Corporate Natural Capital Account for United Utilities

Final Report

United Utilities

March 2023

10F Printing House Yard
Hackney Road, London
E2 7PR

+44 (0) 20 7580 5383
eftec@eftec.co.uk
eftec.co.uk

This document has been prepared for United Utilities by:

Economics for the Environment Consultancy Ltd (eftec)
10F Printing House Yard
Hackney Road, London
E2 7PR
www.eftec.co.uk

Study team:

Natalya Kharadi (eftec)
David English (eftec)
Ian Dickie (eftec)
Duncan Royle (eftec)

Reviewer

Ece Ozdemiroglu (eftec)

Acknowledgements

Clare Bullen, Rebecca Speed and James Airton with whom we have co-produced this natural capital account. As well as department representatives with United Utilities that have provided inputs. Special thanks to Jonathan Porter (Countryscape) for reviewing asset register methodology.

Disclaimer

Document evolution

Report structure	03/01/2023	Reviewed by Ian Dickie
Draft Report	10/02/2023	Reviewed by Ian Dickie
Draft Report	08/03/2023	Audited by Ece Ozdemiroglu
Final Report	23/03/2023	Reviewed by Ian Dickie

This report is based on eftec's Version 3 – January 2021 report template.

Executive summary

This final report is for the Natural Capital Account for land within United Utilities (UU) operating area. The aim of this work is to update UU's Natural Capital Account (for 2021) for the land owned and/or managed as part of UU's operations (henceforth "UU land assets"). The 2021 Natural Capital Account captures key benefits and costs supported by UU land assets, as well as reflecting any changes in natural capital value as compared to the UU Baseline Natural Capital Account (2016/17).

The accounting process is described within this report, with full detail of calculations, data sources and assumptions used captured in the accompanying Excel™ natural capital workbook (UU-CNCA-workbook_230323.xls).

Summary of 2021 Natural Capital Account Table ES.1.1 is the Natural Capital Balance Sheet for UU's land assets, providing a breakdown of benefits and costs, and their distribution to different beneficiary groups.

The breakdown of asset values shows a wide range of significant benefits that are derived from UU's land assets. The balance sheet shows the significant returns to UU from the natural capital assets equating to £6.6 billion over 60 years, which is driven by the gross value of water supply (£6.3 billion). In addition, UU's land assets provide natural capital benefits to tenants through agricultural output (£29 million) and wider society through carbon sequestration and recreation (£4.3 billion in total). The gross natural capital asset value of UU's land assets equates to approximately £11 billion in present value terms.

These benefits are compared to the costs of maintaining the natural capital assets, which include peatlands, farmland and woodlands. The gross liabilities reflect estimates of current spend on maintenance activity. The liabilities represent the costs of managing UU's land assets in productive condition and include the costs of delivering legal obligations (e.g., complying with water quality standards), and discretionary spending (e.g., supporting recreational activity beyond the company's statutory duties).

However, while the net natural capital asset value of UU's land assets have an overall positive asset value of £4.5 billion across beneficiary groups, this does not guarantee future management of the natural capital assets is sustainable. Whether current activity and expenditure is sufficient to maintain natural capital assets in their current condition is a question that is still to be tested. The intent of this account is to highlight the value of UU's land assets and the level of maintenance provision required to maintain the productivity of these natural assets in the long term.

Table ES.1.1: United Utilities Detailed 2021/22 Natural Capital Balance Sheet (PV60 £m)

Produced at: February 2023	Valuation metric	Value to United Utilities	Value to Tenants	Value to the rest of society	Total
Asset values (monetised)					
Agricultural output	Livestock gross margins	-	7	-	7
	Agri-environment scheme income	-	21	-	21
	Rents paid by tenants	61	-	-	61
Timber	Value of timber production	19	-	-	19
Water supply	Revenue value of water production	6,310	-	-	6,310
Renewable energy	Value of energy production	203	-	-	203
Carbon sequestration[1]	Value of CO_2e sequestered by woodland, grassland and saltmarsh	-	-	386	386
	Value of CO_2e emitted by habitats	-	-	(470)	(470)
	Value of CO_2e emitted by livestock	-	-	(89)	(89)
Air quality regulation[2]	Value of PM2.5 removal by woodland	-	-	451	451
Recreation	Welfare value of recreation	-	-	883	883
	In-hand income from recreation activities	1	-	-	1
Physical health	Avoided medical treatment costs	-	-	546	546
Tourism	Domestic tourism spend attributed to natural capital	-	-	864	864
Water quality	Welfare of avoiding deterioration in rivers	-	-	1,702	1,702
	Welfare of avoiding deterioration in lakes	-	-	7	7
Total gross asset value		**6,595**	**29**	**4,280**	**10,903**
Asset values (non-monetised)					
Biodiversity	Total SSSI area: 22,523 hectares				
Other material unquantified benefits: Education, Volunteering and Mental Health					
Liabilities					
Production costs[3]	Water supply	(5,943)	-	-	(5,943)
	Other production costs[4]	(84)	(94)	-	(178)
Total natural capital maintenance costs[5]		(254)	-	-	(254)
Total gross liabilities		**(6,281)**	**(94)**	**-**	**(6,375)**
Total net asset value (monetised)		**314**	**(65)**	**4,280**	**4,528**

Table notes:
[1] Value of carbon emissions increase over time in line with BEIS (2021).
[2] Underlying modelling factors in changes in population and pollution density (eftec et al., 2019).
[3] Costs that are necessary to produce existing benefits (e.g., water supply, agricultural output).
[4] Includes agricultural output and renewable energy.
[5] Costs associated with activities that are required to maintain natural assets, including legal obligations such as conservation of designated sites.

Changes since the previous Account

Table ES.1.2: Change in asset values 2016/17 - 2021/22 (PV60 £m)

Produced at: February 2023	Valuation metric	Value to United Utilities	Value to Tenants	Value to the rest of society	Total
Asset values (monetised)					
Agricultural output	Livestock gross margins	-	(69)	-	(69)
	Agri-environment scheme income	-	(69)	-	(69)
	Rents paid by tenants	42	-	-	42
Timber	Value of timber production	11	-	-	11
Water supply	Revenue value of water production	(4,459)	-	-	(4,459)
Renewable energy	Value of energy production	74	-	-	74
Carbon sequestration	Value of CO_2e sequestered by woodland, grassland and saltmarsh	-	-	145	145
	Value of CO_2e emitted by habitats	-	-	(231)	(231)
	Value of CO_2e emitted by livestock	-	-	(89)	(89)
Air quality regulation	Value of PM2.5 removal by woodland	-	-	451	451
Recreation	Welfare value of recreation	-	-	(214)	(214)
	In-hand income from recreation activities	(12)	-	-	(12)
Physical health	Avoided medical treatment costs	-	-	546	546
Tourism	Domestic tourism spend attributed to natural capital	-	-	864	864
Water quality	Welfare of avoiding deterioration in rivers	-	-	1,702	1,702
	Welfare of avoiding deterioration in lakes	-	-	7	7
Total gross asset value		**(4,344)**	**(139)**	**3,181**	**(1,302)**
Liabilities					
Production costs[1]	Water supply	4,319	-	-	4,319
	Other production costs[2]	(7)	69	-	62
Total natural capital maintenance costs[3]		(143)	-	-	(143)
Total gross liabilities		**4,168**	**69**	**-**	**4,237**
Total net asset value (monetised)		**(175)**	**(70)**	**3,181**	**2,936**

Table notes:

[1] Costs that are necessary to produce existing benefits (e.g., water supply, agricultural output).

[2] Includes agricultural output and renewable energy.

[3] Costs associated with activities that are required to maintain natural assets, including legal obligations such as conservation of designated sites.

This table is produced within UU's 2021/22 Natural Capital Accounting workbook (tab R1.3).

UU and eftec have worked collaboratively to produce the 2021 Natural Capital Account, with eftec providing support to UU through the identification of relevant biophysical, financial, and socio-economic data from internal and external sources. In doing so, UU are building capability and carrying out more assessment of data internally.

Since 2017, there have been significant developments in natural capital accounting within the UK natural capital evidence base and approach. This has resulted in changes to both the natural capital accounting outputs as well as accounting process for UU. One of the drivers of change for UU's account has been the BS 8632 Standard on Natural Capital Accounting for Organisations, which has resulted in more transparent reporting of all data, assumptions, gaps, and implications for how UU's natural capital accounting can and should be integrated into other decisions. Furthermore, alignment to the BS 8632 supports quality assurance of the accounting outputs (i.e., this report and accompanying accounting workbook) to be consistent with good practice. These procedural changes have resulted in improved accounting outputs (e.g., Natural Capital Balance Sheet) as well as better documentation of materiality and risks.

The BS 8632 does not provide guidance on the analysis of natural capital value. However, environmental valuation evidence has developed significantly since 2017, and has become formally recognised in government guidance including the HM Treasury Green Book guidance on economic appraisal (2022b) and Defra's Enabling a Natural Capital Approach (ENCA). This reflects changes in UK environmental policy and general concern for the state of the environment, and the objective to improve it for future generations as part of Defra's 25 Year Environment Plan. Furthermore, UU has undertaken work to develop a North West Regional Natural Capital Account (produced in 2021). In light of new evidence, methodological updates have been undertaken in the UU 2021 natural capital account to ensure alignment to the latest government guidance and North West Regional Account.

Recommendations

The account produced provides insights into how natural capital values have changed over time, identifying why changes in value have arisen. Few organisations have completed distribution analysis as presented here, and as part of final reporting this account will also be audited for alignment with the BS 8632 standard.

Nevertheless, there are areas where the account can be improved in the future, including: Establishing an internal procedure to update the natural capital account (e.g., data log). Further information on natural capital asset condition (e.g., peatland condition) to better reflect and monitor quality of UU's land assets. Refinements to the accuracy of asset values (e.g., water supply, renewable energy) and maintenance costs.

There is also scope to expand analysis completed as part of the reporting year account, including disaggregation to the North West Regional accounting sub-regions, assess benefits that accrue

to UU customers and development of a natural capital income statement in line with BS 8632 (Scope I or II).

Contents

Tables

1. Introduction

This is the final report for the 2021 Natural Capital Account for United Utilities (UU) operating area. The account identifies the value of the assets and the cost of operations and natural capital maintenance activities.

1.1 Project objectives

The aim of this work is to provide support to UU to produce the 2021/22 natural capital account for the land it manages. Updating the 2016/17 UU natural capital account supports the identification of trends and changes in UU's land assets (extent and condition) and the flows of benefits they provide. In doing so, better understanding of how UU's land assets have been managed in the last five-years can be inferred. A further aim of the work is to support UU staff to identify relevant biophysical, financial, and socio-economic data from internal and external sources, and providing advice and guidance to facilitate the construction of the account. The account captures the key natural capital assets of UU land, the benefits they provide to UU and wider society, and the economic value of these benefits. It compares these benefits to an assessment of the costs of maintaining UU's natural capital assets into the future.

This comparison, in the form of a Natural Capital Balance Sheet, should focus on whether the maintenance activities are appropriate and sufficient to maintain the assets. In other words, a positive bottom line (asset values greater than cost of production and maintenance) does not mean sustainable natural capital asset management. The balance sheet, including the questions about maintenance activities it cannot answer should inform future management, including the role of current and future investment decisions. Where possible, future asset values take into account expected trends in the quantity or quality of natural capital assets and the value of the benefits provided. Where this information is not available, benefits are assumed to be constant over the accounting period. This assumption introduces uncertainty, and the link between future benefit flows and the future state of natural capital assets can be strengthened through better information on trends. Better trend information will also help assess what future maintenance investments are needed, both for regulatory requirements and/or voluntary actions to address risks such as climate change and external objectives (e.g., compare UU land to North West Region).

The process of building the Natural Capital Balance Sheet is a systematic way of pulling different types of data together and better understanding information is material to the business. Repeating the accounting process over the years makes it easier to identify future changes in the extent and condition of the assets, and management practices, and how these will affect asset values and maintenance costs.

1.2 Structure of this report

This report is structured in the following way:

- Section 1 – Introduction: This section introduces the project.
- Section 2 – Approach: Provides an overview of the natural capital accounting method, preparation of the project outputs and the auditing process.
- Section 3 – Summary of account: Presents the scope and final results of the natural capital accounts.
- Section 4 – Natural Capital Balance Sheet: Presents the updated balance sheet for UU's operational land and key observations.
- Section 5 – Analysis of Movement in Value: Outlines the approach to assessing change between the reporting year and baseline account and provides commentary on the identified changes.
- Section 6 – Conclusions and recommendations: Concludes and provides recommendations for future work.

The report also has four Appendices:

- Appendix 1 – Further details on the natural capital accounting approach used.
- Appendix 2 – Audit statement that checks the alignment of this account to BS 8632 (Natural Capital Accounting for Organizations) and response from the account preparers.
- Appendix 3 – Asset register methodology.
- Appendix 4 – Methods used to estimate the flows of benefits from natural capital assets and costs of maintenance.

2. Approach

This section provides a description of the natural capital accounting method used and the approach taken to develop an account for land owned and/or managed as part of UU's operating area (henceforth "UU land assets").

2.1 Natural capital accounting

Natural Capital is "the stock of renewable and non-renewable natural resources (e.g., plants, animals, air, water, soils, and minerals) that combine to yield a flow of benefits to people"[1]. A natural capital approach can be defined as distinguishing between the natural capital stocks and the flows of benefits they provide; projecting benefits into the future and linking the provision of benefits to the extent and condition of assets. The intention is to ensure that business decisions prioritise maintaining the assets to maintain benefits, and not to maximise one of the benefits at the expense of others or the natural capital asset itself.

Systematic and consistently generated evidence and repeated updates are what distinguish accounting from one-off assessments. Accounting offers comparability across space and time, bringing rigour to the presentation of data on natural capital assets, the services they provide, the benefits and hence value of those services, and the distribution of those benefits across society and into the future.

The approach to developing this baseline account is based on the Corporate Natural Capital Account (CNCA) framework for the Natural Capital Committee in 2015 (eftec, RSPB and PWC, 2015). This framework is also the basis of BS 8632 on Natural Capital Accounting for Organizations[2], to which this account is aligned as shown in Section 2.3. Natural capital accounting involves producing a Natural Capital Balance Sheet and a Natural Capital Income Statement. This mirrors traditional financial accounting; the intention is to present information to the decision makers in a format they are familiar with so that the organisation's impacts and dependencies on the natural capital is considered more explicitly and in conjunction with other forms of capital.

The monetary flow and liabilities accounts distinguish private values for UU from external values to the rest of society. These supporting schedules provide all the data required for the Natural Capital Balance Sheet which compares the asset values to cost of maintaining those assets. Where understanding and evidence allows, calculation of assets and liabilities can take account of expected changes to future costs and benefits of management, and external factors such as population growth or climate change. Otherwise, caution is needed when interpreting the bottom line of Natural Capital Balance Sheet – as BS 8632 states, a positive net asset value is not necessarily an indication of sustainable asset management.

2.2 Preparing a Natural Capital Balance Sheet

The accounting workbook (UU-CNCA-workbook_230323.xls) contains all the supporting schedules and the Natural Capital Balance Sheet. The project was conducted in the following four-stage approach:

[1]Natural Capital Protocol https://naturalcapitalcoalition.org/natural-capital-protocol/
[2]https://www.bsigroup.com/en-GB/topics/sustainable-resilience/net-zero/natural-capital-accounting/

Stage 1 – Start-up meeting. eftec developed a template accounting workbook in Excel™ which was used to provide a structure for organising data to produce the Natural Capital Balance Sheet. The project start-up meeting confirmed the objectives of the project and provided an opportunity to think about the materiality assessment for the natural capital account. This meeting was followed up by a demonstration of the workbook to the UU team, as an important first step in understanding the structure of the account.

