



ANNEX B5

Environmental Regulatory Assessments (Natural Capital)

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Severn Trent Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

Severn Trent Sources Strategic Resource Option

B5. STS Natural Capital Assessment

Severn Trent Water Limited

03 August 2022

5213609 / 9.5 / DG / 005



Notice

This document and its contents have been prepared and are intended solely as information for Severn Trent Water Limited and use in relation to STS SRO Gate 2 submission.

Atkins Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

The information which Atkins Limited has provided has been prepared by environmental specialists. Atkins Limited confirms that the opinions expressed are our true and professional opinions.

This document does not purport to provide legal advice.

This document has 56 pages including the cover.

Document history

Document title: B5. STS Natural Capital Assessment

Document reference: 5213609 / 9.5 / DG / 005

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	Draft for Client review	AS RM	JN	Mb	PMU	01/06/2022
2.0	Revised for Client Review	AS RM	JN	PMU	PMU	16/06/2022
3.0	Revised following NAU review	MB	MH	PMU	PMU	03/08/2022

Contents

Chapter	Page
1. Introduction	5
1.1. Background	5
1.2. Purpose of report	5
1.3. Structure of report	6
2. Scheme description	8
2.1. Mythe WTW temporary abstraction licence transfer (15 MI/d)	8
2.2. Netheridge WwTW discharge diversion to Haw Bridge pipeline (35 MI/d)	8
2.3. Indicative operation of STS SRO	8
3. Methodology	10
3.1. Approach	10
3.2. Scenarios assessed	11
3.3. Step 1: Natural capital asset baseline	12
3.4. Step 2: Change in asset stocks and condition	13
3.5. Step 3: Ecosystem services screening	14
3.6. Step 4: Qualitative assessment	15
3.7. Step 5: Quantitative assessment and monetisation	15
3.8. Step 6: Translation to Natural Capital metrics	20
3.9. Limitations and assumptions	21
4. Assessment outcomes	22
4.1. Natural capital baseline (asset register)	22
4.2. Change in natural capital assets	22
4.3. Qualitative assessment	23
4.4. Quantitative assessment and monetisation	30
5. Conclusions and recommendations	41
5.1. Next steps	41
Appendices	43
Appendix A. Gate 1 recommendations	44
Appendix B. Scoring framework for the qualitative assessment	47
Appendix C. Scheme map	53
Appendix D. On-site Baseline Habitats	54
Appendix E. On-site Post-Scheme Habitats	55
Tables	
Table 3-1 - Alignment with relevant guidance	10
Table 3-2 - Scenarios assessed	11
Table 3-3 – Mapping of services assessed for Gate 2 to WRP	15
Table 3-4 – Summary methodologies for each ecosystem service, and comparison with guidance and Gate 1 approach	16
Table 3-5 - Carbon sequestration of land use from EA WRP Supplementary Guidance	19

Table 3-6 – Department for Business, Energy and Industrial Strategy (BEIS) Carbon 2045 values per tonne19	20
Table 3-7 – ENCA data book air quality values by habitat type	20
Table 3-8 – WRPG natural hazard regulation values by habitat type	20
Table 3-9 – Food provisioning values calculated using Defra Farmscoper library	20
Table 4-1 – Baseline land cover areas within the Scheme indicative site boundary for the eight ENCA broad habitat classifications	22
Table 4-2 – Baseline land condition based on BNG assessment	22
Table 4-3 – Summary asset register for baseline and post-construction land cover areas and conditions (without BNG)	23
Table 4-4 – Summary asset register for baseline and post-construction land cover areas and conditions (with BNG)	23
Table 4-5 – Qualitative assessment results by service (without BNG mitigation)	24
Table 4-6 – Qualitative assessment results by service (with BNG mitigation)	27
Table 4-7 – Results: Climate regulation (carbon storage and sequestration) – Central values (£2021)	30
Table 4-8 - Results: Climate regulation (carbon storage and sequestration) – Low values (£2021)	31
Table 4-9 - Results: Climate regulation (carbon storage and sequestration) – High values (£2021)	31
Table 4-10 – Results: Air Pollutant removal (£2021)	32
Table 4-11 – Results: Natural Hazard (flooding) regulation	32
Table 4-12 – Results: Recreation on-site (£2021)	33
Table 4-13 – Results: Food Production (£2021)	33
Table 4-14 Summary results table for the Scheme across all ecosystem services from the NCA undertaken within this study: without BNG	36
Table 4-15 Summary results table for the Scheme across all ecosystem services from NCA undertaken within this study: with BNG	37
Table 4-16 - STS Gate 2 NC metrics	39
Table 4-17 Gate 1 and Gate 2 comparison of ecosystem service changes with and without BNG40	
Table A-1 - STT Sources SRO Gate 2 NCA developments following Gate 1 recommendations44	

Figures

Figure 1-1 - Environmental assessment integration with SRO Gates; Natural Capital Assessment requirements highlighted in red.	7
Figure 3-1 - Steps in the STT Sources SRO Gate 2 NCA	10
Figure 4-1 – Annual change in ecosystem services for each scenario (without BNG) (£2021)	38
Figure 4-2 – Annual change in ecosystem services for each scenario (with BNG) (£2021)	38
Figure 4-3 – Sensitivity analysis: change in carbon regulation value (£/year) – comparison of low, central and high values for the Climate Regulation service	39

1. Introduction

1.1. Background

This report provides a Natural Capital Assessment (NCA) of the Severn Trent Sources (STS) Strategic Resource Option (SRO) ('the Scheme') at Gate 2. The Scheme includes:

- A 15 MI/d licence transfer from Mythe Water Treatment Works (WTW) to the Severn to Thames Transfer (STT) pipeline abstraction location at Deerhurst.
- A transfer of up to 35 MI/d of final effluent from Netheridge Wastewater Treatment Works (WwTW) (approx. grid reference: SO 80891 15805) to the River Severn at Haw Bridge (approx. grid reference: SO 84595 27955). Prior to the transfer to Haw Bridge, the Netheridge WwTW final effluent receives additional treatment, including removal of ammonia using a Multi-Bed Bio Reactor (MBBR), removal of phosphorus using 'CoMag'®, and removal of selected organic compounds including phenols, perfluorooctane sulfonic acid (PFOS) and some pesticides using Ozone, Biological Aerated Flooded Filter (BAFF) and Granulated Activated Carbon (GAC).

It builds on an NCA conducted for the Scheme at Gate 1 and is based on the All Companies Working Group (ACWG) guidance for Gate 2 and the Environment Agency's final Water Resources Planning Guidance (WRPG) supplementary guidance 'Environment and Society in decision making'¹. The ACWG guidance indicates that at Gate 2 water companies must provide an NCA aligned with WRPG and Defra's Enabling a Natural Capital Approach (ENCA)² methodologies as highlighted in Figure 1-1. This assessment is to be read alongside the other environmental assessments as part of the Integrated Environmental Assessment (IEA).

Natural capital is defined by the UK Government's 25-Year Environment Plan as '*the elements of nature that either directly or indirectly provide value to people*'³. Natural capital is an economic concept recognising that nature provides benefits and value to people. It considers natural capital (habitats, species, air, soil, water, oceans, minerals and natural processes) as a stock, from which ecosystem services flow, providing valuable benefits. Natural capital has emerged as the framework of choice for gaining a better appreciation of the interlinkages between the economy and the environment and has been promoted by the Government in the 25-Year Environment Plan.

The purpose of an NCA as stated in the WRPG supplementary guidance is to '*make decisions that do not devalue and look to enhance the value of the natural world for society benefit*'. The Scheme has the potential to change natural capital stocks and therefore alter the flows of benefits (ecosystem services) they provide. NCA is not a statutory requirement but is built into the ACWG guidance and other associated WRPG guidance.

1.2. Purpose of report

The purpose of this NCA report is to provide an assessment of the potential impacts of the Scheme on natural capital and the ecosystem services it provides. The Gate 1 NCA included a list of recommendations for the Gate 2 NCA (see Appendix A). This report builds on the work undertaken for Gate 1 which generated sufficient information for an initial assessment of identified strategic solutions.

According to the ACWG guidance, at Gate 2 the NCA should support detailed feasibility, concept design and multi-solution decision making. The ACWG guidance recommends that at Gate 2 the NCA should be informed by Defra's ENCA guidance and may consider additional ecosystem services than those undertaken at Gate 1. The ACWG guidance recommends that where possible monetisation of the natural capital metrics (ecosystem services) should occur, and outputs incorporated into the cost benefit ratio as a discrete input as a single figure defined by the maximum natural capital benefit. The cost of the option will not be considered within this assessment as it is assessed as part of the engineering design. ENCA guidance and supplementary valuation databases are recommended to provide a suitable source for the information required, and the majority of input data to be used is publicly and freely available.

¹ Environment Agency (2022). Water resources planning guideline supplementary guidance – Environment and society in decision-making. External guidance: Version 2. Published 03/02/2022

² Defra (2021). Enabling a Natural Capital Approach (ENCA). Available from: <https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca>

³ Defra (2018). 25 Year Environment Plan. Available from: <https://www.gov.uk/government/publications/25-year-environment-plan>

The scope of this assessment includes the following components:

- Reviewing the outcomes of the Gate 1 NCA.
- Based on refined Scheme information available for Gate 2, establish an updated baseline of the natural capital assets and quantify how they will change with the Scheme in place.
- Qualitative and quantitative assessment of the ecosystem services that would be provided by natural capital assets, including monetary valuation of these where possible.

The NCA considers the two Scheme parts outlined above in the qualitative assessment. Where impacts are considered likely to be significant, these are taken forward for quantitative assessment and monetisation, where possible.

1.3. Structure of report

The structure of this report is as follows:

- Section 2 provides an overview of the Scheme.
- Section 3 outlines the methodology used for the NCA.
- Section 4 provides the results of the qualitative and quantitative assessment.
- Section 5 provides the conclusions of the NCA and recommendations for Gate 3.

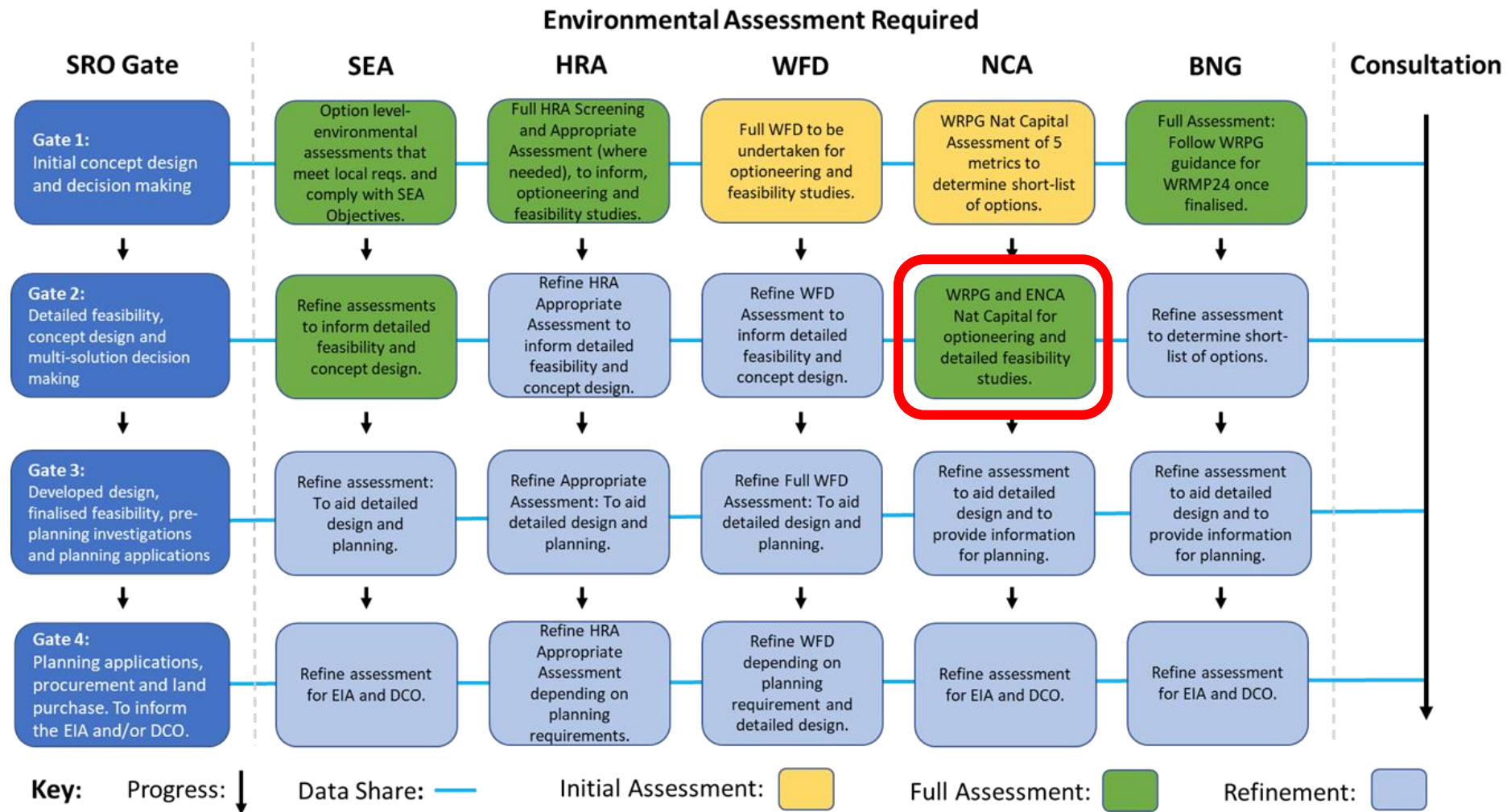


Figure 1-1 - Environmental assessment integration with SRO Gates; Natural Capital Assessment requirements highlighted in red.

2. Scheme description

A summary of the two main STS SRO components is provided in Sections 2.1 and 2.2, with the overall implications of their joint operation outlined in Section 2.3. A map of the STS SRO Scheme is available in Technical Appendix B5.B. The Scheme description provided at Gate 2 (on which Gate 2 assessments have been based) will be subject to further review in Gates 3 and 4.

