



Environmental Report

Yorkshire Water Services Limited
Water Resource Management Plan 2019
Strategic Environmental Assessment

Report for Yorkshire Water Services, in association with Ove Arup and Partners

Customer:

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Non-technical summary

Introduction

Every five years water companies in England and Wales are required to produce an updated Water Resources Management Plan (WRMP). The WRMP sets out how water companies aim to balance supply and demand for water over the next 25 years, ensuring the efficient use of water and sustainable water supplies are available to meet customers' needs. Since publishing the statement of response, Yorkshire Water has made further changes to the WRMP2019 to adjust the implementation of its future leakage activity and to include a proposal to increase a river abstraction licence that will provide additional winter resilience.

In preparing its WRMP, Yorkshire Water has considered the environmental and social impact assessment of each alternative option and has carried out a Strategic Environmental Assessment (SEA), as set out in this Environmental Report. The SEA and the WRMP have also been informed by Habitats Regulations Assessment (HRA) screening and a Water Framework Directive (WFD) compliance assessment. These assessments are reported separately. Together, these assessments have formed an integral part of the decision-making process to determine the preferred WRMP.

Strategic environmental assessment screening

Water companies, as responsible authorities under the Environmental Assessment of Plans and Programmes Regulations 2004 (subsequently referred to as the SEA Regulations), must themselves determine if their WRMP falls within the scope of the SEA Directive.

Government SEA guidance provides directions for determining whether an SEA is required for a WRMP. Application of this guidance indicated that the WRMP falls within the scope of the SEA Directive, principally due to the risk that the plan may include schemes which will require environmental impact assessment, for example water pipelines, desalination plants or raising of reservoir dams.

Strategic environmental assessment and water resources management planning

In the context of water resource management planning, the SEA process can assist in the identification of potential environmental effects (adverse or beneficial) associated with alternative options being considered by a water company to balance supply and demand over the 25-year planning horizon. Knowledge of these effects helped to evaluate and identify a preferred plan of schemes for balancing supply and demand over this planning horizon, in particular contributing to the option and plan appraisal processes. The preferred plan forms the basis of the WRMP.

The WRMP process already requires a substantial element of environmental assessment and consideration. Certain environmental and social impacts are monetised and incorporated into the planning process by adding them to the capital and operating costs of schemes. SEA can add value to the appraisal process by promoting the consideration of a wider range of impacts that cannot be monetised. The SEA process also identifies cumulative effects within Yorkshire Water's WRMP and with other policies, plans, programmes and projects.

There are five key stages of the SEA process:

- Stage A: Setting the context, identifying objectives, problems and opportunities, and establishing the environmental baseline (scoping).
- Stage B: Developing and refining options and assessing effects (impact assessment).
- Stage C: Preparing the SEA Environmental Report (recording results).
- Stage D: Consulting on the draft WRMP and the SEA Environmental Report (seeking consensus).
- Stage E: Monitoring the significant effects of the plan or programme on the environment (verification).

In using the SEA to support decision-making, care must be taken to ensure that environmental and social impacts are not 'double-counted' in both the monetisation process and the SEA, as this may potentially skew the options and plan appraisal process.

The SEA provides information on the relative environmental performance of alternatives, and is intended to make the planning and decision-making process more transparent. The SEA can, therefore, be used to support the timing and implementation of water resource management planning options.

An SEA Scoping Report was issued in May 2017 to statutory consultees (the Environment Agency, Natural England and Historic England) giving them an opportunity to provide their views on the proposed scope and level of detail of this SEA Environmental Report. Issues raised by consultees at the scoping stage were considered throughout the SEA process. The findings of the SEA are presented within this Environmental Report which were subject to public consultation on the draft WRMP.

Assessment methodology

The assessment has been 'objectives-led'. SEA objectives have been derived from environmental objectives established in law, policy or other plans and programmes, and from a review of the baseline information. The SEA objectives have been categorised under the following topic areas: biodiversity, flora and fauna, population and human health, material assets and resource use, water, soil, geology and land use, air and climate, archaeology and cultural heritage, and landscape and visual amenity and are set out in **Table NTS1**. The overall findings of the SEA describe the extent to which objectives for each topic are met by each of the water resource management plan options.

The outputs of the assessment are a completed detailed appraisal framework table for each of the different water resource management options, and a colour coded summary visualisation matrix (ranging from major beneficial impacts to major adverse impacts). This provides a comparative assessment of the residual environmental effects of implementing each water resource management plan option.

The appraisal tables provide an evaluation of impact scale, certainty, duration and permanence in compliance with criteria for determining the likely significance of effects specified in the SEA Directive Article 3(5) and Annex II, and the SEA Regulations Part 2, Regulation 9(2a) and Schedule 1. The assessment assumes implementation of standard best practice in implementing the option, and any proposed mitigation measures incorporated into the option conceptual design and costs. This enables assessment of the significance of residual effects after mitigation, in-line with the Office of the Deputy Prime Minister (ODPM) Practical Guide and UKWIR SEA national guidance. The residual adverse and beneficial effects are identified separately to avoid mixing adverse and beneficial effects, in line with SEA best practice. This enables adverse and beneficial impacts to be independently assessed, maintaining transparency throughout the WRMP decision-making process.

A cumulative, or in-combination, assessment has also been undertaken which has involved examining the potential impacts of the options included in the preferred plan in combination with each other, as well as in combination with other relevant plans and programmes.

Environmental Baseline

An essential part of the SEA process is to identify the current baseline conditions and their likely evolution in the absence of WRMP2019. It is only with knowledge of baseline conditions that potential impacts of the WRMP2019 and its schemes can be identified, monitored, and if necessary mitigated. However, it is important to note that the future baseline is not a 'do nothing' option with respect to water resources planning. There will be elements of Yorkshire Water's current WRMP (published in 2013) that will continue in the absence of the new 2019 plan (e.g. increased water metering, continuing leakage reduction and water efficiency measures to implement Yorkshire Water policy), which will act to alter the future baseline.

This Environmental Report covers the full duration of the current WRMP, i.e. 2019/20-2044/45. The statutory process requires WRMPs to be produced every five years, as such, the schemes and programmes for balancing supply and demand for water will be reviewed again and subject to SEA in 2023-24. Future WRMP cycles will revisit options beyond the current plan's period and the SEA will be updated at that time.

The best available projections for environmental and social characteristics have been considered and summarised, but there is significant uncertainty due to the substantial differences in the availability and temporal resolution of robust projections across the various SEA topic areas, which increases with time. A scenario approach has been adopted to test the sensitivity of the WRMP against the assessment of environmental and social effects based on known or likely changes. In this way, the resilience of options, programmes and the overall plan can be assessed and used to inform decision-making as well as future recommendations for monitoring of the effects of the plan to provide data for subsequent WRMPs and associated SEAs.

Baseline data have been drawn from a variety of sources, including the review of relevant plans, policies and programmes. The likely future trends in the environmental and social issues considered have been presented where information is available to do so. However, reliance on these data sets has in some cases meant that this information has become outdated. Whilst this is sufficient for the SEA process, local and/or site-specific data would be collected during the later EIA process where required.

The SEA study area comprises the entirety of Yorkshire Water's supply area which is also considered to be the natural catchment of the water company's operations. The study area also includes an additional 10 km wide "corridor" of the Tyne and Tees to cover the potential development of river transfer and/or pipeline schemes to transfer water to the Yorkshire Water region. This corridor is within the Kielder SWZ which is included in the environmental baseline review. Therefore, the baseline information presented in this report may not identify specific, localised issues that are not reflective of the general trends of the region.

The Yorkshire Water region has a varied landscape with the Pennines stretching to the west, the North York Moors in the north, and the low lying southern and eastern parts of the region. Annual average rainfall across the region varies. The highest rainfall is near the Pennines, whilst low lying areas average less than half that volume of rainfall each year, with little seasonal variation.

Urban areas in the west and south of Yorkshire are principally supplied from reservoirs in the Pennines. Reservoirs located in the Pennines and the valleys of the River Don, Aire, Wharfe, Calder, Nidd and Colne provide the largest upland sources of water in the region. Yorkshire Water operates over 100 impounding reservoirs of which two are major pumped storage reservoirs. The total storage capacity of all the supply reservoirs amounts to some 160,000 Ml.

Key issues arising from the review of baseline conditions for each of the SEA topics are summarised in Table NTS1. These key issues have been used to support the development of the SEA objectives in Section 5.

Table NTS1 Summary of key sustainability issues from the review of the baseline conditions

SEA topic	Key issues
Biodiversity, flora and fauna	<ul style="list-style-type: none"> • The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation. • The need to avoid activities likely to cause irreversible damage to natural heritage. • The need to take opportunities to improve connectivity between fragmented habitats. • The need to control the spread of Invasive Non-Native Species (INNS). • The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services.
Population and human health	<ul style="list-style-type: none"> • The need to ensure water supplies remain affordable especially for deprived or vulnerable communities • The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas.

SEA topic	Key issues
	<ul style="list-style-type: none"> • The need to ensure public awareness of drought conditions and importance of maintaining security of supply without the need for emergency drought measures. • The need to ensure water quantity and quality is maintained for other users including tourists, recreational users and other users such as farmers. • The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities local residents and tourists, including opportunities for access to recreation resources and the natural and historic environment. • The need to accommodate an increasing population. • Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.
Material assets and resource use	<ul style="list-style-type: none"> • The need to minimise the consumption of resources, including water and energy • The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill. • Need to reduce leakage from the water supply system. • Daily consumption of water resources is higher than the national average in the area and there is a need to encourage more efficient use.
Water	<ul style="list-style-type: none"> • The need to further improve the quality of the regions river, estuarine and coastal waters taking into account WFD status targets. • The need to maintain the quantity and quality of groundwater resources taking into account WFD status targets. • The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface waters and groundwaters. • The need to ensure sustainable abstraction. • The need to ensure that people understand the value of water. • The need to reduce and manage flood risk.
Soil, geology and land use	<ul style="list-style-type: none"> • The need to protect geological features of importance and maintain and enhance soil function and health. • The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources). • The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region.