Stage 2 – Support to building the account. Following the start-up meeting, ongoing support was provided through regular update calls and web-meetings on how to use the workbook. This included data collection and processing for each of the supporting schedules and the balance sheet, to assist UU staff in choosing appropriate data and methods throughout. The work required use of internal UU data (e.g., on assets and costs) and to identify external data (e.g., on some monetary valuation methods) which could be used in the account, with eftec advising on the correct calculation processes for quantifying benefits and expressing the values in monetary terms.

As part of updating UU's account, eftec led on highlighting differences between the 2016/17 and 2021/22 account. As such, any cumulative gains/losses, additions/disposals and revaluations and adjustments have been clearly assessed to show how and why monetary values in the balance sheet have changed between the two accounting periods. The method and implications of which are detailed in Section .

Stage 3 – BSI alignment audit. In line with eftec's quality assurance processes, the UU natural capital accounting workbook and report is reviewed internally. This includes a review of the structure and the boundary of the account, the quality of the input evidence, and consistent application of calculation processes aligned to British Standard on Natural Capital Accounting for Organizations (BS 8632). Details on this are provided in Section 2.3.

Stage 4 – Output. The outputs of the work include a 2021/22 natural capital accounting workbook for UU's land assets, reflecting input data sources, assumptions and calculations required to produce the supporting schedules and Natural Capital Balance Sheet. This report describes the approach taken to construct the workbook and results, including key gaps and uncertainties, as well as giving recommendations on interpretation of and future updates to the account.

Note that discussions with external stakeholders (i.e., those outside of UU) have not been undertaken as part of this work. However, the UU project team already works with a range of external stakeholders (e.g., wildlife trusts). Throughout the project cycle engagement with internal stakeholders has been undertaken, for example across various UU departments (e.g., finance) as part of the data collection process and meeting with UUs Chief Finance Officer on accounting process and water valuation approach.

2.3 BSI alignment

The methods used to produce the UU account reflect the developments in natural capital accounting since 2017, in particular the British Standard on Natural Capital Account for Organisations (BS 8632), published in June 2021. The UU final account for 2021/22 has been reviewed and audited against the BSI standard. The audit for alignment follows the process for completing a Natural Capital Account including the supporting schedules produced, transparency in methods and assumptions applied as well as integration of the natural capital accounting outputs into decision-making. The key audit comments and responses to

them including report revisions and recommended future actions are in Appendix 2. Any required revisions have been incorporated into the final report.

3. Summary of account

This section presents the supporting schedules, described in Appendix 1.

3.1 Scope

The account covers key natural capital assets of UU's landholdings. This reflects UU's land management boundary, including assets that UU either own or are responsible for managing. This corresponds to the Scope 1 of the Natural Capital Balance Sheet in the BS 8632. This is an account for 2021, therefore 2021/22 data is used where possible and monetary values are reported in 2021 price year.

The asset values and liabilities estimated are reported in the Natural Capital Balance Sheet. The asset values are separated into benefits to UU (i.e., private) and benefits to the wider society. Asset values are calculated by summing the expected future annual flow of benefits over 60 years. Future flows of private benefits and costs (i.e., those that arise to UU) are discounted using UU's Weighted Average Cost of Capital (WACC) (2.9%) to utilise UU's opportunity cost of capital, whilst benefits and/or costs to other beneficiaries (e.g., wider society) are discounted according to HM Treasury Green Book Guidance (2020) (3.5% declining or 1.5% declining as appropriate) to express in present value terms.

Where possible, future values take into account expected trends in the quantity and/or value of the benefit. Where this information is not available, benefits are assumed to be constant over time – this assumption increases the uncertainty of the results, the implications of which are reported in Section 0.

3.2 Asset register

The asset register is a register of all natural capital assets within the boundary of the account. It forms the foundation of the account and records both the extent and condition of UU's land assets. The asset register was compiled by UU using ArcGIS. Support was provided by Countryscape to ensure that the latest evidence was used, and the analysis outputs have been reviewed. The methodology to compilation is provided in Appendix 3.

The asset register is also the basis for the materiality assessment (Section 3.3) to determine the content of the benefit flows and liabilities account, and for scoping the natural capital risk register (Section 3.4).

3.2.1 Extent account

The assets within the account are classified by land-use and habitat types and are summarised in Table 3.1. Total area of UU's land assets is approximately 56,300 hectares of which the predominant habitats are mountain moorlands and heath (38%) and grassland (31%). Changes in the extent account are driven largely by updated data source for mapping natural capital assets (i.e., use of North West Regional account mapping). There have not been any major changes in land use or ownership (e.g., selling/buying) since the last accounting period.

Table 3.1: United Utilities extent account – comparing baseline and reporting year accounts

Habitat	Baseline year (2016/17)		Reporting year (2021/22)		Change from Baseline*
	Area (ha)	% of total	Area (ha)	% of total	
Enclosed farmland	5,265	10%	4,681	8%	↓
Grassland	20,643	37%	17,360	31%	↓
Mountain, moorland and heath	18,459	33%	21,254	38%	↑
Woodland	6,468	12%	7,006	12%	↑
Urban area	852	2%	1,111	2%	↑
Coastal margins	69	0.1%	64	0.1%	↓
Freshwater	3,297	6%	4,317	8%	↑
Other	72	0.1%	522	1%	↑
Total	**55,125**	**100%**	**56,315**	**100%**	↔

*If the absolute value of the percent change from the baseline year is less than 3%, then it has been assessed as having no change since the previous account.

3.2.2 Condition account

The type and size of benefits provided by natural capital assets are determined by the extent (quantity) and condition (quality) of those assets. Therefore, the natural capital asset register also includes data on condition. Such data needs to be collected through establishing indicators of condition such as different land use, existing monitoring data and designations. These include recreation land (parks), open access land, and specific designations such as Sites of Special Scientific Interest (SSSI), National Parks and Areas of Outstanding Natural Beauty (AONB), a summary of terrestrial designations is shown in Table 3.2. These categories are generated separately and will overlap with habitat areas and other designations. For example, for a given area of woodland, the specific area which is designated as SSSI or Ancient Woodland can also be recorded.

In addition, the asset register presents condition data on designated SSSIs, the water environment including Water Framework Directive status (length or area of water bodies by overall status). In

Table 3.3 changes in the extent of SSSIs since the 2016/17 CNCA suggest that their condition has worsened over time. The differences in extent, however, are minor and may reflect changes in the datasets used and the GIS analyses performed rather than an actual decline in condition. Additional data on the extent and condition of SSSIs can be found in UU's 'SSSI Condition Summary Report 2004 – 2023'.

Table 3.2: Areas of designated sites – comparing baseline and reporting year accounts

Designation type	Baseline year (2016/17)		Reporting year (2021/22)		Change from Baseline*
	Area (ha)	% of total UU area	Area (ha)	% of total UU area	
Total SSSI	22,436	41%	22,522	41%	↔
Total RAMSAR	-	-	1	<0.1%	↑
Total Special Area of Conservation	10,969	20%	10,981	20%	↔
Total Special Protected Area for Birds	14,598	26%	14,363	26%	↔
Total within National Parks	25,616	46%	25,616	46%	↔
Total within Area of Outstanding Natural Beauty	11,450	21%	11,159	20%	↔

*If the absolute value of the percent change from the baseline year is less than 3%, then it has been assessed as having no change since the previous account.

Table 3.3: United Utilities condition account – comparing baseline and reporting year accounts

Indicator	Baseline year (2016/17)		Reporting year (2021/22)		Change from Baseline*
Designated SSSIs	**Area (ha)**	**% of total**	**Area (ha)**	**% of total**	
Area in favourable condition	1,901	8%	1,790	8%	↓
Area in unfavourable recovering condition	19,183	86%	18,748	83%	↔
Area in unfavourable declining condition	-	-	622	3%	↑
Area in unfavourable no change	1,352	6%	1,362	6%	↔
Area in part destroyed	-	-	-	-	↔
Area in destroyed	-	-	<0.1	<0.1%	↑
Total	**22,436**	**100%**	**22,523**	**100%**	↔
Overall WFD Status - rivers	**Length (km)**	**% of total**	**Length (km)**	**% of total**	
Good			-	-	
Moderate			2,442	83%	
Poor			422	14%	
Bad			67	2%	
Total			**2,931**	**100%**	
Overall WFD Status - lakes	**Area (ha)**	**% of total**	**Area (ha)**	**% of total**	
Good			-	-	
Moderate			2,659	100%	
Poor			<0.1%	-	
Bad			<0.1%	-	
Total			**2,676**	**100%**	

*If the absolute value of the percent change from the baseline year is less than 3%, then it has been assessed as having no change since the previous account.

3.3 Materiality assessment

A materiality[3] assessment is used to determine which benefits should be included in the account, given the natural capital assets in scope.

All the individual benefits in Defra's ENCA guidance (2021) were considered for inclusion in the account[4]. The assessment shows which benefits are considered material, and out of the material benefits which have been possible to include in this account and which have not. The assessment has been undertaken using a service-asset attribute matrix which aims to show:

- Which ecosystem services are material for each asset within the UU account boundary;
- Of these material ecosystem services, which benefits have been assessed and how; and
- Which have not been possible to measure in biophysical units or value in monetary terms and why.

The materiality assessment for the UU natural capital account is shown in Table 3.4. The assessment was conducted in consultation with the UU project team to determine which services were material within the accounting boundary.

From the ENCA benefits list, fishing (commercial) and fibre and materials have been excluded as these services are not supported by UU's land assets. There are also no marine natural capital assets within the accounting boundary.

Benefits that are considered not to be material for these accounts include:

- **Temperature regulation:** Service mainly relates to benefits provided by urban vegetation and greenspace, a habitat type which is not believed to occur within the UU accounting boundary.
- **Minerals:** No mineral extraction is known to occur within the UU accounting boundary. Existing quantities of minerals (i.e., unexploited resource) is unknown.

The following benefits are recognised as material benefits from UU's land assets, but currently cannot be reliably measured or valued. They can be recognised through relevant KPIs (e.g., SSSI condition) and are listed as 'key non-monetised benefits' in the account summary.

- **Biodiversity:** The monetary valuation of wildlife and habitat is complex and, in many contexts, contentious. A portion of this value is indirectly captured in the biodiversity indicators presented in the account for SSSI condition, as well as through the value of other benefits to which biodiversity contributes.

[3] This is defined in the Natural Capital Protocol as "an impact or dependency on natural capital is material if considering it, as part of the set of information used for decision making, has the potential to alter that decision" (p. 43, Capitals Coalition, 2016).

[4] Defra's ENCA (2021) also reflects 'bundled' benefits which include amenity, soil, landscape and non-use values. These are not considered for this account to avoid double-counting with the individual benefits already included (e.g., recreation).

The following benefits are considered material, but remain unquantified:

- **Education:** It is uncertain if data can be gathered on the total annual number of educational visits by school children to sites within UU's accounting boundary. It is likely that this is better measured for specific sites with nature-education facilities that encourage learning in the natural environment. If visits to nature could be measured, they could be valued based on the costs of providing outdoor learning activities (see ENCA (Defra, 2021) for further guidance).
- **Volunteering:** As with education, this is difficult to capture across UU's accounting boundary but may be more evident at the site-level. Value of time (at average wage) can be used as a proxy to value the benefits of volunteer activities in nature (e.g., from Heritage Fund[5]).
- **Mental health benefits of engagement with nature:** Following current ENCA guidance (Defra, 2021), only physical health benefits are valued in this report as there is currently insufficient evidence to value mental health benefits in general terms. While the evidence for mental health benefits from green and blue space is strong, it is context dependent and not readily generalisable for the purposes of accounting and policy analysis.

The exclusion of biodiversity and mental health benefits are expected to be significant omissions in terms of measuring the total value supported by UU's land assets to the rest of society – however given what is currently captured in the UU's 2021/22 natural capital account, it is not expected to change the overall interpretation of the Natural Capital Balance Sheet produced (i.e., net natural capital asset value). Whilst, education and volunteering are material, but are expected to reflect a small additional value to UU's Natural Capital Balance Sheet.

[5] Heritage Fund. (n.d.). How to calculate volunteer time. [online]. Available at: https://www.heritagefund.org.uk/discussions/how-calculate-volunteer-time

Table 3.4: Materiality assessment

	Natural Capital Assets							
Public and private benefits	**Enclosed farmland**	**Grass-land**	**Mountain, moorland and heath**	**Wood-land**	**Urban area**	**Coastal margins**	**Fresh-water**	**Other**
Agricultural output	●	●	●					
Fish (commercial)								
Timber				●				
Fibres & materials								
Water supply							●	
Renewable energy								●
Minerals								
Carbon sequestration	○	●	●	●		●		
Air quality regulation	○	○	○	●				
Flood risk management	○	○	○	○		○		
Noise reduction				○				
Temperature regulation				○				
Recreation	●	●	●	●	●	●	●	●
Physical health	●	●	●	●	●	●	●	●
Mental health	○	○	○	○	○	○	○	○
Tourism	●	●	●	●	●	●	●	●
Education		○	○	○	○	○	○	○
Volunteering		○	○	○	○	○	○	○
Water quality	●	●	●	●			●	
Property value	○	○	○	○	○	○	○	○
Biodiversity	◖	◖	◖	◖	◖	◖	◖	◖

Legend	
Material benefit estimated in quantitative and monetary terms	●
Material benefit estimated in non-monetary terms	◖
Material benefit not assessed	○
No material service provision	
No service provision	

3.4 Risk register

All risks that have the potential to impact the extent and condition of natural capital assets, and in particular their ability to provide the type, quantity and/or value of benefits identified in the account are relevant. The purpose of understanding the risks is to, as far as possible:

- Reflect them in the projections of benefits and liabilities over time (i.e., a dynamic baseline); and

- To provide commentary as to whether maintenance activities are adequate to sustain the asset base in the face of future risks.

UU's natural capital risk management framework (corporate and operational) has been reviewed, along with the accompanying risk escalation process. Specific risks that are escalated to the UU Board include climate change, water resources, wastewater back into the environment and use of bio-resources and break down in biogas and biosolids. Given the existing risk management system within UU, a separate risk register has not been developed as part of this accounting process. Instead, the natural capital accounting schedules produced (e.g., materiality assessment) should be incorporated into existing risk management systems. This should ensure that risks to natural capital are captured in the same way as other risks to organisational assets and operations and addressed through UU's existing risk management system in the same way. This will ensure that consideration of natural capital assets and associated risks are embedded into UU's operations and processes at all levels.

Both internal and external natural capital risks should be factored into UU's corporate risk management processes.

3.5 Natural capital asset values

3.5.1 Methodology

Table 3.5 provides an overview of the benefits included in the accounts and the methods used to measure and value them. The methods applied to produce the account reflect developments in natural capital accounting since 2017, in particular:

- Progress in natural capital measurement and valuation tools (e.g., updated ORVal (Day and Smith, 2018)) and evidence (e.g., latest carbon values (BEIS, 2021)) in the UK, using the latest methods now reflected in Defra's ENCA guidance.
- The BSI standard (8632: Natural Capital Accounting by Organizations).

Furthermore, the range of methods applied for the UU organisational account is aligned with the North West regional account to facilitate comparison, with exception for water supply and renewable energy methods.

For those services which appeared in the previous UU CNCA (2016/17), the assessment methodologies used remain the same and data sources have been updated. Services which appeared in the previous iteration of the account include:

- Agricultural output: Called 'Food' in the previous UU CNCA, this measures the volume of agricultural production and its value.
- Timber: The volume and value of timber harvested from timber stands.
- Water supply: The volume of water abstracted and its value to UU.

