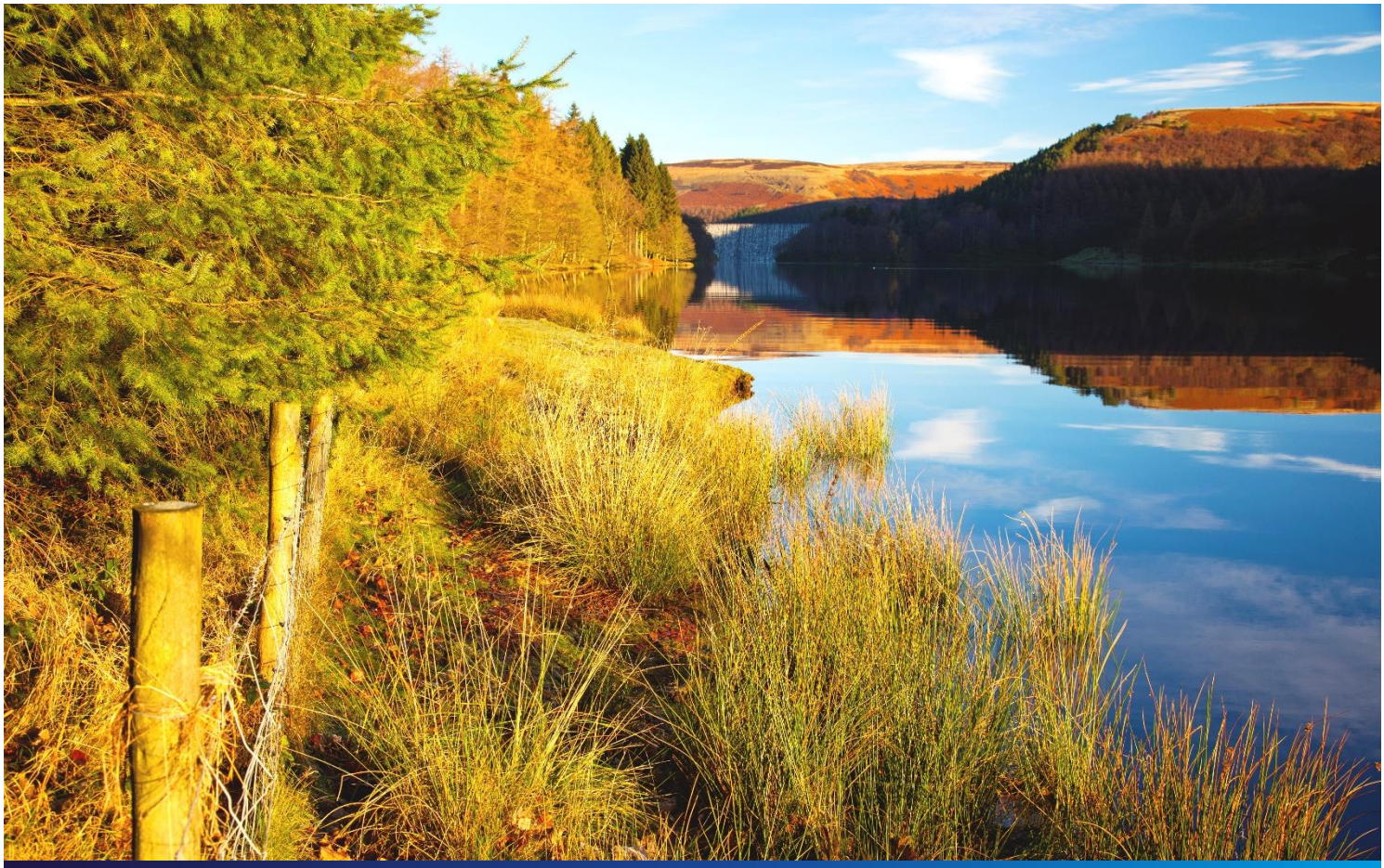

BIODIVERSITY NET GAIN AND NATURAL CAPITAL ASSESSMENT

Draft Water Resources Management Plan 2024

Severn Trent Water

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EXECUTIVE SUMMARY

Water companies in England and Wales are required to produce a Water Resources Management Plan (WRMP) every five years. The Plan sets out how the company intends to maintain the balance between supply and demand for water over the long-term planning horizon in order to ensure security of supply in each of the water resource zones making up its supply area.

Through an extensive optioneering process, considering a wide range of potential options to balance future supply and demand, Severn Trent has selected the most suitable options to make up the feasible options list. This list includes both demand side and supply side options, of which only the latter requires a Natural Capital and Biodiversity Net Gain assessments.

The 81 supply side options that make up part of the feasible options list have been subject to a Stage 1 initial screening, Stage 2 Biodiversity Net Gain and Stage 3 Natural Capital assessments.

In determining the draft WRMP24 preferred plan of options, Severn Trent used the findings of the option-level assessments to inform the programme appraisal process. Severn Trent has set out six candidate programmes as part of the draft WRMP24 are as follows:

- Preferred Programme
- Least Cost Programme (*the same as the preferred programme*)
- Ofwat Core Programme
- Environmental Stretch
- Climate Adjustment
- Gated Success

43 supply side options were selected into Severn Trent's preferred programme with a further 5 options selected as part of one or more of the alternative programmes above. The Stages 4 (Biodiversity Net Gain) and 5 (Natural Capital) assessments were undertaken for the preferred programme and reasonable alternative programmes. This report provides the results generated from undertaking the Natural Capital and Biodiversity Net Gain assessments (including assessment of habitat enhancement opportunities). The approaches taken are in line with relevant guidance, notably the WRPG 2024 Supplementary Guidance on Environment and Society in Decision-making. Any options within the Plan that need planning permission are legally required to provide BNG of 10% in England due to the Environment Act (2021), thus all options included within the preferred programme and any reasonable alternatives demonstrate that 10% BNG can be reached if required.

The biodiversity losses were were re-calculated for the 43 options in the Preferred Programme, the additional five options in the reasonable alternative plans, then these were used to calculate losses for the different plans presented.

- The total habitat units lost as a result of the **Least Cost Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.
- The total habitat units lost as a result of the **Least Cost Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.
- The total habitat units lost as a result of the **Ofwat Core Programme** are calculated to be -4050 ABHU. 10% net gain could be achieved through reinstating 2604 ABHU on-site and creating or enhancing habitat equating to 3621 ABHU off-site.
- The total habitat units lost as a result of the **AP2 Environmental Stretch (S11) Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.
- The total habitat units lost as a result of the **AP6 – Climate Adjustment (S14) Programme** are calculated to be -7539 ABHU. 10% net gain could be achieved through reinstating 4969 ABHU on-site and creating or enhancing habitat equating to 7196 ABHU off-site.

- The total habitat units lost as a result of the **AP5 Gated Success (S4) Programme** are calculated to be -6745 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6925 ABHU off-site.

Out of the all the programmes presented, the lowest initial biodiversity loss was associated with the Ofwat Core Programme, the greatest initial loss was associated with Climate Adjustment programme. The key outcomes of the assessments were that the greatest impacts on biodiversity and the associated regulating ecosystem services tend to be associated with options with long pipelines and or reservoir enlargement. However, all programmes presented can meet the 10% BNG requirement. Key opportunities for biodiversity opportunity areas in close proximity to the options in the Preferred Programme and reasonable alternatives are also outlined within this report.

1. INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF REPORT

Water companies in England and Wales have a statutory requirement to prepare a Water Resources Management Plan (WRMP) every five years. The latest Water Resource Planning Guideline (WRPG) produced by the regulatory bodies (Ofwat, The Environment Agency and Natural Resources Wales) states that water companies are required to ensure their WRMP delivers net biodiversity gain where appropriate and uses a proportionate natural capital approach. This report is driven by this requirement and demonstrates how Severn Trent will meet these requirements in the assessment of their WRMP24 feasible options and preferred programme.

1.2 BIODIVERSITY NET GAIN, NATURAL CAPITAL AND ECOSYSTEM RESILIENCE

Biodiversity Net Gain (BNG) is an approach to the development of land and marine management that aims to leave biodiversity in a measurably better condition than prior to development. BNG seeks to provide a means of quantifying losses or gains in biodiversity value brought about by changes in land use, when designed and delivered well, BNG can secure benefits for nature, people and places, and for the economy[1].

Natural Capital (NC) studies key components of nature which are essential for the long-term provision of benefits on which society relies. These components can have a direct or indirect value to people. A natural capital approach, which has been followed in this assessment, understands that nature underpins human wealth, health, wellbeing and culture and seeks to demonstrate the value of the natural environment for people and the economy[2].

Natural assets provide ecosystem services such as regulating floods and improving air quality, and those ecosystem services provide benefits such as reducing the chance a house will flood or improved health. This benefit can then be valued through use of natural capital metrics and can be used to help in the support of delivery of targets, such as putting a value on the potential delivery of BNG.

If any options affect Wales, a Sustainable Management of Natural Resources (SMNR) approach has been followed. The SMNR Principles aim to utilise natural resources in a way, and at a rate that, maintains and enhances the resilience of ecosystems and the benefits they provide. In doing so, the needs of present generations are met without compromising the ability of future generations to meet their own needs[3]. Following the SMNR Principles will also help to achieve the Wellbeing Goals, which have been put in place to improve the social, economic, environmental and cultural wellbeing of Wales[4]. These goals fall under the Well-being of Future Generation (Wales) Act 2015. The application of the SMNR Principles and Wellbeing approach can help to identify solutions which provide multiple benefits under appropriate management. **Appendix A** sets out the SMNR principles and Wellbeing Goals, in relation to an SMNR assessment[5].

While the Environment (Wales) Act (2016) and the Environment Act (2021) in England are not completely synergistic, in this report the terms NCA and BNG have been used for ease of reference, noting that this method also takes into account ecosystem resilience and enhancement opportunities, as required for Wales.

1.3 SUBJECT AREA REQUIREMENTS FOR WRMPS

The purpose of a WRMP is to set out how a water company will achieve a secure supply of water for its customers whilst protecting the environment and demonstrate that it is resilient to a range of future challenges including more extreme droughts, climate change, population growth.

As part of the WRMP, water companies must demonstrate that they have considered a range of environmental legislation and guidance, including the Environment Bill (2021) and Environment (Wales) Act (2016).

[1] Natural England (2021), Biodiversity Net Gain – more than just a number. Accessible via: https://naturalengland.blog.gov.uk/2021/09/21/biodiversity-net-gain-more-than-just-a-number/

[2] UK Government (2021), Enabling a Natural Capital Approach (ENCA) – Updated 20 August 2021

[3] https://naturalresources.wales/media/678063/introducing-smnr-booklet-english-final.pdf

[4] https://gov.wales/well-being-future-generations-act-essentials-html#section-60668

[5] SMNR approach is summarised here to fulfil requirements of assessment; however section 3 shows that no assessment of the feasible options had direct impacts in Wales.

Additionally, the EA and NRW have published separate supplementary guidance on Environment and Society in decision-making[6,7], which provides more detail about the expectation for NCA or ecosystem resilience in England and Wales respectively, and how a Natural Capital Assessment (NCA) and ecosystem resilience can support decision-making. The purpose of this is to allow water companies and Regional Groups to "make decisions that do not devalue and look to enhance the value of the natural world for society benefit" (WRPG Supplementary Guidance[8]) together with supporting water companies within WRW to promote plans that have the potential to deliver wider environmental and social benefits.

The requirements for BNG, NC and biodiversity resilience assessments (in Wales) of a water company WRMP are outlined in the 2022 WRPG, as shown in **Box 1**.

Box 1 WRPG 2022

Section 4.1.1 High-level considerations

England and Wales

Ensure your plan contributes to the conservation and enhancement of biodiversity, delivers net biodiversity gain where appropriate, delivers environmental gain and uses a proportionate natural capital approach.

Consider your duty to conserve biodiversity under section 40 of the Natural Environment and Rural Communities Act (2006) and the list of species and habitats of principal importance set out in section 41 of the Act (England).

Takes a catchment-based approach.

Wales

If your plan affects Wales, ensure your plan delivers biodiversity and environmental requirements and uses a proportionate natural capital approach.

Consider the biodiversity and resilience of ecosystems duty, the section 7 biodiversity lists and duty under the Environment (Wales) Act and Nature recovery action plan for Wales if you supply customers in Wales or your plan affects sites in Wales.

[6] EA (2021) WRPG 2024 supplementary guidance – Environment and society in decision-making. Published 24/03/2021

[7] NRW (2021) WRPG 2024 supplementary guidance – Environment and Society in decision-making (Wales). Published 07/04/2021

2. APPROACH TO THE BIODIVERSITY NET GAIN AND NATURAL CAPITAL ASSESSMENTS

2.1 OVERVIEW OF APPROACH

2.1.1 Biodiversity Net Gain Approach

The BNG assessment is based on use of the Defra Biodiversity Metric 3.0, to assess losses of biodiversity as a result of the options[8]. A GIS-based system has been used, using national datasets, to provide comprehensive coverage of habitat data.

To ensure Severn Trent's preferred programme contributes to the conservation and enhancement of biodiversity and delivers biodiversity net gain, Defra's Biodiversity metric 3.0 has been used to demonstrate how net gain could be achieved on and off-site. Any options within the plan that need planning permission are legally required to provide BNG of 10% in England due to the Environment Act (2021). This is not a legal requirement of the WRMP itself, but it is logical to meet this requirement within the plan to demonstrate Severn Trent Water's commitment to protecting and enhancing biodiversity and demonstrate that 10% BNG can be achieved when required.

For options within the preferred programme, Potential Biodiversity Opportunity (PBO) areas have been identified. These sites are all within 5km from the option locations and are based on a scoring system largely based on the Lawton principles, which is outlined in **Section 2.3**. These sites should then be used in conjunction with the results from the Biodiversity metric, with the metric calculating how much mitigation would be required, and the PBO identification showing potentially beneficial locations for off-site mitigation.

2.1.2 Natural Capital Assessment Approach

WRPG Supplementary Guidance states that NCAs in England should include as a minimum the following five ecosystem services:

- Biodiversity and habitat
- Climate regulation
- Natural hazard regulation
- Water purification
- Water regulation

In addition to those services required as a minimum, we have also considered a **food production** ecosystem service metric. Assessment of social benefits is also advocated by RAPID, therefore additional ecosystem services of **recreation and tourism** has been included to support this requirement noting that:

- 'Health & Well-being' services, which will support compliance with the `Well-being of Future Generations Act' of Wales. This is currently considered to be inherent in the services listed above and is not assessed in its own right
- Agriculture assessment related to food production.

For consistency across the companies in Water Resources West, all of the ecosystem services listed above are included in the assessments for all companies, including this report for Severn Trent.