2.1. Mythe WTW temporary abstraction licence transfer (15 MI/d)

This part of the Scheme provides support to the STT System from the Severn catchment by temporarily redeploying 15 MI/d of the existing STW abstraction licence at its Mythe WTW intake in the lower River Severn. When the licence transfer is in operation, this infrequently used licensed volume from Mythe would now remain in the River Severn for abstraction downstream at Deerhurst. When the licence transfer is not in use, STW will retain the 15 MI/d as usable at Mythe. STW has advised that no construction works would be required to redeploy the spare licence volume for abstraction. It is understood from STW that no specific additional resource to replace this current abstraction licence volume has been determined to date but will need replacing within the STW network prior to the transfer being made available. The Mythe WTW abstraction licence Scheme will not operate alone and will operate in-combination with the Netheridge WwTW discharge diversion to Haw Bridge, based on current utilisation assumptions from STT and may be subject to change as plans for STT develop.

2.2. Netheridge WwTW discharge diversion to Haw Bridge pipeline (35 MI/d)

Currently treated effluent from the Netheridge WwTW is discharged into the upper Severn Estuary. STS SRO proposes to divert a 35 MI/d portion of this treated discharge to a new outfall at Haw Bridge (just downstream from Deerhurst), on the freshwater River Severn to support STT abstraction at Deerhurst. The outfall location to the River Severn will be located just upstream of the level gauge at Haw Bridge. The discharge diversion from Netheridge WwTW would be pumped by a new pumping station, located at the WwTW via a 700 mm diameter pipeline approximately 18.5 km long with tunnelling under main watercourses (such as the River Severn).

The pipeline discharge to Haw Bridge will not be continuous. It will range from zero (when flows are high enough in the River Severn to support the STT transfer) to 35 MI/d when fully operational (during periods of lower flows in the River Severn). The pipeline will include nine drain-down points through which water in the pipeline is drained following completion of each operating cycle to prevent it becoming septic and posing a greater risk to the environment on start up of the next operating cycle. It is estimated that the pipeline would need to be drained within three days of completing an operation cycle to maintain sufficient water quality standards. The drain-down points will not be opened during pipeline operation. The drain-down points will be a combination of either pumped or gravity-flow outlets, set back at least 10 m from water courses with the discharge piped into rivers, small water courses and, where possible, returned to the main pipeline for gravity discharge. The locations of the drain-down points (see Technical Appendix B3.3) will be dictated by topography (at low points) and crossing points (e.g. tunnel crossings of rivers, railways, etc.). The current drain-down plans are draft only and further details for a more complete assessment are expected at Gate 3.

The Netheridge WwTW final effluent would receive additional treatment to mitigate any water quality issues.

2.3. Indicative operation of STS SRO

There are the following modes of operation. Please note the duration of the Scheme's operation is indicative at this stage and could be refined based on further modelling or changes to river flow triggers.

- Mode 1 - STT SRO sweetening flow provided by unsupported river abstraction: STS SRO is not in operation and STT is also off. There is enough water in the River Severn at Deerhurst to provide the 20 MI/d STT sweetening flow between the River Severn to the Thames, with no undesirable effects on the River Severn.
- Mode 2 - STT SRO sweetening flow provided by STS Netheridge WwTW effluent transfer at 20 MI/d: STS is 'on' but STT off. This means 20 MI/d is piped from Netheridge WwTW to Haw Bridge because STT is not working and thus only requires the sweetening flow, which the river can't provide. This mode of operation would be expected to occur 12% of the time (modelled over a 47-year period).

- Mode 3 - STT SRO water resources provided by the STS Netheridge WwTW effluent transfer at 35 MI/d: STS is 'on' and STT is 'on'. This means 35 MI/d is piped from Netheridge to Haw Bridge to allow a 35 MI/d STT abstraction. STT takes the additional 15 MI/d from Mythe WTW temporary abstraction licence transfer, so STT takes a 50 MI/d contribution from STS overall. This mode of operation would be expected to occur 16% of the time (modelled over a 47-year period).

3. Methodology

3.1. Approach

According to the ACWG⁴, an NCA at Gate 2 should support detailed feasibility, concept design and multi-solution decision making. The ACWG recommends that at Gate 2 the NCA should be informed by Defra’s ENCA guidance⁵ as well as the WRPG⁶, and may consider additional ecosystem services than those undertaken at Gate 1. The methodology applied in this NCA was therefore developed to use aspects of the “Appraisal” category of Natural Capital Approach listed in ENCA in combination for those detailed listed in the WRPG. Table 3-1 details how the approach used aligns with key guidance.

Table 3-1 - Alignment with relevant guidance

Guidance	Key applications
All Companies Working Group (ACWG) WRMP environmental assessment guidance and applicability with SROs	Use of ENCA tools where appropriate Additional ecosystem services assessed compared to WRPG ‘minimum 5’ and Gate 1 Use of ENCA services data book sources for quantification and valuation of some ecosystem services, where appropriate, e.g., air pollutant removal
Defra’s Enabling a Natural Capital Approach (ENCA) guidance	Use of the HM Treasury Greenbook 4-step approach in the qualitative assessment Use of ENCA tools where appropriate Use of ENCA services data book sources for quantification and valuation of some ecosystem services, where appropriate, e.g., air pollutant removal
Water Resources Planning Guidelines (WRPG) and Supplementary Guidance (SG) Environment and Society in Decision Making	Assessment of the ‘minimum’ five ecosystem services (in addition to others considered relevant as explained below) Application of ‘minimum’ and where appropriate ‘best practice’ approaches

The stages of the STT Sources SRO Gate 2 NCA consists of six steps, as illustrated in Figure 2-1:

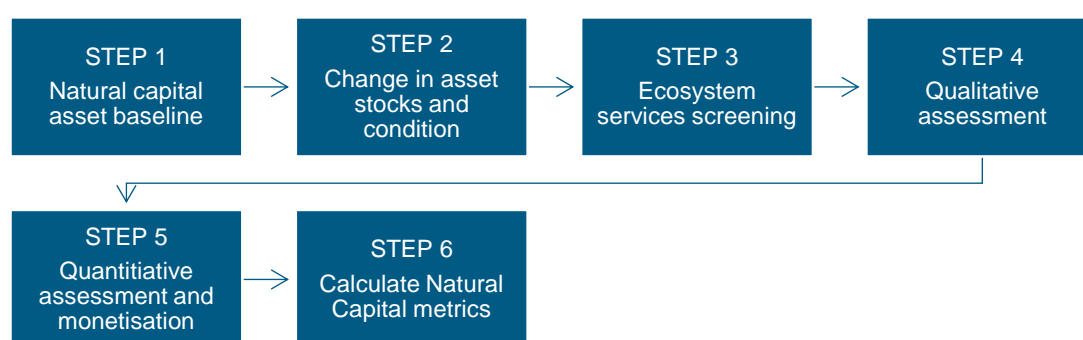


Figure 3-1 - Steps in the STT Sources SRO Gate 2 NCA

⁴ All Companies Working Group (ACWG) - WRMP environmental assessment guidance and applicability with SROs (October 2020), Mott Macdonald

⁵ <https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca>

⁶ <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline>

3.2. Scenarios assessed

The scenarios used for the NCA reflect the assessment of biodiversity impacts and Biodiversity Net Gain (BNG) undertaken for Gate 2, as documented in Technical Annex B6 (Biodiversity Net Gain Assessment). For the purposes of clarity, the principles behind the BNG approach are summarised below. Steps 1 and 2 below were undertaken as part of the BNG assessment and these are also summarised below in Sections 3.3 and 3.4 in order to provide a clear summary of the overall methodology used for the NCA.

BNG is an approach that aims to leave the natural environment in a measurably better state than beforehand. The British Standard BS 8683:2021⁷ defines BNG as a:

“a specific, quantifiable outcome from project activities that deliver demonstrable benefits for biodiversity compared to the baseline situation.”

Natural England’s Biodiversity Metric 3.0 provides a way of measuring and accounting for biodiversity losses and gains resulting from development or land management change⁸.

Whilst BNG is not currently mandatory, it will become a legal requirement for development once the appropriate provisions of the Environment Act 2021, in relation to nature and biodiversity, come into force. Schedule 14 of the Act makes provisions for planning permission granted in England to be subject to a condition to secure that the biodiversity gain objective is met and that the biodiversity value attributable to the development exceeds the pre-development biodiversity value of the onsite habitat by at least the relevant percentage, which is 10%.

Delivering net gain for the environment has also become a recent planning policy requirement. The National Planning Policy Framework (NPPF)⁹ emphasises the importance of protecting and enhancing the natural environment. The NPPF approach to BNG is set out in Paragraph 179b, which is to:

“Promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.”

Within the BNG assessment undertaken at Gate 2 for the Scheme (see Technical Annex B6 (Biodiversity Net Gain Assessment)), the biodiversity gains and losses resulting from implementation of the Scheme are calculated. The BNG assessment goes on to outline examples of how net habitat and hedgerow and river unit losses, respectively, could be offset through off-site habitat interventions to achieve no net loss and 10% net gain. These two scenarios have therefore been reflected in the NCA through an assessment of the baseline and two post-scheme scenarios:

- **Post-Scheme - without BNG:** this scenario represents the impacts of scheme construction without implementation of any off-site habitat interventions to mitigate habitat loss.
- **Post-Scheme with off-site habitat creation to deliver 10% BNG:** this scenario sets out habitat interventions that could be delivered to achieve a 10% BNG.

Four sets of results are provided within the next section to reflect these two scenarios. Further explanation of these is provided in Table 3-2 below.

Table 3-2 - Scenarios assessed

Scenario	Description
Baseline	This scenario represents the baseline natural capital assets and value of ecosystem services delivered by these assets within the Scheme red line boundary, which includes the pipeline route and WwTW expansion land area.

⁷ The British Standards Institution 2021. BS 8683:2021 Process for designing and implementing Biodiversity Net Gain – Specification. BSI Standards Limited 2021.

⁸ Stephen Panks, Nick White, Amanda Newsome, Jack Potter, Matt Heydon, Edward Mayhew, Maria Alvarez, Trudy Russell, Sarah J. Scott, Max Heaven, Sarah H. Scott, Jo Treweek, Bill Butcher and Dave Stone (2021). Biodiversity metric 3.0: Auditing and accounting for biodiversity – User Guide. Natural England.

⁹ Ministry of Housing, Communities & Local Government. National Planning Policy Framework. MHCLG, July 2021.

Scenario	Description
Baseline + 90.3ha cropland off-site	This scenario represents the baseline natural capital assets and value of ecosystem services delivered by these assets within the Scheme red line boundary, plus the river and hedgerow enhancements and 90.3ha off-site cropland that was identified within the BNG assessment as providing the potential to be used for off-site habitat interventions to deliver 10% BNG. The location of this off-site area has not been determined as part of Gate 2.
Post-Scheme (without BNG)	This scenario represents the natural capital assets and value of ecosystem services delivered by these assets within the Scheme red line boundary following construction of the Scheme, without any off-site habitat creation to deliver BNG.
Post-Scheme + 10% off-site BNG scenario	This scenario represents the natural capital assets and value of ecosystem services delivered by these assets within the Scheme red line boundary following construction of the Scheme, plus the river and hedgerow enhancements and 90.3ha off-site area that was identified within the BNG assessment as providing the potential to be used for off-site habitat interventions to deliver 10% BNG. In this scenario, cropland has been converted predominantly to grassland, woodland and mixed scrub and up to 2.1 km river length is enhanced. The location of these off-site areas has not been determined as part of Gate 2.

3.3. Step 1: Natural capital asset baseline

3.3.1. Development of scheme boundary in GIS

As outlined above, Steps 1 and 2 were undertaken as part of the BNG assessment and these are summarised here in order to provide a clear summary of the overall methodology used for the NCA. Further information is provided in Technical Annex B6 (Biodiversity Net Gain Assessment).

To generate the Scheme red line boundary, the pipeline construction corridor was generated by Ricardo using GIS based on designs produced by WSP. The working width of the corridor is 40 m, which includes 20 m buffer either side of the pipeline and reduces to 20 m (10 m buffer either side of the pipeline) at sensitive ecological features, as advised by WSP. Compared to Gate 1, the Gate 2 assessment now also includes land at the Netheridge Wastewater Treatment Works (WwTW) and additional connecting pipework, which link the treatment works extension to the extent of habitat assessment undertaken in Gate 1. Both the pipeline route and the WwTW footprint have been used for assessment at Gate 2 and form part of the Scheme's indicative site boundary.

3.3.2. Baseline habitat prediction

The majority of the baseline habitat data used was received from Ricardo, who have developed a tool that predicts baseline habitats based on open-source data. The opensource data used by Ricardo are as follows:

- National Forest Inventory;
- Ordnance Survey (OS) Zoomstack Surface Water;
- Priority Habitats Inventory (PHI);
- OS Zoomstack Greenspace;
- Copernicus (CORINE) High Res Grassland;
- Copernicus (CORINE) High Res Urban; and
- CORINE Land Cover (CLC) 2018.

Ricardo refined their predictions (including assumed condition assessment scores) by using information gathered on habitat type and condition during a limited number of walkover surveys undertaken in summer 2021¹⁰.

¹⁰ Further information on these surveys can be found in the following reports: STT-G2-S3-109-Protected Habitats Evidence; STT-G2-S3-123-Protected Species Evidence.

Once the output of Ricardo's tool was received, the output was translated (where required¹¹) to the habitat types used in the Biodiversity Metric (which are largely based on the UK Habitat Classification¹²) using professional judgement. For some areas, baseline habitats were manually predicted based on aerial imagery and using professional judgement.

The OS Open Rivers¹³ dataset was used to identify watercourses that were crossed by the pipeline. Those that were not captured in the OS Open Rivers data were manually digitised from aerial imagery. None were identified as Priority River Habitats¹⁴.