- Renewable energy generation: The volume and value of energy generated by solar, wind and hydro sources.
- Carbon sequestration: The sequestration and emissions from UU's land assets. This benefit has been expanded from the previous account to include emissions from livestock.
- Recreation: The number of local recreational visits and the welfare value derived from these visits.

The distribution of benefits between private benefits to UU and benefits to wider society, is also noted. The distribution of values across business sectors outside of the water sector can be readily extracted from the accounts, for several benefits:

- Agriculture sector – arable and livestock income;
- Forestry sector – softwood removals value;
- Hydropower and onshore wind sector - renewable energy resource rent;
- Tourism and outdoor leisure – domestic tourism spending (note this excludes spending in trips of under 3-hour durations, but this spending is known to be very small compared to overall tourism spending (eftec et al, 2019)).

Note that benefit approaches applied have also factored in potential for double counting between benefits. In particular, there is a risk of double counting between recreation and tourism beneficiaries, as well as recreation and water quality through the valuation method. This has been avoided by considering and adjusting for attribution to beneficiaries (e.g., distinction between recreation visit and tourism visit) as well as potential valuation overlap in the data sources used (e.g., ORVal and NWEBs). More detail on these adjustments is provide in Appendix A4.1.

Estimating present values

The physical and monetary values of benefits are calculated as annual values and used as the primary input to estimating present values[6]. To support this, assumptions on future trends and changes in physical and/or monetary values need to be made. A simple assumption is to assume that physical and monetary flows remain constant into the future (i.e., 2021/22 estimate is projected forward). This reflects the value of UUs land assets if their ability to provide benefits can be maintained and the value of those benefits remains constant. In reality, the extent and condition of natural capital assets, their ability to provide benefits and the monetary values of those benefits, is expected to change over time due to environmental factors such as climate change, pressures from economic activities as well as changes to the beneficiaries (such as the resident population).

The UU 2021/22 account assumes that most future flows of physical and monetary values remain constant over the assessment period due to insufficient data availability. Notable exceptions are

[6] Sum of discounted annual flows over time.

for the monetary value for carbon sequestration and future flows (both physical and monetary) for air quality regulation, where source modelling (BEIS, 2021; eftec and CEH, 2019, respectively) have captured an estimated trend. The results are shown in the Natural Capital Balance Sheet in Section 4.

Table 3.5: Overview of benefits included in the asset values of the UU Natural Capital Balance Sheet

Benefit	Description	Annual Physical Flow Measure	Monetary Valuation Metric & Method	Beneficiary	Change in method since 2016/17 account?
Agricultural output	Estimated gross margin for land in agricultural use is assumed to have typical livestock yields for the location and farming systems valued at market prices.	Area of land in agricultural production (ha); Number of livestock	Tenant benefit calculated as average gross margin livestock (Redman, 2019; 2020; 2021)[7] minus the rent paid to UU	UU tenants	N
	Estimated income from agri-environment schemes (£/yr).		Agri-environment scheme income for farm tenants, as reported by UU (£/yr)	UU tenants	N
	Land rental income to UU from tenants for arable and livestock production. This rental amount is subtracted from the benefit to UU tenant farmers.		Private rental income to UU	UU	N
Timber	Volume of annual timber production harvested within the UU accounting boundary. Valued at market price of timber production (£/m^3).	Volume of standing timber harvested annually (m^3/yr)	Sales value of standing timber removals[8] (£/m^3 overbark)	UU	N
Water supply	Estimated annual volume of water abstracted for the purposes of public water supply provision and its resource rent value (£/Ml).	5-year average water abstraction (Ml/year)	Sales value of water net of operating and overhead costs for UU (£/Ml)	UU	N
Renewable energy	On-site use of energy from solar, wind and hydro generation in the UU accounting area (i.e., owned or managed by UU). Valued at the cost of grid energy (£/kWh).	On-site energy use (kWh/yr.)	Avoided energy costs from on-site use (£/kWh)	UU	Y (Not capturing FiT tariffs)
Carbon sequestration	Estimated for woodland, improved grassland and saltmarsh habitats using the average UK sequestration rate (tonnes CO_2 equivalent per hectare) and the non-traded value of carbon.	Carbon sequestered in habitat (tCO_2e/yr)	Non-traded central carbon value BEIS (2021)[9] £/t/CO_2e	Global society	Y (Expanded assets captured)
	Estimated for peatland habitat using the IUCN Peatland Code (2015) rates (tonnes CO_2 equivalent per hectare) and the non-traded value of carbon.	Carbon emitted by peatland (tCO_2e/yr)			N

[7] Redman, G. (2021) The John Nix Pocketbook for Farm Management 2022. 52nd edition. Melton Mowbray: Agro Business Consultants.

[8] Forest Research. (2021). Timber Price Indices: Coniferous Standing Sales Price Index for Great Britain, Table 2. [online]. Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices/

[9] BEIS. (2020). Green Book supplementary guidance: valuation of energy use and greenhouse gas emission for appraisal. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Benefit	Description	Annual Physical Flow Measure	Monetary Valuation Metric & Method	Beneficiary	Change in method since 2016/17 account?
	Emissions are estimated using livestock emission factors by livestock type (Defra, 2019b; Jones et al., 2019) and the non-traded value of carbon (BEIS, 2021).	Carbon emitted by livestock (tCO_2e/yr)			Y
Air quality regulation	Estimated for woodland using the average rate of PM2.5 removal for the local authorities covered by the account and avoided health risks and medical costs as a result.	PM2.5 removed by woodland (kg/yr)	Avoided cost (medical treatment and productivity) and welfare gain(£/ha) by eftec and CEH (2019)[10]	UK society	Y (New benefit)
Recreation	Estimated in terms of number of visits to accessible greenspaces (that are less than three hours in duration), and the welfare value associated with these visits.	Recreational visits, less than 3-hours (visits/yr)	Benefit to visitors evaluated as total welfare value from (ORVal) tool[11].	Visitor population	N
	Measured in terms of income generated from rents and payments for specific activities within the account boundary.		Income from other recreation activities.	UU	N
Physical health	Estimated by the proportion of the visits that are active, the health benefits of active recreation (in terms of improvements in Quality Adjusted Life years – QALYs[12]) and the economic value of health improvement. Avoiding these costs is additional to the welfare from enjoying good health/recreation.	Total active visits	Avoided medical treatment costs per year, based on Claxton et al. (2015)[13].	Visitors	Y (New benefit)
Tourism	Measured in terms of the number of day visits (i.e., of more than 3 hours) and overnight tourism visits by domestic visitors to areas within the UU accounting boundary. These are valued using the average expenditure per visit for local authorities within each reporting area (Kantar, 2019a; 2019b). This is then adjusted to reflect the attributable spend to nature (approx. 8% of total spend based on ONS (2021).	Total domestic tourism visits (visits/yr)	Expenditure by domestic tourism attributed to nature (£/trip)	Local businesses	Y (New benefit)
Water quality	Estimated as the welfare gain from maintaining the Water Framework Directive (WFD) quality status of the waterbodies (Environment Agency, 2020) as reported in the natural capital asset register. The welfare gains from maintaining the WFD status makes use of the NWEBS values for each river basin district in the accounting boundary.	Length (km) and area (km^2) of WFD waterbodies by status	Willingness to pay for avoided deterioration from NWEBS (£/km) (Metcalfe, 2012; NERA Economic Consulting, 2007)	UK society	Y (New benefit)

[10] eftec and CEH (2019). Pollution removal by vegetation. Available at: https://shiny-apps.ceh.ac.uk/pollutionremoval/

[11] Day, B. H., and G. Smith (2018) Outdoor Recreation Valuation (ORVal) User Guide: Version 2.0, Land, Environment, Economics and Policy (LEEP) Institute, Business School, University of Exeter. https://www.leep.exeter.ac.uk/orval/

[12] QALY is a health measurement used widely in health and health economics research. QALY of zero denotes death, and 1 denotes full health.

[13] Claxton K, Martin S, Soares M, Rice N, Spackman E, Hinde S, et al. (2015). Methods for the Estimation of the NICE Cost Effectiveness Threshold. Health Technology Assess. [online]. Available at: https://www.york.ac.uk/che/research/teehta/thresholds/

Benefit	Description	Annual Physical Flow Measure	Monetary Valuation Metric & Method	Beneficiary	Change in method since 2016/17 account?
Biodiversity	The valuation of biodiversity is complex and, in many contexts, contentious. A portion of this value is indirectly captured in the biodiversity indicators presented in the account for SSSI condition, as well as through the value of other benefits to which biodiversity contributes.	Area of SSSI (hectares)	Not evaluated in monetary terms.	UK society	Y (New benefit)

3.5.2 2021/22 physical and monetary accounts

The physical and monetary estimates for each benefit are given a confidence rating which is described in Table 3.6. The estimated annual physical and monetary values are summarised in Table 3.7, following the approaches summarised in Table 3.5 and in Appendix A4.1.

Table 3.6: Assessing data quality

Level of confidence	Symbol	Description
Low	L	Evidence is partial and significant assumptions are made so that the data provides only order of magnitude estimates of value to inform decisions and spending choices.
Medium	M	Science-based assumptions and published data are used but there is some uncertainty in combining them, resulting in reasonable confidence in using the data to guide decisions and spending choices.
High	H	Evidence is peer reviewed or based on published guidance so there is good confidence in using the data to support specific decisions and spending choices.
No colour		Not valued

Table 3.7 shows the wide range of benefits supported by UU's natural capital assets. They show significant values for provisioning (e.g., agricultural output), regulating (e.g., carbon sequestration) and cultural (e.g., recreation) services, as well as significant health benefits in relation to physical activity and air quality regulation. Overall, there is medium to high confidence for most benefit estimates, except for tourism spend attributed to nature, which has low confidence.

The value of natural capital assets is predominantly driven by the gross value of water supply (56% of total value), which is unsurprising given UU's obligation to supply water to its customers in the North West (in addition to wastewater treatment services). Although a natural capital account is intended to highlight the benefits from natural capital assets, other capital assets are also involved in the provision of these benefits. In this account, the value of benefits such as water supply and renewable energy follow a resource rent approach[14]. This means they are adjusted to be net of the contribution of other forms of capital (e.g., built infrastructure) that contribute to the provision of the ecosystem services. This is a conservative approach to assessing the value from natural capital assets but is aligned to approaches used in UK national natural capital accounts (ONS, 2022), and methods used in UU's 2016/17 natural capital account.

The total net annual benefit value for the UU accounting boundary is approximately £388 million in 2021 prices. This comprises both positive (e.g., carbon sequestration) and negative impacts (e.g., carbon emissions) from monetised benefits. Note that the value is the net flow of benefits; it is not 'net' in the sense of netting out the production and maintenance costs which are covered in the liabilities section.

[14] See Appendix 4 for further details on the methodology applied.

Table 3.7: Final physical and monetary flows

Produced at February, 2023	Physical flow quantity			Monetary value		
	Unit/yr	2021	Confidence	Valuation metric (£m/yr)	2021	Confidence
Key monetised benefits						
Agricultural output	Number of sheep (no.)	36,431	H	Tenant gross margins for sheep and cattle	0.3	H
	Number of cattle (no.)	1,799	H	Tenant agri-environment scheme income	1	H
				In-hand income from tenant rents	2	H
Timber	Volume of timber produced (m^3)	16,700	H	Value of timber production	1	H
Water supply	Volume of water abstracted from UU land ('000 Ml)	233	H	Revenue value of water production	218	H
Renewable energy	Renewable energy generated (kWh)	40,875,646	H	Value of renewable energy production	7	H
Carbon sequestration	CO_2e sequestered by woodland, grassland, and saltmarsh (t)	43,012	M	Value of CO_2e sequestered by woodland, grassland, and saltmarsh	11	M
	CO_2e emitted by peatland (t)	(52,378)	M	Value of CO_2e emitted by peatland	(13)	M
	CO_2e emitted by livestock (t)	(9,931)	M	Value of CO_2e emitted by livestock	(2)	M
Air quality regulation	PM2.5 removal by woodland (kg)	41,595	H	Value of PM2.5 removal by woodland	17	H
Recreation	Recreation visits under three-hours (no.)	7,474,361	M	Welfare value of recreation	34	M
				In-hand income from recreation activities	0.03	H
Physical health	Number of active visits (no.)	3,849,296	M	Avoided medication treatment costs	13	M
Tourism	Domestic day visits and overnight trips attributed to natural capital (no.)	957,985	M	Domestic tourism expenditure attributed to natural capital	33	L
Water quality	Length of WFD rivers (km)	2,931	H	Welfare of avoided deterioration in rivers	65	M
	Area of WFD lakes (ha)	2,676	H	Welfare of avoiding deterioration in lakes	0.3	M
				Total	**388**	M
Key non-monetised benefits						
Biodiversity	Total area of SSSI (ha)	22,523	H			
Other material unquantified benefits: Education, Volunteering and Mental health						

3.6 Natural capital liabilities

3.6.1 Methodology

Liabilities in the natural capital accounts consist of both production costs and natural capital maintenance costs. Classification and estimation of production and maintenance costs were established through discussion with the UU finance team and were sourced from UU's finance systems, using either budget or actual spend data for the financial year 2021/22.

Natural capital maintenance costs are associated with activities that are required to maintain natural assets (at least in their current condition), or restore where necessary, and so sustain their forecast benefits in the long term. These costs included spend on catchment management activities, conservation sites, and maintenance of natural habitat. Production costs relate to activities that are primarily undertaken to realise a particular benefit (rather than spend on natural assets which in turn produce multiple benefits).

In practice the distinction between these two categories of cost is not always clear, as some activities can both maintain a natural asset and be instrumental in producing a particular benefit (e.g., catchment management activities improve the water environment but also play a role in reducing water supply costs). Hence some judgement is required in determining the appropriate approach to categorisation on a case-by-case basis. Table 3.8 provides a summary of natural capital liabilities included in UU's natural capital account. It should be noted that disaggregating the cost of legal from non-legal obligations is challenging, but the two categories specified have been used to identify the costs of obligations that are mainly determined by legal requirements.

Table 3.8: Summary of natural capital liabilities

Liabilities	Definition	Relevant UU cost categories
Production costs	All costs that are necessary to produce existing benefits are classified as production costs.	• Agricultural output (labour and overhead costs of food production). • Water supply costs (including, operating costs, capital depreciation costs and return on capital employed). • Renewable energy costs (including, operating costs, capital depreciation costs).
Natural capital maintenance – Legal Obligations	All natural capital maintenance due to legal obligations which are mandated by safety or other regulatory policies are included in this category.	• Maintaining designated sites (SSSI) and • Water safeguarding zones.
Natural capital maintenance - Other maintenance costs	Other natural capital maintenance costs on activity required to maintain natural capital assets in current condition.	Due to practical limitations of extracting information from UU finance systems, the only cost included in this category is catchment management activities.

Estimating present values

The estimated annual liabilities are used to generate present values, following a similar approach to the

estimation of future benefit flows (see Section 3.5.1). The UU 2021/22 account assumes that future flows of liabilities remain constant over the assessment period due to insufficient data availability. The results are shown in the Natural Capital Balance Sheet in Section 4.

An alternative approach would be to consider historical trends in the cost categories included in Table 3.8 and assume average annual cost (e.g., five-years) is representative of future years. The trends in UU's financial account can also be reviewed in conjunction with extent and condition of natural capital assets. This would enable the identification of changes in UU's cost activities as a result of changes to the land assets they manage and/or own. In addition, it is expected that future maintenance costs will change due to external pressures such as climate change as well as changes in regulation of the water industry.