2.2 SEQUENTIAL PROCESS

Throughout the WRMP process BNG and NCA have been considered in increasing levels of detail, proportionate to the wider WRMP programme. **Figure 2.1** shows the sequential process followed for the assessments. The approach taken for feasible options and consequent programmes of options is as follows:

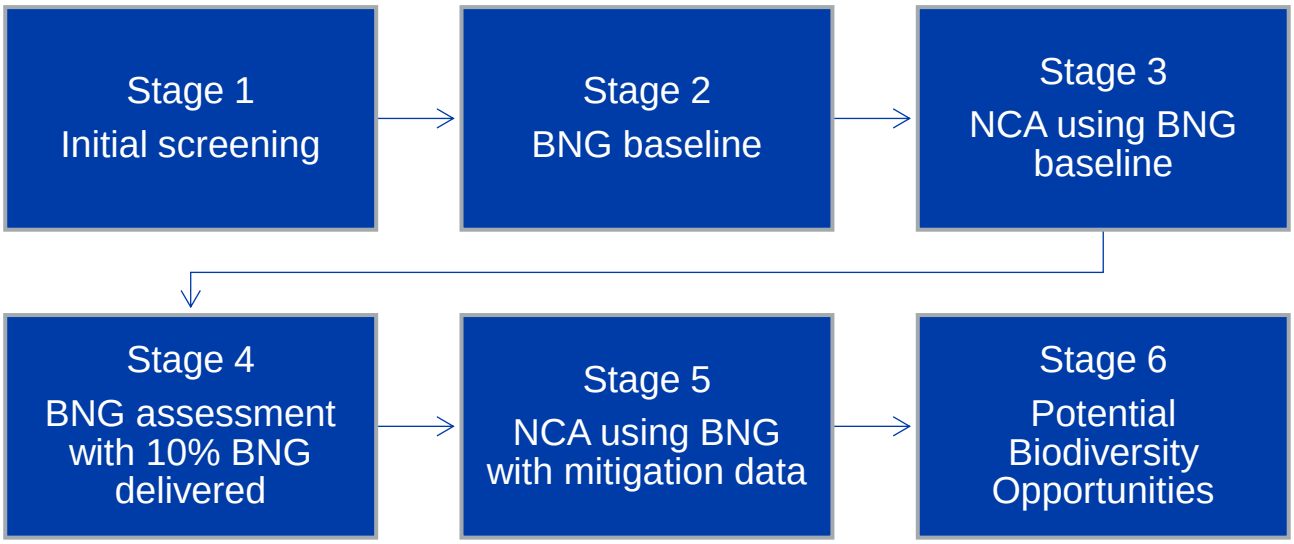
- Feasible options – Stages 1 to 3 of **Figure 2.1**

[8] While a newer version of the metric, v3.1, has now been released, v3.0 has been used for these assessments to provide consistency across multiple WRMPs and through the stages of assessment

- Preferred programme, and any reasonable alternative plans– Stages 1 to 6 of **Figure 2.1**.

In addition, for any options affecting Wales, an SMNR assessment is included between Stages 5 and 6.

Figure 2.1 The sequential process followed for the NC and BNG assessments



2.3 METHODOLOGY

2.3.1 Stage 1 – Initial screening

This high-level qualitative scoring was necessary to assist with the development of the SEA and support detailed screening of options (and associated ecosystems) for the identification the preferred programme. The scoring also fed into Multi Criteria Decision Analysis (MCDA) and helped to support early decision making using the feasible options. Scores from 0 to +3 to 0 to -3 were awarded for each ecosystem service metric as a reflection of the potential level of benefit and disbenefit associated with the metric (allowing for benefits and disbenefits to be recognised separately where appropriate). Overall scores were calculated based on magnitude, scale, and duration of expected impacts, with each of magnitude and duration also being scored between -3 to +3, following the same rules as for the ecosystem services. A brief commentary was also included to describe the benefits or disbenefits.

The results of the Stage 1 assessments are not presented in this report, as they were used only to inform preliminary stages of assessment and were superseded by subsequent stages of assessment.

2.3.2 Stage 2 – Biodiversity Net Gain baseline calculation

Baseline habitat area and condition

Areas of habitats were calculated in QGIS. The CORINE land cover dataset[9] forms the basis of the habitat data, providing continuous coverage across the whole of the UK. This has been supplemented by other datasets where available, to provide improved resolution:

- The Priority Habitats Inventory[10], covering all nationally mapped areas of priority habitat
- National Forest Inventory 2018, to provide improved information about areas of forestry
- OS Zoomstack, providing data about areas of open water and urban extents.

The footprint of impact was calculated for each option using GIS data provided by Severn Trent:

[9] https://www.data.gov.uk/dataset/cd2c59e7-afd9-471d-a056-c5845619dcd7/corine-land-cover-2018-for-the-uk-isle-of-man-jersey-and-guernsey

[10] https://www.data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england

- Where shapefile polygons were available for on-site infrastructure such as water treatment works or pumping stations, they were used directly
- Where polygons were not available, a best estimate of area was made using grid references
- For pipelines, a 30m buffer (15m on each side) was assumed around polyline shapefiles

All areas were defined as having either a temporary or permanent loss of habitat. Pipelines were assumed to have a temporary impact, unless passing through woodland. The latter was classed as permanent to recognise the longer time period to reinstatement. All other types of infrastructure were classed as permanent. The areas of permanent and temporary loss were mapped over the habitat data and ran through a model that identified habitats which would be impacted by the construction and operation of the option. This model prioritises the habitat layers that have high resolution, importance and validity. This ensured that the most accurate and important data was not missed due to overlapping data of lower resolution.

All habitats within the construction buffer are assumed to be lost and re-instated with the existing baseline habitat type and restored to the same condition, except those that will be replaced by permanent above-ground infrastructure.

2.3.3 Stage 3 – Natural Capital Assessment

Data sources, gaps, and assessment

The NCA has been completed using the data sources described below, as recommended by the All Company Working Group (ACWG) environmental assessment guidance for SROs[11] and the EA Water Resources Planning Guideline (WRPG) WRMP24 Supplementary Guidance on Environment and Society in Decision-Making[12].

Natural Capital stocks

The assessment for the NC approach is based on the same available open-source data as used for the Stage 2 BNG assessment. The habitat types used for BNG were converted to broad habitat types to give the total area of each broad habitat impacted by each option. The conversion from the detailed habitat layers to broad habitat was undertaken and is outlined in **Appendix B**.

Broad habitat groupings were determined following the broad groups identified for calculation of carbon sequestration by land use from the EA's Supplementary Guidance (see **Table 2.1** below). Modified grassland has been classified as arable land and not grassland, as per advice from the Office for National Statistics (ONS) in developing a semi-natural grassland ecosystems account[13]. The UK NEA differentiates semi-natural grassland from improved and amenity grassland, as semi natural grassland has a much higher species-richness[14]. Where a land cover class could belong in multiple broad habitat groups it was placed within the one that had a lower carbon sequestration rate, to give a more conservative estimate of benefits.

Climate Regulation (carbon sequestration)

The carbon sequestration rates for NC stocks have been taken from the EA WRPG Supplementary Guidance, as shown in **Table 2.1**. Carbon sequestration rates of the relevant Natural Capital assets have been converted into monetary values using the Department for Business, Energy, and Industrial Strategy (BEIS) Carbon Values. As the prices published by BEIS are in £2020, GDP deflators were used to adjust them to the £2019 base year of modelling.

It is not possible to quantify the non-spatial changes in biodiversity and habitat ecosystem services arising from habitat condition improvement due to limited information currently available. To avoid overestimating the beneficial impact of the change in non-traded carbon sequestration value following BNG habitat creation / reinstatement, this value has been calculated by summing the change in non-traded carbon sequestration value during construction (the temporary loss), the permanent loss and creation.

The monetisation is based on the size of the area, temporary or permanent loss, and biodiversity value of the habitats affected. Higher biodiversity value habitats (e.g., woodland, lowland meadows, heathland) have higher

[11] All Company Working Group (2020). WRMP environment assessment guidance and applicability with SROs

[12] Environment Agency (2020) Water resources planning guideline 2024 supplementary guidance- Environment and society in decision-making (England).

[13] Office for National statistics (2018) Developing semi-natural grassland ecosystem accounts

[14] UK Habitat Classification Working Group (2018). UK Habitat Classification - Habitat Definitions V1.0 at hhtp://ecountability.co.uk/ukhabworkinggroup-ukhab

carbon sequestration monetised value. The higher biodiversity habitats are typically more difficult to recreate following completion of the construction phase so loss and reinstatement of these habitats will result in a greater impact relative to lower value habitats (e.g., arable fields or modified grassland).

Table 2.1 Carbon sequestration of land use from EA WRPG Supplementary Guidance

Land use type	C seq rate (t/CO2e/ha/yr)
Woodland (deciduous)	4.97
Woodland (coniferous)	12.66
Arable land	0.10
Pastoral land	0.39
Grassland	0.39
Heathland & shrub	0.7
Urban	0

Natural Hazard Regulation

For the purposes of this assessment, flooding was determined to be the most significant natural hazard risk. A high-level qualitative assessment has been undertaken based on the EA flood risk zones[15] and the habitats impacted within the buffer area accounting for both temporary and permanent loss of grassland and woodland relative to natural hazard potential risks. A drought risk has been considered related to Catchment Abstraction Management Strategy (CAMS) data with the impact to groundwater and surface water impact reviewed at a high level.

Monetary values were sourced per broad habitat type from existing studies conducted in the UK. Values for woodland and wetlands/ floodplains broad habitat types were identified using the ENCA Services Databook[16], where the associated studies were evaluated to ensure their suitability for benefit transfer.

An annual monetary value was only derived for the flood regulating services of woodland and wetland/ floodplain assets (see **Table 2.2**). Robust monetary values for other broad habitat types, and which could be considered comparable to the values in **Table 2.2**, are not currently available. As a result, it has not been possible to provide a monetised estimate of other services.

Table 2.2 Benefit Transfer Values: Natural Hazard Regulation[17]

Broad habitat type	Annual value	Reference
Woodland	115 (£2018/ha)	Forest Research (2018) & ENCA Services Databook
Freshwater (Open waters/ wetlands/ floodplains)	407 (£2011/ha)	Morris & Camino (2011) & ENCA Services Databook

Water Purification

The WRPG does not require the monetisation of Water Purification services, as these services are highly dependent on local factors (e.g., proximity to a water body) and there are limited tools available to provide accurate monetised assessment. Thus, only a qualitative assessment (as at Stage 1) has been undertaken. The qualitative assessment was based on habitat data and WFD status information from the EA's Catchment Explorer.

[15] https://flood-map-for-planning.service.gov.uk/location

[16] https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca#enca-services-databook

[17] References:

- Forest Research (2018). Valuing flood regulation services of existing forest cover to inform natural capital accounts.
- Morris & Camino (2011) UK National Ecosystem Assessment Economic Analysis Report, School of Applied Sciences, Cranfield University.

Water Regulation

The WRPG does not require the monetisation of Water Regulation services. It is considered that this service is well represented by the Water Framework Directive (WFD) compliance assessment, so to avoid double counting, Water Regulation has been screened out of the assessment.

Recreation and Tourism

The Outdoor Recreation Valuation Tool (ORVal)[18] was used to estimate recreation demand from greenspaces, as a proxy for recreation value. Both open greenspaces and public footpaths were considered.

A conditional percentage was applied to the footpath values depending on the number of footpath intersections (and therefore alternative routes) present.

- If there are no intersections, and therefore no alternative routes, then we take 100% of the footpath value;
- If there are 1-2 intersections present, then 50% of the value is taken;
- If there are 3-4 intersections present, then 25% of the value is taken;
- And if there are 5+ intersections present, 10% of the value is taken.

The use of the ORVal tool has uncertainties surrounding the 'true' impact that the construction may have on recreation and tourism, with ORVal potentially giving an overstated account of the impact. This uncertainty has been reduced by using a developed conditional multipliers approach as outlined above. Additionally, the uncertainty has been reduced by assuming that the impact to recreation and tourism will be, in almost all cases, a temporary impact, although at this stage of assessment and when using the ORVal tool the actual duration of impact (e.g. a footpath closure) is not known. However, at this level of assessment, ORVal remains the recommended and most informative data set to use. The ORVal values are priced to £2016, and the values have been adjusted to £2019 for this assessment.

Agriculture

This assessment adopts the same principles for ecosystem services associated with agriculture as outlined in the UK Natural Capital Accounts, i.e. the distinction between what is considered 'natural capital' and what is 'produced capital' is defined as the "point at which vegetable biomass is extracted"[19]. For the purposes of this assessment, to estimate the annual value per ha of ecosystem services relevant to agricultural production, an adaptation of the whole-farm income method outlined by the UK Office of National Statistics (ONS) Natural Capital Accounts was used[20]. This approach was used as opposed to the industry residual value method adopted for the 2020 ONS Natural Capital Accounts as it allows for differentiation between the provisioning services associated with different farm types (in this case arable and pasture), and was therefore considered more appropriate for this assessment. The marginal values estimated per hectare derived from this method (presented in **Table 2.3** below) remain comparable to the estimated industry residual value per hectare reported by the ONS for their 2020 accounts (£241.80/ ha in 2018).

Table 2.3 Benefit transfer values: provisioning services supporting agriculture

	All farm types (average value/ha, £2019)	Arable (cropping) (average value/ha, £2019)	Pasture (grazing livestock) (average value/ha, £2019)
Northwest (Severn Trent)	236.83	279.86	207.34
Wales (Welsh Dwr Cymru)	155.65	NA	158.57
West Midlands (Severn Trent)	325.26	408.86	206.56
East of England (South Staffs Water)	365.68	354.99	286.29

[18] https://www.leep.exeter.ac.uk/orval/

[19] ONS (2017) Principles of Natural Capital Accounting. [Last accessed 29/04/2021] Accessible via: https://www.ons.gov.uk/economy/environmentalaccounts/methodologies/principlesofnaturalcapitalaccounting

[20] Office for National Statistics (ONS), 2019. UK natural capital accounts methodology guide: October 2019, s.l.: ONS

These values represent the average farm output level estimate of the industry residual value for farms in the Northwest of England. Data was obtained from the Farm Business Survey (England)[21] and was subject to the following high-level calculation:

$$\frac{Average\ output\ from\ agriculture\ -Average\ costs\ for\ agriculture}{Average\ total\ farm\ area\ (ha)}$$

The original method outlined by the ONS (2019) was adapted after calculations with Southeast specific data resulted in a negative residual value per hectare for both arable and pasture. This would imply that the provisioning services of these natural assets have no inherent value and that they do not contribute to agricultural production. It is concluded in the literature that a probable explanation of negative resource rents is that they reflect market distortions such as subsidies[22]. The original method outlined by the ONS excludes subsidies and agri-environment payments and activities from their calculation, however the adapted method adopted for this assessment includes these factors. An overview of what is included is outlined in **Table 2.4**.

The total annual benefit values calculated for this assessment make use of the Southeast estimated averages calculated for each of the variables and component for each of the high-level farm types associated with this assessment (arable and pasture) noting that the average used is defined as the average for all farms in that region for one year.