All habitat data has been processed using GIS. As part of the BNG assessment, GIS was used to calculate the areas of each habitat type or lengths of hedgerow or watercourse within Scheme indicative site boundary, which were further broken down by condition score to give the overall area or length of each habitat type of each condition score.

The habitat categories used for the BNG assessment were then mapped to the relevant habitat categories for each of the ecosystem services included in the assessment, and to the ENCA eight broad asset types. The ENCA broad habitats noted in the Scheme area are:

- Urban
- Enclosed farmland
- Mountains, moors and heath
- Woodland
- Semi-natural grassland

3.4. Step 2: Change in asset stocks and condition

3.4.1. Post-scheme habitat prediction

There are three areas of assumed permanent habitat area loss within and adjacent to the Netheridge WwTW as determined within the BNG assessment. The pipeline outfall at Haw Bridge also creates a permanent loss of river habitat as it will result in modifications to the riverbank potentially causing a decline in condition which is represented in Biodiversity Metric 3.0 as a loss of river habitat. These areas of proposed permanent loss and built development were calculated using GIS.

It has been assumed that all of the remaining habitats and hedgerows within the Scheme indicative site boundary will be lost, as a result of the Scheme construction, with the majority then being reinstated to the same condition as they were previously, except where:

- Baseline habitats are currently in good condition where it has been assumed they will be reinstated to moderate condition. This is a precautionary assumption considering the higher level of management generally required to achieve and maintain the target of good condition habitat.
- Baseline habitats are restored in the same location within two years.

Further information on the post-scheme habitat prediction approach is provided in the accompanying BNG report (Technical Annex B6 (Biodiversity Net Gain Assessment)).

3.4.2. Post-scheme with BNG scenario

Following the BNG assessment of the habitat losses resulting from the Scheme, an additional scenario was created as part of the BNG assessment which sets out how 10% net gain could be achieved through off-site interventions. For the habitat area interventions, main scenario developed takes BNG trading rules into account and assumed all units would be delivered through habitat creation on **90.3ha** of land supporting cereal crops and **0.6 km** hedgerows. This achieves a BNG of **10.13%** for habitat units and **10.33%** for hedgerow units.

¹¹ Translation was not required for some habitats as they already directly translate to a Metric 3.0 habitat type, e.g., Lowland meadows.

¹² Butcher, B., Carey, P., Edmonds, R., Norton, L. and Treweek, J. (2020). UK Habitat Classification V1.1. Available at: <http://ukhab.org>

¹³ Ordnance Survey Open Rivers. Available at: <https://www.ordnancesurvey.co.uk/business-government/products/open-map-rivers>

¹⁴ Natural England (2021) Priority River Habitats. Available via: <https://data.gov.uk/dataset/20019cdb-9fef-4024-81af-daf1d1b74762/priority-river-habitat-rivers>

To achieve $\geq 10\%$ BNG for river habitats, off-site mitigation has also been identified as being required. If **2.1 km** of river is enhanced by 1 condition category off-site but within the same WFD water bodies as those where watercourses are lost, **+12.44%** net gain can be achieved for rivers and streams.

Alternatively, if the watercourses undergoing open cutting were enhanced by 1 condition category whilst they were reinstated, BNG on-site would be +5.9%. Only **0.2 km** of off-site enhancement would be required within the same WFD water bodies to achieve **+11.30%**.

Further information is provided in the accompanying BNG report (Technical Annex B6 (Biodiversity Net Gain Assessment)).

3.5. Step 3: Ecosystem services screening

Natural capital assets deliver valuable benefits to people through flows of ecosystem services. The ACWG guidance specifies that a NCA should consider the minimum five ecosystem services set out in the WRPG Supplementary Guidance (SG) (definitions accord with WRPG SG usage):

- **Biodiversity and Habitat:** biodiversity acts as a supporting service, underlying the provisioning of many other ecosystem services.
- **Climate Regulation (carbon storage):** the capture and secure storage of carbon [by natural capital assets] that would otherwise be emitted to, or remain, in the atmosphere (in addition to construction and operational carbon).
- **Natural Hazard (flood and drought) Regulation:** different habitat types have intrinsic flood risk management values by intercepting, storing and slowing water flows, and mitigate impacts of drought or improve drought resilience.
- **Water Purification:** the treatment service of natural capital assets, i.e., an asset that intercepts, removes or stores pollutants.
- **Water Regulation:** value of the benefit of the water to customers, current and future abstractors, as well as the value of leaving the water in the environment (note: this usage corresponds to description of the “water supply” as a provisioning service in ENCA (Defra, 2020), rather than the “water flow regulation” used in ENCA or National Ecosystem Assessment (NEA, 2011)).

The WRPG SG states that it should be considered whether a NCA should go beyond the minimum five services noted above. The STS SRO Gate 1 NCA assessed two additional ecosystem services:

- **Air Pollutant Removal:** by improving air quality, vegetation helps to lessen these impacts on health and wellbeing, resulting in lower health costs. This service was included at Gate 1 because it was a required assessment within the Water Resources South East (WRSE) guidance.
- **Recreation:** the recreational value of natural spaces reflects both the natural setting and the facilities on offer at the site and varies with the type of habitat, location, population density and the availability of substitute recreational opportunities. This service was included at Gate 1 to “*provide a more holistic view of natural and associated social capital*”. Recreation was also required assessment within the WRSE guidance.

Both services have also been scoped in for the Gate 2 NCA as it is considered that the Scheme has the potential to affect flows of these two ecosystem services. This Gate 2 NCA has considered an additional ecosystem service due to the presence of land used for agriculture within the site boundary:

- **Food Production:** food in its various forms is produced by a range of ecosystems. This is a recognised service within the ENCA guidance and other ecosystem services frameworks.

Table 3-3 shows how the Gate 2 NCA ecosystem services assessed (column in the left) correspond to the WRPG SG five minimum ecosystem services (column on the right).

Table 3-3 – Mapping of services assessed for Gate 2 to WRPG

Gate 2 ecosystem services assessed	WRPG SG five minimum ecosystem services
Biodiversity	Biodiversity and Habitat
Water regulation (supply)	Water Regulation
Carbon sequestration	Climate Regulation (Carbon Storage)
Air quality	<i>Not included</i>
Water purification	Water Purification
Natural hazard regulation	Natural Hazard (Flood and Drought) Regulation
Recreation & Tourism	<i>Not included</i>
Food Production	<i>Not included</i>

3.6. Step 4: Qualitative assessment

The NCA considers the two parts of the scheme within the qualitative assessment and their relevant components:

1. Mythe Licence Transfer (15 MI/day)
2. Netheridge Transfer (35 MI/day)
 - a. Netheridge WwTW advanced treatment
 - b. Netheridge to Haw Bridge pipeline construction inc. WwTW expansion
 - c. Diverted effluent at Haw Bridge

The qualitative assessment follows the HM Treasury Green Book 4-Step Natural Capital Assessment initial assessment of the natural capital effects of a project or policy (Section 3.4 of the document: "Enabling a Natural Capital Approach: Guidance")¹⁵. This Excel template used for carrying out Green Book 4-Step Natural Capital Assessment is version: August 2021.

Each of the selected ecosystem services has been assessed qualitatively for the STS SRO scheme in accordance with the WRPG SG. This is based on the Gate 1 SEA results and the natural capital asset register developed in the first stage of the NCA. The purpose of the qualitative assessment is to support the quantitative assessment and interpret the results of monetisation. A qualitative assessment of significance has been assigned to help determine which selected services could be significantly improved or diminished under each option. Where considered inappropriate or not possible for services to be quantified or monetised at Gate 2, this qualitative score can be used.

3.7. Step 5: Quantitative assessment and monetisation

The ecosystem services selected for assessment were quantified and (where possible) monetised for the Scheme. For the Netheridge to Haw Bridge pipeline construction and WwTW expansion components of the Scheme, this was based on the asset quantity indicator (area in hectares) calculated in the asset register. Ecosystem services flows and values have therefore been quantified based on the change in area for each asset type, if applicable. This aligns with the ACWG guidance and the ENCA guidance approach.

Since the Gate 2 WFD and HRA assessments for the Mythe Transfer component of the Scheme concluded that there is unlikely to be a significant impact on water quality and flows and this component does not result in any land use change, this part of the Scheme was scoped out of the quantitative assessment.

In accordance with best practice, valuation databases listed within the WRPG SG list of suitable datasets have been used to monetise these services. The sources of the monetary values are reported, and it is highlighted and justified where these deviate from the WRPG SG, ACWG guidance and Gate 1 assessment. Sensitivity

¹⁵ Defra (2021). Enabling a Natural Capital Approach (ENCA). Available from: <https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca>

analysis was completed using lower and upper annual values for the Carbon ecosystem services only due to missing data for other services.

Where relevant all values are provided in 2021 price levels to ensure comparability between the baseline and post-construction and are calculated on a “per year £ value” rather than total across the scheme lifetime. To ensure values are representative against the most up-to-date prices, monetary values were converted using the most recent government GDP deflators (UK Government, 2022)¹⁶.

The detailed methods used in the quantitative assessment and valuation for each ecosystem service are discussed Table 3-4 below, including alignment with relevant guidance. For all services, a value transfer approach was used, whereby values from existing economic evidence were applied to the present study. This approach is commonly used where resources do not allow use of primary valuation approaches and where such an approach would not be proportionate. However, it is important to acknowledge key limitations and assumptions associated with this approach. These are summarised below in Section 3.9.

Appendix A sets out the recommendations for the Gate 2 NCA that were identified at Gate 1 and how these have been considered and implemented.

Table 3-4 – Summary methodologies for each ecosystem service, and comparison with guidance and Gate 1 approach

Ecosystem service	Quantification and valuation approach ¹⁷	Alignment with relevant guidance	Alignment with Gate 1 approach
Biodiversity	Please refer to the BNG assessment and report.		Biodiversity also assessed using the Biodiversity Metric.
Water regulation (Supply)	The approach follows the WRPG SG recommended best practice approach to quantify the change in water resources provision generated by the Scheme and monetise this using the ONS resource rent value of £0.38/m ³ (2019 price levels). However, as per the guidance, this is not included in the overall results as it is advised that this is not used for decision making. The results of the STS Gate 1 Water Framework Directive Assessment (Technical Annex B3) are used to inform the qualitative assessment of the impact on water resources provision on other existing and future users and businesses.		Water Regulation was screened out of Gate 1 to avoid double counting because the main benefit of the STS SRO is considered to be deployable output rather than this being an additional natural capital benefit. For Gate 2, the decision was taken to assess this to ensure alignment with best practice for the service according to the WRPG SG. As the impact is not included in the overall results, the risk of double counting is considered mitigated.
Climate regulation (carbon storage and sequestration)	Carbon sequestration rates have been taken from the Environment Agency WRPG SG (from JBA Consulting) ¹⁸ , as shown in Table 3-5. The WRPG SG was used to provide a clearer assessment of the variation of the carbon sequestration rates among various habitats than the ENCA Service Databook provides. The sequestration rates were used to calculate the amount of carbon sequestered both pre-and post-scheme. These	The approach aligns with the WRPG SG as the carbon sequestration rates used are those provided in the guidance.	Same approach as Gate 1, although carbon £ values were based on older Government values (non-traded price of carbon) as the latest BEIS carbon values had not been published at the time of the assessment.

¹⁶ <https://www.gov.uk/government/statistics/gdp-deflators-at-market-prices-and-money-gdp-march-2022-spring-statement>

¹⁷ All values are in 2021 price levels using the most recent government GDP deflators (UK Government, 2022)

¹⁸ Table 7 of the EA Supplementary Guidance: Environment and Society in Decision-Making (2020).

Ecosystem service	Quantification and valuation approach ¹⁷	Alignment with relevant guidance	Alignment with Gate 1 approach
	<p>values were combined with the 2045 carbon £ values per tonne of CO₂e taken from the Department for Business, Energy & Industrial Strategy's (BEIS) Valuation of greenhouse gas emissions guidance¹⁹, published September 2021 (Table 3-6).</p> <p>The 2045 values have been selected for use as this is most likely the year that construction will be completed based on current information. As carbon values are projected to increase into the future, it was considered important not to underestimate the carbon impacts of the scheme.</p> <p>Note that the Climate Regulation service is the only ecosystem service in this quantitative assessment that provides low, central and high values and, as such, the Climate Regulation service forms the basis of the sensitivity analysis.</p>		
Air quality	<p>Values provided by the ENCA Services Databook (Table 3-7) were used to convert land cover types, including rural woodland, into estimates of monetary values of annual pollutant absorption.</p>	<p>A method is not specified for this service in the WRPG SG or ACWG. Therefore, values from the ENCA data book have been used.</p>	<p>Gate 1 used values from the ENCA service data book; however, Gate 1 only assessed areas within the zone of influence (Zol) intersecting with Air Quality Management Areas (AQMAs). In Gate 2, this service has been quantified for all land within the Scheme boundary because the site is close to a built up area (Gloucester).</p>
Water purification	<p>Gate 2 provides no quantification and monetisation of water services as the Natural Environment Valuation Online (NEVO) tool recommended within the WRPG SG is not suitable to use for site scale as it provides limited spatial resolution at a 2 km² grid scale. No other suitable tools were identified for the Gate 2 NCA that could provide suitably robust</p>	<p>The WRPG does not require the monetisation of Water Purification Services.</p> <p>The WRPG SG refers to the use of the NEVO tool; however, it specifies any appropriate tool can be used as long as</p>	<p>The Gate 1 NCA undertook a qualitative and quantitative rather than a monetised assessment of this service based on habitat data, WFD status information from the EA's Catchment Explorer and outputs at the river basin scale from the NEVO tool. Values at the site scale were not assessed.</p>

¹⁹ Available from: <https://www.gov.uk/government/publications/valuing-greenhouse-gas-emissions-in-policy-appraisal/valuation-of-greenhouse-gas-emissions-for-policy-appraisal-and-evaluation>

Ecosystem service	Quantification and valuation approach ¹⁷	Alignment with relevant guidance	Alignment with Gate 1 approach
	<p>estimates of the water purification natural capital impacts of land use change at the spatial resolution required. This service is therefore considered qualitatively within the assessment.</p>	<p>the approach taken is justified.</p>	
<p>Natural hazard regulation</p>	<p>Values from the WRPG SG (Table 3-8 below) were used to convert land cover types into estimates of monetary values of natural hazard (flood) regulation.</p> <p>The WRPG SG was used to provide a clearer assessment of the variation of flood benefits among various habitats than the ENCA Service Databook provides.</p> <p>Note, an annual monetary value was only derived for the flood regulating services of woodland, semi-natural grassland, and wetland/floodplain assets. Note that this an approximation based on habitat type only and is NOT based on the Flood Hazard Research Centre's (FHRC) Multi-Coloured Manual.</p>	<p>This approach is fully aligned with the WRPG SG methodology.</p>	<p>Gate 1 used values from the ENCA Services Databook for woodland and wetlands/floodplains habitats, and additional studies²⁰ for semi-natural grassland habitats.</p>
<p>Recreation & tourism</p>	<p>The Outdoor Recreation Valuation Tool (ORVal)²¹ was used to estimate recreation demand (the welfare value and number of visitors) impacted by the pipeline construction in the ZoI. A proportional approach was taken to calculate demand dependent on the area/length of a park/path impacted by the pipeline. The total welfare value and visitor numbers of a park/path were reduced in proportion to the area/length impacted. The ORVal values were uplifted from 2018 to 2021. However, one limitation of the tool is that it is unable to account for additional or lost</p>	<p>The WRPG SG suggests using ORVal.</p>	<p>The ORVal tool was also used in Gate 1.</p>

²⁰ [REDACTED]
2011. Economic Valuation of the Benefits of Ecosystem Services delivered by the UK Biodiversity Action Plan. Report to Defra, London: Aberystwyth University.

