3 Strategic Environmental Assessment

### Overview

1.3.1 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.”*

1.3.2 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.

1.3.3 In this context, SEA of the Draft WRMP is being undertaken in order to:

- ▶ identify the potentially significant environmental effects of the 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 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

1.3.4 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.

1.3.5 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 for the SEA of the Draft WRMP in November 2016 for a consultation period of five weeks.

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

- ▶ an initial high level assessment of all feasible (constrained) resource and demand management options;
- ▶ a high level assessment of alternative plans; and

- ▶ a more detailed assessment of the Preferred Plan including the constituent preferred options.
- 1.3.7 The findings of the assessments are presented in the SEA Environmental Report (**Stage C**). This document presents the assessment of the Manchester and Pennine Resilience solutions, which has been undertaken in a manner consistent with the assessment of the feasible water management options, as supplementary information to the Environmental Report.
- 1.3.8 The Draft WRMP and accompanying documents including the Environmental Report and this document have been published for consultation (**Stage D**). Following consultation, United Utilities will amend the Draft WRMP as necessary and identify its preferred Manchester and Pennine Resilience solution; following direction from the Secretary of State, United Utilities will publish the Final WRMP and implement it accordingly. United Utilities will also issue a Post Adoption Statement, which 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. This will include further assessment of the preferred resilience solution if required. The SEA then requires monitoring of any resulting environmental effects of the WRMP (**Stage E**).

## 1.4 Approach to the Assessment

### The Assessment Framework

- 1.4.1 Each of the 34 resilience options have been assessed using the same assessment methodology as that which has been employed for the Draft WRMP19 feasible options, as set out in detail in Section 4 of the Environmental Report. This methodology uses an assessment framework to assess the economic, social and environmental effects of options. The framework consists of 12 SEA objectives and 57 guide questions that were developed as part of the preparation of the SEA Scoping Report and subject to consultation<sup>3</sup> in late 2016.
- 1.4.2 The framework that has been used to assess the resilience options is shown in **Table 1.2**. The performance of each option has been assessed against the 12 SEA objectives to ensure that the options are appraised in a robust and consistent manner.

Table 1.2 Assessment Framework for the SEA of the Resilience Options

| Topic Area               | SEA Objective   | Guide Questions   |
|--------------------------|---|---|
| <b>Biodiversity</b>      | 1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits. | <i>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)?</i> |
|                          |   | <i>Will the option protect and enhance non-designated sites and local biodiversity?</i>   |
|                          |   | <i>Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?</i>   |
|                          |   | <i>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</i>  |
|                          |   | <i>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</i>   |
| <b>Geology and Soils</b> | 2. To ensure the appropriate and efficient use of land and  | <i>Will the option prevent the spread/introduction of invasive non-native species?</i>  |
|                          |   | <i>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?</i>  |

<sup>3</sup> The Scoping Report was issued to the statutory consultation bodies (the Environment Agency, Natural England, Historic England, Natural Resources Wales, Cadw and the Welsh Government).



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

| Topic Area   | SEA Objective   | Guide Questions   |
|--|---|---|
| <b>Human Environment - Health</b>                                | 7. To ensure the protection and enhancement of human health.                          | <i>Will the option ensure the continuity of a safe and secure drinking water supply?</i>  |
|  |   | <i>Will the option affect opportunities for recreation and physical activity?</i>   |
|  |   | <i>Will the option maintain surface water and bathing water quality within statutory standards?</i>   |
|  |   | <i>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</i>  |
| <b>Human Environment - Social and Economic Well-Being</b>        | 8. To maintain and enhance the economic and social well-being of the local community. | <i>Will the option ensure sufficient infrastructure is in place for predicted population increases?</i>   |
|  |   | <i>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</i>   |
|  |   | <i>Will the option help to meet the employment needs of local people?</i>   |
|  |   | <i>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</i>  |
|  |   | <i>Will the option improve access to local services and facilities (e.g. sport and recreation)?</i>   |
|  |   | <i>Will the option contribute to sustaining and growing the local and regional economy?</i>   |
|  |   | <i>Will the option avoid disruption through effects on the transport network?</i>   |
|  |   | <i>Will the option be resilient to future changes in resources (both financial and human)?</i>  |
| <b>Material Assets and Resource Use - Water Resources</b>        | 9. To ensure the sustainable and efficient use of water resources.                    | <i>Will the option lead to reduced leakage from the supply network?</i>   |
|  |   | <i>Will the option improve efficiency in water consumption?</i>   |
| <b>Material Assets and Resource Use – Waste and Resource Use</b> | 10. To promote the efficient use of resources.  | <i>Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials?</i>  |
|  |   | <i>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</i>   |
|  |   | <i>Will the option encourage the use of sustainable design and materials?</i>   |
| <b>Cultural Heritage</b>   | 11. To conserve and enhance cultural and historic assets.                             | <i>Will the option reduce or minimise energy use?</i>   |
|  |   | <i>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?</i> |
|  |   | <i>Will the option avoid or minimise damage to archaeologically important sites?</i>  |
|  |   | <i>Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits?</i>   |
| <b>Landscape</b>   | 12. To conserve and enhance landscape character.                                      | <i>Will the option affect public access to, or enjoyment of, features of cultural heritage?</i>   |
|  |   | <i>Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?</i>                             |
|  |   | <i>Will the option protect and enhance landscape character, townscape and seascape?</i>   |

| Topic Area | SEA Objective | Guide Questions  |
|------------|---------------|--|
|            |               | 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.