Table 2.4 Components included within the adapted farm income method

Variable	Components included
Output from agriculture	• Output from agriculture (excl. subsidies and agri-environment payments) • Subsidies and payments to agriculture (excl. agri-environment payments • Agri-environment and related payments (incl. HFA) • Basic Farm payment • Output from diversification
Costs for agriculture	• Costs for agriculture (excluding agri-environment activities) • Costs for agri-environment work • Costs of diversification out of agriculture • Costs associated with Basic Payment Scheme

2.3.4 Stage 4 – Biodiversity Net Gain Assessment with mitigation

This stage is only undertaken for the Preferred Programme and any Reasonable Alternatives.

The calculation of net loss/gain within the Biodiversity Metric 3.0 considers both direct impacts resulting in habitat loss (whether permanent or temporary) and changes in habitat condition. The areas required to achieve 10% net gain for each option have been identified based on the baseline habitats present within the option footprint and following the requirements of the Biodiversity Metric 3.0. This included requirements such as requiring the same habitat (for High distinctiveness habitats) or replacement with the same habitat type or one of higher distinctiveness (for low distinctiveness habitats).

The off-site mitigation required used in the assessments is intended to provide an indicative area off site habitat required to achieve 10% net gain for the schemes. Habitats, where possible, were used in the same proportions as the baseline habitats, excluding habitats which do not provide BNG Units and are not possible to enhance within the metric (e.g., Urban-sealed surface). Moderate to Very high distinctiveness habitats were mitigated through off site enhancement e.g., poor to moderate or moderate to good. It is not possible to enhance cropland in the Biodiversity Metric, so consequently modified grassland was used for off-site mitigation to offset impacts to crop land using a change in habitat type from poor condition Modified grassland to moderate condition Neutral grassland. Examples are shown in **Table 2.5** below.

[21] https://farmbusinesssurvey.co.uk/

[22] Obst, C., Hein, L., & Edens, B., (2016). National Accounting and the Valuation of Ecosystem Assets and their Services, Environ Resource Econ 64, pp 1-23.

Table 2.5 Off-site habitat enhancement rules used to calculate habitat area required to achieve 10% net gain

On-site baseline habitat lost	Off-site habitat pre-mitigation		Off-site habitat post-mitigation	
	Habitat	Condition	Habitat	Condition
Cropland	Modified grassland	Poor	Other neutral grassland	Moderate
Modified grassland	Modified grassland	Moderate	Other neutral grassland	Moderate
Other neutral grassland	Neutral grassland	Moderate	Other neutral grassland	Good
Woodland (broad leaved)	Modified grassland	Moderate	Woodland (broad leaved)	Moderate
Woodland (mixed)	Modified grassland	Moderate	Woodland (mixed)	Moderate
Traditional orchards	Modified grassland	Moderate	Traditional orchards	Moderate
Floodplain wetland mosaic (CFGM)	Modified grassland	Moderate	Floodplain wetland mosaic (CFGM)	Moderate
Lowland calcareous grassland	Lowland calcareous grassland	Moderate	Lowland calcareous grassland	Good

2.3.5 Stage 5 – Natural Capital Assessment using the Biodiversity Net Gain Assessment with mitigation

This stage is only undertaken for the Preferred Programme and any reasonable alternatives.

The NCA undertaken in Stage 5 presents the temporary and permanent loss as at Stage 3, and also takes account of the areas planned for habitat creation and habitat improvement, including consideration of required mitigation for BNG (as calculated at Stage 4).

Between Stages 3 and 5, updated option information was received for some options, which in some cases has resulted in the temporary and permanent impacts differing slightly between the stages of assessment. Besides this, the same data sources were used in both Stage 3 and 5.

Monetary values were sourced per broad habitat type from existing studies conducted in the UK. Values for woodland and wetlands/ floodplains broad habitat types were identified using the ENCA Services Databook[23], where the associated studies were evaluated to ensure their suitability for benefit transfer.

At this stage, with the data currently available, only the impacts of habitat succession can be quantified and not a change in habitat condition. For example, the impact on natural capital of land changing from arable land to semi-natural grassland can be quantified, but that of an area of semi-natural grassland changing condition from moderate to poor cannot be quantified. Quantification of land use change has taken place for natural hazard regulation and climate sequestration by calculating the monetary value of the baseline and post mitigation environment and subtracting the baseline from the post mitigation value.

It has not been possible to monetise the recreation and tourism benefits of the component with BNG uplift as the details of the habitat creation opportunities have not been agreed, therefore these cannot be assessed using the ORVal tool. It is unknown whether new habitat creation sites will provide additional recreation facilities as public access is unknown.

Stage 5 additions in comparison to Stage 3

As a proportionate approach has been taken there are key differences with the water purification, water regulation and natural hazard regulation assessments between Stage 3 and 5. The additional work carried out in Stage 5 for these ecosystem services is outlined below.

Water purification

In addition to the qualitative assessment carried out in Stage 3, a baseline quantitative assessment for Water purification was undertaken using the Natural Environment Valuation Online (NEVO)[24] .

[23] https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca#enca-services-databook

[24] https://sweep.ac.uk/portfolios/natural-environment-valuation-online-tool-nevo/

Natural hazard regulation

For the purposes of this assessment, flooding was determined to be the most significant natural hazard risk, however, the drought risk has also been considered. A high-level qualitative assessment has been undertaken based on the EA flood risk zones[25], this assessment examined the grassland and woodland that would be impacted within the ZoI and considered both the temporary and permanent loss caused by the construction and operation of the option. The drought risk has been considered in relation to the Catchment Abstraction Management Strategy (CAMS) data with the impact to groundwater and surface water impact reviewed at a high level. This approach has enabled a high-level assessment of key questions related to economics, drought mitigation, water storage, and natural function related to water course to be provided.

Water regulation

A high-level assessment has been undertaken, highlighting water resource availability through CAMS data.

2.3.6 Stage 6 – Potential Biodiversity Opportunity areas identification

For options within the preferred programme, Potential Biodiversity Opportunity (PBO) areas have been identified. These sites are all within 5km of the option locations and have been identified based on a scoring system (as shown in **Table 2.6**). A bespoke model has been developed, as outlined in **Figure 2.2**. It pools together more than 20 datasets (outlined in **Table 2.6**) to identify the PBOs, assign scores to them so they could be prioritised, and identify the most suitable PBOs for habitat restoration or creation. The scoring system is largely based on the Lawton principles[26], whereby effort should be made for new/enhanced habitats to be actively incorporated into a healthy ecological network (including landscape corridors, buffer zones, sustainable use areas, etc.), rather than being isolated.

In addition to the datasets listed in **Table 2.6**, the system also considers variables from the Biodiversity Metric. GIS processes such as buffering were carried out on each dataset (where applicable), scores were assigned, and the modified datasets were then rasterised at a 5m resolution (for computational efficiency). These rasters were added together and constraints such as building, railways, roads and planned developments were removed. This dataset was then polygonised, then the areas of each polygon and associated scores (based on the criteria) were calculated. Areas of less than 0.5 ha were removed. The overall score was calculated, and the dataset assigned IDs and exported into shapefile and excel spreadsheet formats that prioritise PBO sites based on an overall score. Sites can then be linked to the outputs from the BNG calculations based on requirement for habitat type and location.

Table 2.6 Scoring criteria for Potential Biodiversity Opportunity areas

Scoring criteria	Dataset/source	Score			
		3	2	1	0
Distance to pipeline	Pipeline options	<1 km	1-3 km	3-5 km	>5 km
Within same LPA as scheme/option – county boundaries	Pipeline options Ordnance Survey GB Counties	Yes	-	-	No
Non-statutory designation	Local wildlife sites, proposed country parks, ecosites	Yes	-	-	No
Proximity to statutory sites	National Nature Reserves, Ramsar sites, Special Areas of Conservation, Special Protection Areas, SSSI sites, Local Nature Reserves	Within 2 km	Within 5 km	-	No

[25] https://flood-map-for-planning.service.gov.uk/location

[26] Prof. J. Lawton (2010), Making Space for Nature. Report for the UK Government

Scoring criteria	Dataset/source	Score			
		3	2	1	0
Strategic significance designation	Canal conservation and restoration, green networks, local greenspace, special landscape, sites for green infrastructure	Yes	-	-	No
Proximity to ancient woodland	Ancient Woodland England and Wales	0.3 km	1 km	-	No
Owned/operated or managed by the relevant water company/companies	Information provided by relevant water company	Yes	-	-	No
Identified as common land	Common Land England	-	-	No	Yes
Size	Calculated using QGIS	>5 ha	1-5 ha	<1 ha	-

3. ASSESSMENT OF THE FEASIBLE OPTIONS

Following the GIS methodology outlined in Section 2.3 that identified both temporary and permanent direct impacts related to the options, it was identified that there was no direct interface with areas of land with Wales. As such no SMNR assessment was carried out.

This section outlines:

- The options in the feasible list for Severn Trent's WRMP24
- The final outcomes of the Natural Capital and Biodiversity Net Gain at an option-level for each of the options in the feasible list for Severn Trent's WRMP24.

3.1 FEASIBLE OPTIONS INCLUDED

Through an extensive optioneering process, considering a wide range of potential options to balance future supply and demand, Severn Trent have selected the most suitable options to make up the feasible options list. This list includes both demand side and supply side options, of which only the latter require a WFD Compliance Assessment. The supply side options are presented in **Table 3.1.**

Table 3.1 List of Severn Trent's draft WRMP24 feasible options

Option Category	WRMP24 Ref.	Option Name
Trunk mains renewal/new	5	Derwent Valley Transfer Main
Reservoir enlargement	6	Upper Derwent Valley Reservoir Expansion (UDVRE)
Groundwater enhancement	22	Recommission Elmhurst GW source
Water treatment works capacity increase	29	Homesford WTW capacity increase
New reservoir	31C	E. Midlands Raw Water Storage (CQ)
New reservoir	31D	E. Midlands Raw Water Storage (CHQ)
Water treatment works capacity increase	32	Little Eaton Expansion (supported by Carsington Reservoir)
Water treatment works capacity increase	33Z	Shelton WTW Expansion
Water reuse	38	Minworth effluent re-use (Large scheme)
Water reuse	39	Minworth effluent re-use (Medium scheme)
New surface water	44	New R Sow abstraction and WTW near Stafford
New surface water	54	River Soar to Cropston WTW
New surface water	58	River Weaver to New WTW at Stoke
Groundwater enhancement	64	Rehabilitation Milton GW Source
Water treatment works capacity increase	66	Strensham WTW Expansion
Internal potable transfer	79A	Wolves-Bham Strategic Link Main (large)
Internal potable transfer	79B	Wolves-Bham Strategic Link Main (small)
Reservoir enlargement	84A	Stanford Minor Dam Extension (84A)
Reservoir enlargement	84B	Lower Shustoke Minor Dam Extension (84B)
Reservoir enlargement	84C	Whitacre Minor Dam Extension (84C)
New surface water	88	River Weaver to Tittesworth WTW
Water treatment works capacity increase	95B	Ogston WTW Expansion
External potable bulk supply/transfer	101	Kinsall Additional Resource (UU import)
New/Enhanced pumping station	103	Mardy Support Link

Option Category	WRMP24 Ref.	Option Name
Internal potable transfer	104	Newark Support Link
Internal potable transfer	105	Ruyton Support Link
Internal potable transfer	108	Stoke to Stafford link main
Internal potable transfer	110	Wolves to Stafford link main
Internal potable transfer	111	Melbourne to Staffs link main
Internal potable transfer	112	Croxton GW to Hob Hill
External potable bulk supply/transfer	117	Peckforton Bulk Import from UU
Trunk mains renewal/new	120	River Severn to Draycote
Internal raw water transfer	121	Mythe to Mitcheldean main
Reservoir enlargement	122A	Draycote Reservoir WL increase (6%)
Reservoir enlargement	122B	Draycote Reservoir WL increase (25%)
Reservoir enlargement	122C	Draycote Reservoir WL increase (50%)
Reservoir enlargement	123A	Raise Dam at Tittesworth Reservoir (5%)
Reservoir enlargement	123B	Raise Dam at Tittesworth Reservoir (25%)
Internal raw water transfer	128	Carsington to Tittesworth main (large)
Internal raw water transfer	128Z	Carsington to Tittesworth main (small)
Internal potable transfer	132	Whaddon to Forest Transfer
Trunk mains renewal/new	134A	Blackbrook reservoir to Cropston WTW
Surface water enhancement	142	Utilise Linacre Reservoirs
New reservoir	143	W.Midlands Raw Water Storage
New surface water	150	Little Haywood new WTW on Upper Trent
New surface water	152	Hampton Loade to Sedgley SR
External raw water bulk supply/transfer	169	Terminate raw water export to Yorkshire Water
Reservoir enlargement	187A	Expand Carsington Reservoir (10000 Ml)
Reservoir enlargement	187B	Expand Carsington Reservoir (16000 Ml)
Reservoir enlargement	187C	Expand Carsington Reservoir (25000 Ml)
New surface water	190	Third party reservoir and new WTW's
Groundwater enhancement	191	Increase Diddlebury/Munslow GW sources and remove network constraints.
External potable bulk supply/transfer	301A	UU import from Llanforda to Shelton (small)
External potable bulk supply/transfer	301B	UU import from Llanforda to Shelton (large)
External raw water bulk supply/transfer	303A	UU release from Vyrnwy (75 Ml/d)
External raw water bulk supply/transfer	303B	UU release from Vyrnwy (40 Ml/d)
External raw water bulk supply/transfer	303C	UU release from Vyrnwy (25 Ml/d)
Internal potable transfer	304	Ambergate to Mid-Notts transfer
Internal potable transfer	305	Heathy Lea to North Notts transfer
Internal potable transfer	309	Transfer from Hampton Loade WTW to Nurton (large)
Internal potable transfer	309Z	Transfer from Hampton Loade WTW to Nurton (small)
Trunk mains renewal/new	313	DVA capacity increase to Heathy Lea (reduce Rivelin export)

Option Category	WRMP24 Ref.	Option Name
Trunk mains renewal/new	314	Expand Bamford WTW and DVA capacity increase (terminate Rivelin export)
New surface water	406	New abstraction and WTW on River Trent
Water treatment works capacity increase	420	Campion Hills WTW DO Recovery
Water treatment works capacity increase	423	Draycote WTW DO Recovery
Water treatment works capacity increase	426	Little Eaton WTW DO Recovery
Water treatment works capacity increase	429	Mythe WTW DO Recovery
Water treatment works capacity increase	430	Ogston WTW DO Recovery
Water treatment works capacity increase	431	Shelton WTW DO Recovery
Water treatment works capacity increase	434	Trimpley WTW DO Recovery
Water treatment works capacity increase	435	Whitacre WTW DO Recovery
Reservoir enlargement	437	Finham FE to expanded Draycote Reservoir and WTW
External potable bulk supply/transfer	523	UU Mow Cop BH Treated water import
New groundwater	528	New GW Source Soar - PT Sandstone nr Coalville
External raw water bulk supply/transfer	549A	Raw water transfer from Congleton to Tittesworth Reservoir (UU import)
External potable bulk supply/transfer	549B	Treated water transfer from Congleton to Tittesworth Reservoir (UU import)
External potable bulk supply/transfer	552	UU Bearstone treated water Import
Trunk mains renewal/new	556	ASL Capacity Increase - Hallgates to Oldbury
Trunk mains renewal/new	557	ASL Capacity Increase - Oldbury to Meriden

3.2 STAGE 2 (BIODIVERSITY NET GAIN OUTCOMES)

The results of the Stage 2 Biodiversity Net Gain calculations are presented for all options in **Appendix D**.