²¹ <https://www.leep.exeter.ac.uk/orval/>

Ecosystem service	Quantification and valuation approach ¹⁷	Alignment with relevant guidance	Alignment with Gate 1 approach
	<p>visitor numbers, i.e., temporary construction impact.</p> <p>It was not possible to quantify or monetise the impacts of the off-site habitat creation scenario because the location of the site is not determined at the present time.</p>		
Food production	<p>The net profit per hectare, assumed to be broadly equivalent to the resource rent of different crop types and grazing land was calculated based on cost and income data included in the Defra Farmscoper tool (Table 3-9).</p> <p>It was assumed that grassland has agricultural value for grazing, most likely for dairy, beef and sheep. The average resource rent for multiple cereal crops was used in the assessment.</p>	<p>This method aligns with the ENCA guidance as Farmscoper is included as a recognised tool within ENCA. Use of a resource rent approach is also recognised as an appropriate method within the ENCA data book for Food production.</p> <p>A method is not specified for this service in the WRPB SG or ACWG.</p>	Not included in Gate 1 approach.

Table 3-5 - Carbon sequestration of land use from EA WRPB Supplementary Guidance

Land Use type	C sequestration rate (t/CO ₂ e/ha/yr)
Woodland (deciduous)	4.97
Woodland (coniferous)	12.66
Arable land	0.11
Pastoral land	0.40
Peatland - Undamaged	4.11
Peatland - Overgrazed	-0.10
Peatland - Rotationally burnt	-3.66
Peatland - Extracted	-4.87
Grassland	0.40
Heathland/Shrub	0.70
Saltmarsh	5.19
Urban	0.00
Green urban	0.40

Table 3-6 – Department for Business, Energy and Industrial Strategy (BEIS) Carbon 2045 values per tonne¹⁹

Value	Value (£/tonne - £2021)
Low	178
Central	355
High	533

Table 3-7 – ENCA data book air quality values by habitat type²²

ENCA Air Quality Habitat Types	Value (£/ha - £2021)
Urban woodland	934
Rural woodland	297
Urban grassland	181
Enclosed farmland	17
Coastal margins	32

Table 3-8 – WRPG natural hazard regulation values by habitat type

Broad Habitat Type (Natural Hazard Regulation)	Value (£/ha - £2021)
Woodland	125.58
Semi-natural grasslands	210.67

Table 3-9 – Food provisioning values calculated using Defra Farmscoper library

Crop type	Estimated resource rent/ha (£2015)	Average resource rent (£/ha - £2021)
Winter wheat	857	813
Winter barley	674	
Spring barley	676	
Winter OSR	838	
Maize	1,019	
Orchards	9,275	9,275
Grassland (assumed to be grazing)	381	443

3.8. Step 6: Translation to Natural Capital metrics

In translating the results of this study into Gate 2 NC metrics, it is important to recognise that there are both benefits and disbenefits associated with the Scheme due to differences in the direction of change for individual ecosystem services. It is important to recognise this in decision making and informing further development of the Scheme because trading off benefits against disbenefits of one service against another might not be appropriate in all circumstances. For the Scheme, three metrics have therefore been generated by this assessment:

- Total disbenefit: sum of services with negative change values (baseline versus post-scheme).
- Total benefit: sum of services with positive change values (baseline versus post-scheme),

²² <https://data.gov.uk/dataset/3930b9ca-26c3-489f-900f-6b9eec2602c6/enabling-a-natural-capital-approach>

- Net benefit: overall change in value across all services.

It is recommended that both the disbenefits and benefits are recognised in investment decision making. Note that these values are for the operational period of the Scheme only, with the natural capital value during construction assumed to be zero. This because of a lack of data showing projections for land use change over the construction period. For a qualitative assessment of construction impacts the SEA should be consulted.

3.9. Limitations and assumptions

The assessment is a high-level appraisal of the potential ecosystem services impacts of the Scheme. It uses the data available for the Scheme, combined with secondary datasets. The figures generated should be considered as indicative only, representing an order of magnitude level of accuracy. Other key limitations are as follows:

- The results are based on value transfer approach, typically using national values, rather than primary valuation studies or locally specific values due to data availability, so should therefore be considered as indicative.
- Not all ecosystem service benefits have been or can be quantified and monetised, meaning the results of the benefits assessment are best considered as a conservative estimate and likely to increase if additional, more detailed assessments are undertaken (e.g., for recreation and tourism).
- For the purposes of the study, single average annual pre- and post-scheme values have been calculated. In reality, habitats and their associated quality and ecosystem services will change over time.
- All impacts have been calculated to reflect the period when the Scheme is operating. A detailed assessment of impacts during construction was outside the scope of the NCA but is considered within the Strategic Environmental Assessment for Gate 2 (Technical Annex B1).
- The negative environmental externalities arising from agricultural activity (including water pollution, air pollution and carbon) have not been included in the assessment as these do not form part of the natural capital framework included under the WRPG, although they are acknowledged in ENCA.

Key assumptions include the following:

- As described in Section 3.4 above, as part of the BNG assessment and NCA, it was assumed that except where habitat is permanently lost due to expansion of the WwTW, all of the remaining habitats, including rivers, other watercourses and hedgerows within the Scheme indicative site boundary will be lost and then reinstated to the same condition as they were previously, except where:
 - Baseline habitats are currently in good condition where it has been assumed they will be reinstated to moderate condition. This is a precautionary assumption considering the higher level of management generally required to achieve and maintain the target of good condition habitat.
 - Baseline habitats are restored in the same location within two years (in this case habitat is recorded as 'retained').
- As part of the BNG assessment and NCA, no operational impacts to terrestrial habitats are assumed. The operational impact of the Scheme on rivers is assumed to be a small reduction in flows downstream of Haw Bridge.
- 'Other neutral grassland', 'modified grassland' and 'Coastal and Floodplain Grazing Marsh (CFGM)' is assumed to be used for grazing and therefore have a food provisioning value under this ecosystem service.

4. Assessment outcomes

4.1. Natural capital baseline (asset register)

The majority of land within the Scheme indicative site boundary is categorised as semi-natural grassland: this is the largest stock by land area (68%). The second largest area consists of enclosed farmland (26%). The full breakdown of assets for the area of construction is detailed in Table 4-1 by ENCA broad habitat classification. Table 4-2 provides a summary of baseline land condition from the BNG assessment; this shows that the vast majority of baseline land is in moderate condition, with a small amount of grassland (3%) in poor condition and a small amount of woodland and forest (2%) in good condition.

Table 4-1 – Baseline land cover areas within the Scheme indicative site boundary for the eight ENCA broad habitat classifications

ENCA Eight Broad Habitats	Baseline land cover within Scheme indicative site boundary (ha)	Baseline percentage (%)	Baseline + 90.3ha cropland off-site land cover (ha)	Baseline + 90.3ha cropland off-site land cover percentage (%)
Urban	0.6	1.5	0.6	0.5
Enclosed farmland	10.8	26.3	101.1	76.9
Mountains, moors and heath	0.8	1.9	0.8	0.6
Woodland	1.0	2.3	1.0	0.7
Semi-natural grassland	28.0	68.0	28.0	21.3
Total	41.3	100.0	131.5	100.0

Table 4-2 – Baseline land condition based on BNG assessment

Broad habitat (BNG metric)	% Poor	% Moderate	% Good
Urban	N/A	N/A	N/A
Cropland	N/A	N/A	N/A
Grassland	3%	97%	0%
Heathland and shrub	0%	100%	0%
Woodland and forest	0%	98%	2%

4.2. Change in natural capital assets

Table 4-3 and Table 4-4 below provide the asset register for the two post-scheme scenarios. In Table 4-3 it can be seen that there is a small increase in urban land cover due to expansion of the WwTW, also resulting in a small decrease in woodland and semi-natural grassland area. All restored habitat following scheme construction is assumed to be in Moderate condition.

In Table 4-4 it can be seen that there is a significant reduction in enclosed farmland due to the off-site habitat creation, a significant increase in mountains, moors and heath (more specifically, this will be mixed scrub), a small increase in woodland and a small increase in urban land cover due to expansion of the WwTW. Under this scenario, all restored and new habitat created is assumed to be in moderate condition.

Table 4-3 – Summary asset register for baseline and post-construction land cover areas and conditions (without BNG)

Habitat (ENCA)	Baseline land cover (ha)	Post-scheme land cover (ha)	Change in land cover (ha)
Urban	0.6	2.5	+1.8
Enclosed farmland	10.8	10.8	0.0
Mountains, moors and heath	0.8	0.8	0.0
Woodland	1.0	0.3	-0.6
Semi-natural grassland	28.0	26.8	-1.2
Totals	41.3	41.3	-

Table 4-4 – Summary asset register for baseline and post-construction land cover areas and conditions (with BNG)

Habitat (ENCA)	Baseline + 90.3ha cropland off-site land cover (ha)	Post-scheme land cover with off-site BNG (ha)	Change in land cover (ha)
Urban	0.6	2.5	+1.8
Enclosed farmland	101.1	11.0	-90.1
Mountains, moors and heath	0.8	32.6	+31.8
Woodland	1.0	6.5	+5.5
Semi-natural grassland	28.0	79.0	+51.0
Totals	131.5	131.6	-

4.3. Qualitative assessment

Table 4-5 presents the results of a qualitative assessment of the Scheme for each individual ecosystem service without BNG mitigation and Table 4-6 presents the assessment with BNG mitigation. The scoring criteria are based on SEA criteria scoring matrices currently being used for water resources planning at a regional level; see Appendix B for details on the scoring criteria. The changes are assessed for the period in which the new assets have had time to become fully established; following BNG guidance, this is assumed to be two years after construction is complete. Further information on construction impacts is provided in the accompanying SEA report.

Table 4-5 – Qualitative assessment results by service (without BNG mitigation)

Services / benefits / impacts ²³	Potential impact of the Scheme on the ecosystem service	Identify any groups affected	Can the effect be monetised?	Commentary
Biodiversity	Moderate negative impact	Local communities, local councils, national government, local and national environmental Non-Government Organisations (NGOs)	No – not recommended within the WRPG. Quantified within the BNG assessment.	The BNG assessment for the Scheme has concluded a significant net loss of habitat units, including both hedgerow units and river units as a result of the Scheme. This is based on the route option provided for the Gate 2 assessment including its connection to Netheridge WwTW, and an expansion of Netheridge WwTW to accommodate additional tertiary treatment. The BNG assessment notes that part of the route is through Alney Island Local Nature Reserve (LNR) and recommends that this ‘lowland meadow’ area should be a priority for field survey to confirm its status, and for design review to see if it can be protected. It is understood that losses have been reduced through design by following the route of a historic train / tram line through the reserve, and that detailed design should continue to seek to minimise losses.
Water regulation (supply)	Major positive impact	Businesses, communities and local councils in London (as the increased supply will be transferred to the River Thames via the Severn Thames Transfer pipeline), Thames Water, ST Water and other water companies.	Yes – although the WRPG recommends that this isn’t used for decision making purposes.	The Scheme is currently estimated to deliver an additional deployable output (DO) in water supply of up to 50 MI/d for abstraction, representing a positive change in provision of this service for customers in the Thames region. We note, however, that the expected DO benefit is still to be quantified following DO modelling. Considering the provision of this service for other abstractors (current and future), the Gate 2 WFD assessment indicates that overall, there will be a minor percentage reduction in flows during operation

²³ The services listed below only focus on those screened for this Gate 2 assessment and align with the ENCA template.