### Assessment Methodology

1.4.3 Both the construction and operational effects of each resilience option have been assessed against all of the SEA objectives. This approach recognises that many of the options under consideration are likely to be very different in nature in their construction and operational phases.

1.4.4 A matrix similar to that shown in **Table 1.3** has been used to capture the assessment of each resilience option. A key to the meaning of the symbols is presented in **Table 1.4**. Each option has been scored against each SEA objective with commentary on performance.

Table 1.3 Assessment Matrix

| Option   | Stage        | 1. Biodiversity | 2. Geology and Soils | 3. Water Quantity and Quality | 4. Flood Risk | 5. Flood Risk | 6. Climate Change | Etc... |
|--|--------------|-----------------|----------------------|-------------------------------|---------------|---------------|-------------------|--------|
| Option Name  | Construction | --              | -                    | 0                             | -             | 0             | --/?              |        |
|  | Operation    | --/?            | 0                    | 0                             | -             | 0             | --                |        |
| <b>Construction</b>  |              |                 |                      |                               |               |               |                   |        |
| <i>A description of the likely significant effects of the option on the SEA objectives during construction is included here.</i> |              |                 |                      |                               |               |               |                   |        |
| <b>Operation</b>   |              |                 |                      |                               |               |               |                   |        |
| <i>A description of the likely significant effects of the option on the SEA objectives during operation is included here.</i>    |              |                 |                      |                               |               |               |                   |        |

Table 1.4 Assessment Matrix

| Score                       | Description   | Symbol |
|-----------------------------|---|--------|
| Significant Positive Effect | Significant positive effect of the resilience option on this objective  | ++     |
| Minor Positive Effect       | Positive effect of the resilience option on this objective  | +      |
| Neutral                     | Overall neutral effect of the resilience option on this objective   | 0      |
| Minor Negative Effect       | Negative effect of the resilience option on this objective  | -      |
| Significant Negative Effect | Significant negative effect of the resilience option on this objective  | --     |
| No Relationship             | There is no clear relationship between the resilience option and the achievement of the objective or the relationship is negligible.  | ~      |
| Uncertain                   | The resilience 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 resilience option on this objective   | +/-    |

1.4.5 The resilience options have been 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 A**) to provide direction on what constitutes a significant effect. The completed assessment matrices are contained in **Appendix B**.

1.4.6 To determine the effects of the five resilience solutions, the cumulative effects of the composite resilience options have been identified, described and evaluated. On this basis, **Section 2** presents the findings of the assessment of the resilience solutions.

## 1.5 Report Structure

1.5.1 This report is structured as follows:

- ▶ **Section 1: Introduction** - Provides an overview of the Draft WRMP, Manchester and Pennine Resilience, SEA, the approach to the assessment and the structure of this report;
- ▶ **Section 2: Assessment of Resilience Options and Solutions** - Presents the findings of the assessment of the individual resilience options and each solution;
- ▶ **Section 3: Conclusions and Next Steps** - Summarises the findings of the assessment and sets out the next stages in the SEA process.

## 1.6 How to Comment on this Report

1.6.1 This report is being published alongside the Draft WRMP for formal consultation until 25<sup>th</sup> May 2018. Details of how to respond are provided below.

## **This Consultation: How to Give Us Your Views**

We would welcome your views on any aspect of this report, together with supporting evidence where appropriate. We are particularly interested to receive your response to the following questions:

1. Do you think that the report has correctly identified the likely significant effects of the potential Manchester and Pennine Resilience solutions? If not, what other significant effects do you think we have missed, and why?
2. Do you agree with the conclusions of the report?

If you would like to submit a response to this report, please send comments to the Secretary of State by 25<sup>th</sup> May 2018 to consider within our draft WRMP19 consultation process, either by post:

Secretary of State, Department for Environment Food and Rural Affairs (Defra)  
United Utilities draft Water Resources Management Plan: Manchester and Pennine Resilience  
Water Resources  
Department for Environment Food and Rural Affairs  
Area 3D  
Nobel House  
17 Smith Square  
London  
SW1P 3JR

United Utilities draft Water Resources Management Plan: Manchester and Pennine Resilience  
Head of Water Network Plus  
Haweswater House  
Lingley Mere Business Park  
Lingley Green Avenue  
Great Sankey  
Warrington  
WA5 3LP

Or by e-mail (titling your email 'United Utilities draft Water Resources Management Plan: Manchester and Pennine Resilience'):

[water.resources@defra.gsi.gov.uk](mailto:water.resources@defra.gsi.gov.uk)

[wrmconsult@uuplc.co.uk](mailto:wrmconsult@uuplc.co.uk)

If emailing, please also cc [Water-Company-Plan@environment-agency.gov.uk](mailto:Water-Company-Plan@environment-agency.gov.uk) and [wrm@ofwat.gsi.gov.uk](mailto:wrm@ofwat.gsi.gov.uk).