Temporary losses of habitat (associated with pipeline construction) vary between 0 and 2818 Area Based Habitat Units (ABHU) per option. The greatest losses are associated with options that have the longer lengths of new pipeline that will need to be installed. The types of habitats that would be disturbed by pipeline construction vary, with extensive areas of modified grassland but also some high value habitat such as floodplain wetland mosaic.

Permanent losses of habitat include those associated with new permanent above-ground infrastructure. Permanent losses vary between 0 and -4139 ABHU per option. The greatest losses are generally associated with reservoir enlargement.

3.3 STAGE 3 (NATURAL CAPITAL OUTCOMES)

The results of the Stage 3 Natural Capital calculations are presented for all options in **Appendix E**.

Climate regulation

Temporary losses of the climate regulation service have been valued at between £0 and -£9,211 per year per option. The greatest losses relate to long pipelines.

Permanent losses of the climate regulation service have been valued at between £0 and -£18.306 per year per option. The greatest losses are associated with reservoir enlargement.

Natural hazard regulation

Temporary losses of the natural hazard regulation service (with a focus on flooding) have been valued at between £0 and -£2,438 per year per option. As with climate regulation, the greatest losses relate to long pipelines.

Permanent losses of the natural hazard regulation service have been valued at between £0 and -£142,038 per year per option. The greatest losses are again associated with reservoir enlargement.

Recreation and tourism

Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at between £0 and -£1,457,804 per year per option. The losses are associated with disruption to public footpaths, assuming that footpaths crossed by the pipeline route could not be used during construction. In general, options with longer pipelines and those in more highly populated/visited areas experience the greatest losses of value (the former because a longer pipeline has the potential to cross more footpaths. The latter because footpaths in highly populated/visited areas tend to have a higher value).

The values obtained from Orval provide a useful comparison between options. However, they should not be compared to the other monetised services that are discussed here, because the Orval values are considered to be incomparably high.

Agriculture

Temporary losses of the agriculture service have been valued at between £0 and -£119,530 per year per option. The greatest losses relate to long pipelines that cross extensive areas of farmland.

Permanent losses of the agriculture service have been valued at between £0 and -£415,948 per year per option. As mentioned above, this high value is related to reservoir enlargement.

4. ASSESSMENT OUTCOMES FOR THE PREFERRED PROGRAMME

4.1 INTRODUCTION

This section presents the results for Stages 4-6 assessments for Severn Trent's WRMP24. These stages of assessment have been carried out for the options that are included in the preferred programme and any reasonable alternatives

The preferred programme contains 43 supply-side options, these are outlined in **Table 4.1**.

Table 4.1 Supply-side options included in the preferred programme

WRMP24 Ref.	Option Name
6	Upper Derwent Valley Reservoir Expansion (UDVRE)
22	Recommission Elmhurst GW source
29	Homesford WTW capacity increase
31C	E. Midlands Raw Water Storage (CQ)
31D	E. Midlands Raw Water Storage (CHQ)
33Z	Shelton WTW Expansion
44	New R Sow abstraction and WTW near Stafford
58	River Weaver to New WTW at Stoke
64	Rehabilitation Milton GW Source
66	Strensham WTW Expansion
79A	Wolves-Bham Strategic Link Main (large)
84A	Stanford Minor Dam Extension (84A)
84B	Lower Shustoke Minor Dam Extension (84B)
84C	Whitacre Minor Dam Extension (84C)
95B	Ogston WTW Expansion
101	Kinsall Additional Resource (UU import)
103	Mardy Support Link
105	Ruyton Support Link
117	Peckforton Bulk Import from UU
122A	Draycote Reservoir WL increase (6%)
123B	Raise Dam at Tittesworth Reservoir (25%)
128	Carsington to Tittesworth main (large)
128Z	Carsington to Tittesworth main (small)
134A	Blackbrook reservoir to Cropston WTW
143	W.Midlands Raw Water Storage
169	Terminate raw water export to Yorkshire Water
187C	Expand Carsington Reservoir (25000 Ml)
190	Third party reservoir and new WTW's
301B	UU import from Llanforda to Shelton (large)
303C	UU release from Vyrnwy (25 Ml/d)
304	Ambergate to Mid-Notts transfer
305	Heathy Lea to North Notts transfer
309Z	Transfer from Hampton Loade WTW to Nurton (small)
406	New abstraction and WTW on River Trent
420	Campion Hills WTW DO Recovery
423	Draycote WTW DO Recovery
426	Little Eaton WTW DO Recovery

WRMP24 Ref.	Option Name
434	Trimpley WTW DO Recovery
435	Whitacre WTW DO Recovery
523	UU Mow Cop BH Treated water import
528	New GW Source Soar - PT Sandstone nr Coalville
552	UU Bearstone treated water Import
557	ASL Capacity Increase - Oldbury to Meriden

The Stages 4 (BNG) and 5 (Natural Capital) assessments are presented first, for the preferred programme (**Section 4.2**) and reasonable alternative plans (**Section 4.3**). Subsequently, in **Section 4.4**, the Opportunity Mapping (Stage 6) is presented.

4.2 PREFERRED PROGRAMME

4.2.1 Stage 4 (Biodiversity Net Gain) outcomes

The results of the BNG assessment for the preferred programme are presented in **Table 4.2**. This shows the losses that would occur from both temporary and permanent land take. The gains have been calculated to achieve 10% net gain in response to both temporary and permanent losses. While not all of the options may require planning permission (in which case there would not be a statutory requirement for BNG), it was agreed with Severn Trent that 10% net gain should be assumed for all activities involving land take and should include temporary activities. The latter was agreed on the basis that the activities could last for two years or longer, which is the threshold at which BNG is required.

The total habitat units lost as a result of the preferred programme are calculated to be -172 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site an creating or enhancing habitat equating to 6908 ABHU off-site. Some options have been assessed as n/a for a BNG assessment due to the nature of the option, such as water imports.

Table 4.2 Stage 4 Biodiversity Net Gain outcomes

Option ID	Land cover loss type	On-site baseline (ABHU)	On-site post-intervention (ABHU)	On-site net % change	Off-site baseline (ABHU)	Off-site post-intervention (ABHU)	Total net unit change (ABHU)
6	Temporary	199.38	87.01	-56.36	275	408.69	21.32
	Permanent	313.25	0	0	486.2	30.8	31.35
22	Temporary	183.86	152.87	-16.86	112.75	167.19	23.44
	Permanent	0.41	0	0	0.66	1.12	0.05
29	Permanent	9.2	5.39	-41.4	3.63	8.51	1.07
31C	Temporary	111.61	97.01	-13.08	27.5	53.63	11.53
	Permanent	31.97	15.97	-49.61	27.5	46.61	3.39
31D	Temporary	477.77	384.28	-19.57	193.6	337.13	50.05
	Permanent	22.79	0	0	27.5	52.92	2.63
33Z	Permanent	24.07	0	0	38.5	65.1	2.53
44	Temporary	573.81	437.3	-23.79	187.66	382.18	58.01
	Permanent	81.72	0	0	183.7	274	8.58
58	Temporary	12.46	6.61	-46.93	5.72	12.87	1.31
	Permanent	87.49	0	0	244.2	341.26	9.57
64	Temporary	19.38	17.72	-8.53	3.3	7.15	2.2
66	Temporary	46.31	41.42	-10.57	10.34	20.29	5.06

Option ID	Land cover loss type	On-site baseline (ABHU)	On-site post-intervention (ABHU)	On-site net % change	Off-site baseline (ABHU)	Off-site post-intervention (ABHU)	Total net unit change (ABHU)
	Permanent	20.51	0	0	22.99	45.59	2.08
79A	Temporary	195.33	167.78	-14.1	33.22	81.23	20.46
	Permanent	3.81	0	0	3.52	7.77	0.44
84A	Permanent	0.81	0	0	0.73	1.65	0.12
84B	Permanent	1.42	0	0	1.21	2.83	0.2
84C	Permanent	0.75	0	0	0.48	1.33	0.1
95B	Temporary	32.58	22.31	-31.52	17.05	31.04	3.72
101	Temporary	1.13	0.98	-13.28	0.4	0.67	0.13
103	Permanent	12.24	0	0	23.1	36.89	1.55
105	Temporary	50.63	40.74	-19.53	33.22	49.53	6.42
117	Temporary	8.15	6.81	-16.33	3.85	6.01	0.83
122A	Permanent	7.4	0	0	8.58	16.76	0.78
123B	Permanent	55.1	0	0	93.5	154.6	6
128	Temporary	787.9	641.68	-18.56	306.9	535.37	82.25
	Permanent	40.3	0	0	113.08	157.97	4.59
128Z	Temporary	787.9	641.68	-18.56	306.9	535.37	82.25
	Permanent	40.3	0	0	113.08	157.97	4.59
134A	Temporary	137.23	111.18	-18.98	63.8	104.58	14.73
	Permanent	15.58	0	0	16.17	33.45	1.7
143	Temporary	53.19	36.93	-30.57	19.25	40.94	5.43
	Permanent	137.14	0	0	135.3	286.38	13.94
169	Temporary	N/A	N/A	N/A	N/A	N/A	N/A
	Permanent	N/A	N/A	N/A	N/A	N/A	N/A
187C	Permanent	408.01	0	0	649	1101.53	44.51
190	Temporary	356.85	310.11	-13.1	62.92	145.65	35.99
	Permanent	9.47	0	0	7.15	17.66	1.04
301B	Permanent	0.31	0	0	0.53	0.9	0.06
303C	Permanent	8.74	0	0	6.82	16.61	1.05
304	Temporary	364.41	302.37	-17.02	207.9	309.39	39.46
	Permanent	49.9	0	0	68.2	123.64	5.54
305	Temporary	306.71	251.85	-17.89	151.8	237.74	31.08
	Permanent	14.95	0	0	24.2	40.65	1.5
309Z	Temporary	311.34	250.2	-19.64	86.9	180.02	31.97
	Permanent	14.63	0	0	18.7	34.97	1.64
406	Temporary	101.16	86.51	-14.48	19.8	45.04	10.59
	Permanent	6.19	0	0	5.5	12.43	0.74
420	Permanent	2.92	0	0	2.86	6.1	0.31
423	Permanent	4.55	0	0	14.52	19.6	0.53
426	Permanent	1.09	0	0	1.32	2.53	0.12
434	Permanent	6.42	0	0	10.12	17.31	0.77
435	Permanent	12.46	0	0	12.32	26.2	1.42

Option ID	Land cover loss type	On-site baseline (ABHU)	On-site post-intervention (ABHU)	On-site net % change	Off-site baseline (ABHU)	Off-site post-intervention (ABHU)	Total net unit change (ABHU)
523	Temporary	N/A	N/A	N/A	N/A	N/A	N/A
	Permanent	N/A	N/A	N/A	N/A	N/A	N/A
528	Temporary	25.4	19.9	-21.65	6.16	14.36	2.7
	Permanent	3.81	0	0	2.64	6.95	0.5
552	Temporary	N/A	N/A	N/A	N/A	N/A	N/A
	Permanent	N/A	N/A	N/A	N/A	N/A	N/A
557	Temporary	141.88	125.85	-11.3	19.8	50.7	14.87
	Permanent	0.42	0	0	0.24	0.75	0.08
Total		**7890.71**	**5056.06**		**4961.73**	**7828.07**	**832**

4.2.2 Stage 5 (Natural Capital) outcomes

The results of the Natural Capital Assessment for the preferred programme are presented in **Table 4.3**. Like **Table 4.2**, some options are greyed out in **Table 4.3** due to the nature of the option which is not suitable for a NC assessment.

Table 4.3 Stage 5 Natural Capital outcomes

Option ID	Climate regulation			Natural hazard regulation			Recreation		Agriculture		
	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)
6	-£134	-£49,431	-£4,202	£0	-£8,590	£1,423	-£16,757	Assume 100% restored	-£26	-£236	-£236
22	-£292	-£292	£652	-£82	-£182	£380	-£46,322		-£14,352	-£38	-£38
29	£0	£0	£199	£0	-£123	£71	£0		£0	£0	£0
31C	-£340	-£340	£133	£0	-£233	£164	-£51,021		-£6,497	-£2,613	-£2,613
31D	-£1,108	-£1,108	£3,037	£0	-£842	£820	-£114,884		-£20,582	-£1,173	-£1,173
33Z	£0	£0	£262	£0	-£1	£57	£0		£0	-£2,232	-£2,232
44	-£1,318	-£1,318	£5,551	£0	£1,072	£1,582	-£135,671		-£21,138	-£2,214	-£2,214
58	-£4	-£4	£588	£0	-£140	£234	-£8,004		£0	-£1,206	-£1,206
64	-£46	-£46	£41	£0	£0	£0	-£12,468		-£2,675	£0	£0
66	-£102	-£102	£456	-£13	-£371	£299	-£14,238		-£5,964	-£1,325	-£1,325
79A	-£361	-£361	£354	-£57	-£376	£146	-£151,998		-£20,947	-£351	-£351
84A	£0	£0	£70	£0	-£35	£36	-£15,506		£0	-£29	-£29
84B	£0	£0	£8	£0	£0	£0	-£15,506		-£16	£0	-£16
84C	£0	£0	£23	£0	-£4	£8	-£15,506		£0	-£82	-£82
95B	-£19	-£19	£652	-£173	-£235	£322	£0		-£1,084	£0	£0
101	-£2	-£2	£2	£0	£0	£0	£0		-£105	£0	£0
103	£0	£0	£196	£0	-£130	£104	£0		£0	-£204	-£204
105	-£308	-£308	£455	-£21	£0	£69	-£3,925		-£2,815	£0	£0
117	-£12	-£12	£266	£0	-£13	£88	-£9,004		-£713	£0	£0
122A	£0	£0	£26	£0	-£294	£57	-£24,141		£0	-£249	-£249
123B	£0	£0	£491	£0	-£1,074	£448	£0		£0	-£446	-£446
128	-£1,303	-£1,303	£1,938	£0	-£1,254	£241	-£87,548		-£60,445	-£460	-£460
128Z	-£1,303	-£1,303	£1,938	£0	-£1,254	£241	-£87,548		-£60,445	-£460	-£460
134A	-£260	-£260	£2,121	-£118	-£386	£1,348	-£32,081		-£14,008	-£537	-£537
143	-£39	-£39	£625	-£32	-£2,473	£741	-£5,796		-£2,278	-£3,929	-£3,929

Option ID	Climate regulation			Natural hazard regulation			Recreation		Agriculture		
	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)
169											
187C	£0	£0	£11,894	£0	-£3,425	£3,019	£0		£0	-£11,053	-£11,053
190	-£732	-£732	-£313	-£182	-£713	£71	-£23,805		-£42,405	-£1,270	-£1,270
301B	£0	£0	£2	£0	£0	£0	£0		£0	-£29	-£29
303C	£0	-£182	£181	£0	-£153	£198	£0		£0	-£477	-£477
304	-£961	-£961	£1,153	£0	-£385	£142	-£109,790		-£11,507	-£880	-£880
305	-£556	-£556	-£1,149	-£241	-£952	£101	-£161,397		-£28,676	-£169	-£169
309Z	-£498	-£498	£4,055	-£642	-£1,507	£1,751	-£34,834		-£28,661	-£199	-£199
406	-£178	-£178	£960	-£27	-£180	£340	-£67,095		-£10,419	-£1,112	-£1,112
420	£0	£0	£5	£0	£0	£0	£0		£0	-£289	-£289
423	£0	£0	-£14	£0	£0	£0	£0		£0	£0	£0
426	£0	£0	£57	£0	-£5	£19	£0		£0	-£70	-£70
434	£0	£0	£180	£0	-£43	£156	£0		£0	-£481	-£481
435	£0	£0	£501	£0	-£140	£165	£0		£0	£0	£0
523											
528	-£452	-£452	£378	-£140	£0	£117	-£19,880		-£2,169	-£534	-£534
552											
557	-£290	-£298	£467	-£62	-£93	£350	-£26,589		-£16,939	-£79	-£79

Climate regulation

In the 43 supply options in the Preferred Programme, the maximum loss of the climate regulation service would be -£4,202 and the maximum gain would be £11,894 per year per option. The option with the highest overall loss is 006, due to the large area of coniferous woodland that would permanently be lost, even with the 10% net gain being delivered there is still expected to be a loss to climate regulation services.