				<p>of the Scheme in the lowermost River Severn. This indicates that the majority of the value of water left in the environment will be maintained, therefore enabling provision of this service to other abstractors.</p> <p>Any further risks to abstractors will be considered as part of the STT SRO.</p>
Climate regulation (carbon storage and sequestration)	Minor negative impact	National government, the global community.	Yes	Loss of grassland and woodland due to expansion of the WwTW is likely to result in a reduction in carbon sequestration by these habitats.
Air quality	Minor negative impact	Local businesses and communities, local councils, NHS.	Yes	Loss of grassland and woodland due to expansion of the WwTW is likely to result in a reduction in air quality regulation by these habitats. This could result in a minor reduction in this service to local built-up areas including Gloucester.
Water purification (quality)	Neutral	Local businesses and communities, local councils, water companies.	No	Loss of grassland and woodland due to expansion of the WwTW is likely to result in a reduction in water purification services by these habitats, although the area of impact is relatively small, so impacts are not considered to be material. However, modelling undertaken as part of the Gate 2 Habitats Regulation Assessment has also indicated an overall net reduction in inputs of nitrate to the River Severn Estuary due to operation of the scheme. This is as a result of the enhanced treatment of wastewater that would normally be discharged to the estuary. The overall impact of the Scheme on water purification services is therefore considered to be neutral.
Natural hazard regulation	Minor negative impact	Local businesses and communities, local councils.	Yes	<p>Based on an overall reduction in woodland and grassland habitat area, the Scheme has the potential to negatively impact natural hazard regulation in the Scheme area.</p> <p>It should also be noted that the Scheme is part of an overall strategy to transfer water from the north of England to alleviate water stress in the south east. However, potential impacts on regional water stress</p>

				<p>from the Scheme will be considered as part of the regional planning process, so the qualitative assessment reflects flood regulation impacts only.</p> <p>We also note that the WRPG decision-making guidance states that "<i>Drought is a factor of major importance in water resource management planning. However, no common approaches to assessing the value of natural capital assets in mitigating against the risk of drought which were applicable to a UK context were found.</i>" Therefore, quantification of the drought regulation impacts of the changes in natural capital assets associated with the Scheme is challenging due to current data limitations.</p>
Recreation & tourism	Neutral	Local businesses and communities, tourists, local councils.	Yes	<p>The habitat along the pipeline route is assumed to be restored, including river habitats, and therefore no long-term impact on recreation from this part of the scheme is assumed, although short-term disruption could be significant during construction. The expansion of the WwTW results in the loss of a proportion of public footpaths, but this assessment recommends and assumes this footpath be reinstated²⁴ to prevent reduced recreational activity in this area over the long-term.</p>
Food production	Minor negative impact	Local businesses and communities, agriculture businesses.	Yes	<p>Cropland is maintained, with a minor reduction in grassland due to expansion of the WwTW. The Scheme therefore has potential to result in a minor reduction to food provisioning services, although short-term disruption during construction could be significant at certain locations.</p>

²⁴ Personal communication between [REDACTED] 10th June 2022, 09:09.

Table 4-6 – Qualitative assessment results by service (with BNG mitigation)

Services / benefits / impacts ²⁵	Potential impact of the Scheme on the ecosystem service	Identify any groups affected	Can the effect be monetised?	Commentary
Biodiversity	Minor positive impact	Local communities, local councils, national government.	No – not recommended within the WRPG. Quantified within the BNG assessment.	The BNG assessment has set out a post-Scheme habitat creation scenario that delivers the 10% BNG required for development once the appropriate provisions of the Environment Act 2021, in relation to nature and biodiversity, come into force. This includes the conversion of 90 ha of cropland to grassland, mixed scrub and woodland and enhancement of up to 2.1 km of river. However, the BNG assessment also notes that there is likely to be a loss of 0.25 ha of lowland meadow, a habitat of very high distinctiveness, as a result of the Scheme. As losses of irreplaceable or very high distinctiveness habitat cannot adequately be accounted for through the Biodiversity Metric, this habitat type has been excluded from the Metric calculations. For this loss, if it cannot be avoided, bespoke compensation would need to be agreed with the relevant decision maker.
Water regulation (supply)	Major positive impact	Businesses, communities and local councils in London (as the increased supply will be transferred to the River Thames via the Severn Thames Transfer pipeline), Thames Water, ST Water and other water companies.	Yes – although the WRPG recommends that this isn't used for decision making purposes.	The Scheme is currently estimated to deliver an additional deployable output (DO) in water supply of up to 50 Ml/d for abstraction, representing a positive change in provision of this service for customers in the Thames region. We note, however, that the expected DO benefit is still to be quantified following DO modelling. Considering the provision of this service for other abstractors (current and future), the Gate 2 WFD assessment indicates that overall, there will be a minor percentage reduction in flows during operation of the

²⁵ The services listed below only focus on those screened for this Gate 2 assessment and align with the ENCA template.

Services / benefits / impacts ²⁵	Potential impact of the Scheme on the ecosystem service	Identify any groups affected	Can the effect be monetised?	Commentary
				Scheme in the lowermost River Severn. This indicates that the majority of the value of water left in the environment will be maintained, therefore enabling provision of this service to other abstractors. Any further risks to abstractors will be considered as part of the STT SRO.
Climate regulation (carbon storage and sequestration)	Moderate positive impact	National government, the global community.	Yes	The conversion of cropland to grassland, mixed scrub and woodland is likely to result in an overall increase in carbon sequestration over the Scheme plus off-site area.
Air quality	Minor positive impact	Local businesses and communities, local councils, NHS.	Yes	The conversion of cropland to grassland, mixed scrub and woodland is likely to result in an overall increase in air quality regulation over the Scheme plus off-site area.
Water purification (quality)	Minor positive impact	Local businesses and communities, local councils, water companies.	No	The conversion of cropland to grassland, mixed scrub and woodland is likely to result in an overall increase in water quality purification over the Scheme plus off-site area. Furthermore, modelling undertaken as part of the Gate 2 Habitats Regulation Assessment has also indicated an overall net reduction in inputs of nitrate to the River Severn Estuary due to operation of the scheme. This is as a result of the enhanced treatment of wastewater that would normally be discharged to the estuary. The overall impact of the Scheme on water purification services is therefore considered to represent a minor positive impact.
Natural hazard regulation	Moderate positive impact	Local businesses and communities, local councils.	Yes	Based on an overall increase in woodland and grassland habitat area, the Scheme has the potential to enhance natural hazard (flooding) regulation in the Scheme area.

Services / benefits / impacts ²⁵	Potential impact of the Scheme on the ecosystem service	Identify any groups affected	Can the effect be monetised?	Commentary
				<p>It should, however, also be noted that the Scheme is part of an overall strategy to transfer water from the north of England to alleviate water stress in the south east. However, potential impacts on regional water stress from the Scheme will be considered as part of the regional planning process, so the qualitative assessment reflects flood regulation impacts only.</p> <p>We also note that the WRPG decision-making guidance states that "<i>Drought is a factor of major importance in water resource management planning. However, no common approaches to assessing the value of natural capital assets in mitigating against the risk of drought which were applicable to a UK context were found.</i>" Therefore, quantification of the drought regulation impacts of the changes in natural capital assets associated with the Scheme is challenging due to current data limitations.</p>
Recreation & tourism	Minor positive impact	Local businesses and communities, tourists, local councils.	Yes – however, requires identification of specific site for habitat creation.	There is no habitat or footpath use lost from the from expansion of the WwTW, due to reinstatement. Therefore, long-term recreational activity will not be reduced. On the contrary, the conversion of cropland to grassland, scrub and woodland through the off-site habitat creation may provide additional opportunities for recreation and increased visitor numbers.
Food production	Moderate negative impact	Local businesses and communities, agriculture businesses.	Yes	An overall negative impact on this service is likely due to the conversion of higher value cropland to grassland and other non-agricultural habitats.

4.4. Quantitative assessment and monetisation

Based on the natural capital asset types affected and the qualitative assessment above, the following ecosystem services were quantified and monetised:

- Climate Regulation (carbon storage and sequestration)
- Air quality (air pollution removal)
- Natural hazard (flooding) Regulation
- Water regulation (supply)
- Recreation & tourism
- Food production

As described above, **Biodiversity** was quantified as part of the BNG assessment using the Biodiversity Metric 3.0. Results are provided in the accompanying BNG report for Gate 2 (Technical Annex B6).

The results are summarised for each ecosystem service below, with overall results presented in Section 4.4.7.

4.4.1. Climate Regulation (carbon storage and sequestration)

As shown in Table 4-7 there is predicted to be a decrease in the carbon sequestration value of **£1,300 per year** due to implementation of the Scheme, largely to a reduction in woodland area due to expansion of Netheridge WwTW. This reduction is noted in both the low values (Table 4-8) and high values (Table 4-9).

With the off-site BNG mitigation it is estimated that there will be an increase in the overall carbon sequestration value of the Scheme approximately **£11k to £32k** per year (Table 4-8, Table 4-9). This increase in value relates to an increase in the quantities of assets with a higher carbon sequestration potential, such as woodland, heathland and semi-natural grassland, replacing cropland.

Caution is advised in interpreting results as there may be significant carbon losses during land use change associated with construction and it will take time for new landcover to become established before net sequestration rates increase. Results should be compared with assessments of construction and operational carbon emissions to provide a full lifecycle carbon assessment.

Table 4-7 – Results: Climate regulation (carbon storage and sequestration) – Central values (£2021)

ENCA Broad Habitat Type	Baseline values (£/yr)	Post-scheme (£/yr)	Change between baseline and post-scheme (£/yr)	Baseline plus + 90.3ha off-site cropland values (£/yr)	Post-scheme with 10% BNG off-site (£/yr)	Change between baseline and post-scheme with 10% BNG off-site (£/yr)
Enclosed Farmland	£595	£573	−£23	£4,022	£601	−£3,422
Mountains, Moors and Heathland	£199	£199	£0	£199	£8,083	£7,885
Woodland	£1,675	£582	−£1,093	£1,675	£11,443	£9,768
Semi-natural Grassland	£3,786	£3,639	−£146	£3,786	£10,988	£7,203
Total	£6,254	£4,992	−£1,262	£9,682	£31,115	£21,433

Table 4-8 - Results: Climate regulation (carbon storage and sequestration) – Low values (£2021)

ENCA Broad Habitat Type	Baseline values (£/yr)	Post-scheme (£/yr)	Change between baseline and post-scheme (£/yr)	Baseline plus + 90.3ha off-site cropland values (£/yr)	Post-scheme with 10% BNG off-site £/yr)	Change between baseline and post-scheme with 10% BNG off-site (£/yr)
Enclosed Farmland	£298	£287	-£11	£2,017	£301	-£1,716
Mountains, Moors and Heathland	£100	£100	£0	£100	£4,053	£3,954
Woodland	£840	£292	-£548	£840	£5,738	£4,898
Semi-natural Grassland	£1,898	£1,825	-£73	£1,898	£5,510	£3,612
Total	£3,136	£2,503	-£633	£4,855	£15,602	£10,747

Table 4-9 - Results: Climate regulation (carbon storage and sequestration) – High values (£2021)

ENCA Broad Habitat Type	Baseline values (£/yr)	Post-scheme (£/yr)	Change between baseline and post-scheme (£/yr)	Baseline plus + 90.3ha off-site cropland values (£/yr)	Post-scheme with 10% BNG off-site £/yr)	Change between baseline and post-scheme with 10% BNG off-site (£/yr)
Enclosed Farmland	£893	£860	-£34	£6,039	£902	-£5,137
Mountains, Moors and Heathland	£298	£298	£0	£298	£12,136	£11,838
Woodland	£2,515	£874	-£1,641	£2,515	£17,181	£14,666
Semi-natural Grassland	£5,684	£5,464	-£220	£5,684	£16,498	£10,814
Total	£9,391	£7,496	-£1,895	£14,537	£46,717	£32,180

4.4.2. Air quality regulation (air pollution removal)

As shown in Table 4-10 there is predicted to be a minor decrease in air pollutant removal potential of approximately **£200 per year**. The expected decrease relates predominantly to the decrease in woodland area due to expansion of the WwTW.

Despite a large reduction in pollutant absorbing cropland in the off-site land where the BNG mitigation will take place, the increase in woodland landcover has the potential to increase air pollutant removal for the Scheme plus the BNG scenario, resulting in a net increase of approximately **£100 per year**.

Table 4-10 – Results: Air Pollutant removal (£2021)

ENCA Broad Habitat Type	Baseline values (£/yr)	Post-scheme (£/yr)	Change between baseline and post-scheme (£/yr)	Baseline plus + 90.3ha off-site cropland values (£/yr)	Post-scheme with 10% BNG off-site £/yr)	Change between baseline and post-scheme with 10% BNG off-site (£/yr)
Enclosed Farmland	£180	£180	£0	£1,712	£183	-£1,528
Woodland	£282	£98	-£184	£282	£1,927	£1,645
Total	£462	£278	-£184	£1,994	£2,110	£116

4.4.3. Natural Hazard (flooding) Regulation

As shown in Table 4-11 it is predicted there will a slight decrease in the natural hazard regulation (flooding) value due to the Scheme, estimated at approximately **£300 per year**. This decrease relates to the decrease in valuable semi-natural grasslands due to expansion of the WwTW, as well as a decrease in woodland landcover which would otherwise store floodwater via canopy interception.

With the BNG mitigation scenario, however, it is estimated that there will be a large increase in the natural hazard regulation (flooding) per year. This is largely due to a reduction in the lower water storage cropland habitat, and an increase in woodland and semi-natural grassland off-site.

Table 4-11 – Results: Natural Hazard (flooding) regulation

ENCA Broad Habitat Type	Baseline values (£/yr, 2021 price levels)	Post-scheme (£/yr, 2021 price levels)	Change between baseline and post-scheme (£/yr, 2021 price levels)	Baseline plus + 90.3ha off-site cropland values (£/yr, 2021 price levels)	Post-scheme with 10% BNG off-site £/yr, 2021 price levels)	Change between baseline and post-scheme with 10% BNG off-site (£/yr, 2021 price levels)
Woodland	£119	£41	£-78	£119	£815	£696
Semi-natural Grassland	£6,076	£5,823	£-253	£6,076	£23,505	£17,429
Total	£6,195	£5,864	£-331	£6,195	£24,320	£18,125

4.4.4. Recreation and tourism

As shown in Table 4-12, there is no change in recreation value due to the Scheme as it is recommended and assumed that the footpath removed during construction of the WwTW expansion will be reinstated.

It has not been possible to quantify the impact on recreation of the terrestrial off-site habitat recreation area using ORVal, or the river restoration area using National Water Environment Benefits Survey (NWEBS) values for river improvements, because this requires identification of a specific site location. However, it is considered likely that this will result in an increase in value due to the conversion of enclosed farmland to semi-natural grassland, woodland and heathland and the restoration of river habitat.