3.6.2 2021/22 Final liabilities account

Table 3.9 presents the final liabilities for the 2021/22 UU natural capital account. Detail of the methodologies for evaluating these costs are provided in Appendix A4.2. Note that UU's own financial accounts and business plans have been used to populate the natural capital liabilities account, with no external data used to estimate production or maintenance costs. Therefore, there is high confidence in the total annual liabilities, as it reflects UUs actual expenditure.

The liabilities account captures production and natural capital maintenance costs, following the same general approach used in the 2016/17 UU natural capital account. It highlights that UU bears the majority of the costs (98% of total annual liabilities), with some cost arising to tenants associated with agricultural output production. It should be noted that costs associated with recreation (i.e., production costs) and management of woodlands have not been captured within the account, are expected to be an omission within both the baseline (2016/17) and reporting year (2021/22) accounting periods. As stated in Table 3.8, only catchment management activities are reflected in other maintenance costs, however, there may be other costs embedded within other cost centres that could be associated with natural asset maintenance.

Table 3.9: Final liabilities account (£m/yr)

Produced at: February 2023	Cost type	Value to UU	Value to tenants	Value to rest of society	Total annual liabilities
Production costs[1]	Agricultural output	-	(94)	-	-
	Timber	-	-	-	-
	Water supply	(5,943)	-	-	(5,943)
	Renewable energy	(84)	-	-	(84)
	Total production costs	**(6,027)**	**(94)**	**-**	**(6,121)**
Natural capital maintenance costs[2]	Legal obligations	(14)	-	-	(14)
	Other maintenance costs	(240)	-	-	(240)
	Total natural capital maintenance costs	**(254)**	**-**	**-**	**(254)**
	Total annual liabilities	**(6,281)**	**(94)**	**-**	**(6,375)**

Table notes:
[1] Costs that are necessary to produce existing benefit.
[2] Costs associated with activities that are required to maintain natural assets, including legal obligations such as conservation of designated sites.

4. 2021/22 Natural capital balance sheet

While the Natural Capital Balance Sheet format is similar to a financial balance sheet, it has two main differences: (1) asset values are for the stock natural capital assets and calculated as the discounted sum of the flow of benefits from these assets and (2) liabilities are the maintenance and production costs associated with the natural capital assets and the benefits they provide.

As the Natural Capital Balance Sheet (Table 4.1) shows, the gross natural capital asset value of UU's natural capital assets equates to approximately £11 billion in present value terms over 60 years. This is made up of:

- Significant returns to UU of £6.6 billion, which is driven by the gross value of water supply (£6.3 billion);
- Benefits to tenants through agricultural output (£29 million); and
- Benefits to wider society through net carbon sequestration, recreation and tourism (£4.3 billion in total).

The Balance Sheet also shows gross liabilities as around £6.4 billion in present value terms, with UU bearing the majority of these costs £6.3 billion over 60 years (on the basis of current spending continuing).

This results in a positive net natural capital asset value (£314 million over 60 years) to UU, and an overall positive net natural capital asset value of £4.5 billion in present value terms. This figure includes costs of producing the annual benefits from natural capital in Table 4.1, and the costs of maintaining the natural capital assets (e.g., maintenance of SSSIs) over time. It is not possible to conclude whether the liabilities incurred by UU is sufficient to maintain the benefits to UU, its tenants, and the rest of the society.

The total maintenance costs reflect estimates of current spend on maintenance activity. Whether this is sufficient to maintain the natural capital assets in their current condition is not a question that can be answered by the account but by the discussions that follow. The intent of the account is to highlight the value of natural capital assets to help make a business case for their sufficient maintenance. As explained in Section 3.5.1, most benefits are assumed to remain constant into the future, which implies that current liabilities are sufficient to maintain asset values into the future. For example, water quality benefits reflect maintenance of current WFD status, which is reasonable given regulatory context of the water industry and Government nature restoration targets. However, whether the same is applicable to other benefits and management of UUs land assets is generally unknown.

Therefore, a priority recommendation is that UU conducts a review of natural capital asset maintenance activity to define and establish a plan of maintenance activity that sustain, and where necessary enhance asset condition (e.g., risk management, to reverse declining trends). This should factor in internal and external natural capital risks identified in UU's corporate risk register (see Section 3.4).

Table 4.1: United Utilities Detailed Natural Capital Balance Sheet (PV60 £m)

Produced at: February 2023	Valuation metric	Value to United Utilities	Value to Tenants	Value to the rest of society	Total
Asset values (monetised)					
Agricultural output	Livestock gross margins	-	7	-	7
	Agri-environment scheme income	-	21	-	21
	Rents paid by tenants	61	-	-	61
Timber	Value of timber production	19	-	-	19
Water supply	Revenue value of water production	6,310	-	-	6,310
Renewable energy	Value of energy production	203	-	-	203
Carbon sequestration[1]	Value of CO_2e sequestered by woodland, grassland and saltmarsh	-	-	386	386
	Value of CO_2e emitted by habitats	-	-	(470)	(470)
	Value of CO_2e emitted by livestock	-	-	(89)	(89)
Air quality regulation[2]	Value of PM2.5 removal by woodland	-	-	451	451
Recreation	Welfare value of recreation	-	-	883	883
	In-hand income from recreation activities	1	-	-	1
Physical health	Avoided medical treatment costs	-	-	546	546
Tourism	Domestic tourism spend attributed to natural capital	-	-	864	864
Water quality	Welfare of avoiding deterioration in rivers	-	-	1,702	1,702
	Welfare of avoiding deterioration in lakes	-	-	7	7
Total gross asset value		**6,595**	**29**	**4,280**	**10,903**
Asset values (non-monetised)					
Biodiversity	Total SSSI area: 22,522 hectares				
Other material unquantified benefits: Education, Volunteering and Mental Health					
Liabilities					
Production costs[3]	Agricultural output	-	(94)	-	(94)
	Timber	-	-	-	-
	Water supply	(5,943)	-	-	(5,943)
	Renewable energy	(84)	-	-	(84)
Natural capital maintenance costs[4]	Legal obligations	(14)	-	-	(14)
	Other maintenance activities	(240)	-	-	(240)
Total gross liabilities		**(6,281)**	**(94)**	**-**	**(6,375)**
Total net asset value (monetised)		**314**	**(65)**	**4,280**	**4,528**

Table notes:

[1] Value of carbon emissions increase over time in line with BEIS (2021).

[2] Underlying modelling factors in changes in population and pollution density (eftec et al., 2019).

[3] Costs that are necessary to produce existing benefits (e.g., water supply, agricultural output).

[4] Costs associated with activities that are required to maintain natural assets.

4.1 Key observations

The natural capital accounting process has analysed spatial and other data to investigate the materiality and value of several benefits provided by UU's land assets. It also used the UU's own financial accounting system to estimate the production and maintenance costs. The key takeaways from the reported natural capital account are:

1. Key assets such as peatland, grassland and woodland which drive several benefits should be included in the organisational asset register because they have material value to UU and should be managed accordingly.
2. Caution is required in interpreting the final balance sheet values as only a subset of benefits can be captured in monetary terms in this account. This will improve with better data availability and as further evidence is gathered (either by UU, UU partners or for the UK/North West contexts more broadly) about the economic benefits of these services. Although challenging, it is important to consider whether liabilities are sufficient in relation to the full range of material benefits including those not measured in monetary terms.
3. The account provides useful information to help manage natural capital, but the positive values in the balance sheet do not mean that UU's land assets are being managed sustainably. As a result:
    - Expected future changes in the quantity and/or value of benefits are reflected in the estimates where relevant data is available (e.g., increasing value of mitigating carbon emissions). However, there is insufficient data to represent some expected future changes (e.g., climate change risks) in the account.
    - While management effort is made to maintain natural capital assets, it is not certain that current maintenance costs will be sufficient in the long term. Furthermore, there is uncertainty in the forecasted cost categories (e.g., enrolment in agri-environment schemes) that could not be fully addressed within this account.
    - An assessment of future risks and pressures is necessary to identify what actions UU can take to address those risks, and how much these actions will cost. This will help address the points above, going forward and may also be useful at an operational level to help consider risks to projects.
4. While several material benefits are not (fully) captured in the account values, the analysis has used indicators that can help UU identify opportunities, manage synergies and trade-offs between different benefits from its natural capital assets.

5. Analysis of Movement in Value

This section outlines the conceptual approach to assessing changes in natural capital values between the current account (2021/22) and baseline account (2016/17) and includes commentary on the specific changes that have occurred. Note that UU's baseline estimates have been inflated to the current accounting price year (2021 prices) using UK GDP deflators (HM Treasury, 2022), hence any change in value reported is net of price inflation.

5.1 Conceptual approach

The distribution of change is assessed through an analysis of the movement in present values between the baseline and the reporting year. This explains the major reasons for change in value and is categorised into three main causes:

1. **Gains/(losses):** Changes in output and subsequent value arising from a change in long term output from natural capital assets. This will be due to i) change in asset condition through either natural improvement / deterioration or management interventions e.g., changing soil productivity or capacity of habitats to sequester carbon), or ii) change in use of the asset, which may or may not be due to asset condition, is also captured within this category (e.g., change in abstraction volumes, recreation visit numbers which may be unrelated to natural asset condition).
2. **Additions/(Disposals):** Changes in output and value due to the acquisition or disposal of natural capital assets (i.e., change in extent). Note, there is a significance level expected to be used here, and it is not necessary to estimate value changes for relatively minor land acquisition or disposals.
3. **Revaluations & Adjustments:** Changes to values or estimated output that are due to key assumptions, such as market conditions (e.g., unit market prices/costs), or economic valuation methodologies (e.g., adoption of new metrics or scientific evidence to value benefits).

An analysis of variances is carried out for each of the benefits (Section 5.2) and liabilities (Section 5.3) shown in the Natural Capital Balance Sheet (Table 4.1) and summarised in Table 5.1.

Table 5.1: Distribution of change (PV60 £m)

Produced at: February 2023	Valuation metric	Baseline (2016/17)	Cumulative Gains & (Losses)	Additions & (Disposals)	Revaluations & Adjustments	Reporting (2021/22)
Asset values (monetised)						
Agricultural output	Livestock gross margins	77	(0)	-	(69)	7
	Agri-environment scheme income	91	(69)	-	-	21
	Rents paid by tenants	19	(0)	-	42	61
Timber	Value of timber production	8	0	-	11	19
Water supply	Revenue value of water production	10,770	(4,459)	-	-	6,310
Renewable energy	Value of energy production	129	(8)	50	32	203
Carbon sequestration	Value of CO_2e sequestered by woodland, grassland, saltmarsh	241	33	-	112	386
	Value of CO_2e emitted by peatland	(239)	0	-	(231)	(470)
	Value of CO_2e emitted by livestock	-	-	-	(89)	(89)
Air quality regulation	Value of PM2.5 removal by woodland	-	-	-	451	451
Recreation	Welfare value of recreation	1,097	0	-	(214)	883
	In-hand income from recreation activities	13	(12)	-	-	1
Physical health	Avoided medical treatment costs	-	-	-	546	546
Tourism	Domestic tourism spend attributed to natural capital	-	-	-	864	864
Water quality	Welfare of avoiding deterioration in rivers	-	-	-	1,702	1,702
	Welfare of avoiding deterioration in lakes	-	-	-	7	7
	Total gross asset value	**12,204**	**(4,516)**	**50**	**3,165**	**10,903**
Liabilities						
Production costs	Food provision	(163)	69	-	-	(94)
	Timber	-	-	-	-	-
	Water supply	(10,261)	4,319	-	-	(5,943)
	Renewable energy	(78)	18	(25)	-	(84)
Natural capital maintenance costs	Legal obligations	-	(14)	-	-	(14)
	Other maintenance activities	(111)	(129)	-	-	(240)
	Total gross liabilities	**(10,612)**	**4,262**	**(25)**	**-**	**(6,375)**
	Total net natural capital asset value (monetised)	**1,592**	**(254)**	**25**	**3,165**	**4,528**

5.2 Natural capital asset values

This section summarises the changes to natural capital asset values (i.e., present values) between the 2016/17 and 2021/22 accounts.

Agricultural output major changes are as follows:

- Value of livestock output has fallen from a baseline value of £77 million to £7 million, mainly due to lower assumptions on the gross margin of sheep and cattle (i.e., change in key assumptions). The revised approach is in line with the assumptions used in the North West Regional account, and it should be noted that forward projections of sheep gross margins are assumed to be virtually nil (£3 per ewe).
- Agri-environment income has fallen significantly, from £91 million to £21 million. This is due to the phase out of basic payment scheme (BPS), and a lower uptake of environmental stewardship schemes. However, it is not clear that the reporting year has captured all schemes that tenants may have signed up (e.g., HLS, moorland BPS). It is recommended that a full list of all agri-environment schemes are captured going forward.
- Rent and income received by UU from tenants has increased from £19 million to £61 million, due to a higher level of income recorded in 2021/22. However, this may be due to inclusion of other non-agricultural rents and should be investigated to ensure only farm rents are included in the reporting year income.

Timber provision major changes are as follows:

- The value of timber output has increased from a baseline value of £8 million to £19 million. This is due to an increase in timber prices relative (£40 per cubic metre vs baseline value of £27.70 per cubic metre), and a more realistic estimate of timber volume harvested from the estate (16,700 cubic metres per year vs 10,000 cubic metres in baseline).

Water supply value changes are as follows:

- Gross value of water supply has fallen from £10,770 million to £6,310 million, and the difference (£4,459 million) has been recorded as a movement in gains and losses. There have been small movements on water prices and costs since the baseline date, but the main reason for the reduction has been that the volume of water supplied from UU catchment land has fallen to 232,600 Ml/year which represents only 31% of all water supplied, compared to the baseline when 47% of all water supplied was from UU land.

Renewable energy value has increased from £129 million to £203 million (an increase of £74 million) and there are a variety of factors that contribute to this movement:

- Acquisitions of new generating assets have been substantial and whilst this is not a natural capital addition, the impact of these assets has been evaluated under additions/disposals to highlight the increase in output value that may be due to the investment in these new energy generating assets. The exact increase in capacity has not been provided but is estimated at an additional 10,000 MWh. This adds £50 million to energy generation value. Note that this account was developed for the period

prior to the sale of United Utilities Renewable Energy Limited, and benefits specified here all accrue to United Utilities.

- The value of energy generated is 2.73p/kWh higher in 2021/22 compared to the baseline assumption. This higher unit value increases PV by £32 million.
- Gains and losses are calculated as a balancing difference (£8 million loss) which reflects that the current asset is generating slightly less energy per unit of kW installed compared to baseline.

Movements in the value of carbon sequestration/Green House Gas (GHG) flow arise from either a change in the non-traded value of carbon (new series issued in 2021), or due to the inclusion of the item in the account for the first time (such as livestock emissions and saltmarsh sequestration). By line item these movements in value (all revaluations/adjustments) are:

- For sequestration in woodland, saltmarsh and grassland the higher non-traded carbon values, the addition of saltmarsh sequestration, and a revised grassland sequestration assumption increase value by £112 million.
- The non-traded carbon values increase the losses from peatland by £231 million. However, it should be noted that UU are in the process of undertaking a review of peat condition which would provide a more accurate estimate of peat GHG losses, hence in the absence of any new evidence the condition of peat is assumed to be as baseline.
- The inclusion of livestock emissions for the first time produces a disbenefit of £89 million.

Movements in public and private recreation benefits are attributed to:

- For public recreation benefits, the methodology has been updated to reflect the assumption that some of the visits may contribute to tourism income (new benefit) and hence have been excluded from this benefit calculation to avoid double counting. This leads to a revaluation adjustment of £214 million.