The largest gain is provided by option 187C. However, schemes which affect larger areas or habitats with higher distinctiveness require more mitigation, therefore resulting in a larger area of habitat enhancement off site to offset the greater initial impact, leading to a higher monetary gain being provided.

The smallest losses are attributed to options with minimal capital works required. For example, Option 423 requires upgrades to Draycote WTW and is situated entirely within the WTW site boundary. Therefore, negligible habitat loss will be incurred from construction.

Natural hazard regulation

In the 43 supply options in the preferred programme, gains of the natural hazard regulation service would be between £0 and £3,019 per year per option. Following the BNG presented, a net gain of the natural hazard regulation service could ultimately be achieved for all options.

As with the climate regulation service, option 187C, due to its large area coverage and the associated mitigation required, delivers the highest climate regulation benefit.

A qualitative assessment looking at flood zones and area coverage of woodland and grassland has also been carried out for the 43 supply-side options in the preferred programme, results are presented in **Appendix F**. Qualitative assessments to investigate drought risk have also been undertaken. These have used sub-catchment CAMS data to assess the water availability for each option at drought (Q95), pre-drought (Q70) and normal flow (Q50) conditions, and from this a risk rating has been assigned to each one. Options identified as 'Low risk' are unlikely to cause or exacerbate a drought within the catchment. This may be because a surplus of water is already present, or the option will have no effect on water abstraction. Moderate risk options pose a chance to affect water availability. Water may be available for abstraction under some flow conditions but not others, or further information is required to make a more accurate assessment. High risk options will almost certainly contribute to an occurring drought. Water is likely unavailable in conditions where the option would be in use. For options where the scheme is situated in Wales and a CAMS assessment is not available[27] a judgement has been made based on the nature of the scheme. Results are presented in **Appendix F**.

Water purification

At a sub-catchment level, the water purification has been studied for the 43 options in the preferred programme through the NEVO tool, these results are outlined in **Table 4.4**. **Table 4.4** also highlights which sectors are the Reason for Not Achieving Good (RNAG) in relation to WFD compliance.

Table 4.4 NEVO tool results for options in the Preferred Programme

Option ID	Quality element			Commentary based on RNAG	Risk rating
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)		
6	11.459	2.678	0.026	Failing due to naturally high total phosphorus, and high PFOS and PBDE from currently unknown sources	Moderate
22	10.829	4.709	0.77	Failing due to a high phosphate level and high macrophytes and phytobenthos caused by the poor livestock management. It is also failing due to the hydrological regime caused by the water industry which disrupts the ecological continuity and flow regime.	Low

[27] CAMS data can be found on Natural Resources Wales website but has been deemed too out of date to be compared to the other CAMS data as some assessments have not been updated since 2015, and the water availability could have significantly changed since this point.

Option ID	Quality element			Commentary based on RNAG	Risk rating
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)		
29	10.894	6.034	0.189	Failing due to chemical factors caused by mining and quarrying (abandoned mines leaching chemicals). Chemicals include high zinc and cadmium and its compounds.	Low
31C	10.483	8.882	0.329	Failing due to poor ecological status caused by low invertebrate presence. Phosphate is high due to poor livestock management and sewage discharge. There is also high macrophytes and phytobethos due to sewage and livestock.	Moderate
31D	9.801	11.528	0.37	Failing due to high phosphate macrophytes and phytobenthos because of private and public sewage discharge and poor livestock management. The fish populations are also failing due to land draining from rural land management.	High
33Z	10.512	10.103	3.666	n/a - No change predicted as replacing existing processes	Low
44	8.958	7.583	0.414	Failing due to chemical factors (high mercury, PBDE and macrophytes and phytobenthos) caused by unknown activity and sector.	High
58	9.615	9.268	0.214	Failing due to high PFOS, macrophytes and phytobenthos, phosphate and ammonia. There are also low invertebrate and fish populations due to the pollutions. Main causes are due to agriculture/rural land management, water industry, urban/transport, and navigation sectors.	High
64	10.407	6.522	0.169	n/a - No change predicted as replacing existing processes	Low
66	9.85	6.297	0.208	Failing due to high macrophytes and phytobenthos, and phosphate Main causes are due to agriculture/rural land management, water industry, urban/transport, and navigation sectors.	High
79A	9.937	8.516	0.165	n/a - A very small area of arable land will be permanently lost. No other habitats that contribute to water purification are permanently impacted.	Low
84A	9.831	7.77	0.394	Failing due to high phosphate, Macrophytes and phytobenthos from poor livestock management, septic tanks, poor nutrient management and urban development.	Low

Option ID	Quality element			Commentary based on RNAG	Risk rating
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)		
84B	9.895	11.569	0.065	Failing due to poor fish and invertebrate populations, as well as high phosphate levels. This is due to sewage discharge, flood protection structures, poor livestock and soil management and reservoir flow disruption.	Low
84C	9.895	11.569	0.065	Failing due to poor fish populations, as well as high phosphate levels, macrophytes and phytobenthos. This is due to poor nutrient management, urban development, sewage discharge, and poor livestock management.	Low
95B	10.894	6.034	0.189	Failing due to chemical factors caused by mining and quarrying (abandoned mines leaching chemicals). Chemicals include high zinc and cadmium and its compounds.	Moderate
101	10.734	8.717	0.314	n/a - This feature will have no impact on water purification services.	Low
103	10.734	8.717	0.314	Moderate due to high phosphate caused by poor livestock management and sewage discharge.	Low
105	10.734	8.717	0.314	n/a - Water purification services are currently provided by arable and woodland habitats. The pipeline will not be constructed near a waterbody. Therefore, there is a negligible impact to water purification services.	Low
117	7.775	6.372	0.333	n/a - Pipeline is not located near water resources so there is no chance of negative impacts on water purification.	Low
122A	9.315	6.83	0.355	Failing due to high phosphate and macrophytes and phytobenthos because of poor nutrient and livestock management.	Low
123B	10.829	4.709	0.077	Failing due to high phosphate, macrophytes and phytobenthos and poor fish populations. This is due to poor livestock management and physical modification from flow regime caused by the water industry.	High
128	11.065	2.949	0.173	Multiple sections of canal - needs specifying.	Low
128Z	11.065	2.949	0.173	Multiple sections of canal - needs specifying.	Low
134A	10.483	8.882	0.329	Failing due to high phosphate because of poor livestock management.	Low

Option ID	Quality element			Commentary based on RNAG	Risk rating
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)		
143	10.734	8.717	0.314	Failing due to high phosphate because of poor livestock management, and macrophytes & phytobenthos due to poor nutrient management. Both have been exacerbated by intermittent sewage discharge from the water industry.	Moderate
169	11.459	2.678	0.026	n/a – Terminating export from reservoirs is unlikely to affect water purification	Low
187C	11.065	2.949	0.173	Failing due to Macrophytes and phytobenthos from poor livestock management. Also failing due to mercury and PBDE but sources are awaiting classification.	High
190	11.095	7.404	0.251	Failing due to poor biological quality elements (fish populations), high phosphate, macrophytes and phytobenthos. This is due to poor livestock and nutrient management, sewage discharge, private sewage treatment, and physical modification with flood protection. There are also invasive North American crayfish present.	Moderate
301B	11.37	5.496	0.341	n/a - No impacts on any waterbodies	Low
303C	10.918	4.648	0.155	RNAG data unavailable from NRW.	Moderate
304	10.894	6.034	0.189	Failing due to high phosphate, macrophytes and phytobenthos, PBDE, mercury and poor invertebrate and fish populations. This is due to poor livestock management, transport drainage, sewage discharge, and physical modification from the water industry.	Low
305	10.355	3.82	0.101	Failing due to high phosphate, macrophytes and phytobenthos, PBDE, PFOS, mercury, Cypermethrin, poor fish and invertebrate, populations. This is due to poor nutrient management, poor soil management, contaminated land from the water and agricultural industries, sewage discharge/incidents, and physical modification (barriers) from the water industry.	Low
309Z	9.937	8.516	0.165	n/a - Water purification services are currently provided by arable and woodland habitats. The construction of pipeline does not pass any waterbody. Therefore, the impact to water purification services will be negligible.	Low

Option ID	Quality element			Commentary based on RNAG	Risk rating
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)		
406	10.531	9.574	0.347	Failing due to poor biological quality elements (fish and invertebrate populations), high phosphate, macrophytes and phytobenthos, PBDE, and Mercury. This is due to poor livestock management, sewage discharge, transport drainage and land drainage. Sectors responsible are agricultural, urban and transport, and water industry.	High
420	9.955	10.815	0.176	n/a - The update to the current WTW is not expected to have negative impact on water purification services.	Low
423	9.315	6.83	0.355	n/a - Water purification services are currently provided by arable habitats. The upgrade of the existing WTW and assets is not expected to impact water purification services.	Low
426	10.894	6.034	0.189	n/a - Water purification services are currently provided by arable and woodland habitats. The upgrade of the existing WTW and assets is not expected to impact water purification services.	Low
434	11.175	5.753	0.106	n/a - The upgrade of the existing WTW and assets is not expected to impact water purification services.	Low
435	9.895	11.569	0.065	The upgrade of the existing WTW and assets could have a minor impact on water purification services due to the lost 1ha of woodland.	Moderate
523	11.451	7.791	0.326	n/a – Importing treated water will not affect any waterbodies	Low
528	10.407	6.522	0.169	n/a - Water purification services currently provided by arable land, construction of BH PS likely to have minor impact. Operational effects likely to be minor.	Low
552	10.512	10.103	3.666	n/a – Importing treated water will not affect any waterbodies	Low
557	9.895	11.569	0.065	n/a – Scheme involves pipeline to link supply networks and Meriden Reservoir to provide more strategic capacity. No effect on WFD waterbodies predicted.	Low

Water regulation

Table 4.5 presents the CAMS data for each option under normal flow conditions (Q_{50}), pre-drought conditions (Q_{70}), and drought conditions (Q_{95}). 'Green' denotes that water is available under the given drought condition, 'Yellow' indicates that water abstraction is restricted, and 'Red' denotes that water is unavailable. For further analysis on the CAMS data see **Appendix F**.

Table 4.5 Water regulation assessment results for the preferred programme options

Option ID	Gains in WAFU / Savings in Demand on full implementation (Ml/d)	Water availability		
		Q_{95} CAMS Assessment	Q_{70} CAMS Assessment	Q_{50} CAMS Assessment
6	60 Ml/d	Yellow	Red	Red
22	2 Ml/d	Yellow	Yellow	Green
29	5 Ml/d	Yellow	Red	Red
31C	24 Ml/d	Green	Green	Green
31D	45 Ml/d	Green	Green	Green
33Z	12 Ml/d	Red	Red	Yellow
44	23 Ml/d	Yellow	Yellow	Green
58	20 Ml/d	Green	Green	Green
64	4.5 Ml/d	Green	Green	Green
66	15 Ml/d	Red	Yellow	Green
79A	30 Ml/d	Red	Red	Red
84A	3 Ml/d	Green	Yellow	Red
84B	3 Ml/d	Red	Red	Red
84C	3 Ml/d	Red	Red	Red
95B	15 Ml/d	Yellow	Red	Red
101	1 Ml/d	Red	Red	Yellow
103	1 3 in 2050-51 (exc OC)	Red	Red	Yellow
105	1 Ml/d	Red	Red	Yellow
117	5 Ml/d	Green	Green	Green
122A	9 Ml/d	Red	Red	Yellow
123B	14 Ml/d	Red	Red	Red
128	30 Ml/d	Red	Red	Red
128Z	16 Ml/d	Red	Red	Red
134A	8 Ml/d	Yellow	Yellow	Yellow
143	33 Ml/d	Red	Red	Yellow
169	35 Ml/d	n/a	n/a	n/a
187C	110 Ml/d	Red	Red	Red
190	18 Ml/d	Grey	Yellow	Red
301B	25 Ml/d	Red	Red	Yellow
303C	23 Ml/d	n/a	n/a	n/a
304	30 Ml/d	Yellow	Red	Red
305	30 Ml/d	Yellow	Red	Red
309Z	12 Ml/d	Red	Yellow	Green
406	30 Ml/d	Green	Green	Green
420	2 Ml/d	Red	Red	Yellow
423	4 Ml/d	Red	Red	Yellow
426	5 Ml/d	Yellow	Yellow	Yellow
434	4 Ml/d	Red	Yellow	Green
435	4 Ml/d	Red	Red	Red
523	2 Ml/d	n/a	n/a	n/a
528	5 Ml/d	Yellow	Yellow	Yellow

Option ID	Gains in WAFU / Savings in Demand on full implementation (Ml/d)	Water availability		
		Q_{95} CAMS Assessment	Q_{70} CAMS Assessment	Q_{50} CAMS Assessment
552	1 Ml/d	n/a	n/a	n/a
557	15 Ml/d	Red	Red	Red

Recreation and tourism

Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at between £0 and -£161,397 per year per option, with the greatest impact being associated with option 305. The losses are associated with disruption to public footpaths, assuming that footpaths crossed by the pipeline route could not be used during construction. It is assumed that all footpaths would be fully restored following the construction works.

There are not anticipated to be any permanent effects on recreation and tourism associated with the options in the Preferred Programme.