SEA topic	Key issues
Air and climate	<ul style="list-style-type: none"> The need to reduce air pollutant and greenhouse emissions and limit air emissions to comply with air quality standards. The need to mitigate against climate change through the reduction in greenhouse gas emissions to contribute to risk reduction over the long term. The need to adapt to the impacts of climate change for example through, sustainable water resource management, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities of climate change.
Archaeology and cultural heritage	<ul style="list-style-type: none"> The need to conserve or enhance sites of archaeological importance and cultural heritage interest, particularly those which are sensitive to the water environment.
Landscape and visual amenity	<ul style="list-style-type: none"> The need to protect and improve the natural beauty of the region's AONBs and other areas of natural beauty. It is envisaged that landscape and designated sites will be maintained and enhanced for the enjoyment of the public.

Table NTS2 summarises the future environmental baseline in the absence of WRMP2019 based on available information.

Table NTS2 Summary of future environmental baseline in the absence of WRMP2019

SEA topic	Future environmental baseline
Biodiversity, flora and fauna	<p>As part of the post 2010 policy framework for SSSIs, Natural England has developed a trajectory to achieve the move from "recovering" into "favourable" condition with monitoring of sites to measure success.</p> <p>The Natural Environment White Paper¹ identifies the Government's aims to work to achieve more, bigger, better and less-fragmented areas for wildlife, including no net loss of priority habitat and an increase of at least 200,000 hectares in the overall extent of priority habitats and at least 50% of SSSI to be in favourable condition, while maintaining at least 95% in favourable or recovering condition.</p> <p>Natural England has also published a conservation strategy for the 21st century² that sets out the measures that Natural England will take to protect England's natural environments and landscapes, for the public enjoyment and ecosystem services that they provide.</p>
Population and human health	<p>Population is expected to grow at a rate between 8.2% and 16.5% across the region (see Table 4.5), with an increasing proportion of people at or above state pension age. Household projections show potential increases of between 19%</p>

¹ Defra (2011) The Natural Choice: securing the value of nature, The Natural Environment White Paper.

² Natural England (2016). Conservation 21: Natural England's conservation strategy for the 21st century. [Online]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/562046/conservation-21.pdf [Accessed 3 November 2017].

SEA topic	Future environmental baseline
	<p>and 31% across the region, with an increasing proportion of one person households³.</p> <p>In response to recent studies access to the recreational resources, green spaces and the historic environment will have greater importance in future planning⁴. The National Planning Policy Framework (NPPF) suggests a range of areas that should be taken into account, including the provision of appropriate facilities for recreation that preserve the openness of the green belt.</p> <p>The National Ecosystem Assessment and the Marmot Review, Fair Society, Healthy Lives, demonstrate the positive impact that nature has on mental and physical health and as a result the Government intends to establish a Green Infrastructure⁵ Partnership with civil society to support the development of green infrastructure in England.</p> <p>Improvements to the quality of the water environment and certain potential climate change impacts will present opportunities for an expanding tourist industry in the region⁶.</p>
Material assets and resource use	<p>The Government's National Infrastructure Plan⁷ (2011) includes visions to manage natural capital sustainably; treat water and waste in ways that sustain the environment and enable the economy to prosper; ensure a supply of water that meets the needs of households, businesses and the environment now and in the future and deal with waste in accordance with the waste hierarchy moving towards a zero-waste economy. Yorkshire Water's current economic level of leakage target is to reduce its regional level of water leakage from 297.1Ml/d. By 2018/19, the target leakage is reduced by 5Ml/d to 292.1Ml/d, with a further reduction to 287.1Ml/d in 2019/2020. Yorkshire Water's water resources plan for 2019 will include updated projections and targets for per capita water consumption, commercial demand for water and the social and economic level of leakage targets over the next 25 years.</p>
Water	<p>The WFD sets a target of aiming to achieve at least 'good status' in all waterbodies by 2015. However, provided that certain conditions are satisfied, in some cases the achievement of good status may be delayed until 2021 or 2027. The NPPF states that inappropriate development in areas at risk of flooding (in Flood Zone 1⁸, Flood Zone 2⁹, Flood Zone 3a¹⁰ or Flood Zone 3b - the functional floodplain); should be avoided by directing development away from areas at highest risk. The NPPF requires that where development is necessary, it should be made safe without increasing flood risk elsewhere, as defined in the Technical Guidance to the NPPF¹¹. Following application of the Sequential Test, if it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate.</p>

³ ONS (2010) Housing Statistical Release - Household Projections 2008 to 2033, England.

⁴ Defra (2011) The Natural Choice: securing the value of nature, The Natural Environment White Paper

⁵ Green infrastructure is a term used to refer to the living network of green spaces, water and other environmental features in both urban and rural areas.

⁶ Defra (2012) The UK Climate Change Risk Assessment 2012 Evidence Report.

⁷ HM Treasury Infrastructure UK (2011). National Infrastructure Plan.

⁸ Low probability of river or sea flooding (<0.1%) which has critical drainage problems

⁹ Medium probability of river (1%-0.1%) or sea flooding (0.5%-0.1%)

¹⁰ High probability of river (>1%) or sea flooding (>0.5%)

¹¹ Communities and Local Government (2012) Technical guidance to the National Policy Planning Framework

SEA topic	Future environmental baseline
	<p>The Environment Agency has produced 77 Catchment Flood Risk Plans (CFMPs) for England and Wales. The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. For the Yorkshire Water supply region, the following CFMPs have been produced; River Esk and Coastal Streams; River Derwent; River Ouse; River Hull & Coastal Streams; River Aire; River Calder; River Don; and The River Tyne, River Wear and River Tees CFMPs, which will aid the future development of the Tees Swale Transfer</p> <p>Yorkshire Water's 2014 Water Resource Management Plan¹² and its 2013 DP provide details on how water resources will be managed and secured for the future, including in response to the risks presented by climate change. The Water Resources Management Plan identifies that the Yorkshire Water region will remain in a water supply surplus throughout the planning period to 2034/35.</p> <p>The Environment Agency Water Resource Strategy for the Yorkshire and North East Region¹³ used future scenarios to look at future pressures on water resources. By 2050, climate change could reduce summer river flows by up to 80%. Greater concentrations of rainfall in intense events are likely to result in increased ratios of runoff to recharge, leading to further reductions in recharge rates of groundwater.</p> <p>The action plan for the Water Resource Strategy for Yorkshire and North East Region identified three key priorities (with associated actions), including; catchment management, valuing water and minimising and adapting to the impacts of climate change (see Section 4.2 of Appendix D for further details).</p> <p>The UK Climate Change Risk Assessment (CCRA) 2017 Evidence Report¹⁴ draws together and interprets the evidence gathered by CCRA regarding current and future threats and opportunities for the UK posed by the impacts of climate change up until 2100. The findings of the assessment highlight several key issues, including; increasing pressure on the UK's water resources; major supply-demand deficits; increases in water demand for irrigation of crops; lower summer river flows; an increase in precipitation in winter months, and flash-flooding from combine sewer overflows (see Section 4.2 of Appendix D for further details).</p>
Soil, geology and land use	<p>The vision of Defra's Soils Strategy for England¹⁵ is for all England's soils to be managed sustainably and degradation threats tackled successfully by 2030. This will improve the quality of England's soils and safeguard their ability to provide essential services for future generations.</p> <p>The Water White Paper described the Government's intentions to take forward a catchment-based approach to water quality and diffuse pollution and work towards Common Agricultural Policy reforms that will promote the farming industry's role as custodian of the natural environment (see Section 5.2 of Appendix D for further details)¹⁶. These policy objectives were reflected in regulatory guidance from Government for the 2014 water resources management planning process and the 2014 water company price review process. The catchment-based approach has now been implemented across England, with catchment partnerships now in place across the YWSL region to take forward the approach over the coming years.</p>

¹² Yorkshire Water (2009), Water Resources Management Plan 2010-2035

¹³ Environment Agency (2009) Water Resources Strategy – A Regional Action Plan for Yorkshire and North East Region.