For private recreational income, reporting year value is £10.7 million lower than baseline, to reflect the lower value provided in 2021/22. Change in value due to new benefits included in UU's natural capital account have been classified as revaluations/adjustments. This applies to the estimated loss of £89 million from livestock emissions (loss of £89 million in present value terms) and combined additional benefits arising from air quality regulation, physical health, and water quality of £3.6 billion in present value terms. This category also includes a transfer of value from recreational benefit (£200 million) to reflect the proportion of value previously recognised as recreation, but now included tourism spend.

5.3 Natural capital liabilities

It should be noted that the baseline assessment of maintenance costs in 2016/17 was one of the first attempts to develop a natural capital account for an organisation at this scale, and there was significant scope for improvement of the data input into the account. As stated in the previous report:

- **"**Within the CNCA framework, the cost of natural capital maintenance activities that arise from legal obligations should be reported separately from other maintenance liabilities. In the time available it was not possible to distinguish between those activities that arise from legal obligations and consequently all maintenance costs have been accounted for under, 'other maintenance provisions'."

- "Finally, it should be noted that within project timescales it was only possible to estimate the current costs of maintaining natural capital and these were assumed to remain constant over time. An assessment of the sufficiency of this level of expenditure to sustain natural capital assets in the long-term was not conducted."

The first point has been partly addressed in this update to the account, but the second on sufficiency of natural capital maintenance activity is still to be tackled and is a priority recommendation in this report.

For the reporting year there have been some important changes to the presentation of liabilities:

- Firstly, production costs have been separately reported under the liabilities section to highlight the costs involved in realising the gross benefits reported in the asset section of the Natural Capital Balance Sheet. In the previous account the asset benefit values were reported net of production costs, but the new presentation provides a better view of the gross value of natural capital benefits and the costs of production. The net benefit of water supply in the 2016/17 account, for example, was reported as being around £16 million per year. Within this figure, however, is £706 million of gross water sales and £672 million per year of operating and capital costs which were not clearly reflected in the account's reporting. 47% of this net value was attributed to UU, reflecting the proportion of water that was extracted from UU owned land, resulting in the final figure that appears in the baseline account (£16 million). The approach used in this latest account explicitly itemises these costs and benefits for more transparent and informative accounting, detailing the gross value of water supply as well as the production costs associated with water supply.
- Secondly, the costs of legal maintenance obligations have been separately reported and defined as activity to maintain designated sites and safeguard drinking water zones. This is a useful addition to the account as it highlights the extent to which maintenance is a legal obligation for UU.

The overall approach to the inclusion and attribution of maintenance costs on the basis of estate-wide assumptions has not changed between the baseline and reporting year (e.g., that all catchment management spend recorded in UU finance systems is related to natural asset maintenance). Some of these costs may relate to non-natural capital assets, and conversely activity recorded in other maintenance cost centres may relate to natural capital asset maintenance. It is recommended that UU conducts a thorough review of natural capital asset maintenance costs to provide a more accurate view of activity across the organisation.

6. Recommendations

This section makes recommendations about how UU could use the lessons learnt during the preparation of natural capital accounts and the resulting Natural Capital Balance Sheet and its supporting schedules. The 2016/17 and 2021/22 accounts provide UU with a strategic evidence base relating to its long-term management of natural capital to help with its investment planning and operations.

6.1 Using the natural capital account for business planning

The accounts help monitor the performance of natural capital assets in terms of the benefits they provide to UU, their tenants and wider society and the costs of delivering those benefits. The key business question the accounts can *help* answer is whether UU is maintaining its natural capital assets sufficiently well to sustain the benefits they provide today and into the future. The answer will be reached through the interpretation of the data that goes into the accounts and the sense check of the estimates, not through reading the bottom line alone.

The 2021/22 Natural Capital Account provides a snapshot of current natural capital management of UU's land assets, highlighting the overall relative size of the variety of asset values provided. The results can be integrated into UU's six capitals framework, either in its entirety or partially (e.g., specific line items). In addition, the information within the natural capital account can support corporate risk-management and be used with other sources of risk information (e.g., UK Climate Change Risk Assessment)[15]. The accounts provide data that enables reporting against the draft Taskforce on Nature-related Financial Disclosures[16] requirements, and future expected requirements on business reporting linked to the 2022 Kunming-Montreal Global Biodiversity Framework[17].

The natural capital account does not evaluate potential management changes in response to natural capital risks or opportunities. However, the structure of the account (linking the asset register to value calculations) and/or the unit values within the account, can be used to appraise alternative land management scenarios. For example, the Natural Capital Balance Sheet shows that agricultural output benefits are less than costs to tenants as it stands – this could be investigated further to better understand stocking levels and its relationship to supporting other benefits captured (e.g., links between stocking density and water supply).

Despite rapid development of changes in natural capital accounting methods since the baseline account, the accounting structure still enables insightful comparison of data over time. This gives understanding of changes since the 2016/17 account, including:

- The trends in natural capital value between 2016/17 and 2021/22, which help understand future risk and opportunities related to natural capital, and
- What these trends are driven by (e.g., changes to the natural capital assets, the beneficiaries, or other factors).

The 2021/22 account has been updated to reflect, not only changes in UU's land assets, but also changes

[15] Defra. (2022). UK Climate Change Risk Assessment 2022. Available at: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2022

[16] For more information: https://tnfd.global/

[17] More information at: https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222

in natural capital thinking and application. This report captures the process of preparing a natural capital account and its outputs in alignment with BS 8632. A useful follow-up would be for UU to reflect on time spent producing this account, identifying any lessons learnt and opportunities for improvement that should be considered for the next account process. Improvements to UUs practice (in terms of data, methods) is reflected in Section 6.2.

These reflections will inform how results can be used for business planning, including future financing of natural capital. Financing should consider both the future costs to improve the condition of natural capital assets (e.g. through peatland restoration), and the potential benefits from doing so (e.g. reduced carbon emissions). The size and timing of these costs and benefits can inform design of suitable financing approaches (e.g. funding from revenues, or through a separate instrument such as a green bond).

For financing and other purposes, the natural capital accounts can be used as a 'monitoring & evaluation' tool for new sources of finance for UUs production, and in particular, maintenance activities. For example, they could be part of the specification and/or reporting for a green bond. Accounts can also be used to run different maintenance and finance scenarios for comparison to the baseline, thereby informing the business case for private and/or public investment. A clear statement of purpose for UUs natural capital accounting process could be developed, to support not only producing the accounts, but also identify how, where and why results should be integrated into the UUs decision-making processes.

In future iterations, priorities should be on understanding:

- Trends in the extent and condition of the natural capital assets;
- Internal and external risks to the assets (such as from climate change),
- How these risks impact benefits and beneficiaries, and
- The cost of appropriate actions that can address these to maintain the assets.

This work on future risks, benefits and maintenance costs could also be incorporated into the business plan of UU. The account values can also be compared to other uses of natural capital assets such as water transfers.

Through the development of the 2021/22 account, UU's internal capacity and understanding of natural capital accounting has grown. This includes not only with respect to data collection and collation, which have improved since the 2016/17 account but are likely to become more streamlined as the process is embedded within UU's company reporting cycle. In addition, the current accounting period has ensured compatibility between the North West Region Account and UU's Corporate Natural Capital Account through the use of the same habitat extent and condition data for the asset register. In doing so, there is consistency within UU's natural capital approach more broadly. The procedure of compiling the asset register has also supported UU's internal GIS capacity through the analysis of a variety of GIS files (e.g., as described in Appendix 3). The UU project team are now in a better position to carry on the accounting process, and use the accounting outputs (e.g., Natural Capital Balance Sheet) for internal and external stakeholder engagement.

The accounting workbook (UU-CNCA-workbook_230323.xls) has been provided to UU, detailing sources, assumptions and calculations. Note that some manual amendments to the accounting workbook will still

be required as part of the next natural capital account update (e.g., adjusting inflation factors). More automation can be added, however, to ensure effort is proportionate - this can be implemented once the update schedule (and frequency) has been established.

It is recommended that an independent internal audit of the account workbook is undertaken, covering the process used, and the value to private business calculations (e.g. in relation to water supply). This can have multiple purposes: to broaden knowledge of the accounting process and results within UU; to consolidate links between internal data sources and the account (assuming the internal auditor is from UU's finance team or another department that provide data used in the account); and help plan for efficient future updates of the account.

6.2 Improving UU's natural capital accounting practice

The account provides insights into how natural capital values have changed over time, identifying why changes in value have arisen. Few organisations have completed an analysis in movement of value as presented here, and as part of final reporting this account has been audited for alignment with the BS 8632 standard.

Nevertheless, there are areas where the account can be improved in the future, such as for the asset register:

- A review of spatial natural capital extent and condition data should be undertaken ahead of the next account update. This should take account of developments in this data and whether the MasterMap data layer used in the 2021/22 account remains the most appropriate source or should be replaced and/or combined with other datasets (e.g., from remote sensing). It can also include updates to align to data used for key management processes and objectives. An example, of this is UU's participation (as a buyer and/or seller) in new ecosystem markets, such as use the UKHAB typology which forms the basis for biodiversity net gain policy, enabling the account to inform relevant business strategies (e.g., habitat banking).
- Expand the number of condition indicators included in future accounts. There are certain features of UU sites, such as soil organic matter content or diseased trees, which could be used to reflect the quality of UU's land assets.
- It is expected that better information on peatland area and condition will be made available through Peatland partnerships[18]. This would result in better understanding of change in natural capital condition as well as providing a more accurate estimate of carbon emitted by peatland.

Further work can improve the accuracy of asset values in the accounts, including:

- Expanding the scope of activities covered in accounts, particularly with respect to recreation. There are some assets and features on site which do not appear in the present version of the accounts due to a lack of data (as highlighted in Section 3.3).
- The development of a data log (e.g., building on the data request log shared at the start of this project) will facilitate data collection and collation in future updates of UU's natural capital account. This will

[18] Peatland mapping for the UU accounting boundary is currently being undertaken and is expected to be completed in 2024 with the release of the England Peat Map.

ensure that updates are completed systematically. This in turn will support identifying reasons for changes in values.

- Ongoing investigation of emerging methods for the valuation of water supply and possible collaboration with other water companies to develop an approach that could become a norm or standard for the industry.
- Better analysis of the change in renewable energy generation capacity (i.e., installed KW) would enable better assessment of the effectiveness of energy generated per unit of capacity installed. However, the renewable energy business is in the process of transfer to a third party. This means that in a future account this benefit would be split between private benefit for UU (reflecting rents for generation capacity) and wider society benefits (reflecting the value of renewable energy generation, less rents). This may make assessment of this benefit more difficult as UU is less likely to have access to detailed information to assess this benefit.
- Refinement of maintenance costs by conducting a thorough review of natural capital asset maintenance activity to provide a more accurate view of the cost of this activity across the organisation. In addition, it is important to define and establish a plan of maintenance activity that sustains asset condition taking into account future threats and pressures (such as climate change).
- Significant values in UU's 2021/22 Natural Capital Balance Sheet (Table 4.1) should be cross-checked against UU's risk management framework to ensure that high-value natural capital assets and values are captured in internal risk assessments.
- Improve the projections of future asset values by adding the impacts of future trends. The account could consider more refined future trends and scenarios (e.g., drought risk impacts on water supply and agricultural output) to calculate asset values, for both costs and benefits. The main future trend currently factored into the calculation of present values of benefits is the increased future value of carbon sequestration, as reflected in BEIS (2021) escalating values for carbon emissions over time, and future air pollutant removal values, which account for population growth and changes to levels of air pollution.
- For private recreational income, the reporting year value is £12 million lower than baseline, reflecting the lower level of public engagement in recreation in the UU accounting boundary in 2021/22. Note, it is likely that annual recreation income from 2021/22 is not representative of future income due to impacts of the Covid-19 pandemic on public engagement with the outdoors (reporting year income is less than 10% of baseline value). Recommend using five-year average for forecast of future income.
- For agricultural output, the reporting year income includes non-farm rents such as residential and commercial income. This should be refined to reflect the appropriate apportionment that is attributable to natural capital assets, and the account updated. Also, it is not clear that the reporting year has captured all schemes that tenants may have signed up (e.g., HLS, moorland BPS). It is recommended that a full list of all agri-environment schemes is captured going forward.

Further analysis of the Reporting Year account can also include:

- Comparing the results of the 2021/22 Natural Capital Account with outputs from the North West Regional Account. This can be done across key data types (e.g., habitat extent, volume of water abstracted and value of recreation). The North West Regional Accounting outputs have been

compared to the UU Baseline Account (2016/17), as such the existing analysis structure can be re-purposed.

- Disaggregation of benefits and costs to North West Regional accounting sub-regions (e.g., Cumbria). The accounting workbook has been structured to facilitate reporting at the sub-region scale with placeholders built in for UU to populate where appropriate. This is relatively straightforward for the benefits included within the Reporting Year account, however additional assumptions would need to be made to disaggregate costs.
- Further analysis can be undertaken to assess benefits that accrue to UU customers. This would require a revision of the UU 2021/22 natural capital account to identify areas (e.g., travel distances for recreation) and assumptions to determine the proportion of wider society benefits that can be attributed to UU customers.
- Development of a Natural Capital Income Statement in line with BS 8632 (either Scope I or II).

Finally, it is recommended that the update procedure is maintained, to continue to track progress, possibly annually where data facilitates this (e.g., updates to water supply and tenancy information), and more thoroughly every three to five years (e.g., to reflect changes in the asset register). Updates should ensure that UU's natural capital account is up to date to inform asset management planning cycles, both as an input to investment and business plans, and to baseline performance in each investment period. This will help:

- Verify the practicality of the data gathering process to update the account;
- Start a time series to help understand how the data used is likely to vary over time and is sensitive to changes in natural capital assets and benefits; and
- Identify key indicators of natural capital asset management and values from within the account data.