At this stage it has not been possible to monetise the recreation and tourism benefits of the component with BNG uplift as the details of the habitat creation opportunities have not been agreed, therefore these cannot be assessed using the ORVal tool. It is unknown whether new habitat creation sites will provide additional recreation facilities as public access is unknown.

Agriculture

In the 43 supply options in the Preferred Programme, losses to agriculture would be between £0 and £11,053 per year per option.

As before, option 187C, due to its large area coverage causes the greatest lost.

4.3 REASONABLE ALTERNATIVE PLANS

Severn Trent set out five alternative programmes alongside the preferred programme, as part of the draft WRMP24 as follows:

- Preferred Programme
- Least Cost Programme (*the same as the preferred programme*)
- Ofwat Core Programme
- Environmental Stretch
- Climate Adjustment
- Gated Success

4.3.1 Stage 4 (Biodiversity Net Gain) outcomes

The results of the BNG assessment for the additional reasonable alternative programme options are presented in **Table 4.6**, noting that reasonable alternative programmes include options from the preferred programme outlined in **Table 4.5** and one or more of the additional options from **Table 4.6** below.

Table 4.6 Stage 4 Biodiversity Net Gain outcomes

Option ID	Programme	Land cover loss type	On-site baseline (ABHU)	On-site post-intervention (ABHU)	On-site net % change	Off-site baseline (ABHU)	Off-site post-intervention (ABHU)	Total net unit change (ABHU)
Option 112	All programmes	Temporary	105.04	87.28	-16.9	19.14	49.14	12.25
		Permanent	20.33	0	0	9.9	32.77	2.55
Option 187B	Ofwat Core	Permanent	217.66	0	0	293.7	533.82	22.46
Option 303A	Gated Success	Permanent	8.74	0	0	6.82	16.61	1.05
Option 429	Climate Adjustment	Permanent	4	0	0	3.96	8.38	0.42
Option 556	Climate Adjustment	Temporary	796.76	706.32	-11.35	103.4	276.07	82.23
		Permanent	1.68	0	0	1.32	3.17	0.17

The total habitat units lost as a result of the **Least Cost Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.

The total habitat units lost as a result of the **Ofwat Core Programme** are calculated to be -4050 ABHU. 10% net gain could be achieved through reinstating 2604 ABHU on-site and creating or enhancing habitat equating to 3621 ABHU off-site.

The total habitat units lost as a result of the **AP2 Environmental Stretch (S11) Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.

The total habitat units lost as a result of the **AP6 – Climate Adjustment (S14) Programme** are calculated to be -7539 ABHU. 10% net gain could be achieved through reinstating 4969 ABHU on-site and creating or enhancing habitat equating to 7196 ABHU off-site.

The total habitat units lost as a result of the **AP5 Gated Success (S4) Programme** are calculated to be -6745 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6925 ABHU off-site.

4.3.2 Stage 5 (Natural Capital) outcomes

The results of the Natural Capital Assessment for the Preferred Programme are presented in Error! Reference source not found.. The most significant gains and losses for each ecosystem service for each reasonable alternative are outlined below.

Table 4.7 Stage 5 Natural Capital outcomes

Option ID	Climate regulation			Natural hazard regulation			Recreation		Agriculture		
	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Total future (£/year)	Temporary loss (£/year)	Permanent loss (£/year)	Total future (£/year)
112	-£156	-£1,922	-£160	-£142	-£411	£336	-£14,532	Assume 100% restored	-£8,539	-£1,032	-£1,032
187B	£0	-£5,942	£4,138	£0	-£1,839	£1,266	£0		£0	-£5,700	-£5,700
303A	£0	-£182	£181	£0	-£153	£198	£0		£0	-£477	-£477
429	£0	-£5	£14	£0	-£98	£19	£0		£0	-£266	-£266
556	-£1,791	-£1,418	£1,857	-£785	-£475	£1,813	-£135,260		-£102,068	-£233	-£233

Climate Regulation

Least Cost Programme: The total loss of the climate regulation service would be -£108,938. The total gain of the climate regulation service would be £34,239.

Ofwat Core Programme: The total loss of the climate regulation service would be -£87,471. The total gain of the climate regulation service would be £12,481.

AP2 – Environmental Stretch (S11) Programme: The total loss of the climate regulation service would be -£108,938. The total gain of the climate regulation service would be £34,239.

AP6 – Climate Adjustment (S14) Programme: The total loss of the climate regulation service would be -£112,153. The total gain of the climate regulation service would be £36,110.

AP5 – Gated Success (S4) Programme: The total loss of the climate regulation service would be -£109,121. The total gain of the climate regulation service would be £34,420.

Natural hazard regulation

Least Cost Programme: The total loss of the natural hazard regulation service would be -£26,324 The total gain of the natural hazard regulation service would be £15,307.

Ofwat Core Programme: The total loss of the natural hazard regulation service would be -£20,077. The total gain of the natural hazard regulation service would be £9104.

AP2 – Environmental Stretch (S11) Programme: The total loss of the natural hazard regulation service would be -£26,324. The total gain of the natural hazard regulation service would be £15,307.

AP6 – Climate Adjustment (S14) Programme: The total loss of the natural hazard regulation service would be -£27,681. The total gain of the natural hazard regulation service would be £17,138.

AP5 – Gated Success (S4) Programme: The total loss of the natural hazard regulation service would be -£26,477. The total gain of the natural hazard regulation service would be £15,505.

A qualitative assessment looking at flood zones and area coverage of woodland and grassland has also been carried out for the additional options included in the reasonable alternative programmes, this is presented in **Table 4.8**. Additionally, qualitative assessments to investigate drought risk have also been undertaken, these results are presented in **Table 4.9**.

Table 4.8 Flood risk assessment results for additional options included in the reasonable alternative programmes

WRMP24 Ref.	Flood risk assessment	
	Temporary impact	Permanent impact
112	Low	Low
187B	High	High
303A	Medium	Medium
429	Low	Low
556	Low	Low

Table 4.9 Drought Risk Assessment for additional options included in the reasonable alternative programmes

WRMP24 Ref.	Drought risk assessment
112	There is no water available for licensing under Q95, Q70 or Q50. It can be stated that this option would present high risk under drought conditions.
187B	A 4.1m extension on the embankment height of Carsington Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream

WRMP24 Ref.	Drought risk assessment
	impact. There is no water available for licensing under Q95, Q70 or Q50. It can be stated that this option would present medium risk under drought conditions.
303A	Medium risk under drought conditions, as the transfer is proposed to be utilised for 55 days per year, uncertainty due to lack of CAMS data.
429	Option requires upgrades to Mythe WTW to increase its output. The increased intake of the WTW could make this scheme high risk, uncertainty due to lack of CAMS data.
556	Scheme improves resilience by increasing potential to transfer surplus water from East Strategic Grid to South. No additional abstraction will take place. The risk of drought being caused by this option is medium.

Recreation

Least Cost Programme: Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at -£1,291,312.

There are not anticipated to be any permanent effects on recreation and tourism associated with the options in this programme.

Ofwat Core Programme: Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at -£840,525.

There are not anticipated to be any permanent effects on recreation and tourism associated with the options in this programme.

AP2 – Environmental Stretch (S11) Programme: Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at -£ 1,291,312.

There are not anticipated to be any permanent effects on recreation and tourism associated with the options in this programme.

AP6 – Climate Adjustment (S14) Programme: Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at -£1,426,572.

There are not anticipated to be any permanent effects on recreation and tourism associated with the options in this programme.

AP5 – Gated Success (S4) Programme: Temporary losses of recreational benefits, as calculated using the Orval tool (described in **Section 2**), have been valued at -£1,291,312.

There are not anticipated to be any permanent effects on recreation and tourism associated with the options in this programme.

Agriculture

Least Cost Programme: The total loss of the agricultural service would be -£409,292. Following mitigation this loss would reduce to -£34,440.

Ofwat Core Programme: The total loss of the agricultural service would be -£273,719. Following mitigation this loss would reduce to -£19,542.

AP2 – Environmental Stretch (S11) Programme: The total loss of the agricultural service would be -£409,292. Following mitigation this loss would reduce to -£34,440.

AP6 – Climate Adjustment (S14) Programme: The total loss of the agricultural service would be -£511,860. Following mitigation this loss would reduce to -£34,939.

AP5 – Gated Success (S4) Programme: The total loss of the agricultural service would be -£409,769. Following mitigation this loss would reduce to -£34,917.

Water purification

Table 4.10 presents the qualitative assessment that has been undertaken. Impacts to water purification services range from negligible to moderate.

Table 4.10 NEVO tool results for additional options in the Alternative Programme

Option ID	Quality element			Commentary based on RNAG	Risk rating
	Dissolved Oxygen (mg/l)	Nitrogen (mg/l)	Phosphorus (mg/l)		
112	10.447	8.486	0.33	Failing due to high phosphate, invertebrates, Macrophytes and phytobenthos from poor livestock management. This is exacerbated by continuous sewage discharge.	Low
187	11.065	2.949	0.173	Failing due to Macrophytes and phytobenthos from poor livestock management. Also failing due to mercury and PBDE but sources are awaiting classification.	High
303	10.918	4.648	0.155	RNAG data unavailable from NRW.	Low
429	10.603	8.682	0.282	Failing due to high phosphate from poor livestock management and continuous sewage. Also failing due to PBDE, PFOS and mercury, but sources are pending investigation.	Low
556	9.801	11.528	0.37	Failing due to poor invertebrate populations, high phosphate, macrophytes and phytobenthos, and low DO due to poor nutrient management, sewage discharge, and urbanisation. Lead and nickel pollution present from sewage and a quarry. Fish are failing due to land drainage, barriers, urbanisation and sewage discharge.	Moderate

Water regulation

Table 4.11 presents the CAMS data for each additional option within the Alternative Programme under normal flow conditions (Q_{50}), pre-drought conditions (Q_{70}), and drought conditions (Q_{95}). 'Green' denotes that water is available under the given drought condition, 'Yellow' indicates that water abstraction is restricted, and 'Red' denotes that water is unavailable.

Table 4.11 Water regulation assessment results for additional schemes within the Alternative Programme

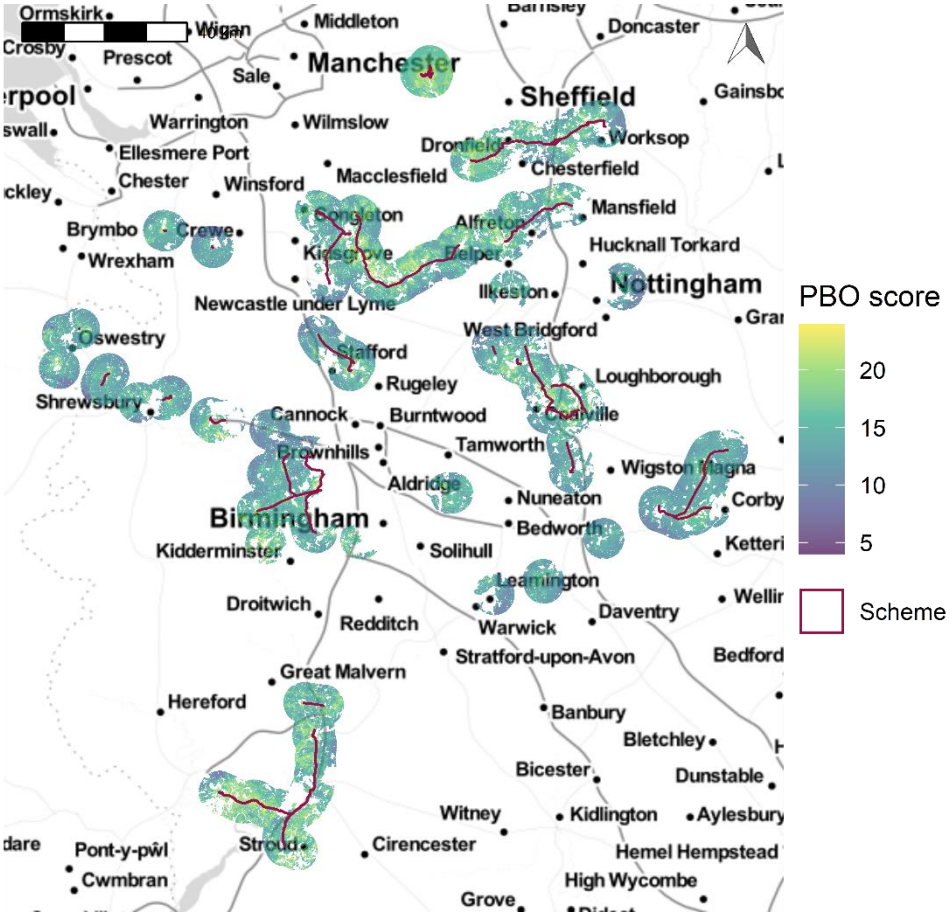
Option ID	Gains in WAFU / Savings in Demand on full implementation (Ml/d)	Water availability		
		Q_{95} CAMS Assessment	Q_{70} CAMS Assessment	Q_{50} CAMS Assessment
112	3 Ml/d	Red	Red	Red
187	75 Ml/d	Red	Red	Red
303A	68 Ml/d	CAMS data unavailable	CAMS data unavailable	CAMS data unavailable
429	1 Ml/d	Red	Yellow	Green
556	15 Ml/d	red	Red	Yellow

4.4 MAPPING OF POTENTIAL BIODIVERSITY OPPORTUNITY AREAS

Potential Biodiversity Opportunity Areas have been identified according to the methodology set out in **Section 2**. A heat-map demonstrating the distribution of areas potentially suitable for biodiversity opportunities is presented in **Figure 4.1**. Higher scores indicate areas of potentially greater opportunity. These maps and the data from which they are created can be used to identify high-scoring sites that present good opportunities for habitat creation within a wider network. These are most extensive in the areas in lighter greens and yellows in **Figure 4.1,** although localised opportunities may still be found elsewhere. It may be important to consider opportunities within the vicinity of individual options, so that the habitat gain is provided close to the losses, and in order to provide the benefit to local communities. It should be noted that on Figure 4.1 some potential biodiversity areas straddle the English/Welsh border. These areas could have the potential to mitigate for English BNG requirements and support Welsh biodiversity resilience related to options that have a foot print in England only.

However, gaining an overview of the optimal options associated with the combined suite of options in the Preferred Programme/Reasonable Alternative Plan may allow more integrated and effective opportunities to be identified. This mapping has been produced based on Option 112, 429 and 556 currently being considered within the preferred programme. As the preferred programme and reasonable alternatives have many options in common, only one PBO map has been presented.

Figure 4.1 Overall PBO map



5. SUMMARY

This report has presented the Biodiversity Net Gain and Natural Capital Assessments that have been undertaken for Severn Trent's draft Water Resources Management Plan 2024. The approaches taken are in line with relevant guidance, notably the WRPG 2024 Supplementary Guidance on Environment and Society in Decision-making.