## 2. Assessment of Effects

### 2.1 Introduction

- 2.1.1 This section presents the findings of the assessment of the five Manchester and Pennine Resilience solutions (as described in **Section 1.2**) in-turn. 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.
- 2.1.2 To provide a detailed and comparable understanding of the likely significant environmental effects, each resilience option has been assessed individually, with the detailed findings presented in **Appendix B**. The assessments of the individual options have then be aggregated to provide an assessment of the predicted cumulative effects on the environment from each potential Manchester and Pennine Resilience solution.
- 2.1.3 All of the resilience options have been assessed using the SEA framework and approach set out in **Section 1.4** to identify the likely environmental effects. Each resilience option has been assessed against the SEA objectives to identify its potential effects in both the short term (during construction) and medium/long term (during operation). The significance of the effect has taken into account: 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 has been available for the resilience option, the assessment has also been informed by reference to threshold values set out in the definitions of significance contained at **Appendix A**.

### 2.2 Solution A

- 2.2.1 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 2.1**. Commentary on the likely significant construction and operational effects of the solution is provided below.



Table 2.1 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 150MI/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             |
| <b>Cumulative Effects of Solution A</b> |                          | C                                 | -               | -                    | -/?                           | 0             | -              | --                | -         | ++/-         | 0                  | --                         | -                     | -             |
|   |                          | O                                 | 0/?             | 0                    | 0/?                           | 0             | 0              | 0                 | ++        | ++           | 0                  | 0                          | 0                     | -             |

## Construction Effects

- 2.2.2 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.
- 2.2.3 No further significant positive effects from construction have been identified during the assessment of Solution A.
- 2.2.4 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<sub>2</sub>e 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).
- 2.2.5 No further significant negative effects have been identified during the assessment of Solution A.
- 2.2.6 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.
- 2.2.7 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.
- 2.2.8 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.
- 2.2.9 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).
- 2.2.10 No effects on flood risk (SEA Objective 4) or water resources (SEA Objective 9) are anticipated during construction.

## Operational Effects

- 2.2.11 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).
- 2.2.12 No further significant positive effects from operation have been identified during the assessment of Solution A.
- 2.2.13 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.
- 2.2.14 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.

## 2.3 Solution B

- 2.3.1 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 2.2**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 2.2 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                     | -             |

| 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                     | -             |
| 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                     | --            |



| 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                     | --            |
| 355 | Metals & UV Treatment of BSPs: Ribblesdale Siphon (1) | C                                 | -               | -                    | 0                             | 0             | 0              | --                | 0          | 0            | 0                  | --                         | 0                     | --            |
|     |   | 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                     | -             |

| 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                     | -             |
| 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             |
| <b>Cumulative Effects of Solution B</b> |   | C                                 | -               | +/-                  | -/?                           | -             | --             | --                | -          | ++/-         | 0                  | --                         | -                     | --            |
|   |   | O                                 | 0               | 0                    | -/?                           | 0/?           | -              | --                | ++         | ++           | 0                  | --                         | -                     | --            |

## Construction Effects

- 2.3.2 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.
- 2.3.3 No further significant positive effects from construction have been identified during the assessment of Solution B.
- 2.3.4 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<sub>2</sub>e during construction which has been assessed as having a significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).
- 2.3.5 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).
- 2.3.6 No further significant negative effects have been identified during the assessment of Solution B.
- 2.3.7 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).
- 2.3.8 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.
- 2.3.9 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).
- 2.3.10 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).
- 2.3.11 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.
- 2.3.12 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).
- 2.3.13 A neutral effect has been determined for water resources (SEA Objective 9).

### Operational Effects

- 2.3.14 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).
- 2.3.15 No further significant positive effects from operation have been identified during the assessment of Solution B.
- 2.3.16 The additional treatment of water associated with Solution B would generate operational greenhouse gas emissions of approximately 1,500 tCO<sub>2</sub>e per annum. Consistent with the definitions of significance contained at **Appendix A**, 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.
- 2.3.17 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).
- 2.3.18 No further significant negative effects have been identified during the assessment of Solution B.
- 2.3.19 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.
- 2.3.20 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).
- 2.3.21 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).

## 2.4 Solution C

2.4.1 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 2.3**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 2.3 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                     | -             |
| <b>Cumulative Effects of Solution C</b> |  | C                                 | -               | -                    | 0                             | -             | --             | --                | --        | ++/-         | 0                  | --                         | -                     | --            |
|   |  | O                                 | 0               | 0                    | 0                             | -             | -              | --                | ++        | ++           | 0                  | --                         | 0                     | --            |

## Construction Effects

- 2.4.2 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.
- 2.4.3 No further significant positive effects from construction have been identified during the assessment of Solution C.
- 2.4.4 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.
- 2.4.5 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<sub>2</sub>e 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).
- 2.4.6 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.
- 2.4.7 No further significant negative effects have been identified during the assessment of Solution C.
- 2.4.8 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).
- 2.4.9 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.

- 2.4.10 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).
- 2.4.11 Neutral effects have been identified in respect of water quantity and quality (SEA Objective 3) and water resources (SEA Objective 9).