¹⁴ Defra (2016) The UK Climate Change Risk Assessment 2017 Evidence Report

¹⁵ Defra (2009), Safeguarding our soils – A Strategy for England

¹⁶ Defra (2011) Water for Life - Water White Paper

SEA topic	Future environmental baseline
	<p>One of the core planning principles of the NPPF is to encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value (for further information regarding other areas of importance in the NPPF, see Section 5.2 of Appendix D).</p> <p>The current agri-environment scheme for landowners is Countryside stewardship. Continued development of this scheme is expected to see an improvement in land use in the future. The UK Countryside Stewardship scheme provides financial incentives for land managers to engage in activities to improve the quality of the management the environment¹⁷. The scheme allocates funding according to the significance of the designated sites, in three levels; Mid-Tier, Higher Tier and Capital Grants. Applicants choose management options and capital items which provide the environmental priorities for their local area, based on the statements of priorities</p>
Air and climate	<p>Government and international targets indicate significant cuts in greenhouse gas emissions will take place by 2027. The UK is currently projected to meet its first three legislated carbon budget targets (until 2022)¹⁸. Objectives are being achieved for many air pollutants (lead, benzene, 1,3-butadiene and carbon monoxide (CO)). However, measurements show that long-term reducing trends for NO₂¹⁹ and PM10²⁰ are flattening or even reversing at a number of locations, despite current policy measures. Projections suggest with a high degree of certainty that objectives for PM₁₀, NO₂ and O₃²¹ will not be achieved by 2020²².</p> <p>The CCRA considered more than 700 risks and selected 100 risks for detailed review. A selection of threats and opportunities identified under the 'medium scenario' are summarised in Figure D8 (see Section 6.2 of Appendix D).</p> <p>As well as reducing the carbon footprint, Yorkshire Water are investing in flood resilience measures such as building flood protection walls around treatment works and raising control panels for electrical equipment above flood levels.</p> <p>They are working in partnership with the government to make sure that critical national infrastructure is able to cope with future weather events. This includes working with local authorities, emergency services and others to test and improve joint emergency response plans.</p> <p>Together with leading academics and experts, Yorkshire Water is also working on research studies and innovative solutions like Sustainable Urban Drainage Systems (SUDs) and real time models of our river networks. These projects will help the company understand and manage the water cycle better so that it can maintain high levels of customer service in a way that is cost effective and which delivers multiple benefits for people, wildlife and the environment.</p>
Archaeology and cultural heritage	<p>The NPPF was introduced in 2012 to replace the Planning Policy Statements. The NPPF aimed to make the planning system less complex and more accessible, and changed the emphasis on planning to have a presumption in favour of development. However, core planning principles include those aiming</p>

¹⁷Gov.UK © (2017). Rural Grants and Payments: Countryside Stewardship. [Online]. Available from: <https://www.gov.uk/government/collections/countryside-stewardship-get-paid-for-environmental-land-management> [Accessed 3 November 2017].

¹⁸ DECC (2015) Updated energy and emissions projections 2015
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501292/eeppReport2015_160205.pdf

¹⁹ Nitrogen dioxide

²⁰ Particulates with a diameter of 10µm or less

²¹ Ozone

²² Defra (2007), The Air Quality Strategy for England, Scotland and Wales

SEA topic	Future environmental baseline
	<p>to protect heritage assets, including “conserve heritage assets in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations”²³. Recent and ongoing national economic difficulties may have a negative effect on removing heritage assets from the heritage at risk register. Climate change could have variable impacts on heritage assets in the future. Some types of assets and landscapes have already experienced and survived significant climatic changes in the past and may demonstrate considerable resilience in the face of future climate change. However, many more historic assets are potentially at risk from the direct impacts of future climate change²⁴.</p>
Landscape and visual amenity	<p>The NPPF highlights the different roles and character of different areas, promoting the vitality of our main urban areas, protecting the Green Belts around them, recognising the intrinsic character and beauty of the countryside and supporting thriving rural communities within it. The NPPF states that great weight should be given to conserving landscape and scenic beauty in National Parks and AONBs, which have the highest status of protection. It identifies that planning permission should be refused for major developments in these designated areas except in exceptional circumstances and where it can be demonstrated they are in the public interest.</p>

²³ CLG (2012) National Planning Policy Framework, Communities and Local Government.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

²⁴ English Heritage, now known as Historic England, (2010) Climate Change and the Historic Environment

Findings of the assessments

The findings of the SEA are summarised below. **Table NTS3** sets out the SEA topics and objectives which are identified in **Tables NTS5, NTS6, NTS7** and **NTS8**.

For each SEA objective, a residual effects assessment was determined against a significance matrix (**Table NTS3**) which took into account the value/sensitivity of the receptor (e.g. air quality, river water quality, landscape value) and the magnitude of the assessed effect. This significance matrix comprised effects from 'major beneficial' to 'major adverse'. This colour coding was used to complete the columns for residual effects in the visual evaluation matrices summarised in **Tables NTS5, NTS6, NTS7** and **NTS8**.

Table NTS3 SEA topics and objectives

Topic	Objective
Biodiversity, flora and fauna	1.1 To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within Yorkshire Water's supply and source area.
	1.2 To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy.
	1.3 To avoid introducing or spreading INNS.
Population and human health	2.1 To protect and improve health and well-being and promote sustainable socio-economic development through provision of access to a resilient, high quality, sustainable and affordable supply of water over the long term.
	2.2 To protect and enhance the water environment for other users, including recreation, tourism and navigation.
Material assets and resource use	3.1 To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, encourage its re-use and eliminate waste sent to landfill.
Water	4.1 To maintain or improve the quality of rivers, lakes, groundwater, estuarine and coastal waterbodies
	4.2 To avoid adverse impact on surface and groundwater levels and flows, and ensure sustainable management of abstractions.
	4.3 To reduce and manage flood risk.
	4.4 To increase awareness of water sustainability and efficient use of water.
Soil, geology and land use	5.1 To protect and enhance geology, geomorphology, and the quality and quantity of soils.
Air and climate	6.1 To maintain and improve air quality.
	6.2 To minimise greenhouse gas emissions.
	6.3 To adapt and improve resilience to the threats of climate change.
Archaeology and cultural heritage	7.1 To conserve and enhance the historic environment, heritage assets and their settings and protect archaeologically important sites.
Landscape and visual amenity	8.1 To protect and enhance designated and undesignated landscapes, townscapes and the countryside.

Table NTS4 SEA significance matrix

Significance of effect		Value/sensitivity of receptor		
		High	Medium	Low
Effect magnitude	High	Major Beneficial Major Adverse	Major Beneficial Major Adverse	Moderate Beneficial Moderate Adverse
	Medium	Major Beneficial Major Adverse	Moderate Beneficial Moderate Adverse	Minor Beneficial Minor Adverse
	Low	Moderate Beneficial Moderate Adverse	Minor Beneficial Minor Adverse	Negligible

Significance levels identified in **Table NTS4** are defined as follows:

- **Major** - effects represent key factors in the decision-making process. They are generally associated with sites and features of international, national or regional importance. If adverse, such resources/features are generally those which cannot be replaced or relocated.
- **Moderate** - effects are likely to be important considerations at a regional or district scale. If adverse, they are likely to be of potential concern.
- **Minor** - effects are not likely to be decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.
- **Negligible** - effects which are not perceptible, being within normal bounds of variation or the margin of forecasting error.

Customer management options

The SEA of customer management options, including supply pipe leakage reduction, business customer audits and retrofit, and metering, concluded that they are unlikely to have any major or moderate adverse effects on any of the SEA objectives (**Table NTS5**). Vehicle journeys undertaken to fit water meters, take meter readings and carry out audits may have minor adverse effects on air quality and greenhouse gas emissions. Minor beneficial effects have been identified for the customer management options in relation to sustainable and efficient use of water resources.

Distribution management options

The distribution management options are also unlikely to have any major adverse effects on any of the SEA objectives (**Table NTS6**). Minor adverse effects were identified on population and human health due to construction activities, material assets due to resource use and waste to landfill, and air and climate due to vehicle movements. Major to minor beneficial effects have been identified for the distribution management options in relation to sustainable and efficient use of water resources. Water

savings brought about by these options would support population health and economic development, and improve climate change resilience.

Production management options

The four production management options involve reduction of process losses from water treatment works (WTW) at specific sites. The sites are sufficiently distanced from sites designated for habitats and landscapes for significant adverse construction effects to occur. Physical improvements at the WTWs are likely to be small-scale and within existing site footprints. Minor adverse impacts on population and human health, and air and climate were identified for all production management options due to noise, disturbance, and air and greenhouse gas emissions associated with construction activities. They would have negligible to minor beneficial effects on water efficiency and sustainable water use, climate change resilience and resource efficiency (**Table NTS7**).

Resource management options

A wide variety of resource management options were identified and assessed, resulting in a range of environmental effects being identified. These reflect the scale of abstraction and/or the location of the option in relation to sensitive environments (aquatic and terrestrial). The smaller scale options generally have fewer environmental effects, and many of the options have no greater than minor adverse effects (**Table NTS8**). However, some options may have moderate or major adverse, including:

- The Ouse Raw Water Transfer (R2) is anticipated to have three moderate adverse effects on biodiversity, greenhouse gas emissions, and archaeology and cultural heritage due to the construction of the abstraction and new pipeline.
- There is a potential moderate adverse impact on archaeology relating to the pipeline of the Increased River Ouse pump storage capacity option (R3).
- The two options located on Aquifer Storage and Recovery Scheme 1 (R5) and Reuse abandoned third party GW source option 1 (R16)) have minor adverse impacts on biodiversity, population, air and climate; all related to option construction.
- Some of the smaller groundwater abstraction options (e.g. R6, R13 and R12) are situated in a sandstone aquifer where groundwater levels are already below sea level. Therefore, increased abstraction (even within existing licence conditions) may have an adverse effect on sustainable water resources and groundwater quality.
- The dam raising options (R21, R23, R24) have the potential for adverse effects on European sites (e.g. special areas of conservation (SAC) and special protection areas (SPA)). Further investigation as to the revised surface area of the reservoir in relation to designated habitats is required, particularly those supporting designated bird species. There is potential for both adverse and beneficial on the landscape and visual amenity. The increased surface water area may be seen as having beneficial effect, but this could be offset by minor inundation of other landscape features.
- The reservoir desilting option (Option R29) relates to 26 separate reservoirs, some of which could lead to adverse effects on European sites depending on the method of desilting that is adopted in the detailed design stage. The risks associated with this scheme would be specific to the reservoir and method chosen. Any option to de-silt would be subject to careful planning and further investigation, and individual reservoirs may be removed from this option if significant environmental impacts cannot be avoided.
- Option R34 (River Calder Abstraction option 1) has the potential for moderate adverse effects on population and human health, and archaeology and cultural heritage. A large proportion of the pipeline route will pass through heavily built areas, leading to temporary adverse effects from noise, dust and vibration and temporary adverse impacts on a range of recreational facilities and historical assets.
- There is also one potential moderate adverse impact for the River Aire Abstraction option 1 (R35), relating to archaeology and cultural heritage due to the pipeline route potentially passing through a World Heritage Site (WHS).
- The River Wharfe Licence Increase (R72) would provide water for public supply which would deliver minor beneficial impacts on population and human health due to the minor deployable

output and continued water supply for economic activity. The option will deliver beneficial impacts with regard to sustainable water supply. The option utilises existing infrastructure and so would have minor beneficial impacts on material assets and resource use, as no construction is required.