Table 4-12 – Results: Recreation on-site (£2021)

Type of recreation service	Baseline + post-scheme values (£/yr)	Change between baseline and post-scheme (£/yr)
Footpath	£64,700	£0
Park	£6,209	£0
Total	£77,434	£0

4.4.5. Food Production

As shown in Table 4-13, there is a minor decrease in the baseline and post-scheme value due to the loss of a small area of grassland. The BNG scenario leads to a significant reduction in food production because the estimated value of the 90.3ha of cropland is higher in economic terms than the semi-natural grassland, woodland and orchards with which it would be replaced.

Table 4-13 – Results: Food Production (£2021)

ENCA Broad Habitat Type	Baseline values (£/yr)	Post-scheme (£/yr)	Change between baseline and post-scheme (£/yr)	Baseline plus + 90.3ha off-site cropland values (£/yr)	Post-scheme with 10% BNG off-site £/yr)	Change between baseline and post-scheme with 10% BNG off-site (£/yr)
Enclosed Farmland	£10,407	£10,407	£0	£83,806	£12,352	£-71,454
Semi-natural Grassland	£12,428	£11,896	-£532	£12,428	£35,024	£35,024
Total	£22,835	£22,304	-£532	£96,234	£47,376	-£36,430

4.4.6. Water Regulation (supply)

The WRPG SG states that the following approach should be used as part of a minimum plus best practice approach for this service:

- **Quantification:** “You should quantify the amount of water resources you use and consider how important each source is as part of your supply. Consider the economic value of water left in the environment for other existing and future users and businesses”.
- **Monetisation:** “You could...apply the ONS resource rent. This should not be used for decision making. Consider the economic value of water left in the environment for other existing and future users and businesses. You could consider monetising the economic dis-benefit to other abstractors from options You could apply a bespoke value instead of ONS resource rent.”

4.4.6.1. Additional water resources supplied

Overall, the Scheme is currently estimated to deliver a DO benefit of up to 50 MI/d for abstraction into the lowermost River Severn, although this is still subject to DO modelling. Using the ONS resource rent value of £0.38/m³ (2019 price levels) provided in the guidance combined with an additional 50 MI/d supply of water for customers in the Thames region, the overall benefit of this service is estimated to be **£19,000 per day** (2021 price levels). This equates to **£1.11m per year** (2021 price levels) when the Scheme is operating. The guidance specifies that this value should not be used for decision making on the Scheme, so it has been excluded from the overall results presented below.

4.4.6.2. Potential disbenefits to other abstractors

The Scheme is considered unlikely to result in significant disbenefits to other abstractors because impacts on flows during operation of the Scheme are considered to be minor, based on the STS Water Framework Directive Assessment report (Technical Annex B3). Furthermore, it is considered unlikely that there are any abstractors downstream of Deerhurst, the stretch of river that will experience reduced flows.

The potential impact of the STS scheme on flows in the River Severn includes the following:

- The abstraction of up to 50 MI/d at Deerhurst for STT and transfer to London.
- The augmentation of 15 MI/d between Mythe WTW and Deerhurst through temporary licence transfer (affecting approximately 3.9 km of the River Severn), with net 15 MI/d reduction downstream of the discharge of treated effluent (affecting the River Severn downstream of Haw Bridge and into the Severn Estuary) – although this flow reduction is equivalent to the existing Mythe WTW abstraction licence being used in full.

Based on the WFD assessment undertaken for Gate 2, the following impacts on the hydrology of the River Severn are expected during operation of the Scheme:

- No change to flow in the River Severn between the Mythe WTW intake and the STT intake at Deerhurst (4.0 km stretch).
- Up to 50 MI/d flow reduction for 16% of the time between the STT Deerhurst intake and Netheridge WwTW effluent transfer outfall at Haw Bridge (3.9 km stretch). This is associated with water transfer for STT and occurs once every two years on average, most regularly in July to October, peaking at 47% of days in August. This effect will be very rare in May, December or January and is not anticipated February to April. The effect occurs at River Severn flows less than 2,568 MI/d.
- A 20 MI/d flow reduction for 12% of the time between the STT Deerhurst intake and Netheridge WwTW effluent transfer outfall at Haw Bridge (3.9 km stretch). This is associated with STT interconnector pipeline maintenance flows and most regularly occurs in June to August, peaking at 44% of days in July. This effect will be very rare in April or October and is not anticipated November to March. The effect occurs at River Severn flows less than 2,568 MI/d.
- Up to 15 MI/d flow reduction for 16% of the time between the Netheridge WwTW effluent transfer outfall at Haw Bridge to the normal tidal limit at Maisemore Weir (12.5 km stretch). This is associated with water transfer for STT, occurring once every two years on average and most regularly in July to October; peaking at 47% of days in August. This effect will be very rare in May, December or January and is not anticipated February to April. The effect occurs at River Severn flows less than 2,568 MI/d.

Overall, there will be a minor percentage reduction in flows during operation of the scheme. Modelling of full stochastic flow series over a representative 47-year period shows there will be a 2.5% reduction in Q95 (very low flows) downstream Deerhurst compared with upstream Deerhurst and a 0.7% reduction in flow downstream Haw Bridge compared with upstream Deerhurst. Further information is provided in the STS Water Framework Directive Assessment report (Technical Annex B3). A monetary value has not been applied to the reduction in flows as it is considered unlikely to affect abstraction for irrigation or potential future abstractions for industry or other uses downstream of Deerhurst (the stretch of the river that will be affected by reduced flows) due to the small magnitude of flow change, as stated above. Any further risks to abstractors will be considered as part of the STT SRO.

4.4.7. Summary across the ecosystem services

Table 4-14 and Table 4-15 below present the overall balance of ecosystem value provided by natural capital assets for the scheme comparing the value before and after the Scheme without and with the BNG mitigation, respectively. This is for all the services quantitatively assessed, excluding water regulation (as per the WRPB SG).

Without the implementation of off-site habitat creation, there is a **decrease in the overall ecosystem services value** due to loss of Netheridge WwTW expansion area of around **£2k per year**. This is primarily driven by the likely decrease in the amount of carbon sequestration; however, all services, excluding recreation and tourism, show a disbenefit under this scenario.

With the delivery of BNG through implementation of off-site habitat creation, there is also a **decrease in the net ecosystem services value** of around **£9k per year**. However, this is mainly due to the replacement of the off-site cropland with other habitats, resulting in a loss to food provisioning services. Excluding this service and recreation and tourism, which has not been quantified for the 'with BNG' scenario, the **overall benefit to ecosystem services** is estimated to be **£40k per year**.

For ease of interpretation, a visual breakdown for the without BNG option is illustrated in Figure 4-1 and the with BNG option in Figure 4-2.

Table 4-14 Summary results table for the Scheme across all ecosystem services from the NCA undertaken within this study: without BNG

Ecosystem service	Unit of measurement	Quantity before the Scheme	Quantity after the Scheme	Central annual value before the Scheme (£2021)	Central annual value after the Scheme (£2021)	Change (central, annual) (£2021)
Biodiversity	See BNG Assessment for more detail.					
Water Regulation	Not to be included in decision making as per the WRP.					
Carbon	Tonnes of CO ₂ sequestered	18	14	£6,254	£4,992	-£1,262
Air Quality	Tonnes of air pollutants absorbed	Not possible to calculate due to availability of ENCA values as £/ha values for pollutant absorption		£462	£278	-£184
Water Purification	Not quantified.					
Natural Hazard (flooding) Regulation	Ha of land providing natural hazard regulation	30	28	£6,195	£5,864	-£331
Recreation & Tourism	Number of visitors per year	23,647	23,647	£77,434	£77,434	£0
Food Production	Ha land with agricultural value	37	37	£22,835	£22,304	-£532
Total	SUM	NA	NA	£113,181	£110,872	-£2,309

Table 4-15 Summary results table for the Scheme across all ecosystem services from NCA undertaken within this study: with BNG

Ecosystem service	Unit of measurement	Quantity before the Scheme	Quantity after the Scheme	Central annual value before the Scheme + the 90.3ha cropland (£2021)	Central annual value after the Scheme + 10% off-site BNG scenario (£2021)	Change with 10% offsite BNG (central, annual) (£2021)
Biodiversity	See BNG Assessment for more detail.					
Water Regulation	Not to be included in decision making as per the WRPB.					
Carbon	Tonnes of CO ₂ sequestered	27	88	£9,682	£31,115	£21,433
Air Quality	Tonnes of air pollutants absorbed	Not possible to calculate due to availability of ENCA values as £/ha values for pollutant absorption		£1,994	£2,110	£116
Water Purification	Not quantified.					
Natural Hazard (flooding) Regulation	Ha of land providing natural hazard regulation	30	118	£6,195	£24,320	£18,125
Recreation & Tourism	Number of visitors per year	23,647*	23,647*	£77,434*	£77,434*	£0*
Food Production	Ha land with agricultural value	129	90	£96,234	£47,376	-£48,858
Total	SUM	NA	NA	£191,539	£182,355	-£9,184

**Figures included in this table are the same as the 'without BNG' scenario as it was not possible to estimate the impact on recreation and tourism of the off-site habitat creation, including river restoration. This is because the location of the site is undetermined at present. This means that the total value is likely to significantly underestimate the ecosystem services benefit of this scenario.*

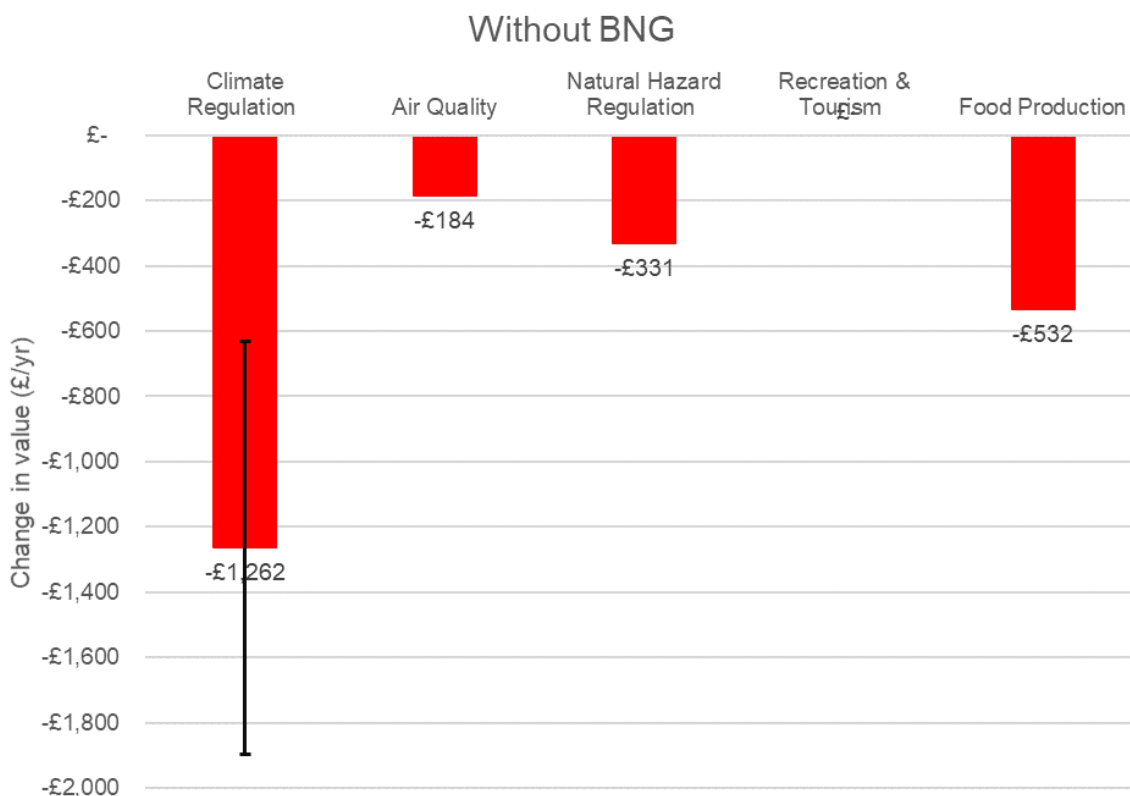


Figure 4-1 – Annual change in ecosystem services for each scenario (without BNG) (£2021)

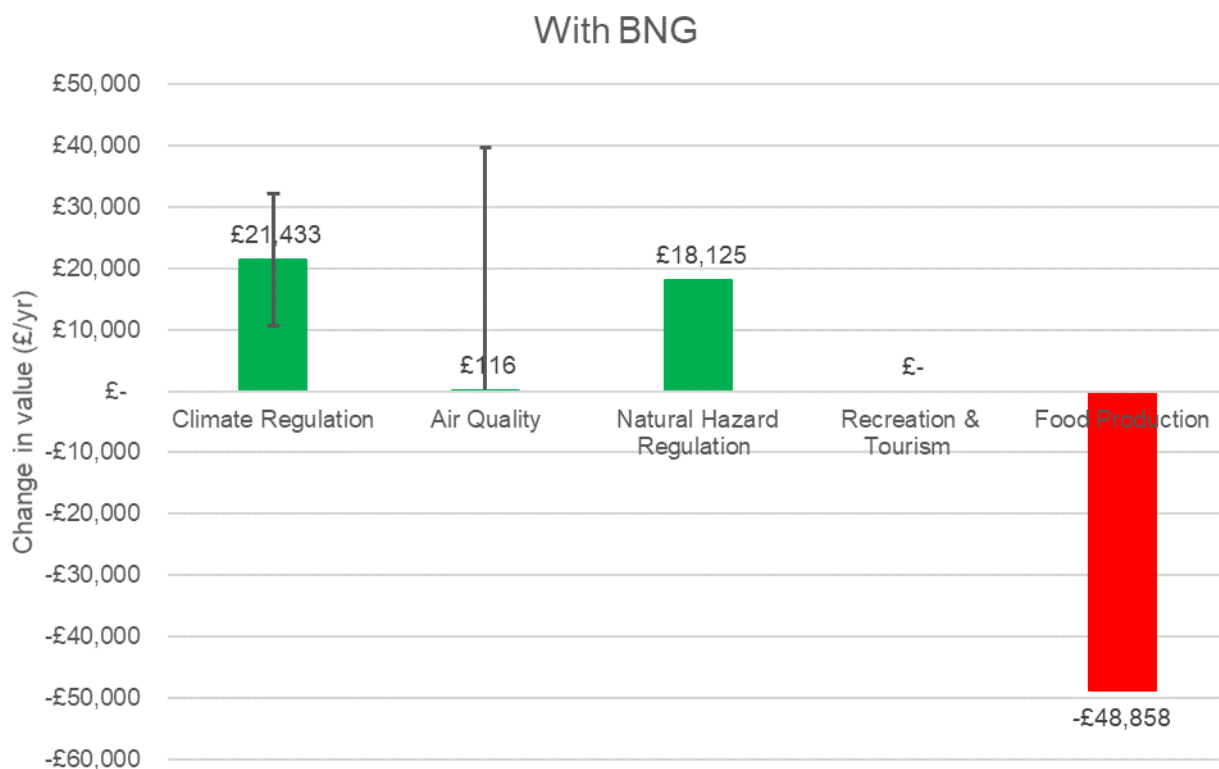


Figure 4-2 – Annual change in ecosystem services for each scenario (with BNG) (£2021)

Sensitivity analysis was completed using lower and upper annual values for the Climate Regulation ecosystem service only. The analysis compared the figures for change in value between options for the different scenarios, with and without BNG. As shown in Figure 4-3, the variation between the low and high values with BNG affect the change in carbon regulation value by approximately a factor of 3. The variation in carbon regulation value change without BNG is smaller in magnitude so some confidence can be taken when assessing the without BNG results; however, care must be taken regardless.