### Operational Effects

- 2.4.12 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).
- 2.4.13 No further significant positive effects from operation have been identified during the assessment of Solution C.
- 2.4.14 Additional treatment and the pumping of water associated with Solution C would generate greenhouse gas emissions of approximately 1,600 tCO<sub>2</sub>e per annum. Consistent with the definitions of significance contained at **Appendix A**, 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.
- 2.4.15 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.
- 2.4.16 No further significant negative effects have been identified during the assessment of Solution C.
- 2.4.17 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.
- 2.4.18 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).
- 2.4.19 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).

## 2.5 Solution D

- 2.5.1 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 2.4**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 2.4 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             |
| <b>Cumulative Effects of Solution D</b> |  | C                                 | -               | -                    | -/?                           | -             | --             | --                | -         | ++/-         | 0                  | --                         | 0                     | -             |
|   |  | O                                 | 0               | 0                    | -/?                           | 0             | 0              | -                 | ++        | ++           | 0                  | -                          | 0                     | 0             |

## Construction Effects

- 2.5.2 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.
- 2.5.3 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.
- 2.5.4 No further significant positive effects from construction have been identified during the assessment of Solution D.
- 2.5.5 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<sub>2</sub>e 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).
- 2.5.6 No further significant negative effects have been identified during the assessment of Solution D.
- 2.5.7 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. 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).
- 2.5.8 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).
- 2.5.9 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. 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.
- 2.5.10 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).
- 2.5.11 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 be 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).
- 2.5.12 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).
- 2.5.13 Neutral effects have been identified in respect of water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

### Operational Effects

- 2.5.14 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).
- 2.5.15 No further significant positive effects from operation have been identified during the assessment of Solution D.
- 2.5.16 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.
- 2.5.17 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).
- 2.5.18 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).

## 2.6 Solution E

- 2.6.1 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 2.5**. Commentary on the likely significant construction and operational effects of the solution is provided below.

Table 2.5 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 150MI/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   |  | 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 |
|----------------------------------|--|-----------------------------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|--------------------|----------------------------|-----------------------|---------------|
|                                  | Alternative Supply: Raw water transfer and WTW (Newton-in-Bowland) | O                                 | 0               | 0                    | 0                             | 0             | 0              | 0                 | +         | +            | 0                  | 0                          | 0                     | --            |
| 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

- 2.6.2 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.
- 2.6.3 No further significant positive effects from construction have been identified during the assessment of Solution E.
- 2.6.4 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<sub>2e</sub> 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).
- 2.6.5 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).
- 2.6.6 No further significant negative effects have been identified during the assessment of Solution E.
- 2.6.7 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. 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.
- 2.6.8 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.

- 2.6.9 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.
- 2.6.10 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).
- 2.6.11 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.
- 2.6.12 No effects are anticipated with respect to water resources (SEA Objective 9).

### Operational Effects

- 2.6.13 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.
- 2.6.14 No further significant positive effects from operation have been identified during the assessment of Solution E.
- 2.6.15 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.
- 2.6.16 No further significant negative effects have been identified during the assessment of Solution E.
- 2.6.17 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.

- 2.6.18 The treatment and pumping of water under this solution would generate circa 400 tCO<sub>2</sub>e 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.
- 2.6.19 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.
- 2.6.20 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).

### 3. Conclusions and Next Steps

#### 3.1 Conclusions

- 3.1.1 United Utilities has identified, and included in its Draft WRMP, five solutions to address the resilience risks associated with the regional aqueduct system which transfers water from the Lake District to supply the Greater Manchester and Pennine areas including parts of Lancashire and south Cumbria.
- 3.1.2 At this stage, United Utilities’ preferred Manchester and Pennine Resilience solution has not been determined; this work is ongoing and will be informed by consultation responses to the Draft WRMP together with further assessment and appraisal. In this context, SEA has been undertaken to assess the likely economic, social and environmental effects of the potential solutions identified by United Utilities and their composite options in order to inform the selection of the preferred Manchester and Pennine Resilience solution.
- 3.1.3 **Table 3.1** presents the overall findings of the assessment for each solution. The subsections below provide a summary of the significant effects identified in respect of each solution in-turn.

Table 3.1 Summary of Effects

| Solution   | 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 |
|------------|-----------------------------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|--------------------|----------------------------|-----------------------|---------------|
| Solution A | C                                 | -               | -                    | -/?                           | 0             | -              | --                | -         | ++/-         | 0                  | --                         | -                     | -             |
|            | O                                 | 0/?             | 0                    | 0/?                           | 0             | 0              | 0                 | ++        | ++           | 0                  | 0                          | 0                     | -             |
| Solution B | C                                 | -               | +/-                  | -/?                           | -             | --             | --                | -         | ++/-         | 0                  | --                         | -                     | --            |
|            | O                                 | 0               | 0                    | -/?                           | 0/?           | -              | --                | ++        | ++           | 0                  | --                         | -                     | --            |
| Solution C | C                                 | -               | -                    | 0                             | -             | --             | --                | --        | ++/-         | 0                  | --                         | -                     | --            |
|            | O                                 | 0               | 0                    | 0                             | -             | -              | --                | ++        | ++           | 0                  | --                         | 0                     | --            |
| Solution D | C                                 | -               | -                    | -/?                           | -             | --             | --                | -         | ++/-         | 0                  | --                         | 0                     | -             |
|            | O                                 | 0               | 0                    | -/?                           | 0             | 0              | -                 | ++        | ++           | 0                  | -                          | 0                     | 0             |
| Solution E | C                                 | -               | -                    | -/?                           | -             | --             | --                | -         | ++/-         | 0                  | --                         | -                     | --            |

| Solution | 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                     | --            |

**Solution A**

3.1.4 Solution A would involve the targeted repair of T05 and T06, centred around uprating the 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 WTW.