For the feasible options in the WRMP, this report has presented losses of biodiversity associated with all options that involve any temporary or permanent land-take. The losses have been assessed using the Defra biodiversity metric V3.0, based on spatial land use and habitat datasets with national coverage. Associated natural capital losses have been calculated for an agreed selection of ecosystem services. The assessment shows that the greatest impacts on biodiversity and associated regulating ecosystem services tend to be associated with options with long pipelines. For permanent above-ground infrastructure, the greatest losses are associated with reservoir enlargement.

The biodiversity losses were re-calculated for the 43 options in the Preferred Programme, the additional five options in the Reasonable Alternative Plan, then these were used to calculate losses for the Least Cost Programme, the Ofwat Core Programme, AP2 Environmental Stretch (S11), AP6 – Climate Adjustment (S14) and AP5 Gated Success (S4).

- The total habitat units lost as a result of the **Least Cost Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.
- The total habitat units lost as a result of the **Least Cost Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.
- The total habitat units lost as a result of the **Ofwat Core Programme** are calculated to be -4050 ABHU. 10% net gain could be achieved through reinstating 2604 ABHU on-site and creating or enhancing habitat equating to 3621 ABHU off-site.
- The total habitat units lost as a result of the **AP2 Environmental Stretch (S11) Programme** are calculated to be -6737 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6908 ABHU off-site.
- The total habitat units lost as a result of the **AP6 – Climate Adjustment (S14) Programme** are calculated to be -7539 ABHU. 10% net gain could be achieved through reinstating 4969 ABHU on-site and creating or enhancing habitat equating to 7196 ABHU off-site.
- The total habitat units lost as a result of the **AP5 Gated Success (S4) Programme** are calculated to be -6745 ABHU. 10% net gain could be achieved through reinstating 4262 ABHU on-site and creating or enhancing habitat equating to 6925 ABHU off-site.

An opportunity mapping exercise has been carried out to identify potentially beneficial areas to locate the net gain associated with the Preferred Programme and Reasonable Alternative Plan. The mapping has taken into account a range of factors including the LPA, local designations, proximity to statutory sites, proximity to ancient woodland and others. Taking these types of factors into account when identifying off-site opportunities for net gain allows a strategic approach to be taken to providing benefits to local communities and incorporating habitats into wider ecological networks. Further work is anticipated within Severn Trent towards selecting optimal sites, building on the mapping exercise that has been undertaken so far.

APPENDICES

Appendix A SMNR principles

SMNR Principles	**Adaptive management**	**Manage adaptively by planning, monitoring, reviewing and where appropriate, changing actions**
	Scale	Consider the appropriate spatial scale for action
	Collaboration and engagement	Promote and engage in collaboration and cooperation
	Public Participation	Make appropriate arrangements for public participation in decision-making
	Evidence	Take account of all relevant evidence, and gather evidence in respect of uncertainties
	Multiple benefits	Take account of the benefits and intrinsic value of natural resources and ecosystems
	Long term	Take account of the short-, medium- and long-term consequences of actions.
	Preventative action	Take action to prevent significant damage to ecosystems
	Building resilience	(i) diversity between and within ecosystems; (ii) the connections between and within ecosystems; (iii) the scale of ecosystems; (iv) the condition of ecosystems (including their structure and functioning); (v) the adaptability of ecosystems
Welsh Wellbeing Goals	A globally responsible Wales	A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.
	A prosperous Wales	An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including action on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.
	A Wales of vibrant culture and thriving Welsh language	A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.
	A Wales of cohesive communities	Attractive, viable, safe and well-connected communities.
	A more equal Wales	A society that enables people to fulfil their potential no matter what their background or circumstances (including their socio-economic background and circumstances).
	A healthier Wales	A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.

Appendix B Conversion from UKHab to Broad Habitats

Land Cover Classification	Broad habitat type
Cropland – Cereal crops	Arable
Modified grassland	Semi natural grassland
Heathland and shrub	Heathland and shrub
Lowland mixed deciduous woodland	Deciduous woodland
Neutral grassland	Semi natural grassland
Lakes – pond	Freshwater
Other coniferous woodland	Coniferous woodland
No habitat	Urban
Broadleaved woodland	Deciduous woodland
Poor semi-improved grassland	Semi natural grassland
Other rivers and streams	Freshwater
Eutrophic standing waters	Freshwater
Other coniferous woodland	Coniferous woodland
River and streams	Freshwater
Sparsely vegetated land	Sparsely vegetated land
Lowland heathland	Heathland and shrub
Other woodland mixed	Deciduous woodland
Traditional orchards	Semi natural grassland
Lowland meadows	Semi natural grassland
Floodplain wetland mosaic	Semi natural grassland
Traditional orchards	Semi natural grassland
Bramble	Heathland and shrub

Appendix C Natural Capital assumptions and caveats

Ecosystem service	Compliance level	Type of assessment	Caveats and assumptions
Biodiversity	Minimum	Qualitative	Full best practice not available at this stage as no data related to condition and extent of habitats, will require more detailed assessment at planning stage
	Minimum	Quantitative	Local Nature Recovery Strategy looked at but until more detail on options/preferences needed to understand exactly where BNG habitats will be best placed.
	N/a	Monetisation	Limited data to apply any proportional monetised approach at this stage. Would require more detailed assessment at planning stage and any future monetisation agree with regulators if required.
	Minimum	Qualitative	The final BNG uplift and mitigation sites will be decided following detailed design, any PBOs identified at this stage are only showing possible suitable locations.
Climate Regulation	Minimum	Qualitative	Knowledge of this in Hectares (Ha) provide an assessment of habitats with carbon storage potential that maybe lost (temporary and permanent) with a key focus on grassland and woodland.
Natural Hazard Regulation	Minimum	Qualitative	Based on flood zone intersection with ZoI, judgement of intersection has been carried out at a high-level.
Water Purification	Minimum	Quantitative	NEVO tool integrated to pull together sub-catchment information on Nitrogen, Phosphorus, Dissolved oxygen and pesticide concentration levels to provide a high-level assessment. Data only at sub catchment level (2 KM + gird) so course information.
	Not essential	Monetisation	Not feasible at this stage noting that best practice requires significant data that is not available for options at this stage.
Water Regulation	Minimum	Qualitative	High level assessment at this stage. Future and current abstractors need to be reviewed during stakeholder engagement at detailed planning stage.
	Minimum	Quantitative	Wider stakeholder engagement has not been carried out at this stage, due to programme uncertainty. Therefore, assessment of water reaming for other existing and future users has not been considered at this stage though recognise this is important.
Recreation	Not essential	Monetised (losses only) provided	Values only relate to recreational assets that will be lost temporarily.

Appendix D Results of Stage 2 (feasible options) BNG calculations

Option ID		Temporary impacts		Permanent impacts	
	Total area (ha)	Temporary area lost (ha)	Total units lost (ABHU)	Permanent area lost (ha)	Total units lost (ABHU)
5	109.71	109.32	-563.09	0.392	-1.64
6	62.68	0	0	62.68	-18.64
22	38.45	38.36	-183.86	0.09	-0.41
29	1.77	0	0	1.767	-9.2
32	1.77	0	0	1.77	-0.7
38	104.96	96.12	-270.84	8.838	-13.71
39	59.16	53.86	-156.82	5.3	-9.69
44	42.00	39.82	-206	2.178	-71.47
54	28.54	19.7	-48.18	8.837	-38.07
58	14.14	1.767	-12.46	12.37	-58.08
64	6.54	6.54	-19.38	0	0
66	20.77	14.97	-46.31	5.803	-20.51
88	118.34	114.297	-517.7	4.046	-18.19
101	0.26	0.257	-1.13	0	0
103	1.77	0	0	1.77	-11.55
104	20.86	20.86	-78	0	0
105	10.63	10.63	-37.62	0	0
108	75.64	72.105	-293.92	3.535	-11.69
110	217.73	209.784	-715.43	7.942	-22.59
111	234.87	229.568	-2817.52	5.302	-2749.18
112	27.61	23.449	-105.04	4.156	-20.33
117	1.80	1.8	-8.15	0	0
120	328.34	328	-1117.43	0.3371	-0.88
121	133.69	91.7439	-346.43	41.95	-41.95
128	177.15	171.85	-787.9	5.303	-26.92
132	0.00	0	0	0	0
142	4.42	0.698	-5.21	3.719	-27.07
143	38.54	9.7083	-53.19	28.832	-137.23
150	39.45	35.454	-201.5	3.991	-37.01
152	68.31	62.725	-201.5	5.583	-31.48
169	0.00	0	0	0	0
190	119.79	116.487	-356.85	3.301	-9.47
191	0.79	0	0	0.7854	-3.40
304	65.98	60.678	-251.38	5.302	-45.05
305	85.08	82.5364	-302.41	2.54	-14.63
309	-308.44	-311		2.56	-14.63
313	18.25	16.481	-87.12	1.768	-5.87
314	143.76	138.46	-715.14	5.3	-22.22
406	29.94	27.22	-100.65	2.72	-6.19
420	1.79	0	0	1.785	-2.28
423	1.77	0	0	1.77	-2.27

Option ID		Temporary impacts		Permanent impacts	
	Total area (ha)	Temporary area lost (ha)	Total units lost (ABHU)	Permanent area lost (ha)	Total units lost (ABHU)
426	1.77	0	0	1.77	-1.09
429	1.77	0	0	1.77	-4
430	1.29	0	0	1.29	-6.01
431	1.74	0	0	1.74	-1.36
434	1.74	0	0	1.74	-6.42
435	1.77	0	0	1.77	-12.46
437	81.84	80.27	-252.63	1.57	-2.38
439	1378.65	283.64	-872.71	1095.01	-4139.32
523	0.00	0	0	0	0
528	8.40	6.6	-25.4	1.8	-3.81
552		0	0	0	0
556	96.42	96.42	-288.75	3.14	-6.89
557	43.194	43.19	-140.74	0.786	-1.84
122A	0	0	0	241.8	-2123.77
122B	0	0	0	252.772	-2181.96
122C	0	0	0	271.341	-2253.93
123A	0	0	0	64.7383	-569.18
123B	0	0	0	74.61	-39.18
128Z	171.85	171.85	-787.9	5.303	-26.92
134A	37.88	37.88	-137.23	2.43	-15.58
187A	0	0	0	321.768	-2749.18
187B	0	0	0	333.284	-2817.52
187C	0	0	0	367.344	-3016.65
301A	0	0	0	0.7854	-0.31
301B	0	0	0	0.7854	-0.31
303A	0	0	0	3.535	-8.74
303B	0	0	0	3.535	-8.74
303C	0	0	0	3.535	-8.74
309Z	86.6153	86.6153	-311.34	2.536	-14.63
31C	26.081	26.081	-111.61	6.757	-31.69
31D	88.29	88.29	-477.77	16.23	-39.18
33Z	0	0	0	6.36	-0.92
549A	0	0	0	0	0
549B	0	0	0	0	0
79a	79.9	79.9	-185.313	1.62	-3.81
79b	79.9	79.9	-185.313	1.62	-3.81
84A	0	0	0	51.85	-455.77
84B	0	0	0	36.9183	-320.72
84C	0	0	0	4.13	-34.42
95B	5.03	5.03	-32.58	0	0

Appendix E Results of Stage 3 (feasible options) Natural Capital calculations

Option ID	Temporary impacts					Permanent impacts				
	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture
	Hectares	£2019/year	£2019/year	£2019/year	£2019/year	Hectares	£2019/year	£2019/year	£2019/year	£2019/year
5	-108.38	-£7,165	-£1,966	-£33,040.34	-£32,360	-1.55	-£138	-£38	£0	-£108
6	0	£0	£0	-£85,641.12	£0	-62.69	-£1,385.32	-£27,952.88	0	-£5.68
22	-38.36	-£832	-£264	-£203,214	-£14,352	-0.09	-£1	£0	£0	-£38
31c	-26.08	-£390	-£96	-£153,086	-£9,926	- 1	-£5	-£22	£0	-£313
31d	0.00	£0	£0	£0	£0	- 16	-£60	-£1,995	£0	-£3,489
33Z	0.00	£0	£0	£0	£0	-6.46	-£73	-£12	£0	-£2,232
29	0.00	£0	£0	£0	£0	-1.77	-£364	-£264	£0	£0
32	0.00	£0	£0	£0	£0	-1.77	-£1	-£0	£0	-£33
38	-94.74	-£2,014	-£470	-£239,368	-£33,136	-8.84	-£50	-£8	£0	-£1,555
39	-53.88	-£1,260	-£313	-£144,329	-£18,155	-5.30	-£79	-£8	£0	£0
44	-39.82	-£2,183	-£537	-£439,434	-£15,125	-2.18	-£139	-£37	£0	-£410
54	-19.70	-£521	-£147	-£120,960	-£4,862	-8.84	-£272	-£372	£0	-£2,873
58	-1.77	-£420	-£140	-£23,834	£0	-12.00	-£80	-£417	£0	-£4,668
64	-6.54	-£46	£0	-£35,775	-£2,675	0.00	£0.00	£0	£0	£0
66	-14.97	-£215	-£51	-£51,197	-£5,964	-5.80	-£363	-£334	£0	-£1,325
79A	-79.90	-£1,327	-£307	-£457,755	-£20,558	-1.62	-£6	-£53	£0	-£351
79B	-79.90	-£1,327	-£307	-£457,755	-£20,558	-1.62	-£6	-£53	£0	-£351
84A	0.00	£0	£0	-£56,493	£0	-51.85	-£1	-£24,210	£0	-£29
84B	0.00	£0	£0	-£56,493	£0	-36.92	-£0	-£16,967	£0	-£16
84C	0.00	£0	£0	-£56,493	£0	-4.13	-£14	-£1,793	£0	-£82
88	-114.30	-£2,420	-£1,071	-£371,587	-£42,360	-4.05	-£91	-£204	£0	-£1,417
95B	0.00	£0	£0	£0	£0	-5.30	-£716	-£408	£0	-£1,084
101	-0.26	-£2	£0	£0	-£105	0.00	£0	£0	£0	£0