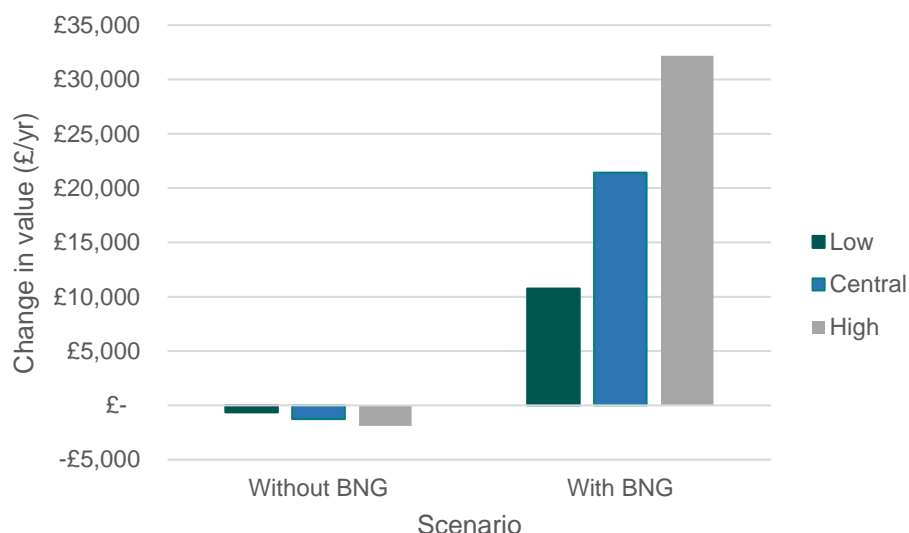


Figure 4-3 – Sensitivity analysis: change in carbon regulation value (£/year) – comparison of low, central and high values for the Climate Regulation service

4.4.8. Translation to Gate 2 Natural Capital metrics

In translating the results of this study into Gate 2 NC metrics, it is important to recognise that there are both benefits and disbenefits associated with the Scheme due to differences in the direction of change for individual ecosystem services, and not all of these have been quantified. The metric excludes the water regulation service which was not valued in monetary terms.

Values are only provided below in Table 4-16 for the ‘without BNG’ scenario as the overall results for the ‘with BNG’ scenario do not include the benefits to recreation and tourism from the off-site habitat creation so could provide a misleading picture when converted to metrics.

Table 4-16 - STS Gate 2 NC metrics

Metric	Netheridge to Haw Bridge Pipeline Construction
Total disbenefit (£/year)	-£2,309
Total benefit (£/year)	£0
Net value (£/year)	-£2,309

4.4.8.1. Comparison to Gate 1 Results

A comparison of Gate 1 and Gate 2 NCA results in Table 4-17 indicates the following:

- The ‘without BNG’ scenario indicates a smaller disbenefit to carbon sequestration for Gate 2 than Gate 1. This is likely to result from the different scheme boundary and Zol used and different assumptions with regards to habitat loss, as the Gate 1 assessment assumed a significant loss of farmland (387 ha) due to the scheme. The ‘with BNG’ scenario shows a similar scale and magnitude of impact of carbon sequestration for both Gates, although the balance of habitat changes assumed differs significantly between Gate 1 and Gate 2, with a significant increase in woodland assumed for Gate 1. In addition, the difference in the monetary valuation results is also likely to be due to the use of different BEIS carbon monetary values between the two assessments; Gate 1 used the BEIS Interim Non-Traded Carbon Values, whereas for Gate 1 the latest BEIS carbon values were used, which were published in September 2021.

- For Natural Hazard (flooding) regulation, the Gate 2 results suggest that there will be greater disbenefits from the 'without BNG' scenario than Gate 1 and indicates greater benefits from the 'with BNG' scenario. As with carbon sequestration, this is likely to result from significant differences in the assumed habitat changes within the scenarios, as the overall approach used is consistent between Gates.
- The loss of tourism and recreation value 'without BNG' for Gate 1 is much greater than for Gate 2. This is because the Gate 1 assessment assumed the "worst-case-scenario" whereby affected recreation sites close down entirely, with potential resulting impacts on physical health and well-being. The Gate 1 assessment notes that "in reality the majority will be able to remain operational throughout construction", which is aligned with the Gate 2 assumption that there will be no significant impact from the pipeline component of the scheme.
- There is no value for air quality regulation for the 'without BNG' scenario in the Gate 1 assessment, because the Netheridge WwTW discharge diversion using the Deerhurst was not considered to be in an Air Quality Management Area. For the Gate 2 assessment, air quality regulation values have been assessed due to the proximity to urban areas such as Gloucester.
- The difference in the BNG assessment and 'with BNG' scenario habitat areas between Gate 1 and Gate 2 is also partially a result of the assessment utilising the BNG Metric 2.0 and the BNG Metric 3.0, respectively.

Table 4-17 Gate 1 and Gate 2 comparison of ecosystem service changes with and without BNG

Ecosystem service	Gate 1 – (£/yr) (£2021 prices)*		Gate 2 – (£/yr) (£2021 prices)	
	Without BNG	With BNG	Without BNG	With BNG
Climate Regulation (carbon sequestration)	-£8,635	£19,314	-£1,262	£21,433
Natural Hazard (Flooding) Regulation	-£97	£7,379	-£331	£18,125
Tourism and recreation	-£1,3456,114	Qualitative only	£0	Qualitative only
Air quality regulation	£0	N/A	-£184	£116
Food production	N/A	N/A	-£532	-£48,858
Total	-£1,464,847	£26,693	-£,309	£9,184

*Results taken from Netheridge WwTW discharge diversion (35 Ml/d) – Deerhurst Pipeline results only

5. Conclusions and recommendations

A Natural Capital Assessment (NCA) has been undertaken of the Severn Trent Sources (STS) SRO, building on an NCA conducted for the Scheme at Gate 1, and is based on the All Companies Working Group (ACWG) guidance for Gate 2 and the Environment Agency's final Water Resources Planning Guidance (WRPG) supplementary guidance 'Environment and Society in decision making'. The ACWG guidelines indicate that at Gate 2 water companies must provide an NCA aligned with WRPG and Defra's Enabling a Natural Capital Approach (ENCA) methodologies.

Based on an assessment of habitat changes for the current baseline and two post-Scheme scenarios – one without the delivery of BNG and one including the delivery of BNG - the Gate 2 NCA has drawn the following conclusions in relation to the impacts of the Scheme on the natural capital assets within the Scheme boundary and the ecosystem services they provide:

- Without the implementation of off-site habitat creation to deliver BNG, there is a **decrease in the overall ecosystem services value** as a result of the Scheme of around **£2k per year** due to expansion of the WwTW area. This is primarily driven by the likely decrease in the amount of carbon sequestration from loss of this area; however, all services quantified, which included carbon sequestration, air quality regulation, natural hazard (flooding) regulation and food production, show a disbenefit under this scenario. This excludes recreation and tourism which showed no change under this scenario.
- With the delivery of BNG through implementation of off-site habitat creation, there is also a **decrease in the net ecosystem services value** of around **£9k per year**. However, this is mainly due to the replacement of the off-site cropland with other habitats, resulting in a loss to food provisioning services. Excluding this service and recreation and tourism, which has not been quantified for the 'with BNG' scenario, the **overall benefit to ecosystem services** is estimated to be **£40k per year**.

For both scenarios, there is an estimated **£1.11m annual** benefit to water regulation (supply); however, the WRPG SG specifies that this value should not be used for decision making on the Scheme, so it has been excluded from the overall results.

It should be noted that this assessment represents a high-level appraisal of the potential ecosystem services impacts of the Scheme. It uses the data available for the Scheme, combined with secondary datasets. The figures generated should be considered as indicative only, representing an order of magnitude level of accuracy.

5.1. Next steps

For Gate 3, the ACWG Guidance indicates that the NCA should include further refinement of the assessment to aid detailed design and to provide information for planning. The following recommendations are therefore made for consideration as part of the Gate 3 NCA:

- The NCA should be refined through provision of greater detail on the habitats affected by the Scheme and length and scale of impacts to provide great clarity on the impact pathways and ecosystem services values. This will be supported by further refinements to the BNG assessment. The BNG assessment also recommends the use of some site surveys to validate habitat types and their quality.
- As with the Gate 1 assessment, the Gate 2 assessment relied on the use of ORVal to estimate changes in recreational value from the Scheme due to data availability. Furthermore, it was not possible to quantify the impacts of the 'with BNG' scenario due to the requirement for a specific site for habitat creation to be identified for both terrestrial and river habitats. For Gate 3, it is recommended that further development of the 'with BNG' scenario is undertaken to enable more robust quantification of the impacts of this scenario on recreation, in addition to other services.
- Due to data limitations, it was not possible to undertake a detailed assessment of potential impacts on natural hazard (flooding) regulation, and the assessment relied on national values by habitat type. For Gate 3 it would be beneficial to undertake a more detailed assessment of this specific service.
- As part of the BNG assessment (see Technical Annex B6 (Biodiversity Net Gain Assessment)), it is recommended that the assessment be updated to Biodiversity Metric 3.1 (or the latest metric version at the time of assessment) for Gate 3, as appropriate. The NCA will need to be updated to align with the updated BNG assessment and the further development of any off-site mitigation area(s).

- For Gate 3, it is recommended that results from the climate regulation (carbon sequestration) assessment be combined with overall operational and embodied carbon impacts from the Scheme to identify the need and means to support delivery of Net Zero targets through the Scheme, e.g., through the use of further habitat creation and nature-based removals of carbon.
- Similarly, it is recommended that for Gate 3 consideration be given to the delivery of environmental net gain (ENG) through the Scheme. ENG is based on the concept of ensuring that development leaves the environment in a measurably better state compared to the pre-development baseline²⁶. There is currently no legal definition of ENG, but the Defra 25 Year Environment Plan indicates that this represents an expansion of BNG to “*include wider natural capital benefits, such as flood protection, recreation and improved water quality and air quality*”²⁷. Furthermore, although not yet a legal requirement, the Government committed to embedding ENG in infrastructure within the 25 Year Environment Plan, and the approach is supported by the National Infrastructure Commission²⁸.

²⁶ National Infrastructure Commission (2021). Natural capital and environmental net gain – a discussion paper. Available from: <https://nic.org.uk/app/uploads/Updated-Natural-Capital-Paper-Web-Version-Feb-2021.pdf> .

²⁷ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

²⁸ <https://nic.org.uk/app/uploads/Updated-Natural-Capital-Paper-Web-Version-Feb-2021.pdf>

Appendices



Appendix A. Gate 1 recommendations

The STT Sources Gate 1 NCA made a set of recommendations for the Gate 2 NCA. Table A-1 below sets out how these recommendations were implemented.