- Six of the options that involve raw water transfers (R51, R54, R56, R58, R59 and R62) have a variety of minor to major adverse impacts due to the scale of construction needed. Major adverse effects include impacts on designated sites for habitats (R54 and R56). Moderate adverse effects include impacts on designated habitats (R62), resource use (R51, R54, R56, R59 and R62), water (R54 and R56), local air quality (R62) cultural heritage (R51, R54 and R56) and landscape (R59).
- The two transfer options to import water from United Utilities Integrated Resource Zone (R58 and R59) vary in impacts. Option R58 only anticipates minor adverse impacts since it utilises existing assets. Option R59 may lead to moderate adverse impacts on resource use and landscape due to the use of construction materials and temporary impacts on an Area of Outstanding Natural Beauty (AONB).
- The East Yorkshire coast desalination (R61) has the potential for major adverse effects on biodiversity as it may impact on the Humber Estuary SAC/SPA/Ramsar, and intersects the impact zone of several SSSIs. In addition, major adverse effects are associated with the significant amount of resource use and energy required to operate this option.

Table NTS5 Visual evaluation matrix summary for customer management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C1a-e Domestic customer audits and retrofit	Adverse																
	Beneficial																
C2 Metering – domestic meter optants	Adverse																
	Beneficial																
C4a-e Metering on change of occupancy	Adverse																
	Beneficial																
C5a-d Smart metering	Adverse																
	Beneficial																
C6a-e Commercial water user audits and retrofit	Adverse																
	Beneficial																

Table NTS6 Visual evaluation matrix summary for distribution management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
D1 Active leakage control: increased find and fix	Adverse																
	Beneficial																
D4 Customer-side	Adverse																
	Beneficial																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial																
D5 Trunk main metering	Adverse																
	Beneficial																
D6 DMA engineering & pressure management	Adverse																
	Beneficial																
D7 Acoustic logging	Adverse																
	Beneficial																
D8 Satellite technology	Adverse																
	Beneficial																
D10 Smart networks	Adverse																
	Beneficial																
D11 Service pipe renewal	Adverse																
	Beneficial																

Table NTS7 Visual evaluation matrix summary for distribution management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Adverse																

P1 Reduction in WTW process losses Option 1	Beneficial																
P2 Reduction in WTW process losses Option 2	Adverse																
	Beneficial																
P3 Reduction in WTW process losses Option 3	Adverse																
	Beneficial																
P4 Reduction in WTW process losses Option 4	Adverse																
	Beneficial																

Table NTS8 Visual evaluation matrix summary for resource management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R1a River Ouse water treatment works extension	Adverse																
	Beneficial																
R2 Ouse Raw Water Transfer	Adverse																
	Beneficial																
R3 Increased River Ouse pump storage capacity	Adverse																
	Beneficial																
R5 Aquifer Storage and Recovery Scheme 1	Adverse																
	Beneficial																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R6 South Yorkshire Groundwater Option 1	Adverse																
	Beneficial																
R9 North Yorkshire Groundwater Option	Adverse																
	Beneficial																
R12 East Yorkshire Groundwater Option 1	Adverse																
	Beneficial																
R13 Yorkshire Groundwater Option 2	Adverse																
	Beneficial																
R16 Reuse abandoned third party GW source option 1	Adverse																
	Beneficial																
R17 Reuse abandoned third party GW source option 2	Adverse																
	Beneficial																
R18 Reuse abandoned third party GW source option 3	Adverse																
	Beneficial																
R19 Reuse abandoned third party GW source option 4	Adverse																
	Beneficial																
R21 Dam Raising Option 1	Adverse																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial																
R23 Dam Raising Option 3	Adverse																
	Beneficial																
R24 Dam Raising Option 4	Adverse																
	Beneficial																
R29 Reservoir De-silting	Adverse																
	Beneficial																
R34 R. River Calder Abstraction option 1	Adverse																
	Beneficial																
R35 R. River Aire Abstraction option 1	Adverse																
	Beneficial																
R37 River Aire Abstraction option 3	Adverse																
	Beneficial																
R72 River Wharfe Licence Increase	Adverse																
	Beneficial																
R49 Supply Dales from the Tees – treated	Adverse																
	Beneficial																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R50 Supply Dales from the Tees - raw 1	Adverse																
	Beneficial																
R51 Supply Dales from the Tees - raw 2	Adverse																
	Beneficial																
R54 Tees - Ouse Pipeline Option 1	Adverse																
	Beneficial																
R56 Tees - Ouse Pipeline Option 2	Adverse																
	Beneficial																
R58 Transfer from UU Option 3	Adverse																
	Beneficial																
R59 Transfer from UU Option 4	Adverse																
	Beneficial																
R61 East Yorkshire coast desalination	Adverse																
	Beneficial																
R62 North Yorkshire rural distribution	Adverse																
	Beneficial																
R63 North Yorkshire Groundwater 2	Adverse																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial																

Formulation of the preferred plan

The SEA evaluation of individual WRMP options indicated that, for the majority of options, effects are no greater than minor adverse. All schemes have beneficial effects on SEA objectives linked to water supply, such as population and human health and climate change resilience. However, a small number of schemes were identified as having moderate to major adverse effects for some SEA objectives.

The preferred plan has been selected in accordance with Yorkshire Water's goal to use demand management and leakage reduction to meet the predicted supply-demand deficit as far as possible. This is also in line with guidance from Ofwat and Defra, and preferences expressed by Yorkshire Water customers. Whilst the WRMP optimisation model delivers a least cost solution, this does not consider regulatory and customer preferences. Yorkshire Water has selected 40% leakage reduction, delivery of which will commence in the last year of AMP6 and continue through to AMP11, as the preferred plan. This removes the deficit forecast from 2035 onwards in the 25-year WRMP period. The preferred plan also includes resilience options at North Yorkshire Groundwater Option and East Yorkshire Groundwater Option 2, which will help to reduce outages. Implementation of these options will be dependent on meeting Environment Agency licensing requirements, and East Yorkshire Groundwater Option 2 will be within any constraints imposed following Water Industry National Environment Programme (WINEP) investigations.

Preferred plan

The preferred plan for Yorkshire Water's WRMP is set out in **Table NTS9**. Whilst the primary criterion in selecting a plan of schemes to meet the supply-demand deficit over the planning period is whole-life cost (including any monetised values for environmental and social costs), the Environment Agency's Water Resources Planning Guideline (WRPG) and other WRMP guidance requires that other criteria should also be considered, including non-monetised environmental and social impacts, climate change and other risks and uncertainties.

The water supply-demand deficit identified for the Grid Surface Water Zone (SWZ) is 6.49MI/d in 2035/36, rising to 33.97MI/d by 2044/45. The preferred plan to address this deficit is presented in Table NTS1. The plan focusses on distribution management options such as leakage reduction (achieving a leakage reduction target of 40%), and also includes investment in resilience options at North Yorkshire Groundwater Option and East Yorkshire Groundwater Option 2 boreholes. To meet the 40% leakage reduction target, distribution management options will commence in the last year of AMP6 (2019) and continue throughout implementation of the WRMP.

Investigations indicate there is no supply-demand deficit for the East SWZ, so the preferred plan does not include resource options targeted at the East SWZ.

Table NTS9 WRMP2019 preferred plan

Reference	Option	Implementation	Yield benefit (MI/d)
D1a-D1j	Active leakage control: find and fix	2019-2044	35.94
D4a-D4f	Customer-side	2019-2044	1.37
D5a-D5f	Trunk main metering	2019-2044	5.23
D6a-D6f	DMA engineering & pressure management	2019-2044	53.98
D7a-D7d	Acoustic logging	2019-2044	18.84
D8a-D8f	Satellite technology	2019-2044	4.06
D10a-D10f	Smart networks	2019-2044	13.41

Reference	Option	Implementation	Yield benefit (Ml/d)
D11a-D11f	Service pipe renewal	2019-2044	3.87
R9	North Yorkshire Groundwater Option	2022	2.00
R13	East Yorkshire Groundwater Option 2	2025	6.00
25-year deficit			33.97
Total leakage benefit			136.70
Total benefit all options			144.70

A visual summary of SEA findings for each of the schemes included in the preferred plan is provided in **Table NTS10**.

All of the demand management options have no greater than minor adverse effects. However, the resource management option, East Yorkshire Groundwater Option 2 (R13) may have moderate adverse effects, including impacts on designated sites for habitats, impacts on natural capital and ecosystem services and adverse effects on sustainable water resources and groundwater quality.

Conversely, several of the demand management options have moderate to major beneficial effects. Major beneficial effects are associated with D1 Active leakage control: find and fix, including benefits towards human health and wellbeing, resource use, sustainable water resources and groundwater quality and resilience to the threats of climate change. Moderate beneficial effects were also identified for these same areas for three of the demand management options (D6, D7 and D11).

Table NTS10 Visual summary for options in the preferred programme																	
Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
D1 Active leakage control: increased find and fix	Adverse																
	Beneficial																
D4 Customerside	Adverse																
	Beneficial																
D5 Trunk main metering	Adverse																
	Beneficial																
D6 DMA engineering & pressure management	Adverse																
	Beneficial																
D7 Acoustic logging	Adverse																
	Beneficial																
D8 Satellite technology	Adverse																
	Beneficial																
D10 Smart networks	Adverse																
	Beneficial																
D11 Service pipe renewal	Adverse																
	Beneficial																

North Yorkshire Groundwater Option	Adverse																
	Beneficial																
East Yorkshire Groundwater Option 2	Adverse																
	Beneficial																

Note: See Section 5.1 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial

Cumulative impact assessment

A cumulative assessment of the preferred plan has been undertaken to consider whether options constructed or operated together may lead to additional effects on each of the SEA topics.