References

Beale, S., Bending, M., Trueman, P. (2007). An Economic Analysis of Environmental Interventions That Promote Physical Activity. University of York: York Health Economics Consortium. As referenced in White et al. (2016) and Defra (2020). [online]. Available at: https://www.nice.org.uk/guidance/ph8/documents/economics-modelling2

BEIS. (2020). Green Book supplementary guidance: valuation of energy use and greenhouse gas emission for appraisal. [online]. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

BEIS. (2021). Valuation of energy use and greenhouse gas. Supplementary guidance to the HM Treasury Green Book on Appraisal and Evaluation in Central Government. Data tables 1 to 19: supporting the toolkit and the guidance. [online]. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal#history

BEIS (2022). Quarterly Energy Prices: UK January to March 2022. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1086569/quarterly_energy_prices_uk_june_2022.pdf

BSI. (2021). Natural Capital Accounting for Organizations. [online]. Available at: https://www.bsigroup.com/en-GB/topics/sustainable-resilience/net-zero/natural-capital-accounting/

Bulb. (2022). Carbon tracker. [online]. Available at: https://bulb.co.uk/carbon-tracker/

Capitals Coalition. (2016). Natural Capital Protocol. [online]. Available at: https://naturalcapitalcoalition.org/natural-capital-protocol/

Cannell, M.G.R., Milne, R., Hargreaves, K.J., Brown, T.A.W., Cruickskank, M.M., Bradley, R.I., Spencer, T., Hope, D., Billett, M.F., Adger, N. and Subak, S. (1999). National Inventories of Terrestrial Carbon Sources and Sinks: The U.K. Experience. Climate Change, 42, p.505-530. [online]. Available at: https://www.researchgate.net/publication/226017164_National_Inventories_of_Terrestrial_Carbon_Sources_and_Sinks_The_UK_Experience

Claxton K, Martin S, Soares M, Rice N, Spackman E, Hinde S, et al. (2015). Methods for the Estimation of the NICE Cost Effectiveness Threshold. Health Technology Assess. [online]. Available at: https://www.journalslibrary.nihr.ac.uk/hta/hta19140/#/full-report

Day, B. H., and G. Smith (2018). Outdoor Recreation Valuation (ORVal) User Guide: Version 2.0, Land, Environment, Economics and Policy (LEEP) Institute, Business School, University of Exeter. [online]. Available at: https://www.leep.exeter.ac.uk/orval/

Defra. (2020). Livestock numbers in England and the UK. [online]. Available at: https://www.gov.uk/government/statistical-data-sets/structure-of-the-livestock-industry-in-england-at-december

Defra. (2021). Enabling a Natural Capital Approach (ENCA). [online]. Available at: https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca#enca-featured-tools

Defra. (2022). UK Climate Change Risk Assessment 2022. Available at: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2022

Defra. (2023). Data Services Platform. [online]. Available at: https://environment.data.gov.uk/

Defra. (2023). Swimfo: Find a bathing water. [online]. Available at: https://environment.data.gov.uk/bwq/profiles/

eftec, RSPB and PWC. (2015). Developing Corporate Natural Capital Accounts. Final Report for the Natural Capital Committee. [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516968/ncc-research-cnca-final-report.pdf

eftec and CEH. (2019). Pollution removal by vegetation. [online]. Available at: https://shiny-apps.ceh.ac.uk/pollutionremoval/

eftec, SQW, CEH, ABPmer. (2019). The ecosystem contribution to tourism and outdoor leisure. Report to Defra, September 2019. [online]. Available at: http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=20245

Environment Agency. (2013). Updating the National Water Environment Benefit Survey values: summary of the peer review. [online]. Available at: https://www.gov.uk/government/publications/updating-the-national-water-environment-benefit-survey-values-summary-of-the-peer-review

Forest Research. (2021). Timber Price Indices: Coniferous Standing Sales Price Index for Great Britain, Table 2. [online]. Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices/

Forest Research. (2022). Timber Price Indices: Coniferous Standing Sales Price Index for Great Britain. [online]. Available at: https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/timber-statistics/timber-price-indices/

Heritage Fund. (n.d.). How to calculate volunteer time. [online]. Available at: https://www.heritagefund.org.uk/discussions/how-calculate-volunteer-time

HM Treasury. (2020). The Green Book: appraisal and evaluation in central government. [online]. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

HM Treasury. (2022a). GDP deflators at market prices, and money GDP, March 2022 (Quarterly National Accounts). [online]. Available at: https://www.gov.uk/government/collections/gdp-deflators-at-market-prices-and-money-gdp

HM Treasury. (2022b). The Green Book: appraisal and evaluation in central government. [online]. Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

IUCN. (2017). Peatland Code Field Protocol: Assessing eligibility, determining baseline condition category and monitoring change. [online]. Available at: http://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/PC_Field_Protocol_v1.1.pdf

Intergovernmental Panel on Climate Change. 2018. Working Group III: Mitigation - Appendix IV: Units, Conversion Factors, and GDP Deflators. [online]. Available at: http://www.ipcc.ch/ipccreports/tar/wg3/index.php?idp=477

Jones et al. (2017). Developing Estimates for the Valuation of Air Pollution Removal in Ecosystem Accounts. Final report for Office of National Statistics, July. [online]. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/articles/developingestimatesforthevaluationofairpollutionineco systemaccounts/2017-07-25

Jones, L., Thistlewaite, G. Passant, N., Wakeling, D., Walker, C., Karagianni, E., Turtle, L., Kilroy, E., Hampshire, K., May, K.,

Webb, N. (2019). National Atmospheric Emissions Inventory: Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2019. [online]. Available at: http://naei.beis.gov.uk/reports/reports?section_id=3

Kantar. (2019a). The Great Britain Day Visitor 2018 Annual Report. [online]. Available at: https://www.visitbritain.org/gb-day-visits-survey-archive

Kantar. (2019b) The GB Tourist 2018 Annual Report. [online]. Available at: https://www.visitbritain.org/archive-great-britain-tourism-survey-overnight-data

Metcalfe, P. (2012). Update of CRP WFD Benefit Value - Economic Component, report for the Environment Agency.

Natural England. (2018). MENE Survey - Local Authority Dashboard. [online]. Available at: https://defra.maps.arcgis.com/apps/MapSeries/index.html?appid=2f24d6c942d44e81821c3ed2d4ab2ada

NERA Economic Consulting. (2007). The benefits of Water Framework Directive Programmes of Measures in England and Wales. Final report to Defra.

ONS. (2019). UK natural capital accounts: 2019. [online]. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/uknaturalcapitalaccounts/2019

ONS. (2021). Tourism and outdoor leisure accounts, natural capital, UK: 2021. [online]. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/tourismandoutdoorleisureaccountsnaturalcapitaluk/2021

Redman, G. (2019). The John Nix Pocketbook for Farm Management 2020. 50th Edition. Melton Mowbray: Agro Business Consultants.

Redman, G. (2020). The John Nix Pocketbook for Farm Management 2021. 51st Edition. Melton Mowbray: Agro Business Consultants.

Redman, G. (2021). The John Nix Pocketbook for Farm Management 2022. 52nd Edition. Melton Mowbray: Agro Business Consultants.

Soussana, J.F.; Tallec, T.; and Blanfort, V. (2009). Mitigating the greenhouse gas balance of ruminant production systems through carbon sequestration in grasslands. [online]. Available at: http://journals.cambridge.org/download.php?file=%2FANM%2FANM4_03%2FS1751731109990784a.pdf&code=3148a5665a431bdda467b20ce538f628

White, M., Elliott, L., Taylor, T., Wheeler, B., Spencer, A., Bone, A., Depledge, M. and Fleming, L. (2016). Recreational physical activity in natural environments and implications for health: A population based cross-sectional study in England. Preventive Medicine, 91, p.383-388. [online]. Available at: https://www.sciencedirect.com/science/article/pii/S0091743516302298

Appendix 1 – Natural capital accounting approach

Natural Capital is "the stock of renewable and non-renewable natural resources (e.g., plants, animals, air, water, soils, and minerals) that combine to yield a flow of benefits to people"[19]. A natural capital approach can be defined as distinguishing between the natural capital stocks and the flows of benefits they provide; projecting benefits into the future and linking the provision of benefits to the extent and condition of assets. The intention is to ensure that business decisions prioritise maintaining the natural capital assets to maintain the benefits, and not to maximise one of the benefits at the expense of others or the natural capital asset itself.

Systematic and consistently generated evidence and repeated updates are what distinguish accounting from one-off assessments. Accounting offers comparability across space and time, bringing rigour to the presentation of data on natural capital assets, the services they provide, the benefits and hence value of those services, and the distribution of those benefits across society and into the future.

The approach to developing this baseline account is based on the Corporate Natural Capital Account (CNCA) framework for the Natural Capital Committee in 2015 (eftec, RSPB and PWC, 2015). This framework is also the basis of BS 8632 on Natural Capital Accounting for Organizations[20], with which this account is aligned as shown in Section 2.3. Natural capital accounting involves producing a Natural Capital Balance Sheet and a Natural Capital Income Statement. This mirrors traditional financial accounting; the intention is to present information to the decision makers in a format they are familiar with so that the organisation's impacts and dependencies on the natural capital is considered more explicitly and in conjunction with other forms of capital.

In this project, a **Natural Capital Balance Sheet** has been produced. This has two parts: asset values (of the benefits natural capital produce for the business and the wider society) and liabilities (of what the business legally or voluntarily spends to maintain natural capital). The balance sheet and its supporting schedules answer five key questions:

I. What assets do we own and/or manage?

II. What benefits do they provide and to whom?

III. What are these benefits worth?

IV. What does it cost to maintain the assets?

V. How do costs compare to benefits over time?

The following supporting schedules hold the information gathered to answer the above questions:

- **Natural capital asset register –** which records the stock of natural capital assets in terms of their extent, condition and spatial configuration (e.g., size and status of designated sites). These indicators help determine the health of natural capital assets and their capacity to provide benefits. The asset register is also the basis for scoping the natural capital risk register, and for a materiality assessment (see Section 3.3) to determine the content of the flows and liabilities accounts.

[19] Capitals Coalition (2016). Natural Capital Protocol. Available at: https://naturalcapitalcoalition.org/natural-capital-protocol/

[20] BSI (2021). Natural Capital Accounting for Organizations. Available at: https://www.bsigroup.com/en-GB/topics/sustainable-resilience/net-zero/natural-capital-accounting/

- **Natural capital risk register –** which records the risk arising from natural capital assets, e.g., where there are material impacts that are not adequately understood, or dependencies on assets that are not being adequately maintained.

- **Physical flow accounts –** which quantifies the benefits that the assets deliver in physical terms. The changes in the quantity and/or quality of the assets and their benefit provision over time are also shown.

- **Monetary flow accounts –** which estimates the economic value of the benefits in monetary terms and discounts the projected future flow of these benefits to provide the present value for the assets. This uses data from actual markets and other (non-market) values. The value of the benefit should be net of the cost of producing the benefit, where possible.[21]

- **Natural capital liabilities account –** which details the costs of activities required to sustain the capacity of the natural capital assets to provide benefits over the long term, including management actions for the habitats identified in the asset register.

The monetary flow and liabilities accounts distinguish private values for UU from external values to the rest of society. These supporting schedules provide all the data required for the balance sheet which compares the asset values to cost of maintaining those values. Where understanding and evidence allow, calculation of assets and liabilities can take account of expected changes to future costs and benefits of management, and external factors such as population growth or climate change. Otherwise, caution is needed when interpreting the bottom line of Natural Capital Balance Sheet – as BS 8632 states, a positive net asset value is not necessarily an indication of sustainable asset management.

[21] Limitations of available data mean that while some data are net of costs (e.g., gross margins for agricultural outputs) some values are 'gross' benefit figures (e.g., tourism spending).

Appendix 2 – BS 8632 audit statement and response

The appendix presents the audit statement for the United Utilities natural capital account. Any revisions to the report or accompanying workbook have been noted as a 'revision' in light of the BS 8632 audit.

Audit Issue	Audit statement	Revision
1. Identify the purpose of the natural capital account	Section 1.1 talks about the overall objectives of preparing a natural capital balance sheet but does not mention the specific purpose for UU to do so. It would be good to add a specific purpose statement of why and how the output is intended to be used (related to the comment under Section 3 below). This will also help with interpreting the accounts for business decisions in Section 6 – in a more specific way than it is currently presented.	This round of accounting has two purposes: • UU are interested in continuing the natural capital accounting process and have decided to produce a 2021/22 account. This is in line with recommendations from the baseline (2016/17) project, where the importance of updating the accounts was highlighted as key to support longevity of the process. • Training and support to build internal capacity at the UU on natural capital and accounting overall. UU want to integrate the accounting outputs into their six capital framework and are also aware of TNFD/TCFD reporting.
2. Describe the organisation	More information on production and maintenance activities as to what they are and whether they are legal/ regulatory or voluntary will help with better interpretation of the account's bottom line and necessary future action (in particular for natural capital asset maintenance).	Table 3.8 has been revised to provide more information on UU cost categories captured within the liabilities account, along with caveating practical limitations to further refinement. Table 3.9 has been re-structured so that production costs have been itemised to reflect the relevant benefit, and natural capital maintenance costs have been itemised to reflect legal obligations and other maintenance cost activities. Discussion included on how costs have been better itemised in this account when compared to the previous CNCA (2016/17).
3. Report stakeholder involvement	Section 2.2 briefly mentions the extent of engagement with external and internal stakeholders. It is implied that external stakeholders are not engaged for the specific purpose of preparing the natural capital account but that internal stakeholders have provided data.	Acknowledge that Audit Statement indicates no revision is necessary, however language in Section 2.2 has been amended to make it clear that no external engagement has been undertaken. Equally, text amended to reflect internal stakeholder engagement for data collection but also wider engagement on what accounting is and why.

Audit Issue	Audit statement	Revision
	There is no need for revision of the reporting here. However, in future, the following will improve transparency and integration of the accounts into decision making: • Provide a list of internal and external stakeholders engaged in the preparation of the accounts and their roles where possible (generic tasks like data provision and review) will suffice. • Describe the engagement process, which should include not only data provision from stakeholders but presentation of the accounts to them and discussion of implications. Data providers and those that attend discussion sessions may not be the same stakeholders. There is no indication in the report as to whether the account has been / will be discussed with others and how UU intends to integrate the key messages from the account into their decision making (even though the importance of this integration is acknowledged in Section 1).	Wider engagement (internal and external) will depend partly on how UU decide to use the natural capital account results and whether the results will be published (note that baseline account was not).
4. Record the scope and type of natural capital account produced	Scope 1 of Natural Capital Balance Sheet is chosen as the focus is UU's own land assets and operations. This is the appropriate scope and both the scope and the type of accounting output are clearly stated.	No further revisions necessary.
5. Undertake materiality assessment	The rationale for the materiality assessment is explained clearly. No further comment on the materiality list (Table 3.4) is necessary. However, two points are worth noting: • For improvement in this report – Defra ENCA and Capitals Coalition NCP are mentioned but these are general references. What are the references used to reach the conclusions about materiality. Even if this assessment is ultimately expert judgement this should be reported – to allow for further	Responses to audit statement: • In Section 3.3 it states: "The assessment was conducted in consultation with the UU project team to determine which services were material within the accounting boundary." • In Section 3.3 impact of the exclusion of material unquantified and non-

Audit Issue	Audit statement	Revision
	scrutiny of this important step. • Exclusions are mentioned in the materiality assessment and notes added later on in physical and monetary flow accounts and the NCBS. However, implications of these exclusions are not mentioned.	monetised benefits has been added. The exclusions are not expected to change the interpretation of UU's 2021/22 Natural Capital Balance Sheet.
6. Collet data and assess its quality for the NCBS	• Section 3.5.2 – Table 3.7 should refer to the relevant worksheet for sources or at least to Table 3.5 • Section 3.6 covers the liabilities account. Table 3.8 distinguishes between production and maintenance costs. It is mentioned that the cost data come from the UU accounts but there are no gap assessment and RAG rankings for confidence. It may be that the UU's own accounts are the best source for this so there are no gaps and the data is of High quality. This is important as if accounts are used for future natural capital management scenarios, the costs would need to be estimated and may have different confidence ratings and may not be as comprehensive.	• Section 3.5.2: Revised to make specific reference to Table 3.5 and Appendix 4 to clarify links between estimated values and data sources. Have not included reference to worksheets as it is not expected that UU's Accounting Workbook will be shared widely, so not of importance to external readers. However, the workbook itself (structure etc.) is familiar to UU project team. • Section 3.6.2: Included statement on confidence rating of estimated liabilities. Note that a separate RAG-rating system is not applied to cost data as inputs have been provided by UU Finance Team based on UU's financial accounts. The revisions in Section 3.6, as a result of report review now more clearly state caveats within the liabilities account with respect to coverage (e.g., natural capital maintenance costs).
7. Prepare the supporting schedules for the NCBS	**Section 3:** • Section 3.2.2: Section 4 talks about expanding the asset register. It'll be good (not essential) if Asset Register refers to Section 4. • Section 3.4: Is on the risk register. But the repost is a methodology review of why we need risk register. UU should explain which risks are considered and how these are incorporated in the 'dynamic baseline' and interpretation of the bottom line. For example, UU may want to consider changes to the	**Section 3:** • Section 3.2.2: No further revision here. Have clarified in Section 4.1 and 6.1 that key assets identified within the asset register should be included in UU's organisational asset register. • Section 3.4: Have amended risk register description to reflect UU's Risk Management Framework (both corporate and operations). Within Section 6 of the report, have included as a recommendation that the 2021/22 accounting schedules should