Table A-1 - STT Sources SRO Gate 2 NCA developments following Gate 1 recommendations

Recommendation made by Ricardo from Gate 1 NCA	Gate 2 NCA Development
<p><i>Refining the zone of influence [ZOI]</i></p> <p>The current ZOI for the assessed elements extends to 1 km from any likely construction zones. Whilst acceptable for a high-level approach as required for Gate 1, greater detail will be necessary for Gate 2. Once the STW source groupings have been developed further, more in-depth analysis of likely effects on factors such as water quality, bankside habitats or groundwater flow will be possible, and may highlight a necessity to expand or reduce our chosen zones. This will ensure that calculations derived from areas of habitat are more accurate, without over/underestimating the areas that may be affected. It will also allow for a greater understanding of the impact on the freshwater environment, as rivers and groundwater are likely to have a different zone of interest to terrestrial impacts.</p>	<p>The ZOI was focused on the two Scheme components listed in Section 0 of the report. The ZOI was defined by the 'red line boundary' of the scheme, including an appropriate buffer either side of the pipeline (20 m or 10 m depending on ecological sensitivity) and allows for works easements around the final route of the pipeline. This was based on an updated engineering design for Gate 2. The ZOI assessed also included the off-site habitat creation area identified as part of the BNG assessment. For aquatic impacts, the ZOI was considered to include affected water bodies.</p>
<p><i>Better representation of recreational areas</i></p> <p>ORVal, used in this assessment to value recreation and tourism, derives site values from a statistical model. This model does not account for individual characteristics which may determine the site's welfare benefit. In future assessments it would be beneficial to capture site specific features and a less generalised figure for visitor numbers to enable accurate valuation of recreation services. In addition, at Gate 1 it has not been possible to monetise the recreation and tourism benefits of the scheme with BNG uplift as details of habitat creation opportunities have not been agreed. These will need to be further assessed and monetised at Gate 2.</p>	<p>The recreation assessment for Gate 2 was also based in ORVal but with a greater degree of accuracy in the specification of the site and areas to be impacted.</p> <p>For BNG uplift areas, the locations of these sites had not been defined at Gate 2. Potential recreational benefits of these areas would need to be explored when these are defined.</p>
<p><i>Better natural hazard regulation</i></p> <p>The assessment currently takes flooding into account as the primary natural hazard, but further investigation into the impact that drought has on habitats ability to slow-flow and provide natural flood resilience. This would help to identify any risk more accurately to natural habitat regulation. In order to accomplish this will require a greater breadth of data than currently available.</p>	<p>Natural Hazard Regulation at Gate 2 has also been focused on flooding. A greater degree of specificity has been achieved using the 'red line boundary' for the scheme. Drought impact was not explored due to lack of suitable information on which to base further assessment and because this will be considered more broadly through the regional planning process.</p>
<p><i>Climate change predictions</i></p> <p>Habitat type and land usage may change in the future due to changes in global climate, creating disparity between the predicted changes caused by element implementation and the observed changes in the future. Given the longevity of the STW</p>	<p>Neither the ACGW, WRPG nor ENCA includes guidelines for how the effects of climate change on the natural capital baseline or Scheme scenarios are to be assessed. The importance of this is recognised and supported for future natural capital assessment methodologies for water resources schemes.</p>

Recommendation made by Ricardo from Gate 1 NCA	Gate 2 NCA Development
sources, predicted climate induced change in Natural Capital will provide a more accurate assessment of benefits to support climate change resilience.	
<p><i>Land use predictions</i></p> <p>The vast majority of our NCA is based on land cover. Upcoming changes in land use will therefore introduce discrepancies in our calculations, making it imperative that we account for planned changes such as large-scale building developments.</p>	<p>A greater degree of specificity has been achieved using the 'red line boundary' for the scheme. No additional building development is anticipated to occur within the 'red line boundary' for the Scheme.</p>
<p><i>Confirming element impacts</i></p> <p>It will be important in Gate 2 to look at how the elements will affect their surrounding habitats in closer detail to confirm our current assessment and develop it further, ultimately giving a more accurate predicted change in Natural Capital values.</p>	<p>A greater degree of specificity has been achieved at Gate 2 through a refined 'red line boundary' for the Scheme area.</p>
<p><i>Incorporating Net Gain to element design and Natural Capital Assessment</i></p> <p>The BNG assessment focusses on quantifying disbenefits to biodiversity and providing the guidelines to not only mitigate them but to create a 10% increase in biodiversity with the implementation of the chosen element(s). It will be necessary to incorporate the quantified values and mitigation plans so that changes in Natural Capital can be calculated with them in mind including air quality and carbon assessment.</p>	<p>The NCA assessed two Scheme scenarios: without BNG and with 10% BNG based on assumed habitat creation areas used in the BNG assessment. This help to quantify and (where appropriate) monetise changes in NC and ecosystem services with 10% BNG. This NCA at Gate 2 extended the Gate 1 assessment by using greater specificity of habitat areas.</p>
<p><i>Accounting for habitat condition improvement</i></p> <p>The BNG assessment considers options to increase the biodiversity metric score through both habitat creation and enhancement. It has not been possible to account for the natural capital benefits related to habitat enhancement at Gate 1 as habitat extent has been used as a proxy for natural capital stock. For Gate 2 it will be important to consider how habitat condition contributes to delivery of ecosystem services and assess how habitat enhancement measures will affect natural capital values.</p>	<p>Habitat condition is included as part of the BNG assessment. It is included in the NCA as part of the qualitative assessment.</p>
<p><i>Inclusion of abiotic features</i></p> <p>Whilst our study considers a variety of biotic factors, WRSE guidance also recommends the assessment of abiotic factors (i.e., minerals, fossil fuels and renewable energy). At present, this study has not valued abiotic services in its assessment of Natural Capital due to limited availability of robust data to represent these features for a project of this scale. At Gate 2 and following increased certainty of the element routes and the (Zol) better representation of abiotic factors should be sought. This will require a review on data availability and potential data collection at that stage.</p>	<p>No additional abiotic features were identified as requiring assessment in the screening or qualitative assessment.</p>

Recommendation made by Ricardo from Gate 1 NCA	Gate 2 NCA Development
<p><i>Key partners collaboration</i></p> <p>At Gate 1 this NCA has focused on the base line Natural Capital within a 1km Zol, an assessment of the potential opportunities for uplift related to BNG and predicted Natural Capital loss as a result of construction/operation of the STW sources and groupings. This has been a desked based study using open source data and outputs from the associated SEA, WFD, and HRA assessments as part of this work. At Gate 2 there is a need to review this work in light of the wider more locally focused Natural Capital work being completed by local partners (especially associated with the Severn and Cotswolds Canal Rivers Trusts) to ensure synergy between approaches and avoid any double counting.</p>	<p>This was not part of the scope for this NCA but could be undertaken at Gate 3 when the details of these other initiatives have matured further.</p>
<p><i>Refinement of biodiversity and habitat assessment, including aquatic habitats</i></p> <p>For Gate 1, the biodiversity and habitats assessment has focussed primarily on high-level broad habitats using CORINE data. The resolution of CORINE data does not allow us to understand local aquatic and terrestrial habitats in detail and what Natural Capital benefits may be related to them. Understanding of impacts will be improved at Gate 2 following detailed aquatic and terrestrial field surveys to confirm habitat condition and extent for BNG assessment, as well as hydrological modelling and detailed WFD assessment. This can then feed into a more detailed assessment of biodiversity ecosystem services.</p>	<p>For Gate 2, the biodiversity and habitats assessment, including aquatic habitats, was based on open-source data, refined by information gathered on habitat type and condition during several walkover surveys. This output was translated to the habitat types used by the Biodiversity Metric 3.0. Further information is provided in the accompanying Biodiversity Net Gain (BNG) report. The results of the BNG assessment should be used in parallel with the NCA results to inform further scheme development.</p>
<p><i>Accounting for Biodiversity and Habitat Ecosystem Services</i></p> <p>At Gate 1 Natural Capital benefits have been aligned with overall high level BNG opportunity areas which have been based on Priority Habitats etc where information has been gained from online sources. There has been no ground truthing of this information to establish where opportunity is likely to be greatest on-the-ground. Ground-truthed BNG and mitigation options (informed by BNG surveys) together with stakeholder engagement (to better understand local authorities) will enable a more refined Natural Capital account to be provided at Gate 2.</p>	<p>As described above, the NCA assessed two Scheme scenarios: without BNG and with 10% BNG based on assumed habitat creation areas used in the BNG assessment. This helps to quantify and (where appropriate) monetise changes in NC and ecosystem services with 10% BNG. This NCA at Gate 2 extended the Gate 1 assessment by using greater specificity of habitat areas.</p>

Appendix B. Scoring framework for the qualitative assessment

The scoring criteria are based on SEA criteria scoring matrices currently being used for water resources planning at a regional level.

Service	Impact level	Description
Biodiversity	Major positive impact	<p>Would result in a major enhancement of the quality of designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat quality and availability.</p> <p>Would result in a major increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or large amounts of creation or enhancement of habitat, promoting a major increase in ecosystem structure and function.</p> <p>Would result in a major reduction or management of INNS.</p> <p>Would deliver Biodiversity Net Gain.</p>
	Moderate positive impact	<p>Would result in a moderate enhancement on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures.</p> <p>Would result in a moderate increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or moderate amounts of creation or enhancement of habitat, promoting a moderate increase in ecosystem structure and function.</p> <p>Would result in a moderate reduction or management of INNS.</p>
	Minor positive impact	<p>Would result in a minor enhancement of the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures.</p> <p>Would result in a minor increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or small amounts of creation or enhancement of habitat, promoting a minor increase in ecosystem structure and function.</p> <p>Would result in a minor reduction or management of INNS.</p>
	Neutral	<p>Would not result in any effects on designated or non-designated sites including habitats and/or species). It will not have an effect on INNS.</p>

Service	Impact level	Description
	Minor negative impact	<p>Would result in a minor negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation.</p> <p>Would result in a minor decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or small losses or degradation of habitat leading to a minor loss of ecosystem structure and function.</p> <p>Would result in a minor increase or spread of INNS.</p>
	Moderate negative impact	<p>Would result in a moderate negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation.</p> <p>Would result in a moderate decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or moderate loss or degradation of habitat leading to a moderate loss of ecosystem structure and function.</p> <p>Would result in a moderate increase or spread of INNS.</p>
	Major negative impact	<p>Would result in a major negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation.</p> <p>Would result in a major decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or large losses or degradation of habitat leading to a major loss of ecosystem structure and function.</p> <p>Would result in a major increase or spread of INNS.</p>
	Uncertain	<p>From the level of information available the effect on this objective is uncertain.</p>
Water regulation (supply)	Major positive impact	<p>Would achieve WFD Good Ecological Status / Good Ecological Potential.</p> <p>Would result in a major improvements in water efficiency, reduces demand and improves resilience.</p>

Service	Impact level	Description
	Moderate positive impact	<p>Would achieve savings through demand management and does not require abstraction to achieve yield.</p> <p>Would address failure of WFD Good Ecological Status / Good Ecological Potential partially.]</p> <p>Would result in a moderate improvements in water efficiency, reduces demand and improves resilience.</p>
	Minor positive impact	<p>Would achieve savings through demand management and does not require abstraction to achieve yield.</p> <p>Would result in a minor improvements in water efficiency, reduces demand and improves resilience.</p>
	Neutral	<p>Would have no discernible effect on river flows or quality.</p>
	Minor negative impact	<p>Would result in minor decreases in river flows. River water quality may be affected and lead to short term or intermittent effects on receptors (e.g. designated habitats, protected species or recreational users of rivers) that could not be avoided but could be mitigated.</p> <p>Would result in minor decreases in water efficiency, increases demand and reduces resilience.</p>
	Moderate negative impact	<p>Would result in moderate decreases in river flows. River water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers) that could not reasonably be mitigated.</p> <p>Would result in the likely deterioration of WFD classification.</p> <p>Would result in moderate decreases in water efficiency, increases demand and reduces resilience.</p>
	Major negative impact	<p>Would result in major decreases in river flows. River water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers) that could not reasonably be mitigated.</p> <p>Would result in the deterioration of WFD classification.</p> <p>Would result in major decreases in water efficiency, increases demand and reduces resilience.</p>
	Uncertain	<p>From the level of information available the effect is uncertain.</p>
Air quality	Major positive impact	<p>Would result in a major enhancement of air quality.</p>
	Moderate positive impact	<p>Would result in a moderate enhancement of air quality.</p>

Service	Impact level	Description
	Minor positive impact	Would result in an enhancement of air quality.
	Neutral	Would not result in any effects on air quality.
	Minor negative impact	Would result in a minor decrease in the quantity of pollutants absorbed.
	Moderate negative impact	Would result in a moderate decrease in the quantity of pollutants absorbed.
	Major negative impact	Would result in a major decrease in the quantity of pollutants absorbed.
	Uncertain	From the level of information available the effect is uncertain.
Climate regulation (carbon storage and sequestration)	Major positive impact	Would achieve net zero through carbon sequestration
	Moderate positive impact	Would result in a moderate increase in carbon sequestration.
	Minor positive impact	Would result in a minor increase in carbon sequestration.
	Neutral	Would have no discernible effect on carbon emissions.
	Minor negative impact	Would result in a small release of previously sequestered carbon.
	Moderate negative impact	Would result in a moderate release of previously sequestered carbon.
	Major negative impact	Would result in a major release of previously sequestered carbon.
	Uncertain	From the level of information available the effect is uncertain.
Natural hazard regulation	Major positive impact	Would result in a major improvement to flood or drought risk.
	Moderate positive impact	Would result in a moderate improvement to flood or drought risk.
	Minor positive impact	Would result in a minor improvement to flood or drought risk.
	Neutral	Would not have an effect on or be affected by flood or drought risk.

Service	Impact level	Description
	Minor negative impact	Would result in a minor increase in flood or drought risk.
	Moderate negative impact	Would result in a moderate increase in flood or drought risk.
	Major negative impact	Would result in a major increase in flood or drought risk.
	Uncertain	From the level of information available the effect is uncertain.
Recreation & tourism	Major positive impact	Would create new, and significantly enhance existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Moderate positive impact	Would enhance existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Minor positive impact	Would slightly enhance existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Neutral	Would not result in any effects on existing recreational facilities and/or tourism.
	Minor negative impact	Would slightly reduce the availability and quality of existing recreational facilities and/or tourism within the operational area.
	Moderate negative impact	Would result in a moderate reduction in existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	Major negative impact	Would result in a significant reduction in existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
Food production	Uncertain	From the level of information available the effect is uncertain.
	Major positive impact	Would result in a major improvement to food production.
	Moderate positive impact	Would result in a moderate improvement to food production.
	Minor positive impact	Would result in a minor improvement to food production.
	Neutral	Would not have an effect on food production.

Service	Impact level	Description
	Minor negative impact	Would result in a minor reduction of food production.
	Moderate negative impact	Would result in a moderate reduction of food production.
	Major negative impact	Would result in a major reduction of food production.
	Uncertain	From the level of information available the effect is uncertain.

Appendix C. Scheme map

Appended to report.

Appendix D. On-site Baseline Habitats

Appended to report.

Appendix E. On-site Post-Scheme Habitats

Appended to report.

[REDACTED]
Atkins Limited
Woodcote Grove
Ashley Road
Epsom
KT18 5BW

[REDACTED]
[REDACTED]
[REDACTED]