The majority of distribution management options included in the preferred plan are compatible, with implementation of each option increasing the overall volume of water savings made. There is a small risk that the simultaneous implementation of the distribution management schemes could lead to cumulative adverse impacts, whereby disturbance to human health, resource, and air greenhouse gas emissions could increase due to network repair and enhancement activities. However, any such cumulative impacts would be minor, as most of these activities would be localised and small in scale, and could be effectively mitigated through careful project management and best practice construction methods.

There is no potential for cumulative impacts between the two resource management options included in the preferred plan, as they abstract from different aquifers. North Yorkshire Groundwater Option abstract from the confined Millstone Grit Group aquifer, while the East Yorkshire Groundwater Option 2 would target the Sherwood Sandstone Group aquifer.

At a plan level, cumulative effects with other relevant plans, programmes and projects have been considered. These included Yorkshire Water's Drought Plan and drought plans from neighbouring water companies, Environment Agency Drought Plans, Canal and River Trust Management Plans, Local Development Frameworks, National Policy Statements and National/Regional Infrastructure Plans, and major projects. No significant cumulative impacts were identified between the WRMP and any other relevant plans, programmes and projects.

The two resource management options (North Yorkshire Groundwater Option and East Yorkshire Groundwater Option 2) in the WRMP2019 preferred plan were reviewed for potential cumulative effects with resource options in the plans of neighbouring water companies. The options are sufficiently distanced from other resource options for cumulative construction effects to be highly unlikely. During operation, no cumulative adverse effects are anticipated as the options will draw from aquifers that are not hydrologically connected to any surface or groundwater bodies that may be subject to other water company's options.

The distribution management options that make up the rest of the preferred programme were also reviewed for potential cumulative effects with other water company WRMPs. The adverse effects associated with these options do not extend beyond Yorkshire Water's supply area and as such cumulative effects are unlikely.

Mitigation

Consideration of mitigation measures has been an integral part of the SEA process. The SEA of each option has been based on residual impacts that are likely to remain after the implementation of reasonable mitigation. Mitigation measures have been identified for each option on a case by case basis and are presented in the assessment framework appraisal tables.

Certain assumptions have been made:

- Where suitable mitigation measures are known and identified, these have been taken into account and reported, such that the resultant residual impact has been determined.
- In line with recommendations made in the UKWIR SEA Guidance, the SEA appraisals have assumed the implementation of reasonable mitigation, such as the use of best practice construction methods.

An example of a mitigation measure is the diversion of a pipeline route to avoid sensitive environmental receptors.

The SEA process has identified potential residual impacts of the preferred plan after mitigation measures have been taken into consideration. **Table NTS11** summarises the residual effects attributable to the preferred plan for the Yorkshire Water WRMP2019. Mitigation of both construction and operation components for each option are presented.

Table NTS11 Residual adverse impacts of options within the preferred plan for the WRMP 2019

Ref	Option	Construction	Operation
D1	Active leakage control: find and fix	No significant effects	No significant effects
D4	Customerside	No significant effects	No significant effects
D5	Trunk mains metering	No significant effects	No significant effects
D6	DMA engineering & pressure management	No significant effects	No significant effects
D7	Acoustic logging	No significant effects	No significant effects
D8	Satellite technology	No significant effects	No significant effects
D10	Smart networks	No significant effects	No significant effects
D11	Service pipe renewal	No significant effects	No significant effects
R9	North Yorkshire Groundwater Option	No significant effects	No significant effects
R13	East Yorkshire Groundwater Option 2	Biodiversity, flora and fauna	Water resources

Attenuation of the residual negative impacts of the preferred plan are proposed. This comprises mitigation of those potential impacts of R13 East Yorkshire Groundwater Option 2:

- The new East Yorkshire Groundwater Option 2 would be located next to an existing reservoir, which is surrounded by Ancient Woodland, a lowland acid oak woodland with ornithological interest. There is existing access to the site. The construction of the new borehole would be likely to cause temporary impacts related to noise, vibration and dust; however, it is expected that these impacts on the neighbouring woodland would be mitigated through best practice construction and timing the construction to avoid adverse impacts on bird populations. The exact route of the pipework connecting the new borehole to the water treatment works and reservoir is unknown and there is a risk of adverse impact on the ancient woodland through disturbance to root structure during excavation activities. Further investigations during design could identify mitigation measures that would avoid impacts on the ancient woodland.
- Water resources were identified as an adverse operational impact of the East Yorkshire Groundwater Option 2. Abstractions will be subject to licensing and may only be allowed to take place at times of high groundwater or river flows. Although abstraction would be within existing licence limits, the increase in actual abstraction could have a moderate adverse effect, although not sufficient to lead to deterioration in WFD status to 'bad'. The previous abstraction abstracted the same quantities as this proposed option. Therefore, it is unlikely to affect the water balance on a groundwater body scale, however further investigation is required.

Mitigation measures for potential cumulative impacts with other plans have also been considered. Potential water resource impacts that could arise due to future, as yet, unknown new abstractions from common sources would be assessed and considered by the Environment Agency as informed by detailed environmental assessment work as part of the abstraction licensing and water resources planning processes.

Liaison with local planning authorities will also be essential to assess any required mitigation measures from any identified cumulative effects on development plans and projects.

Monitoring

Appropriate monitoring has been identified that would trigger the deployment of mitigation measures.

The SEA Directive states that monitoring activities must enable appropriate remedial action to be taken. This requires measures to detect trends and ensure that action is taken where trends are progressively adverse. Key monitoring parameters will be those relating to the abstraction of water and the effects that this may have on waterbodies and their functions as habitats. Additionally, there is also potential for impacts on communities, the built environment, terrestrial habitats, the atmosphere, landscape and heritage assets. Extensive primary data collection is not appropriate for this plan level of monitoring, and use will be made where possible of existing datasets collated by Yorkshire Water or other bodies.

Table NTS12 lists the potential impacts that may arise from implementation of the WRMP preferred plan and which require monitoring in accordance with the SEA Regulations.

Key monitoring parameters at the strategic WRMP level will be those relating to the abstraction of water and the effects that this may have on waterbodies and their functions as habitats. There are also direct potential impacts on humans, the built environment, terrestrial habitats, the atmosphere, landscape and heritage assets, which may arise from construction activities and/or option operation. These parameters should, therefore, be included within the monitoring programme where it is practicable to do so. Extensive primary data collection is neither feasible nor appropriate for this programme level of monitoring, and use should be made where possible of existing datasets and monitoring regimes.

Site-specific monitoring requirements for the two resource options included in the preferred plan (R9 and R13) will be developed during the planning process closer to the time of implementation.

Table NTS12 Proposed SEA monitoring parameters – strategic WRMP monitoring

Impacted receptor	Proposed strategic indicators
Water resources, water quality, biodiversity	Proportion of surface waters and groundwater waterbodies at 'Good' WFD status, surveys to understand potential changes to WFD status, and species and habitats surveys as required.
Climate Factors	Net greenhouse gas emissions per million litres (MI) of treated water (kg CO ₂ equivalent emissions per MI) for Yorkshire Water supply area
Transport	Transport fleet fuel consumption, emissions and business mileage, as monitored by Yorkshire Water
Nuisance/ Community/ Local Economy	Scheme level community disruption of capital works would be monitored through an Environmental Monitoring Plan if required. Complaints logged with Yorkshire Water and Local Authority EHOs. Responses gauged through Yorkshire Water customer satisfaction surveys. Community investment, employee volunteering and match funding by Yorkshire Water.
Air Quality	Scheme related issues of capital works would be monitored through an Environmental Monitoring plan if required. Changes in air quality are monitored by the Automatic Urban and Rural Network ²⁵ administered by Bureau Veritas, and this data would be available if required to inform a baseline

²⁵ Accessed at <http://www.bv-aurmsiteinfo.co.uk/>

Impacted receptor	Proposed strategic indicators
Cultural Heritage	<p>Condition of buried archaeology would be monitored during construction e.g. through appropriate archaeological investigations and watching briefs as required.</p> <p>Consultation with relevant stakeholders to ensure impacts are minimised, e.g. to water level dependent assets.</p> <p>Historic England monitor parameters such as Listed Buildings and Scheduled Monuments, in order to maintain a 'Heritage at risk' register.</p>

The SEA Directive states that monitoring must enable appropriate remedial action to be taken. For the monitoring programme to be effective, there must therefore be a mechanism in place to detect trends and to ensure that action is taken where trends are progressively adverse.

Five-yearly assessment of monitoring and any measures taken would be included within the SEA for the subsequent WRMP development. Through the proposed monitoring and analysis of the results obtained over the five-year period, the SEA will inform and influence the development of the WRMP for future periods.

Consultation

This SEA Environmental Report for the draft WRMP was issued for public consultation and comments were used to support Yorkshire Water in producing its Water Resource Plan in 2019. On adoption of the WRMP, Yorkshire Water will publish a Statement of Response to explain how environmental considerations have been taken into account in the formulation of the WRMP.

Yorkshire Water will continue to use the results of the SEA to support future decisions on the implementation of the plan. The company will also monitor for any key changes to the environmental baseline and the effects of any options implemented on the environment, helping to ensure that the potential impacts identified in the SEA are considered in practice.