**Significant Positive Effects**

3.1.5 The scale of capital investment associated with the implementation of this solution would be substantial and once complete, targeted repair of the Manchester and Pennine Aqueduct together with 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). Solution A has therefore been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

**Significant Negative Effects**

3.1.6 Commensurate with the type, location and scale of development associated with Solution A, adverse environmental effects associated with construction and operational activities would be relatively minor when compared to the alternative resilience solutions. Greenhouse gas emissions and resource use during construction would, however, be substantial and in consequence, the solution has been assessed as having a significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).

**Solution B**

3.1.7 Solution B would involve the construction of 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.

**Significant Positive Effects**

3.1.8 Capital investment associated with Solution B is expected to generate significant employment opportunities and supply chain benefits. During operation, the replacement of those sections of the Manchester and Pennine Aqueduct in poorest condition and targeted treatment to maintain water quality would enhance the resilience of supply. Overall, Solution B has therefore been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

**Significant Negative Effects**

3.1.9 Reflecting in particular the volume of vehicle movements associated with tunnel repair, Solution B has been assessed as having a significant negative effect on air quality (SEA Objective 5) during construction. This solution has also been assessed as having a significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10) reflecting the scale of greenhouse gas emissions and resource use associated with the construction and operation of the resilience options that comprise this solution.

- 3.1.10 This solution would involve development within the Yorkshire Dales National Park and Forest of Bowland AONB and may therefore have adverse impacts on these designated landscapes. In consequence, the solution has been assessed as having significant negative construction and operational effects on landscape (SEA Objective 12).
- 3.1.11 Construction and operational effects on the remaining SEA objectives would be minor or neutral. It should be noted that the assessment has identified that some uncertainty remains with regard to the potential for adverse effects on water quantity and quality (SEA Objective 3). This is due to the possibility for works associated with a new tunnel under Option 37-38 to alter groundwater flows and levels and, in-turn, baseflows to nearby water courses. Further study may indicate that lower permeability strata and superficial deposits could protect surface water bodies from impacts arising from changes in the groundwater regime.

## Solution C

- 3.1.12 Under Solution C, the Manchester and Pennine Aqueduct would be converted to raw water supply with new WTWs at Bury and in the Ribble Valley.

### Significant Positive Effects

- 3.1.13 Construction activity associated with Solution C would represent a significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits. During operation, conversion of the Manchester and Pennine Aqueduct from a treated water aqueduct to a raw water aqueduct 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. Overall, Solution C has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

### Significant Negative Effects

- 3.1.14 Solution C would generate a large number of vehicle movements which, together with the use of plant and machinery, would be expected to produce relatively high levels of emissions to air. Further, works would be in close proximity to an AQMA and could therefore exacerbate existing air quality issues. In consequence, Solution C has been assessed as having a significant negative effect on air quality (SEA Objective 5) as well as on health (SEA Objective 7). However, adverse impacts in this regard would be temporary and are likely to be managed through the implementation of best practice construction methods.
- 3.1.15 This solution would generate greenhouse gas emissions during both construction and operation and would result in the use of raw materials and energy. This has been assessed as having an overall significant negative effect on climate change (SEA Objective 6) and resource use (SEA Objective 10).
- 3.1.16 The assessment has identified that development within the Forest of Bowland AONB under this solution could have a temporary but significant adverse effect on this designated landscape. Solution C has therefore been assessed as having a significant negative effect on landscape (SEA Objective 12) at this stage.
- 3.1.17 Construction and operational effects on the remaining SEA objectives would be minor or neutral.

## Solution D

- 3.1.18 Solution D would involve the construction of new tunnel sections T01, T02, T03, T04, T05 and T06.

### Significant Positive Effects

- 3.1.19 Capital investment associated with Solution D is expected to be substantial and would be likely to generate employment opportunities and supply chain benefits. 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. Overall, Solution D has been assessed as having a significant positive effect on health (SEA Objective 7) and wellbeing (SEA Objective 8).

### Significant Negative Effects

- 3.1.20 Solution D has been assessed as having a significant negative effect on air quality (SEA Objective 5) during construction. This reflects the scale of vehicle movements associated with the tunnel works together with emissions to air from plant and machinery which 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. This 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).
- 3.1.21 Construction and operational effects on the remaining SEA objectives would be minor or neutral. It should be noted that some uncertainty remains with regard to the potential for works associated with a new tunnel to alter groundwater flows and levels and, in-turn, baseflows to nearby water courses.

### Solution E

- 3.1.22 As per Solution D, Solution E would involve the construction of new tunnel sections in addition to the implementation of new sources.

### Significant Positive Effects

- 3.1.23 Construction activity associated with the implementation of 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. 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).

### Significant Negative Effects

- 3.1.24 Solution E has been assessed as having a significant negative effect on air quality (SEA Objective 5). This reflects in particular the scale of vehicle movements associated with the tunnel works together with emissions to air from plant and machinery which 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. This 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).
- 3.1.25 This solution 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. Solution E has therefore been assessed as having a significant negative effect on landscape (SEA Objective 12).