Audit Issue	Audit statement	Revision
	temperature of water in the environment. Temperature is a quality indicator for the water as a natural capital asset affecting some of its benefits. Changing water temperature (mainly warming) is a significant climate change risk according to the UK Climate Change Risk Assessment. This could be a significant risk in the UU area reducing the quality of the environment and benefits to those users for whom the temperature of intake of water is important. • Section 3.5: In terms of projections of physical flows and benefits – it should be more explicit that the only benefit that is projected is Carbon. Trend information is given about assets and physical flows but this is not reflected in quantitative assessments. 'Trends incorporated where possible' should be replaced with phrase that makes it clear only carbon. This is not a criticism of the approach – BS 8632 says do what you can in this respect, but this recommendation is made to improve transparency. • Table 3.5: (a) Is the energy generation owned by UU or is this purchase of renewable energy? If former, we can argue for inclusion in NCBS. But if the latter, I don't think it has a place in the BS. (b) Add statement about the risk of double counting between recreation, physical health and tourism is avoided (c) Related to the interpretation of the account, for water quality it is assumed that current WFD status will be maintained. How is this assumption justified (e.g., is UU spending enough)?	be considered in combination with external sources (e.g., UK Climate Change Risk Assessment). • To Section 3.5.1 and 3.6.1 – have added clearer explanation on how present values have been estimated with what assumptions etc. • Table 3.5: (a) Have clarified that renewable energy is from renewable energy assets owned/managed by UU, given scope of the account. (b) Have included statement on double counting avoided across valuation approaches, as well as referred to Method Appendix for further details on how and why. (c) No further revision to Table 3.5 or Section 3.5.1. Have captured statement on trends assumptions and why (i.e., justification) as part of new sub-heading 'Estimating Present Values'. Have added statement on what the implications of these assumptions are to interpretation of the Natural Capital Balance Sheet (Section 4). **Section 4:** No further revision in light of revisions to Section 3.3 (materiality assessment) and more clearly explaining implications of exclusions. **Section 5:** No further revisions necessary. **Section 6:** • Section 6.1: Have included explanation on Have added learnings on process (i.e., capacity building), changes to the

Audit Issue	Audit statement	Revision
	Consider for other benefits as well. **Section 4:** Point 4 at the end of Section 4.1 – This seems at odds with the list of exclusions and discussion of physical and monetary flow accounts. Specifically they sound more complete than this phrase would lead me to think. **Section 5:** The explanation of changes is clear and it seems the attributed to the right reasons. There are a few comments in the report to improve the clarity of the writing and comparing the text and the table to ensure the figures in both are the same. **Section 6:** • Section 6.1 – There should be a paragraph explaining what the update of 2021/22 tells us: anything new about the data, process, asset values, and maintenance liabilities. The comparison of the numbers between the two accounts is done in Section 5 but what did we learn this time round that will help with using the accounting experience in business decisions in a more involved way than to date. • This report is on the process of preparing a natural capital account and its outputs. For the whole process to be useful, UU should spend time after this step ends in reflecting on what they have learnt from the process and the results in terms of their business model and finances (including green finance). The reflections about what can be improved in the accounting process are detailed because the report is written by those who help prepare the account. But without the reflection about the uses of the account in decision making, it will be difficult to keep repeating the exercise.	account results due to value and what is driving trends in change • Audit statement is not for account preparers to respond to, but rather an element of BS 8632 alignment that is currently unknown – have therefore included audit statement has a recommendation. Note that the Natural Capital Account outputs and accompanying report needs to express intention of what the account will be used for. Note that integration does not mean disclosure, but rather how the accounting outputs can or will be used in decision-making.

Appendix 3 – Asset register methodology

Basic methodology

- Obtain source data e.g., nature conservation data for England and Wales;
- Select subset of data and join England and Wales data;
- Run analysis to identify source data intersecting with UU land holdings, and
- Split results by reporting region and calculate areas of different asset categories.

A3.1 Advanced Processing Steps – Spatial Analysis

Example shown below is for the Sites of Special Scientific Interest (SSSI) data. Similar methods were followed for other data layers.

A3.1.1 SSSI Spatial Analysis Example

1. **Select a subset of the SSSI dataset**
    - Choose Selection, Select By Location Selection method: Select features from
    - Target layers: Add a tick in the SSSI layers for England and Wales
    - Source layer: UU_CNCA_Extent.shp
    - Spatial selection method: intersect the source layer features
    - Click OK
    - You should see that the designations within the extent area are show with cyan boundaries to indicate that they are selected.
2. **Export the subsets**
    - Right click on each layer and export them by choosing Data, Export Data
    - Export: Selected features
    - Name the shapefiles SSSI_England and SSSI_Wales
3. **Merge the two SSSI layers together**
    - Choose Geoprocessing, Merge
    - Input Datasets: SSSI_England and SSSI_Wales
    - Output Dataset: SSSI_Merged
4. **Analyse the intersection of the SSSI with the UU Holdings**
    - Choose Geoprocessing, Intersect
    - Input Features: Land_registry_subareas_union, SSSI_Merged
    - Output Dataset: SSSI_Intersect_UUholding
5. **Dissolve the features within each of the reporting areas**
    - Choose Georocessing, Dissolve
    - Input Features: SSSI_Intersect_UUholding

- Output Feature Class: SSSI_DissolveDissolve
- Field(s): SubAreaNm
- Statistic Field(s):
    a. Field – Statistic Type
    b. SHAPE AREA – SUM
- Create multipart features (optional): Ticked

6. Update the area measurement
    - Start editing the layer
    - Open the attribute table
    - Right click on the area column e.g. SHAPE_AREA and choose 'Calculate Geometry'
    - Property: Area
    - Units: Hectares
7. Save the table as a text file
    - Open attribute table of SSSI_Dissolve
    - Click the drop-down menu in the top left and select Export
    - Name: SSSI_Results
    - Save as type: Text File

A3.1.2 Data Sources

- "UU_CNCA_Extent.shp" is a rectangle that encloses all of the UU land holdings. It is used to select subsets of source datasets to speed up processing. This was provided by Jonathan Porter (Countryscape).
- UU Land holdings .shp is an internal layer used in GIS showing all land owned by UU.
- Bathing waters data obtained from Swimfo https://environment.data.gov.uk/bwq/profiles/
- Following information obtained via government data share websites [Wales - https://lle.gov.wales/catalogue?t=1&lang=en & England https://environment.data.gov.uk/]
    - Total area of SSSI (Using condition units in England)
    - Area of Ramsar Sties
    - Area of Special Area of Conservation
    - Area of Special Protected Area for Birds
    - Area within National Parks
    - Area with Area of Outstanding Natural Beauty
    - Length of Waterbody (WFD River, Canal and Surface Water Transfer Waterbodies)

A3.2 Other Data

A3.2.1 Food provision

- Tenancy and farms information obtained via UU internal GIS system
- No. of livestock obtained via grounds maintenance team headcount
- Total operating and overhead costs obtained via staff headcount, salary band (provided by UU HR), and % time allocated to practical land management
    - Salary x number of staff members x % time on supporting land management = % time spent on practical land management for UU
- Income from tenancies (rent) provided as a figure by UU Grounds Maintenance Team

A3.2.2 Timber

- Provided as a figure (m^3 & £m) split by North, West, and East

A3.2.3 Renewable Energy

- Generation (MWh) provided for land-based assets only split by renewable energy type (Solar/Hydro/Wind)
- Life span assumed 25 years
- Capital costs for energy generation sites by type, £m, 2021/22 provided by UU Finance

A3.2.4 Carbon Sequestration

The mapping information for peatland has not been updated. Therefore, we assumed 2016/17 condition is representative of the condition in 2021/22.

A3.2.5 Recreation

University of Exeter staff confirmed that visitor numbers for top 12 most visited UU sites have not changed since the last account for 2016/17.

Appendix 4 – Benefits and costs methodologies

A4.1 Natural capital benefits

A4.1.1 Agricultural output

Livestock income to tenants

Food provision comprises of livestock outputs and is a significant sector in the region. The benefit is measured based on the marketed production from the sector at the market prices. Benefits to tenanted farmers refer to net income to farmers, which can be proxied by gross margin.

Data on the number of sheep and cattle that occur on the UU land assets, as reported by UU are used as the basis for physical flow measurements.

For the monetary values of produce, the John Nix gross margins for each livestock type has been collated to produce a three-year average estimate based on 2020, 2021 and 2022 figures (Redman, 2019; Redman, 2020; Redman, 2021). Such a rolling average figure is used to adjust for any potential volatility in agriculture markets. To estimate the arable and livestock farm income, the average gross margin unit value (£/head) is multiplied by the estimated livestock production figures (e.g., number of beef and dairy cows) in the UU accounting boundary. The average unit gross margin figures are assumed to be constant over time.

Agri-environment income to tenants

Income from agri-environment schemes that tenanted farmers participate in, as reported by UU, are reported in accounts as a benefit to UU tenant farmers.

Tenant rents received by United Utilities

Benefits which accrue directly to UU from income received from tenants, as reported by UU, are reported as a private benefit to UU.

A4.1.2 Timber

This benefit has been estimated using the data provided by UU on the volume of timber harvested from woodland within the UU accounting boundary. The account uses the average figures and does not differentiate between species. It is assumed that the rate of timber harvesting will remain constant over time.

The value of softwood timber production is based on the Forestry Commission coniferous standing sales price index (Forest Research, 2022). The stumpage price used in the account is estimated as the average of prices recorded in September 2020 and March and September 2022, roughly £40/m^3 overbark in 2021 prices. This monetary unit value is then applied to the estimated volume of softwood removals. It is also assumed that the unit value remains constant over time.

A4.1.3 Water supply

The benefit of water supply from the natural environment is estimated by the quantity of water abstracted (available in the region but apportioned to reflect the proportion of water that is supplied from UU land that is within the accounting boundary). To be consistent with the valuation approach used in the baseline account, and to ensure coherence of the separate calculation of revenue and production costs the resource rent method was used to calculate revenue and costs of water supply. The resource rent method simply takes revenue of goods supplied and deducts the costs of resources and their rent (such as return on financial capital employed) to establish the surplus that is attributable to natural resources.

For the reporting year the method for calculating resource rent has been simplified by the use of allowed revenue and costs from the latest final determination for UU (2020-25)[22]. The five-year average figures (for the period 2020-25) are used to forecast revenue and cost for the next 60 years, assuming a constant value assumption. Water supply was assumed to include the water resources[23] and water network plus[24] sectors of the final determination.

The elements of revenue and cost are calculated as below in Appendix Table 1 . Gross revenue is used to calculate gross water supply value and the sum of the cost elements used to calculate water supply production costs.

Appendix Table 1 2021/22 Water Supply Resource Rent Calculation

Element	Source	Average Value (£m/year)
Gross Revenue	Allowed revenue in final determination	699.5
Less total operating and overhead costs	Totex (Pay as you Go from final determination)	(365.1)
Less capital additions	RCV run-off and post-2020 depreciation from final determination	(207.7)
Less return on capital employed	Allowable Return on Regulatory Capital Value (RCV) from final determination	(95.7)
Add back operating costs accounted for in NC maintenance costs	NC maintenance costs of catchment management (see Section A4.2)	9.7
Resource Rent of Water Supply	**Sum of the above**	**40.7**

The final step involved the attribution of a proportion of the total gross revenue, costs and hence resource rent value to the contribution that UU land makes to this overall benefit. As a forecast of the expected future share of water supplied by UU land, historic abstraction by catchment was averaged over the period 2016-21. While these figures are likely to change over time due, at least, to climate change, this change

[22] 2020-2025 Final Determination - Investor Summary. Available at: https://www.unitedutilities.com/globalassets/z_corporate-site/investor-pdfs/final-determination-2020-2025-summary-document.pdf

[23] Water Resources 'covers activities in relation to abstraction licences and raw water abstraction.'

[24] Water Network Plus 'covers all activities carried out in performance of our functions as a water undertaker that are not designated as Water Resources or Retail activities.

could not be estimated within the scope of this account and the volume of water is assumed to remain constant for the forecast period. Analysis from UU calculated that, 31.1% of the water supplied by UU was attributed to UU land (averaged over the period 2016-21), hence 31.1% of the gross revenue (i.e. £218 million), production costs (£205 million) and hence net resource rent (i.e. £12 million) was assigned to UU land.

A4.1.4 Renewable energy

The account includes renewable energy sources generated from unsealed land (i.e., from land and not from energy generation located on built assets). This includes energy produced by wind, hydro and solar assets which occur within the UU accounting boundary. The volume of energy generated from these sources is taken from internal UU records.

Renewable energy is valued on the basis of avoided costs of grid electricity (BEIS, 2022), which is assumed to be the same across all renewable energy types. This was estimated at 17.15 p/KWh, in 2021 prices. This per KWh cost was multiplied by the total volume of renewable energy produced for an estimate of the total benefit of renewable energy generation on-site. The capital costs for each installation are known and divided over a 25-year replacement cycle to give an annual average cost per kWh generated. Typical operating costs per installed KW capacity are provided by UU energy experts. Other costs such as the management overhead of the UU energy business are not included.

A4.1.5 Carbon sequestration

Carbon dioxide equivalent sequestered in habitats

Woodland, improved grassland, saltmarsh and peatland areas within the accounting boundary sequester carbon. This benefit is estimated using the sequestration rates for each habitat (tonnes CO_2 equivalent per hectare) and the non-traded price of carbon.

Appendix Table 2 Habitat sequestration rates

Habitat	Sequestration rate	Source
Woodland	5.7 tCO_2e/ha/yr	ONS (2019)
Saltmarsh	5.2 tCO_2e/ha/yr	Cannell et al. (1999)
Improved grassland	0.6 tCO_2e/ha/yr	Soussana et al. (2009)

Appendix Table 2 shows the per hectare carbon sequestration rates for woodland, improved grassland and saltmarsh that are used within this assessment. The unit sequestration factor for woodland covers both coniferous and broadleaved woodland. Improved grassland is estimated as 0.18 tonnes of carbon sequestered per hectare (Soussanna et al., 2009). The rate for improved grassland and saltmarsh sequestration is converted to tonnes CO_2e using a conversion factor of 3.67 (IPCC, 2018). Sequestration rates are assumed to remain constant over time.

The total amount of CO_2 equivalent sequestered is estimated by multiplying these per hectare rates with the total hectares of the respective habitat type, as recorded in the asset register. The amount of CO_2e sequestered is then valued following the BEIS (2021) for the non-traded central price, £245 per tonne of

CO_2e in 2021. This is multiplied with the estimated tonnes of CO_2e sequestered. Future flows of carbon are valued using the BEIS (2021) carbon values series until 2050. Following BEIS (2021) advice, a real annual growth rate is then applied starting at the most recently published value for 2050 and into the future.

Carbon dioxide equivalent emitted by peatland

Peatland stores significant quantities of carbon. If peat is in pristine or near natural condition the rate of carbon sequestration is significant but is roughly offset by the warming potential of methane emissions (produced under anaerobic conditions by microbes). Consequently, the net greenhouse gas sequestration potential of peatland in good condition is low or close to zero. However, peatland in drained or eroding condition can emit very large quantities of carbon and other greenhouse gases. The IUCN UK Peatland Code (2017) provides a useful classification and methodology for assessing condition and establishes a range of greenhouse gas emission factors for peatland by condition as shown in Appendix Table 3 .