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Appendices

Appendix A	Statutory consultee responses to the SEA Scoping Report
Appendix B	Quality assurance checklist
Appendix C	Review of policies, plans and programmes
Appendix D	Environmental baseline review
Appendix E	Option assessment matrices

1 Introduction

Strategic Environmental Assessment (SEA) became a statutory requirement following the adoption of Directive 2001/42/EC (the SEA Directive) on the assessment of effects of certain plans and programmes on the environment as transposed into national legislation by the Environmental Assessment of Plans and Programmes Regulations 2004 (subsequently referred to as the SEA Regulations).

The objective of SEA, according to Article I of the SEA Directive, is:

“to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans with a view to promoting sustainable development.”

The SEA Directive requires certain plans and programmes to undergo environmental assessment, and likely significant effects on the following issues must be addressed:

“...biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors.”

These ‘SEA topics’ guide the structure of this Environmental Report (e.g. the baseline review in Section 4). Issues such as noise and transport are addressed within the SEA topics where relevant, e.g. within the population and human health, and air and climate topics.

1.1.1 Information requirements

Annex 1 of the SEA Directive (Directive 2001/42/EC) requires the following specific information to be included within the Environmental Report:

- An outline of the...relationship with other plans and programmes (see Section 3).
- The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme (see Section 4).
- The environmental characteristics of areas likely to be significantly affected (see Section 4).
- Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC (the ‘Birds Directive’) and 92/43/EEC (the ‘Habitats Directive’) (see Sections 1.5 and 1.6).
- The environmental protection objectives, established at international, (European) Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation” (see Section 5).

1.1.2 The Environmental Report

Article 2(b) of the SEA Directive defines ‘environmental assessment’ as:

- The preparation of an Environmental Report documenting the likely significant environmental effects of the plan, including reasonable alternatives;
- Undertaking consultation on the plan and accompanying Environmental Report;
- Taking the Environmental Report and the results of the consultations into account in decision-making; and
- Providing information when the plan is adopted and showing how the results of the SEA have been taken into account.

Article 2(c) of the SEA Directive defines an ‘Environmental Report’ as *“the part of the plan or programme documentation containing the information required in Article 5 and Annex I”*.

1.1.3 SEA approach

The UK Government has produced generic SEA guidance²⁶ that sets out the stages of the SEA process - the 'Practical Guide'. This, along with specific guidance for undertaking SEA and Habitats Regulations Assessment (HRA) of WRMPs²⁷, is being used to inform the SEA of Yorkshire Water's WRMP. The 2016 Final Water Resources Planning Guideline²⁸ (WRPG) also provides guidance on the role of SEA within the water resources management planning process.

SEA incorporates the following generic stages:

- Stage A: Setting the context, identifying objectives, problems and opportunities, and establishing the environmental baseline (scoping).
- Stage B: Developing and refining options and assessing effects (impact assessment).
- Stage C: Preparing the Environmental Report (recording results).
- Stage D: Consulting on the Draft Plan and the Environmental Report (seeking consensus).
- Stage E: Monitoring the significant effects of the plan or programme on the environment (verification).

Figure 1.1 is an extract from the Practical Guide that sets out the main stages of the SEA process and. Specific guidance on the application of the SEA process to WRMPs is provided by UKWIR (2012)²⁹.

1.1.4 Purpose of the Environmental Report

This Environmental Report documents stages B and C (see Figure 1.1) of the SEA being undertaken by Yorkshire Water to establish the environmental effects of meeting its obligation for the long term reliable supply of water to its customers, as identified in the company's WRMP. The purpose and scope of the WRMP is explained in more detail in Section 2.

An SEA Scoping Report was produced and issued to external stakeholders as listed in the SEA Regulations in May 2017. The basis and approach for the SEA was developed through the scoping process and refined as a result of consultation with Environment Agency, Natural England and English Heritage. This consultation was undertaken in accordance with Regulation 12(5) of the SEA Regulations. Stakeholder feedback was collated and summarised so key issues could be addressed and any changes to the approach considered (see Appendix A).

The requirements of the Environmental Report are set out in Regulation 12 of the SEA Regulations. According to Regulation 12(2) the Environmental Report shall

'identify, describe and evaluate the likely significant effects on the environment of-

- a) implementing the plan or programme; and*
- b) reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme.*

Schedule 2 of the SEA Regulations lists specific items of information which should be included in the Environmental Report. The Practical Guide provides a Quality Assurance checklist to help ensure that the requirements of the SEA Directive are met throughout the entire process. Compliance against this checklist is set out in Appendix B.

This Environmental Report identifies the baseline information for options under consideration for Yorkshire Water's WRMP (a 'feasible list' of options), as well as identifying their environmental effects (beneficial or adverse). It also identifies the potential mitigation and enhancement measures, and suggests monitoring that could be undertaken to track the environmental effects of the WRMP once implemented.

²⁶ Office of the Deputy Prime Minister (2005). A Practical Guide to the Strategic Environmental Assessment Directive.

²⁷ UKWIR (2012) Strategic Environmental Assessment and Habitats Regulation Assessment – Guidance for Water Resources Management Plans & Drought Plans (12/WR/02/A).

²⁸ Environment Agency and Natural Resources Wales (2016) Final Water Resources Planning Guideline

²⁹ UKWIR (2012) Strategic Environmental Assessment and Habitats Regulation Assessment – Guidance for Water Resources Management Plans & Drought Plans (12/WR/02/A).

1.1.5 Role of SEA in WRMP decision-making

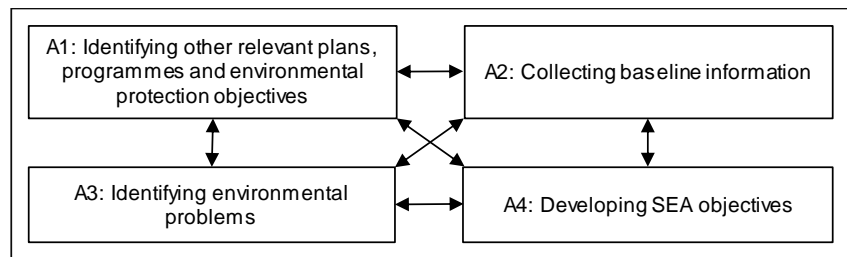
The aim of the WRMP is to find the 'best value' programme of supply and/or distribution options to restore and maintain a supply-demand balance in those WRZs for which a supply deficit has been forecast. The selection process has been facilitated through programme appraisal modelling tools, which have been designed to produce an optimised programme taking account of whole life cost environmental considerations.

The WRMP follows a 'twin track' approach to addressing the supply-demand deficit, with implementation of distribution management and leakage reduction measures to further reduce water consumption per person/per property within Yorkshire Water's supply area. These distribution management and leakage reduction measures compliment options that deliver new water resources.

The WRMP process already requires a substantial element of environmental assessment and consideration. Certain environmental and social impacts are monetised and incorporated into the planning process by adding them to the capital and operating costs of schemes, as documented in the WRMP report. SEA adds value to the appraisal process by promoting the consideration of a wider range of impacts than cannot be monetised. SEA also incorporates results from HRA screening and Water Framework Directive (WFD) compliance assessments, ensuring the WRMP options and preferred plan consider potential impacts on protected habitats and water bodies.

Figure 1.1 SEA stages and tasks

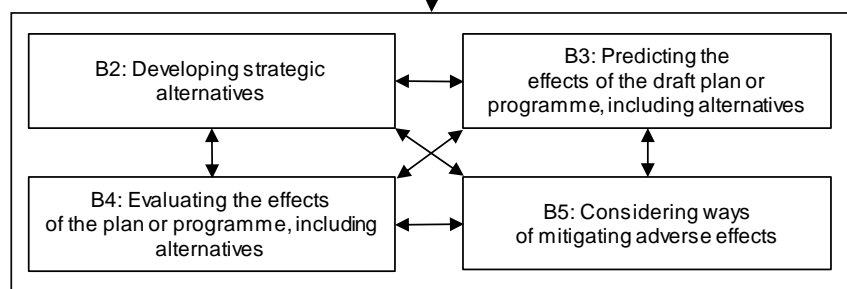
Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope



A5: Consulting on the scope of SEA

Stage B: Developing and refining alternatives and assessing effects

B1: Testing the plan or programme objectives against SEA objectives



B6: Proposing measures to monitor the environmental effects of plan or programme implementation

Stage C: Preparing the Environmental Report

C1: Preparing the Environmental Report

Stage D: Consulting on the draft plan or programme and the Environmental Report

D1: Consulting the public and consultation bodies on the draft plan or programme and the Environmental Report

D2: Assessing significant changes

D3: Decision making and providing information

Stage E: Monitoring implementation of the plan or programme

E1: Developing aims and methods for monitoring

E2: Responding to adverse effects

Source: Office of the Deputy Prime Minister (2005). A Practical Guide to the Strategic Environmental Assessment Directive.

1.1.6 The difference between SEA and EIA

The SEA was informed by quantitative data within the boundaries of the SEA process, however, will not provide the level of detail in these assessments typical of the environmental impact assessment (EIA) process. This is consistent with national guidance on SEA and EIA. Where required, detailed EIAs will be produced to minimise environmental impacts and support the planning process for individual schemes at a later date.

The SEA and EIA processes have similarities, however the aim and approach to these processes are significantly different. While not exhaustive, Table 1.2 provides a brief overview of the differences between these processes.

One of the key differences is that SEA aims to identify potential environmental concerns associated with plans and programmes at a strategic level, while EIA provides a detailed assessment of impacts at the project level. The aims and approach of the SEA process provide a guide for the content of this SEA Environmental Report. The environmental data that will be used in this assessment comprises that which is readily available from existing sources, and no primary research or survey work has been carried out to inform the SEA. Therefore, there may be additional environmental issues that could influence individual WRMP options during a detailed EIA process.