- 3.1.26 Construction and operational effects on the remaining SEA objectives would be minor or neutral. It should be noted that some uncertainty remains with regard to the potential for works associated with a new tunnel to alter groundwater flows and levels and, in-turn, baseflows to nearby water courses.

## Summary

- 3.1.27 The five Manchester and Pennine Resilience solutions identified by United Utilities offer varying degrees of risk reduction, are significantly different in terms of technical and geographical scope, and would give rise to varying levels and types of environmental effect.
- 3.1.28 The assessment presented in this report has 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.
- 3.1.29 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 has identified that Solutions C and E would potentially generate the greatest range and magnitude of significant environmental effects. This in part reflects the fact that these solutions would require new development in the Forest of Bowland 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. This would need careful consideration at the project stage should these solutions be taken forward with appropriate mitigation identified to minimise adverse landscape and visual impacts. Solution C would additionally involve development in close proximity to an AQMA 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.
- 3.1.30 It should be noted that there remains some uncertainty with regard to the potential effects of Solutions A, B, D and E on water quantity and quality and this would need to be explored more fully at the project stage with mitigation identified as appropriate.

## 3.2 Next Steps

- 3.2.1 This report is being published alongside the Draft WRMP for formal consultation until 25<sup>th</sup> May 2018 as supplementary information to the Environmental Report. This consultation is important to ensure that any potentially interested organisations or members of the public have the opportunity to consider the assessment findings. It provides an opportunity for consultees to provide comment on whether we have identified the most relevant potential effects, or whether there are other potential effects that have not been identified in the assessment. Details of how to respond to the consultation are set out in **Section 1.6**.
- 3.2.2 The findings of this assessment, together with responses received to the consultation, will help to inform United Utilities' selection of its preferred Manchester and Pennine Resilience solution. Once the preferred solution has been identified, this will be subject to further detailed assessment if required.



# Appendix A

## Definitions of Significance

| Objective  | Key Questions  | Effect  | Description          | Illustrative Guidance  |
|--|--|---|----------------------|--|
| <b>1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits.</b> | 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)? | ++  | 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.<br>The option would result in a major increase in the population of a priority species.  |
|  | Will the option protect and enhance non-designated sites and local biodiversity?   | +   | 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.<br>The option would result in a minor increase in the population of a priority species.  |
|  | Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?   | 0   | Neutral              | The option would not result in any effects on European, national designated or non-designated sites and/or species.  |
|  | Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?  | -   | 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).  |
|  | Will the option protect, and enhance where appropriate, coastal and marine habitats and species?   | --  | 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. |
|  | Will the option prevent the spread/introduction of invasive non-native species?  | ?   | Uncertain            | 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).<br>From the level of information available, the effect that the option would have on this objective is uncertain.                  |
|  | <b>2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.</b>   | 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? | ++                   | Significant Positive   |
| Will the option utilise previously developed land?   |  | +   | Positive             | The option would be located on a brownfield site and would have no effect on soils or existing land uses.<br>The option would result in the remediation of contaminated land.  |
| Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?         |  | 0   | Neutral              | The option would have no effect on soils or land use.  |
| Will the option minimise the loss of best and most versatile agricultural land?  |  | -   | Negative             | The option would not be 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.<br>The option would result in land contamination.  |
|  |  | --  | 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.<br>The option would result in land contamination.   |
|  |  |   |                      |  |

| Objective   | Key Questions   | Effect | Description          | Illustrative Guidance  |
|---|---|--------|----------------------|--|
| <b>3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies.</b> | 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?   |        |                      |  |
|   | 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.<br>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)?                               | --     | Significant Negative | The option would result in minor decreases in groundwater quality or levels.<br>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?                                | ?      | Uncertain            | The option would result in major decreases in groundwater quality or levels.<br>From the level of information available, the effect that the option would have on this objective is uncertain.   |
| <b>4. To reduce the risk of flooding.</b>   | Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body? |        |                      |  |
|   | 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.   |
|   | Will the option have the potential to help alleviate flooding in the catchment area now or in the future?                                   | +      | Positive             | The option has the potential to help alleviate flooding in the catchment.  |
|   | Will the option be at risk of flooding now or in the future?  | 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.   |
|   | Will the option be at risk of flooding 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.   |
|   |   | --     | Significant Negative | The option would involve the construction of above-ground water supply infrastructure and be located within the 1 in 100 year floodplain.  |