Appendix Table 3 Peatland emission rates

Peatland condition	Emission rate	Source
Near natural	-1.08 tCO_2e/ha/yr	IUCN (2017)
Modified	-2.54 tCO_2e/ha/yr	
Drained	-4.54 tCO_2e/ha/yr	
Eroding	-23.84 tCO_2e/ha/yr	

Blanket bog, heathland and acid grassland habitats in different regions of the UU accounting boundary are assumed to belong to one of the peatland condition categories in Appendix Table 3 . The total amount of CO_2 equivalent emitted is estimated by multiplying the near natural and modified and eroding[25] emission rates by the estimated area of peatland that falls into the respective condition category. The amount of tCO_2e emitted is then valued following the same approach as for tCO_2e sequestered in habitats and in accordance with the BEIS (2021) carbon valuation guidance.

Averted Greenhouse Gas emissions from renewable energy

The total volume of energy generated by renewable energy assets in the UU accounting boundary, as calculated when estimating renewable energy benefits (A4.1.4) is multiplied by the per KWh emissions factor associated with using grid electricity (Bulb, 2022). This yields an estimate of the number of tonnes of CO_2e that would be emitted if renewable energy weren't produced in the UU accounting boundary and grid electricity were used instead. It is assumed that all renewable energy produced on-site would be substituted by grid electricity in the absence of renewable energy assets. The volume of avoided annual GHG emissions figures is then valued following the BEIS (2021) for the non-traded central price, £245 per tonne of CO_2e in 2021. This is multiplied the by estimated tonnes of CO_2e emissions avoided. Future flows of carbon are valued using the BEIS (2021) carbon values series until 2050. Following BEIS (2021) advice, a real annual growth rate is then applied starting at the most recently published value for 2050 and into the future.

Carbon dioxide equivalent emitted by livestock

The account estimates the volume and value of emissions from livestock in carbon dioxide equivalent terms. Emissions from farm operations (e.g., electricity, fuel from vehicles, fertiliser and pesticide use) are not included in the account and hence the total emissions from farming activities are underestimated.

Appendix Table 4 Livestock emission rates

Livestock type	Emission rate	Source
Cattle (other cattle)	-1.5 tCO_2e/head/yr	Defra (2020) and Jones et al. (2019)
Sheep	-0.2 tCO_2e/head/yr	
Dairy cow	-2.1 tCO_2e/head/yr	

[25] It is assumed that no peatland in the UU accounting boundary belongs to the 'Drained' condition category.

Appendix Table 4 shows the per head CO_2 equivalent emission rates for cattle, sheep and dairy cow. The unit emission factors are averages calculated by dividing the total carbon dioxide equivalent emitted by each livestock type in the UK (Jones et al., 2019) by the total number of heads for each livestock type (Defra, 2020). These average emission rates are assumed to remain constant over time.

The total amount of CO_2 equivalent emitted is estimated by multiplying the per head rate for a given livestock type by the corresponding number of heads in a reporting area. The number of dairy cows, cattle and upland sheep is estimated as part of the 'Agricultural output' benefit (Section A4.1.1). The amount of tCO_2e emitted is then valued following the same approach as for tCO_2e sequestered in habitats and in accordance with the BEIS (2021) guidance.

A4.1.6 Air quality regulation

Note: Due to data constraints, a simplified version of the approach described here was used for the assessment of air quality regulation benefits. A summary of this simplified approach can be found at the end of this section.

Air quality benefit arises from the ability of different types of vegetation to remove pollutants from the air. This benefit is estimated for the amount of PM2.5 removed by woodland (which makes up more than 70% of this benefit in the UK (Jones et al., 2017) and the human health benefits of this removal.

Jones et al. (2017) modelled this benefit for the UK national accounts reflecting the variety of different levels of PM2.5 concentration, types and extent of vegetation and density of human population across the country. An update to this study has produced estimates of PM2.5 removal per hectare of woodland by local authority. The kilograms PM2.5 removed by hectare of woodland (eftec and CEH, 2019) is multiplied by the total woodland area in a given local authority in each reporting area. The PM2.5 removal per ha of mature (i.e., existing) woodland is estimated to be falling over the period of 2015-2030 based on the assumption about emissions and concentrations falling over time.

The economic value of this benefit is estimated as the healthcare cost avoided due to avoided illnesses at local authority level (eftec and CEH, 2019). The account estimates this benefit as £ per ha of woodland (in 2021 prices) for a given local authority multiplied by the total woodland area in that local authority (as produced by GIS analysis).

The eftec and CEH (2019) modelling of future benefits declines in line with lower emission / concentrations assumption mentioned above and are discounted at lower levels using the lower health discount rates (HM Treasury, 2020). Therefore, an average £PV60 per ha of woodland (in 2021 prices) for a given local authority is applied to the total woodland area as well.

Approach used for air quality regulation benefits in the 2021/22 UU account

As the woodland extent data is not available by local authority, the total extent of woodland across the entire UU accounting boundary is used.

For the measurement of physical flows an average air pollutant removal rate (PM2.5 kg/ha) for all of the local authorities within the UU accounting boundary is multiplied by the total extent of woodland within

the UU accounting boundary to produce an annual estimate for the annual volume of PM2.5 removed by woodland.

Similarly, for monetary valuation, an average annual value and 60-year present value per ha of woodland for relevant local authorities was multiplied by the total extent of woodland to produce an annual value and 60-year present value for the UU accounting boundary.

A4.1.7 Recreation

Welfare value of recreation for wider society

Recreational benefit is measured in terms of number of visits to accessible greenspaces, and the average welfare value associated with these visits.

The ORVal[26] tool is used to estimate the number and welfare value of visits to the accessible open spaces in the account boundary. ORVal also breaks down the estimated number of visits and associated welfare value by socio-economic group. Estimates can be produced for various spatial breakdowns including local authorities. For a given local authority in a reporting area, the estimated number of visits and associated welfare value produced by ORVal is multiplied by the proportion of the local authority area that lies within the reporting area boundary.

It should be noted that the data from ORVal takes into account the location of the recreation asset, surrounding population, habitat type(s) and local alternatives, but makes the assumption that accessible green space is in average condition for its type. Where this is not the case, green space with better/ worse condition than average will likely have higher/lower values for number and welfare value of visits. Similarly, as the ORVal modelling is based on MENE data (Natural England, 2018)[27], it does not take into account visits by children or overseas visitors to the UK, only domestic visits. Additionally, the MENE data used in ORVal is from 2016, so the same data is used for both the 2016/17 and 2021/22 accounts.

As ORVal captures all domestic recreation visits by adults, there is a risk of double counting with domestic tourism visits, in particular day visits[28]. To adjust the visit numbers to reflect recreation visits under three hours, the MENE cross-tabulation viewer was used to determine the number of visits across England that were over and under 3 hours (Natural England, n.d.)[29]. 78% of visits across England were under three hours, this percentage is applied to the estimated total annual visits in each reporting area. The annual visits under three hours are multiplied by the estimated average welfare value per visit within UU's accounting boundary. The unit monetary value (i.e., £ welfare value per visit) is assumed to remain constant over time.

The MENE survey (Natural England, 2018), which ORVal uses data from, asks respondents about the types of activities they undertake during their recreational visits, including fishing and water sports as broad categories. However, ORVal does not report its results separately for on-water and other activities. While the value of on-water recreation can be estimated using the values for maintaining WFD status from the National Water Environment Benefits Survey (NWEBS) (See Section A4.1.10), using these values would double-count the activities already included in Orval. Therefore, the estimated value of on-water recreation within the NWEBS data is not included in the account to avoid double-counting.

In-hand recreation income to United Utilities

[26] ORVal is a spatial model that shows the recreational sites, number of visits and the benefit to visitors using data from mapping tools, Monitor of Engagement in Natural Environment (MENE) survey and economic valuation literature. University of Exeter (2018) ORVal v2.0 - The Outdoor Recreation Valuation Tool. Available at: https://www.leep.exeter.ac.uk/orval/

[27] See: https://www.gov.uk/government/collections/monitor-of-engagement-with-the-natural-environment-survey-purpose-and-results

[28] A day visits is any leisure visit that is at least 3-hours (round-trip).

[29] This is based on the Year 7 (2015/16) MENE survey weighted base results for "Question 3: How long did this visit last altogether."

Income from recreation activities that United Utilities operates, and for which the public pays UU directly to participate in, are recorded in UU's internal finance documents. This income is reported in the accounts as a benefit to United Utilities.

A4.1.8 Physical health

In addition to improving the general welfare of visitors, if people are active during their visits, recreation can also have measurable physical health benefits. White et al. (2016) estimate that 51.5% of recreation visits[30] are 'active', where an 'active visit' is defined as those who met recommended daily physical activity guidelines either fully, or partially, during visits.

The White et al. (2016) proportion of active visits is applied to the annual visits to greenspaces within the account boundary, producing the number of annual active visits which is assumed to remain constant over time.

The benefit is valued as the health benefits of active recreation (in terms of improvements in Quality Adjusted Life years – QALYs[31]) and the economic value of health improvement (in terms of the avoided health cost due to improvement in QALY). Beale et al. (2007) analyse Health Survey for England data, estimating that 30 minutes a week of moderate-intense physical exercise, if undertaken 52 weeks a year, would be associated with 0.0106768 QALYs per individual per year. Beale et al. (2007) assume this relationship between physical activity and QALYs is both cumulative and linear. Claxton et al. (2015) estimate a cost-effectiveness threshold of a QALY to be roughly £12,900/QALY in 2008 prices. This figure is used as a proxy for health costs, reflecting the avoided health costs when QALY is improved by one unit. Based on this information, the avoided health cost is estimated as £3.36 per active visit in 2021 prices. The monetary unit value is assumed to remain constant over time.

A4.1.9 Tourism

Note: The methodology described below was used for the Northwest Regional Natural Capital Accounts. The results from this approach were scaled to apply to the UU accounting boundary. Due to data constraints, a simplified version of the approach described here was used for the assessment of tourism benefits. A summary of this approach can be found at the end of this section.

Domestic tourism is measured in terms of the number of day visits (i.e., visits that are more than three hours but do not include an overnight stay) and the number of domestic overnight trips and the associated expenditure of these visits and trips that are attributable to natural capital. The Great Britain Day Visitor Survey (Kantar, 2019a) and the Great Britain Tourist Survey (Kantar, 2019b) produce annual figures for Great Britain, but also three-year average visit and trip. The day visits (i.e., over three hours) and overnight trips are treated as additional to the recreation visits (i.e., those under three hours).

The number of day visits per year and the number of overnight trips per year for each reporting area are estimated by multiplying the total visits[32] in a local authority by the proportion of that local authority area that falls within the reporting area boundary. Total domestic tourism visits for a reporting area are the sum of the estimated annual day visits and domestic overnight trips. The same proportional approach is applied

[30] Refers to recreation visits that are under three hours, as reflected in Section A.9.

[31] QALY is a health measurement used widely in health and health economics research. QALY of zero denotes death, and 1 denotes full health.

[32] A day visit is treated as equal to an overnight trip, therefore visit = trip.

for the three-year average expenditure for each visitor type, in each local authority across the six reporting areas. This provides an estimate of the total expenditure that supports the local economy.

The proportion of visits and trips and their associated expenditure that are attributable to natural capital is estimated as 8% by the ONS (2021) Tourism and Leisure Natural Capital Account for the UK. This proportion is applied to total number of tourism visits (day-visits and overnight trips) and their associated total expenditure, to produce an estimate of the natural capital attributable visits and expenditure within each reporting area. Both visits and expenditure are assumed to remain constant over time.

Approach used for tourism benefits in the 2021/22 UU account

Data is not available on the spatial scale necessary to estimate the total number of tourism visits to the UU accounting boundary. Therefore, the tourism results for the North West Region (the methodology for which is described above) are scaled down based on the percentage of the North West Region which is comprised of the UU accounting boundary. In total, it is estimated that 3.3% of the North West Region is comprised of the UU accounting boundary. The total volume and value of tourism visits to the North West Region (£362m and £12.4bn, respectively) are multiplied by this percentage.

A4.1.10 Water quality

Maintaining the quality of water in the environment could have financial benefits for businesses (e.g., avoided water treatment costs) and welfare benefits to the public as proxy for many ecosystem services provided. The approach taken here is the latter and the welfare benefits are linked to maintaining the Water Framework Directive (WFD) quality status of the waterbodies as reported in the natural capital asset register.

The physical change is estimated by a given status (i.e., change in the WFD status from Good to Moderate). The economic value is based on the National Water Environment Benefits Survey (NWEBS) values (NERA Economic Consulting 2007; Metcalfe, 2012). The NWEBS values provide low, central, and high estimates of values for coastal and transitional water bodies, in 2012 prices. NWEBS values have been inflated to 2021 prices using the HM Treasury (2022a) GDP deflator.

The NWEBS values represent survey respondents' willingness to pay for six equally weighted ecosystem components (Defra, 2015, p.69):

- Fish;
- Other animals such as invertebrates;
- Plant communities;
- The clarity of water;
- The condition of the river channel and flow of water; and
- The safety of water for recreational contact.

As on-water and other recreation is already shown in the accounts (Section A4.1.7), one sixth of the estimated total value is deducted from the account values. It should be interpreted with caution as it has not been possible to disaggregate the impact of water quality on other benefits valued in the account.

This assessment uses the central value estimates for avoiding the deterioration of lakes, coastal and transitional water bodies and for rivers in the catchments relevant to the account boundary: Humber, Northumbria, North West, Solway Tweed, Severn, Dee and Western Wales River Basin Districts. Estimates are produced for lakes (i.e., annual £ value per km^2) and rivers (i.e., annual £ value per km). Using the central estimates, the total annual value of avoiding the deterioration of the current water quality across all identified water bodies in the UU accounting boundary is estimated using the relevant river basin district values for each reporting area.

The quality of bathing waters is reflected in the natural capital asset register using the Bathing Water Directive quality classification. The benefit of recreation in bathing waters is not valued separately as it is assumed to be adequately covered by the ORVal data described in A4.1.7.

A4.2 Natural capital liabilities

Natural capital liabilities are split by (i) the production costs of the benefits evaluated in the asset section of the Natural Capital Balance Sheet, and (ii) costs of those activities that are undertaken to maintain the quantity and quality of natural assets.

Production costs of benefits are calculated as follows:

- Water supply production costs are the sum of operating costs, capital additions and return on capital employed as set out in section A4.1.3. The operating costs excluded natural capital maintenance costs accounted for separately (see maintenance costs below). Finally, as explained in section A4.1.3, 31% of UU land contributed to water supply, then this proportion is used to calculate production costs.
- Renewable energy production costs are calculated based on an average annual life cycle cost of solar, wind and hydro generating assets over an assumed 25-year life cycle, as provided by UU. Capital costs represent the major element of production cost and were provided by UU.
- Agricultural output costs represent the labour and overhead costs of tenant farmers and is provided by UU.

Natural capital maintenance costs include activities due to legal obligations, and any other natural capital maintenance activity calculated as follows:

- Legal obligations are assessed as the costs of maintaining designated sites (SSSIs) and water safeguarding zones. These are based on an annual average of a five year programme of costs (including capital costs) for these activities.
- Other maintenance costs are based on the costs of catchment management activity, based on current year costs as reported from UU finance systems.

Note, there may be other costs embedded within other UU cost centres that could be associated with natural asset maintenance, and a recommendation to conduct a thorough review of this is included in Section 6.

10F Printing House Yard, Hackney Road
London E2 7PR

+44 (0) 20 7580 5383

eftec@eftec.co.uk

eftec.co.uk

@eftecUK