Table 1.1 Key differences between SEA and EIA

Topic	SEA	EIA
Aim	To provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparations and adoption of plans and programmes with a view of promoting sustainable development.	To ensure that planning decisions are made with full knowledge of a project's likely significant environmental effects, and that any negative effects are prevented, reduced or offset, while positive effects are enhanced.
Approach	Pro-active approach to development plans and programmes	Reactive approach to project-level development proposal
Impact assessment	Assesses impacts at a strategic level, with regard to environmental objectives. More qualitative assessment.	Identifies specific impacts on the environment. More quantitative assessment.
Alternatives	Considers broad range of potential alternatives	Considers limited number of feasible alternatives
Assessment outcome	Provides information to be taken account of in the decision, but does not determine it . A post-adoption statement must be produced outlining changes made to the plan or programme as a result of the SEA, responses to consultations, and the reasons for choosing the plan in light of other reasonable alternatives dealt with.	In determining the project application, the competent authority is required to have regard to the Environmental Statement, as well as to other material considerations.

1.2 SEA screening for Yorkshire Water's Water Resources Management Plan

As stated in the WRPG, water companies need to demonstrate that they have investigated whether a SEA is required of its WRMP. As responsible authorities under the SEA Regulations, water companies must themselves determine if its WRMP falls within the scope of the SEA Directive.

The UKWIR Guidance, from which Figure 1.2 is adapted, provides directions as to how the requirement for SEA should be determined for WRMPs. The boxes and arrows highlighted in red on Figure 1.2 describe the provisions and route through the flow chart applicable to Yorkshire Water's WRMP, and demonstrate that the WRMP falls within the scope of the SEA Directive. Notably, it is possible that the WRMP will include schemes that will require EIA (Box 3 in Figure 1.2).

Acknowledging that the WRMP process intrinsically includes some consideration of environmental and social effects, SEA can add value to the process. It promotes consideration of a wider range of effects than cannot be monetised; it contributes to the development and assessment of alternative solutions; and it provides a mechanism for consideration of potential cumulative effects within the WRMP, and with other plans and programmes. Additionally, it facilitates consultation and includes consideration of Habitats Regulations³⁰ and Water Framework Directive (WFD)³¹ implications for the WRMP (as explained further in Sections 1.4 and 1.5 below).

1.3 SEA and water resources management planning

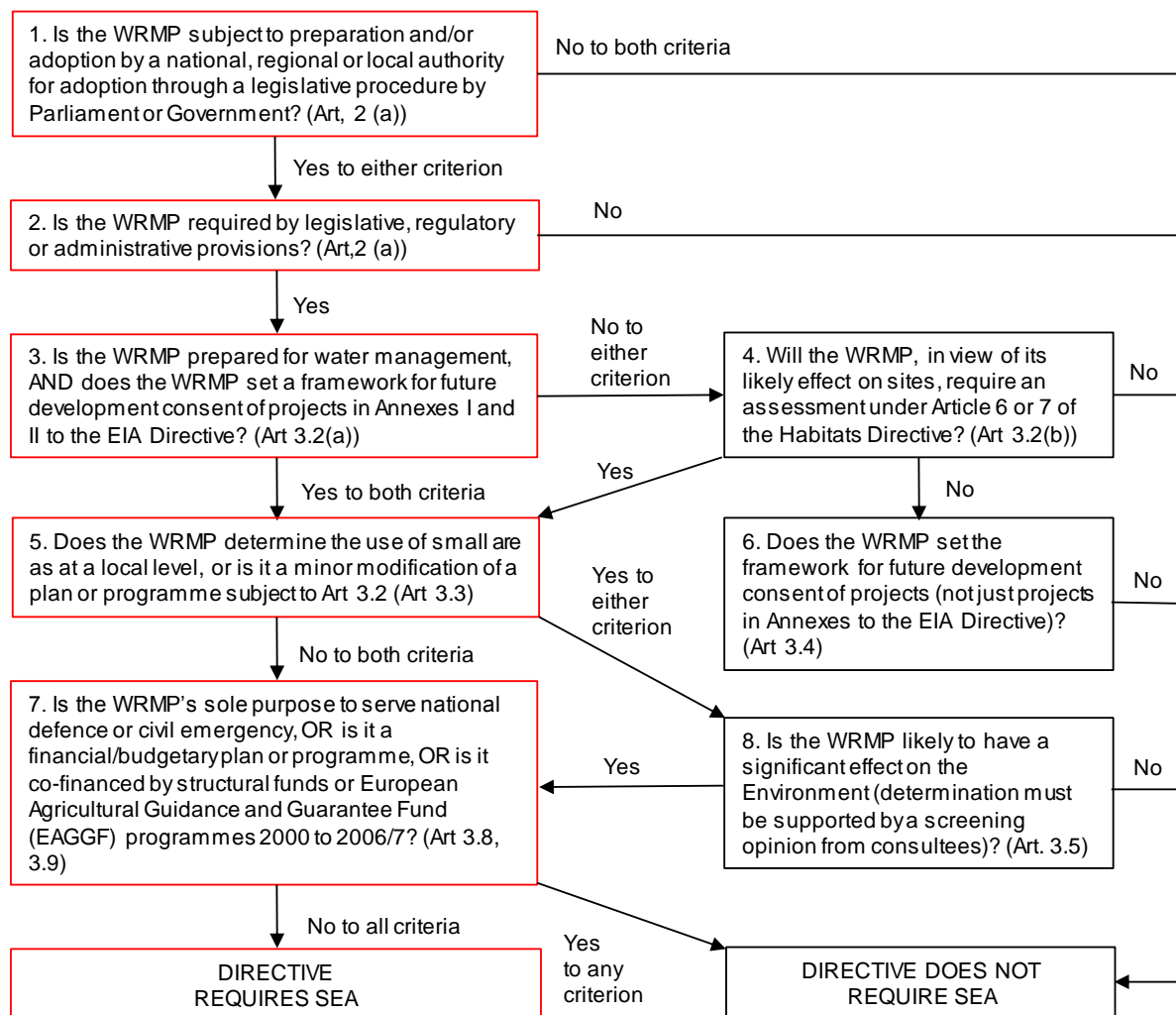
In the context of water resource management planning, SEA can assist in the identification of the potential environmental effects (adverse and beneficial) of the options available to ensure long-term resilient water supplies to Yorkshire Water's customers. Knowledge of these effects can help to identify a preferred plan of options for each water resource zone (WRZ)³² that make up Yorkshire Water's supply area to ensure a balance is maintained between available water supplies and demand for water. The SEA informs the consideration of each option and the programme appraisal process, as well as development of the overall WRMP. The SEA can identify cumulative effects between different environmental and social aspects of a particular option, programme or plan, as well as between alternative options and programmes. SEA also helps to identify potential cumulative effects of the WRMP with other plans, programmes and projects.

The WRMP process, as set out by guidance (revised WRPG, UKWIR Economics of Balancing Supply and Demand (EBSD) Guidelines), already requires a substantial element of environmental assessment and consideration. Certain environmental and social effects are monetised and incorporated into the planning process by adding them to the capital and operating costs. The SEA process requires further environmental assessment and consideration of assessment outcomes. Care must be taken to ensure that environmental and social effects are not 'double-counted' as monetised and SEA assessed effects, potentially skewing the options and programme appraisal process.

³⁰ The Conservation of Habitats and Species Regulations 2010 (as amended)

³¹ Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy

³² UK Water Industry Research/Environment Agency define a WRZ as: 'The largest possible zone in which all resources, including external transfers, can be shared, and hence, the zone in which all customers will experience the same risk of supply failure from a resource shortfall.'

Figure 1.2 SEA screening process

Source: Office of the Deputy Prime Minister (2005). A Practical Guide to the Strategic Environmental Assessment Directive.

1.4 Habitats Regulations Assessment

As a competent authority, Yorkshire Water must ensure that its WRMP meets the requirements of the Habitats Regulations prior to implementation. If the WRMP (i.e. one or more schemes within it) may cause a likely significant effect on one or more European sites³³, either alone or in-combination with other schemes, plans or projects, the WRMP must be subject to Appropriate Assessment. In accordance with Conservation of Habitats and Species Regulations 2017, Yorkshire Water has undertaken a Habitats Regulations Assessment (HRA) screening of its WRMP. This includes the consideration of Special Areas of Conservation (SACs), Special Protection Areas (SPAs) designated under the Birds Directive and Ramsar Sites designated under the Ramsar Convention. The results of the assessment are summarised in Section 6 and detailed in the HRA Screening Report submitted to the Environment Agency and Natural England in support of the WRMP.

³³ European sites are taken to include Special Areas of Conservation (SACs), candidate SACs, Special Protection Areas (SPAs), potential SPAs, Ramsar and proposed Ramsar sites, and sites identified as compensatory habitat for any of the aforementioned designations.

The HRA process has four stages:

1. **Screening**, which identifies likely effects, alone or in-combination with other projects or plans, and considers whether these effects are likely to be significant.
2. **Appropriate assessment**, specifically the assessment of the effects of the WRMP (alone and in combination with other plans and projects) on European sites such that a conclusion can be made as to whether the WRMP will affect site integrity, taking into account potential alternative solutions and mitigation measures.
3. **Assessment of alternative solutions**, where alternative solutions are identified and consideration of their effects are given in comparison to those in the WRMP.
4. **Assessment where no alternatives exist and adverse effects remain**, which provides an assessment of imperative reasons of overriding public interest and compensatory measures required.

Stages 2 to 4 are only invoked if an option were to be included in the preferred plan that may cause likely significant effects on a European site.

Screening of the constrained list of options considered in developing the WRMP and of the WRMP preferred plan has been undertaken and the outcomes have been discussed with Natural England and the Environment Agency. The process and findings are documented in the HRA Screening Report.