| Objective  | Key Questions  | Effect | Description          | Illustrative Guidance  |
|--|--|--------|----------------------|--|
| <b>5. To minimise emissions of pollutant gases and particulates and enhance air quality.</b> | <p>Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates?</p> <p>Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)?</p> <p>Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?</p> <p>Will the option reduce the need to travel or encourage sustainable modes of transport?</p> | ?      | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.   |
|  |  | ++     | Significant Positive | No options are expected to result in a significant positive effect on achieving this objective.  |
|  |  | +      | 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.  |
|  |  | -      | 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.   |
|  |  | --     | 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).   |
|  |  | ?      | Uncertain            | 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.  |
| <b>6. To limit the causes and potential consequences of climate change.</b>                  | <p>Will the option reduce or minimise greenhouse gas emissions?</p> <p>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</p> <p>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</p> <p>Will the option increase environmental resilience to the effects of climate change?</p>  | ?      | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.   |
|  |  | ++     | Significant Positive | No options are expected to result in a significant positive effect on achieving this objective.  |
|  |  | +      | Positive             | The option would result in a sustained decrease in greenhouse gas emissions (100-999 tonnes CO <sub>2</sub> e/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.  |
|  |  | -      | Negative             | The option would result in a minor or temporary major increase in greenhouse gas emissions (100-999 tonnes CO <sub>2</sub> e) or the option would not increase resilience/decrease vulnerability to climate change effects.  |
|  |  | --     | Significant Negative | The option would result in major or long term increases in greenhouse gas emissions (>1000 tonnes CO <sub>2</sub> e) and the option would not increase resilience/decrease vulnerability to climate change effects.  |
| <b>7. To ensure the protection and</b>   | <p>Will the option ensure the continuity of a safe and secure drinking water supply?</p>   | ?      | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.   |
|  |  | ++     | Significant Positive | The option would lead to a major increase in design capacity (>10 MI/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.  |

| Objective  | Key Questions   | Effect   | Description          | Illustrative Guidance  |  |
|--|---|--|----------------------|--|--|
| <b>enhancement of human health.</b>  | Will the option affect opportunities for recreation and physical activity?  | +  | Positive             | The option would lead to a minor increase in design capacity (1-10 MI/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.                       |  |
|  | Will the option maintain surface water and bathing water quality within statutory standards?  | 0  | Neutral              | No option is expected to have a neutral effect on achieving this objective.  |  |
|  | Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)? | -  | 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.   |  |
| <b>8. To maintain and enhance the economic and social well-being of the local community.</b> | Will the option ensure sufficient infrastructure is in place for predicted population increases?  | ++   | Significant Positive | The option would result in a significant increase in construction jobs (capital spend of >£10m).<br>The option would create new, and significantly enhance existing, recreational facilities within the operational area.<br>The option would provide an additional design capacity of >10 MI/d. |  |
|  | Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?  | +  | Positive             | The option would result in an increase in construction jobs (capital spend £5-9.9m).<br>The option would enhance existing recreational facilities within the operational area.<br>The option would provide an additional design capacity of 1-10 MI/d.   |  |
|  | Will the option help to meet the employment needs of local people?  | 0  | Neutral              | The option would have no effect on local employment opportunities, the regional or local economy, or on recreational facilities.<br>The option would provide an additional design capacity of <1 MI/d.   |  |
|  | Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?                                   | -  | Negative             | The option would reduce the availability and quality of existing recreational facilities within the operational area.  |  |
|  | Will the option improve access to local services and facilities (e.g. sport and recreation)?  | --   | Significant Negative | It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity.<br>The option would result in the removal of existing recreational facilities within the operational area.  |  |
|  | Will the option contribute to sustaining and growing the local and regional economy?  | --   | Significant Negative | It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity.   |  |
|  | Will the option avoid disruption through effects on the transport network?  | ?  | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.   |  |
|  | Will the option be resilient to future changes in resources (both financial and human)?   | ?  | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.   |  |
|  | <b>9. To ensure the sustainable and efficient use of water resources.</b>   | Will the option lead to reduced leakage from the supply network? | ++                   | Significant Positive   | The option would involve reducing leakage from the supply network or is a water efficiency option with a design capacity of >5 MI/d. |
|  |   | 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 MI/d. |
|  |   | 0  | Neutral              | The option is not a leakage reduction or water efficiency option.  |  |



| Objective  | Key Questions   | Effect | Description          | Illustrative Guidance   |
|--|---|--------|----------------------|---|
| <b>10. To promote the efficient use of resources.</b>            | <p>Will the option source and use recycled aggregates/materials in construction, ahead of using 'new' materials?</p> <p>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</p> <p>Will the option encourage the use of sustainable design and materials?</p> <p>Will the option reduce or minimise energy use?</p>  | -      | 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.  |
|  |   | ++     | 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.<br>The option would result in a minor increase in energy consumption.   |
| <b>11. To conserve and enhance cultural and historic assets.</b> | <p>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?</p> <p>Will the option conserve or enhance archaeologically important sites and/or remains?</p> <p>Will the option avoid damage to important wetland areas with potential for palaeoenvironmental deposits?</p> <p>Will the option affect public access to, or enjoyment of, features of cultural heritage?</p> | --     | 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.<br>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.  |
|  |   | ++     | 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: <ul style="list-style-type: none"> <li>Securing repairs or improvements to heritage assets, especially those identified in the Historic England Buildings/Monuments at Risk Register;</li> <li>Improving interpretation and public access to important heritage assets.</li> </ul> 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.<br>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.  |
|  |   | -      | 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.<br>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.   |
|  |   | -      | 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.<br>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.   |



| Objective  | Key Questions   | Effect | Description          | Illustrative Guidance   |
|--|---|--------|----------------------|---|
| <b>12. To conserve and enhance landscape character</b> | <p>Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?</p> <p>Will the option protect and enhance landscape character, townscape and seascape?</p> <p>Will the option affect public access to existing landscape features?</p> <p>Will the option minimise adverse visual impacts?</p> | --     | Significant Negative | <p>The option would diminish the significance of designated heritage assets and/or their setting such as:</p> <ul style="list-style-type: none"> <li>Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register;</li> <li>Loss of public access to important heritage assets and lack of appropriate interpretation.</li> </ul> <p>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.</p> |
|  |   | ?      | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.  |
|  |   | ++     | 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 | <p>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.</p> <p>The option would result in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.</p>  |
|  |   | ?      | Uncertain            | From the level of information available, the effect that the option would have on this objective is uncertain.  |