Option ID	Temporary impacts					Permanent impacts				
	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture
	Hectares	£2019/year	£2019/year	£2019/year	£2019/year	Hectares	£2019/year	£2019/year	£2019/year	£2019/year
103	0.00	£0	£0	£0	£0	-1.77	-£391	-£130	£0	-£270
104	-20.86	-£360	-£73	-£73,480	-£8,247	0.00	£0	£0	£0	£0
105	-10.63	-£248	-£68	-£17,651	-£4,024	0.00	£0	£0	£0	£0
108	-71.76	-£1,830	-£606	-£254,731	-£27,457	-3.54	-£25	£0	£0	-£1,445
110	-208.81	-£3,143	-£789	-£686,094	-£67,613	-7.94	-£56	-£54	£0	-£2,103
111	-229.33	-£5,565	-£2,417	-£891,115	-£82,409	-5.30	£0	£0	£0	£0
112	-23.45	-£904	-£362	-£42,228	-£8,539	-4.16	-£1,177	-£191	£0	-£1,032
117	-1.85	-£50	-£13	-£28,259	-£713	0.00	£0	£0	£0	£0
120	-328.05	-£6,776	-£1,337	-£912,203	-£119,530	-0.38	-£1.68	-£5.28	£0	-£98
122a	0.00	£0	£0	-£84,395	£0	-241.80	-£4	-£112,751	£0	-£249
122b	0.00	£0	£0	-£89,870	£0	-252.77	-£45	-£114,895	£0	-£2,628
122c	0.00	£0	£0	-£104,473	£0	-271.34	-£200	-£116,143	£0	-£8,214
123a	0.00	£0	£0	£0	£0	-64.74	-£248	-£30,039	£0	-£4
123b	0.00	£0	£0	£0	£0	-74.61	-£2,460	-£32,305	£0	-£446
128Z	-172.86	-£5,090	-£1,617	-£290,162	-£60,445	-6.30	-£259	-£152	£0	-£1,835
128	-171.86	-£5,090	-£1,617	-£290,162	-£60,445	-5.30	-£259	-£152	£0	-£1,835
121	-60.15	-£1,058	-£420	-£164,538	-£21,506	-7.34	-£1,177	-£841	£0	-£322
132	0.00	£0	£0	£0	£0	0.00	£0	£0	£0	£0
134A	-37.88	-£979	-£360	-£94,997	-£14,008	-2.43	-£383	-£144	£0	-£537
142	-0.70	-£184	-£62	£0	-£70	-3.72	-£712	-£620	£0	-£357
143	-9.71	-£1,529	-£498	-£15,724	-£2,278	-28.83	-£4,219	-£2,007	£0	-£3,937
150	-35.45	-£630	-£101	-£195,102	-£13,398	-3.99	-£28	£0	£0	-£1,631
152	-62.73	-£1,311	-£443	-£176,893	-£22,590	-5.58	-£741	-£241	£0	-£1,424
169	0.00	£0	£0	£0	£0	0.00	£0	£0	£0	£0
187A	0.00	£0	£0	£0	£0	-321.77	-£4,166	-£139,166	£0	-£4,044

Option ID	Temporary impacts					Permanent impacts				
	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture
	Hectares	£2019/year	£2019/year	£2019/year	£2019/year	Hectares	£2019/year	£2019/year	£2019/year	£2019/year
187B	0.00	£0	£0	£0	£0	-333.28	-£5,942	-£139,986	£0	-£5,700
187C	0.00	£0	£0	£0	£0	-367.34	-£11,171	-£142,038	£0	-£11,053
190	-116.49	-£2,651	-£804	-£65,130	-£42,405	- 3.30	-£22	-£92	£0	-£1,270
191	0.00	£0	£0	£0	£0	-0.79	-£5	£0	£0	-£316
301A	0.00	£0	£0	£0	£0	-0.79	-£0	£0	£0	-£29
301B	1.00	£0	£0	£0	£0	0.21	-£0	£0	£0	-£29
303A	0.00	£0	£0	£0	£0	-3.54	-£182	-£153	£0	-£477
303C	0.00	£0	£0	£0	£0	-3.54	-£182	-£153	£0	-£477
303c	0.00	£0	£0	£0	£0	-3.54	-£182	-£153	£0	-£477
304	-60.68	-£998	-£738	-£321,220	-£22,623	-5.30	-£716	-£235	£0	-£1,333
305	-82.54	-£3,174	-£713	-£480,883	-£28,698	-2.54	-£1,395	-£240	£0	-£199
309	-86.62	-£4,509	-£1,908	-£98,723	-£28,661	-2.54	-£1,395	-£240	£0	-£199
309Z	-85.62	-£4,509	-£1,908	-£98,723	-£28,661	-1.54	-£1,395	-£240	£0	-£199
313	-16.48	-£1,606	-£463	-£72,058	-£4,701	-1.77	-£134	-£44	£0	-£241
314	-138.41	-£9,211	-£2,438	-£343,296	-£41,957	-5.30	-£633	-£128	£0	-£1,346
406	-27.22	-£713	-£180	-£183,182	-£10,419	-2.72	-£19	£0	£0	-£1,112
420	0.00	£0	£0	£0	£0	-1.79	-£6	£0	£0	-£349
423	0.00	£0	£0	£0	£0	-1.77	-£4	£0	£0	-£211
426	0.00	£0	£0	£0	£0	-1.77	-£15	-£5	£0	-£70
429	0.00	£0	£0	£0	£0	-1.77	-£15	-£5	£0	-£70
430	0.00	£0	£0	£0	£0	-1.29	-£38	-£35	£0	-£293
431	0.00	£0	£0	£0	£0	-1.74	-£49	-£16	£0	-£1
434	0.00	£0	£0	£0	£0	-1.74	-£49	-£16	£0	-£1
435	0.00	£0	£0	£0	£0	-1.77	-£420	-£140	£0	£0
437	-80.28	-£1,234	-£189	-£198,607	-£30,527	-1.57	-£4	£0	£0	-£222

Option ID	Temporary impacts					Permanent impacts				
	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture	Biodiversity	Climate Regulation	Natural Hazard Regulation	Recreation and Tourism	Agriculture
	Hectares	£2019/year	£2019/year	£2019/year	£2019/year	Hectares	£2019/year	£2019/year	£2019/year	£2019/year
439	-283.64	-£5,093	-£1,078	-£1,457,804	-£92,732	-1095.01	-£18,306.45	-£3,345	£0	-£415,948
523	0.00	£0	£0	£0	£0	0.00	£0.00	£0	£0	£0
528	-6.60	-£452	-£140	-£14,037	-£2,169	-1.82	-£9.17	£0	£0	-£536
549A	0.00	£0	£0	£0	£0	0.00	£0.00	£0	£0	£0
549B	0.00	£0	£0	£0	£0	0.00	£0.00	£0	£0	£0
552	0.00	£0	£0	£0	£0	0.00	£0	£0	£0	£0
556	-96.43	-£1,085	-£138	-£396,031	-£38,475	-3.14	-£36.52	£0	£0	-£942
557	-43.19	-£567	-£86	-£75,428	-£17,028	-0.79	-£11.30	-£2	£0	-£314

Appendix F Natural Hazard Regulation assessment results drought and flood risk

Option ID	Estimated flood risk related to change/loss in habitats within ZoI	Estimated flood risk related to change/loss in habitats, related to permanent loss
6	High	High
22	Low	Low
29	High	High
31C	High	High
31D	High	Low
33Z	Low	Low
44	High	High
58	High	High
64	Low	Low
66	High	Medium
79A	Low	Low
84A	High	High
84B	High	High
84C	High	High
95B	Medium	Medium
101	Low	n/a
103	Low	Low
105	High	n/a
117	Low	n/a
122A	Low	Low
123B	High	High
128	High	Low
128Z	High	Low
132	High	High
134A	High	High
143	High	High
169	n/a	n/a
187C	High	High
190	High	Low

Option ID	Estimated flood risk related to change/loss in habitats within ZoI	Estimated flood risk related to change/loss in habitats, related to permanent loss
301A	Low	Low
301B	Low	Low
304	High	Low
305	High	Low
309Z	Low	Low
406	Low	High
420	Low	Low
423	Low	Low
426	Low	Low
434	High	High
435	Low	Low
523	Low	Low
528	Low	Low
552	Low	Low
557	Low	Low

Option ID	Drought risk
6	A 10m extension on the dam height of Howden Reservoir involves no additional abstraction from the waterbody. There is restricted water available for licensing under Q95, and none available under Q70 and Q50. It can be stated that this option would present medium risk under drought conditions.
22	Further information required to understand GW availability. Further study into BH records and local geology would lay outside the scope of this assessment.
29	The option would involve an increase in rate of abstraction under high flows in spring/summer. Most recent CAMS assessment indicates no water availability under Q70 and Q50, therefore the option would present high risk under drought conditions.
31C	The option would involve the abstraction of 50Ml/d from the River Soar. Although there is water available for abstraction in this catchment, the proposed abstraction would reduce flows to zero under Q95 and Q70, and significantly reduce flow magnitude under Q50. Therefore this option is designated as high risk under drought conditions.

Option ID	Drought risk
31D	The 50Ml/d abstraction would have negligible effects on the flows in the River Trent. The recent CAMS assessments indicates that there is water available for abstraction. The risk under drought conditions of this option is low.
33Z	The utilisation of the full abstraction license on the River Severn resulting in a further 10Ml/d flow reduction would present a moderate risk under drought conditions. Despite the minimal reduction in flow, the recent CAMS assessment indicates no availability for abstractions in this catchment.
44	An abstraction of 25Ml/d is unlikely to have significant impacts on the River Sow due to the HoF protecting Q95 flows. There is limited water available as indicated by the recent CAMS assessment, however the hydrological impact assessment is likely to have under represented the baseline flows of the River Sow due to a number of upstream tributaries unaccounted for. The risk under drought conditions therefore can be classed as low.
58	The abstraction of 20Ml/d at the river Weaver would have a limited impact on low flows due to the HoF. Due to the recent CAMS assessment indicating that water is available at all flow scenarios, it can be stated that the risk under drought conditions is low.
64	Recent CAMS assessment indicate water is available under all 3 flow scenarios, the addition of a groundwater abstraction will not negatively impact the availability in the catchment. The risk under drought conditions is low.
66	The abstraction of 30Ml/d from the River Severn will have minimal impact on ow flows due to the fact that the option will be operational predominantly during winter when flows are high. The risk under drought conditions is therefore low.
79A	This option does not involve any additional abstractions. It is therefore low risk in regard to drought.
84A	A 0.22m extension on the dam height of Stanford Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream impact. There is water available for licensing under Q95, therefore it can be stated that this option would present low risk under drought conditions.
84B	A 0.52m extension on the dam height of Shustoke Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream impact. There is no water available for licensing under any of the flow scenarios, therefore it can be stated that this option would present medium risk under drought conditions.

Option ID	Drought risk
84C	A 0.17m extension on the dam height of Whitacre Minor Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream impact. There is no water available for licensing under any of the flow scenarios, therefore it can be stated that this option would present medium risk under drought conditions.
95B	Improved WTW would draw more water from Ogsten Reservoir. The reservoir is fed from three sources (incl. transfer from Carsington Reservoir) which provides a degree of protection, but the most recent CAMS assessment indicates no water availability under Q70 and Q50, therefore the option would present high risk under drought conditions.
101	Increased abstraction from the Vyrnwy Aqueduct while there is no water available at Q70 or Q95 would present a high risk under drought conditions.
103	Scheme is supported by existing outputs from multiple WTWs, so no additional abstraction is required. The drought risk is therefore low.
105	Scheme is supported by existing outputs from Pentre, so no additional abstraction is required. The risk under drought conditions is therefore low.
117	Scheme uses Vyrnwy Aqueduct to reduce reliance on boreholes. Water is also available at drought conditions. This therefore has a low risk under drought conditions.
122A	A 0.6m extension on the dam height of Draycote Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream impact. There is no water available for licensing under Q95 and Q70 and restricted at Q50. It can be stated that this option would present medium risk under drought conditions.
123B	A 2.5m extension on the dam height of Tittesworth Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream impact. There is no water available for licensing under Q95, Q70 or Q50. It can be stated that this option would present medium risk under drought conditions.
128	Scheme involves transferring raw water from Carsington Reservoir to Tittesworth Reservoir, however there is no water available for licensing under Q95, Q70 or Q50. Providing there is no additional abstraction from the River Derwent, this option would present moderate risk under drought conditions.
128Z	Scheme involves transferring raw water from Carsington Reservoir to Tittesworth Reservoir, however there is no water available for licensing under Q95, Q70 or Q50. Providing there is no additional abstraction from the River Derwent, this option would present moderate risk under drought conditions.

Option ID	Drought risk
134A	Transferring surplus from Blackbrook Reservoir will not increase abstraction into in. Therefore the risk of this option is low under drought conditions.
143	Although there is no water availability at drought (Q95) or pre-drought (Q70) conditions, this scheme will only abstract water for storage at high flow, and then release up to 50Ml/d back into the Severn at low flow. This therefore has a low risk under drought conditions.
169	Due to the nature of the scheme, which is to terminate an export agreement, this scheme has a low risk under drought conditions.
187C	A 6.4m extension on the dam height of Carsington Reservoir involves no additional abstraction from the waterbody. The reservoir spill regime is not known; therefore no comment can be made on the downstream impact. There is no water available for licensing under Q95, Q70 or Q50. It can be stated that this option would present medium risk under drought conditions.
190	The scheme itself will not directly impact drought risk as the reservoir will simply be used for different customers. Providing industry is not affected, this option should have low risk under drought conditions.
301B	Assumes that water will be available from UU, but is restricted even at Q50, and unavailable at Q70 and Q95. This options therefore poses a high risk under drought conditions.
303C	Medium risk under drought conditions, as the transfer is proposed to be utilised for 55 days per year, uncertainty due to lack of CAMS data.
304	Scheme relies on existing water being present in the Strategic Grid WRZ. Water is restricted during droughts (Q95) and unavailable under pre-drought (Q70) and regular flows (Q50). Therefore this option poses a high risk under drought conditions.
305	Scheme relies on existing water being present in the Strategic Grid WRZ. Water is restricted during droughts (Q95) and unavailable under pre-drought (Q70) and regular flows (Q50). Therefore this option poses a high risk under drought conditions.
309Z	Reduction in supply to Wolverhampton WRZ will need to be absorbed by any surplus or substituted by another scheme. Lack of availability under drought conditions (Q95) and restrictions at pre-drought conditions would make this option high risk under drought conditions.
406	Water is available during drought conditions, and this level of abstraction at this point in the Severn will only create a minor flow change. This option therefore poses a low risk under drought conditions.
420	Option requires upgrades to Campion Hills WTW to increase its output. The increased intake of the WTW when water is unavailable at both Q70 and Q95 make this scheme high risk under drought conditions.
423	Option requires upgrades to Draycote WTW to increase its output. The increased intake of the WTW when water is unavailable at both Q70 and Q95 make this scheme high risk under drought conditions.

Option ID	Drought risk
426	Option requires upgrades to Little Eaton WTW to increase its output. The increased intake of the WTW when water is restricted at both Q70 and Q95 make this scheme moderate risk under drought conditions.
434	Option requires upgrades to Trimpley WTW to increase its output. The increased intake of the WTW when water is restricted at Q70 and unavailable at Q95 make this scheme high risk under drought conditions.
435	Option requires upgrades to Whitacre WTW to increase its output. The increased intake of the WTW when water is unavailable at Q70 and Q95 make this scheme high risk under drought conditions.
523	Risk is low in STW area due to the nature of the scheme which is to transfer water from United Utilities area.
528	Scheme requires abstraction from two new boreholes in an area with restricted water during normal flow conditions (Q50), as well as pre-drought (Q70) and drought (95) conditions. This therefore has a moderate risk under drought conditions.
552	Risk is low in STW area due to the nature of the scheme which is to transfer water from United Utilities area.
557	No abstraction is required by the scheme. Capital works will only enable the movement of water between two reservoirs if needed. Despite there being no water availability at any flow state, the risk is low under drought conditions.

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