# Appendix B

## Resilience Options Assessment Matrices



| 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 |
|---|--------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|-------------------|-------------------------|-----------------------|---------------|
| <b>3: Manchester and Pennine Aqueduct to Raw: 2 Stage filtration (Bury)</b> | 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<sub>2</sub>e 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<sub>2</sub>e) 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 be 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 MI/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/MI) 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<sub>2</sub>e/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 MI/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 MI/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 MI/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 MI/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/MI) 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 |
|--|--------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|--------------------|-------------------------|-----------------------|---------------|
| <b>037-038:</b><br><b>Manchester and Pennine Aqueduct section T05 to T06</b> | 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<sub>2</sub>e 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 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 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:<br>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 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<sub>2</sub>e 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 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 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<sub>2</sub>e/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 150MI/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 3.1MI break tank and intermediate pumping facilities to enable the transfer of 150 MI/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<sub>2</sub>e 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 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 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<sub>2</sub>e/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<sub>2</sub>e. 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 MI/d, with a maximum treatment capacity of 60 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 145 kWh/MI, 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 MI/d (with an average treatment of 41 MI/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<sub>2</sub>e 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<sub>2</sub>e 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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 105 kWh/MI, 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 MI/d (with an average treatment of 9 MI/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<sub>2</sub>e 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 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 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/MI) 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<sub>2</sub>e/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 MI/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 MI/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 |
|--|--------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|--------------------|-------------------------|-----------------------|---------------|
| <b>216: Alternative Supply: Raw water abstraction and WTW (Haslingden)</b> | 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<sub>2</sub>e 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 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 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<sub>2</sub>e/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 5.1MI/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 MI/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<br>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<sub>2</sub>e 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 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).

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<sub>2</sub>e/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 |
|--|--------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|--------------------|-------------------------|-----------------------|---------------|
| <b>218: Alternative Supply: Raw water transfer and WTW (Preston)</b> | 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<sub>2</sub>e 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 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).

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<sub>2</sub>e/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<sub>2</sub>e 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/MI) 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<sub>2</sub>e/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:<br>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<sub>2</sub>e 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 actual 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 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 movements 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<sub>2</sub>e 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:<br>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<sub>2</sub>e 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<sub>2</sub>e 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<sub>2</sub>e 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<sub>2</sub>e 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 access 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<sub>2</sub>e 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<sub>2</sub>e 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 0.75MI to 9.0MI).

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<sub>2</sub>e 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 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 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 Arncliffe 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 Craggs 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 9MI 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<sub>2</sub>e 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 9MI 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 9MI 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/MI). 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 MI/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 MI/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/MI), 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 9MI 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<sub>2</sub>e 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<sub>2</sub>e 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 these 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 274 kWh/MI, 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 MI/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 MI/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<sub>2</sub>e 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<sub>2</sub>e 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 MI/d, with a maximum treatment capacity of 0.57 MI/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<sub>2</sub>e 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 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 19 tonnes CO<sub>2</sub>e 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 MI/d, with a maximum treatment capacity of 6.04 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 251 kWh/MI, 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 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 23,305 kWh/MI, 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 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 23,305 kWh/MI, 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 MI/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<sub>2</sub>e 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<sub>2</sub>e 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 |
|---|--------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|--------------------|-------------------------|-----------------------|---------------|
| <b>355: Metals &amp; UV Treatment of BSPs: Ribblesdale Siphon (1)</b> | 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 MI/d, with a maximum treatment capacity of 0.03 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 11,739 kWh/MI, 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 MI/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 MI/d, with a maximum treatment capacity of 5.05 MI/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<sub>2</sub>e 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<sub>2</sub>e 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 MI/d, with a maximum treatment capacity of 2.17 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 302 kWh/MI. 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 MI/d (with an average treatment of 2.10 MI/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 MI/d, with a maximum treatment capacity of 43.05 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 107 kWh/MI 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 MI/d (with an average treatment of 33.51 MI/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 MI/d, with a maximum treatment capacity of 6.83 MI/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<sub>2</sub>e 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<sub>2</sub>e would be emitted per year during operation. The operational energy demand would be 271 kWh/MI 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 MI/d (with an average treatment of 5.23 MI/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 MI/d, with a maximum treatment capacity of 9.96 MI/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<sub>2</sub>e 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<sub>2</sub>e 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 |
|--|--------------|-----------------|----------------------|-------------------------------|---------------|----------------|-------------------|-----------|--------------|-------------------|-------------------------|-----------------------|---------------|
| <b>382: Manchester and Pennine Aqueduct to Raw: WTW reduced flow</b> | 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 MI/d to 80 MI/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 MI/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<sub>2</sub>e 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 be 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<sub>2</sub>e/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).