Outcomes of the HRA screening have informed the SEA at each stage of the assessment process.

Figure 1.3 (adapted from the UKWIR SEA guidance) illustrates how the SEA and HRA processes are aligned with the WRMP development process.

1.5 Water Framework Directive Assessment

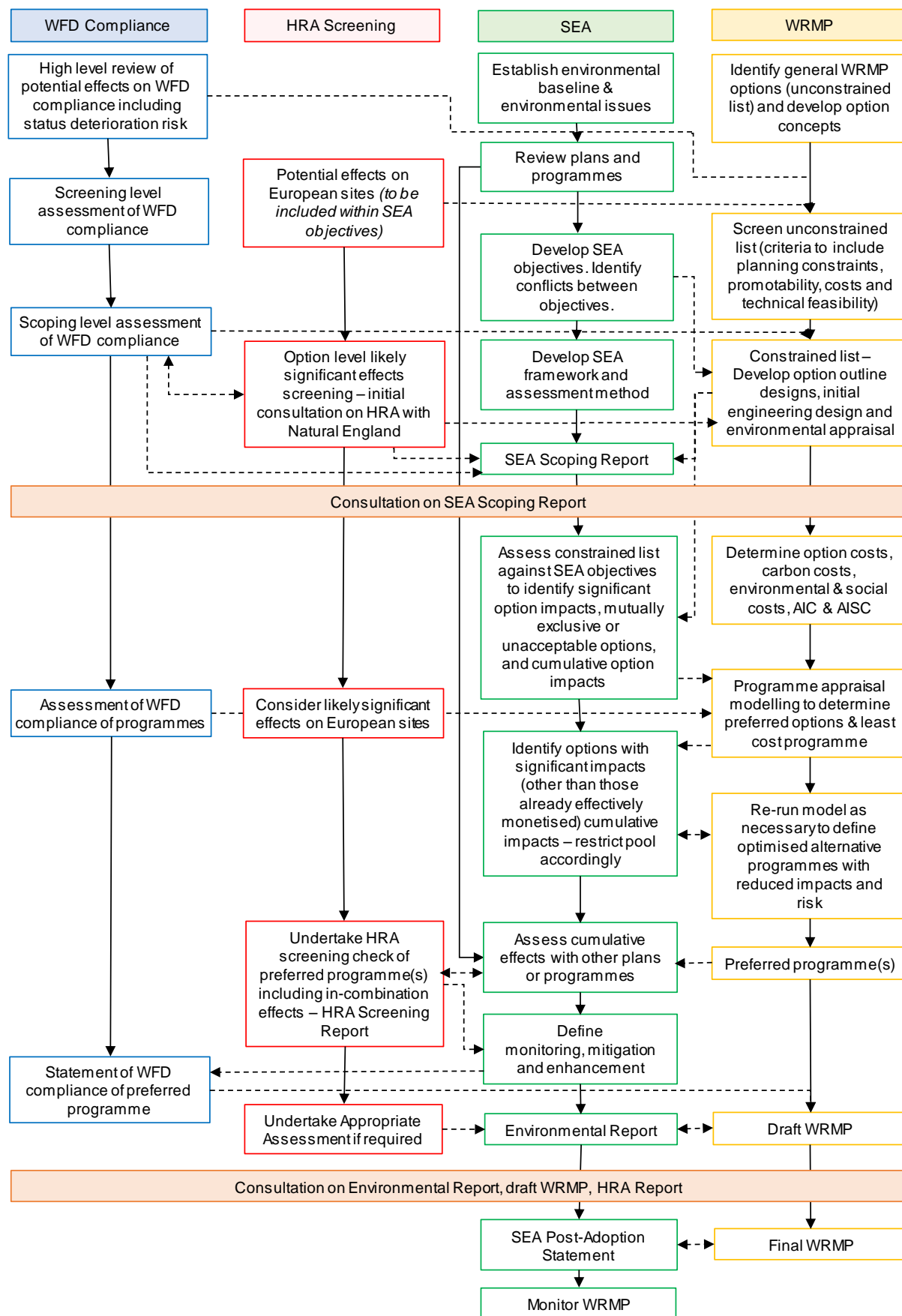
In line with the WRP, water companies must also consider the impact of options, programmes and plans on relevant water bodies as defined under the WFD. In particular, companies must ensure that its proposed activities do not result in any deterioration between status classes of any water body (as assessed through a series of objective measures, including biological, chemical and morphological condition) or prevent the achievement of “Good Ecological Status”.

WFD compliance assessment has been coordinated with the SEA process, and detailed WFD assessments will be required to support planning applications should the potential for non-compliance with WFD objectives be identified by the compliance assessment. Yorkshire Water has submitted the WFD compliance assessment to the Environment Agency in support of the WRMP.

For each option, the WFD assessment has evaluated:

- Potential effects on the status of WFD elements, i.e. fish, macroinvertebrates, macrophytes and phytobenthos (diatoms).
- Compliance with WFD objectives, i.e.:
 - No deterioration between status classes.
 - No impediments to Good Ecological Status / Potential (GES/GEP).
 - No compromises to water body objectives.
 - No effects on other waterbodies.
 - Assists attainment of water body objectives.
 - Assists attainment of protected area objectives.

Findings from the WFD compliance assessment have been integrated in to assessments of relevant SEA topics.

Figure 1.3 SEA and HRA aligned with the WRMP Process

Source: Adapted from UKWIR (2012) Strategic Environmental Assessment and Habitats Regulation Assessment – Guidance for Water Resources Management Plans & Drought Plans (12/WR/02/A).

1.6 Consultation

The SEA Regulations require consultation at the scoping stage and on the assessments documented in the Environmental Report. Scoping with the statutory consultation bodies defined by the SEA Regulations (the Environment Agency, Natural England and Historic England) is mandatory at both stages. Consultation with the public is only mandatory at the Environmental Report stage.

Scoping consultation comments received from statutory consultees and Yorkshire Water's response to those comments are set out in Appendix A, along with the consequent actions. The assessment stage was undertaken according to the scope and approach agreed through consultation on the Scoping Report.

The Environmental Report underwent consultation during March 2018. Comments informed changes to the Environmental Report of the revised draft WRMP. These changes, plus the further changes made in the WRMP2019, will be documented in the SEA Post-Adoption Statement, published by Yorkshire Water, which sets out how the SEA and any views expressed by the consultation bodies or the public have influenced the WRMP.

1.7 Structure of the Environmental Report

This Environmental Report is the output of Stages B and C of the SEA process and documents the findings throughout the SEA process as described in Section 1.1. It has been prepared to facilitate consultation on the SEA process and outcomes (Stage D). The Environmental Report is structured as follows:

This Section (**Section 1**) of the report describes the requirement for, purpose and process of the SEA, and its context in relation to the WRMP.

The remainder of the report is structured as follows:

- **Section 2** – describes Yorkshire Water's supply system and its approach to water resources management planning; describes how Yorkshire Water will develop its plan to provide reliable and resilient water supplies to its customers over the long-term planning horizon.
- **Section 3** – policy context; identifies key messages and environmental protection and social objectives from a review of relevant policies and plans.
- **Section 4** – environmental baseline review; draws out the key environmental and social issues that Yorkshire Water intends considered in the SEA. Identifies the current and future baseline conditions within the area of potential influence of the WRMP. Also included is a discussion of limitations identified in the data and the reasoning behind any assumptions made. The baseline review is structured in accordance with the SEA topics identified in Section 1.2. These topics comprise and are presented in full in Appendix D:
 - Biodiversity, flora and fauna.
 - Population and human health.
 - Material assets and resource use.
 - Water.
 - Soil, geology and land use.
 - Air and climate.
 - Archaeology and cultural heritage.
 - Landscape and visual amenity.
- **Section 5** – Describes the methodological framework and processes that have been used to undertake the SEA of the individual options and assess any potential cumulative effects of options included in Yorkshire Water's WRMP. Assessment of individual water resource options, presents the potential impacts of the various options against the SEA framework. Full details are provided in Appendix E.
- **Section 6** – Provides a summary of the Habitats Regulations Assessment

-
- **Section 7** – Provides an assessment of options and cumulative effects assessment, discussing the potential in-combination impacts of individual options (intra-zone and inter-zone) and with other relevant programmes, plans and projects.
 - **Section 8** – SEA and programme appraisal highlights the role of SEA in programme and WRMP decision making and looks at SEA of alternative programmes for each WRZ. Outlines the SEA of the WRMP in a wider context, providing a cumulative effects assessment of the WRMP and its impact with other plans, programmes and projects
 - **Section 9** – Mitigation and enhancement, discusses measures envisaged to prevent, reduce and offset any significant adverse effects of implementing the WRMP
 - **Section 10** – Monitoring to track the environmental effects against the assessments, to help identify any adverse impacts and trigger deployment of any mitigation measures where necessary.

2 Planning

2.1 Introduction

This section provides a brief overview of the water resource management planning process, the Yorkshire Water supply system and Yorkshire Water's WRMP 2019. Full details can be found in the WRMP published alongside this Environmental Report.

Water resource management planning is undertaken by all water companies in England and Wales in order to ensure a long-term, sustainable balance between water supply availability and the demand for water from water company customers. It is the process of working out how much water customers will need over a 25-year planning period (assessing demand) and how best to provide it (assessing options to manage distribution and/or provide additional water supply). Companies are required to prepare a WRMP every five years. It also forms a component part of the company business plan submitted every five years by each water company to Ofwat (the water industry economic regulator) as part of the regulatory periodic price review process. The next periodic price review will take place in 2019 - this will be the seventh price review for the water industry since it was privatised in 1989. Engagement with regulators, licensed water suppliers, other water companies, customers and stakeholders is key to the WRMP process, and formal consultation was undertaken on the draft WRMP alongside this Environmental Report.

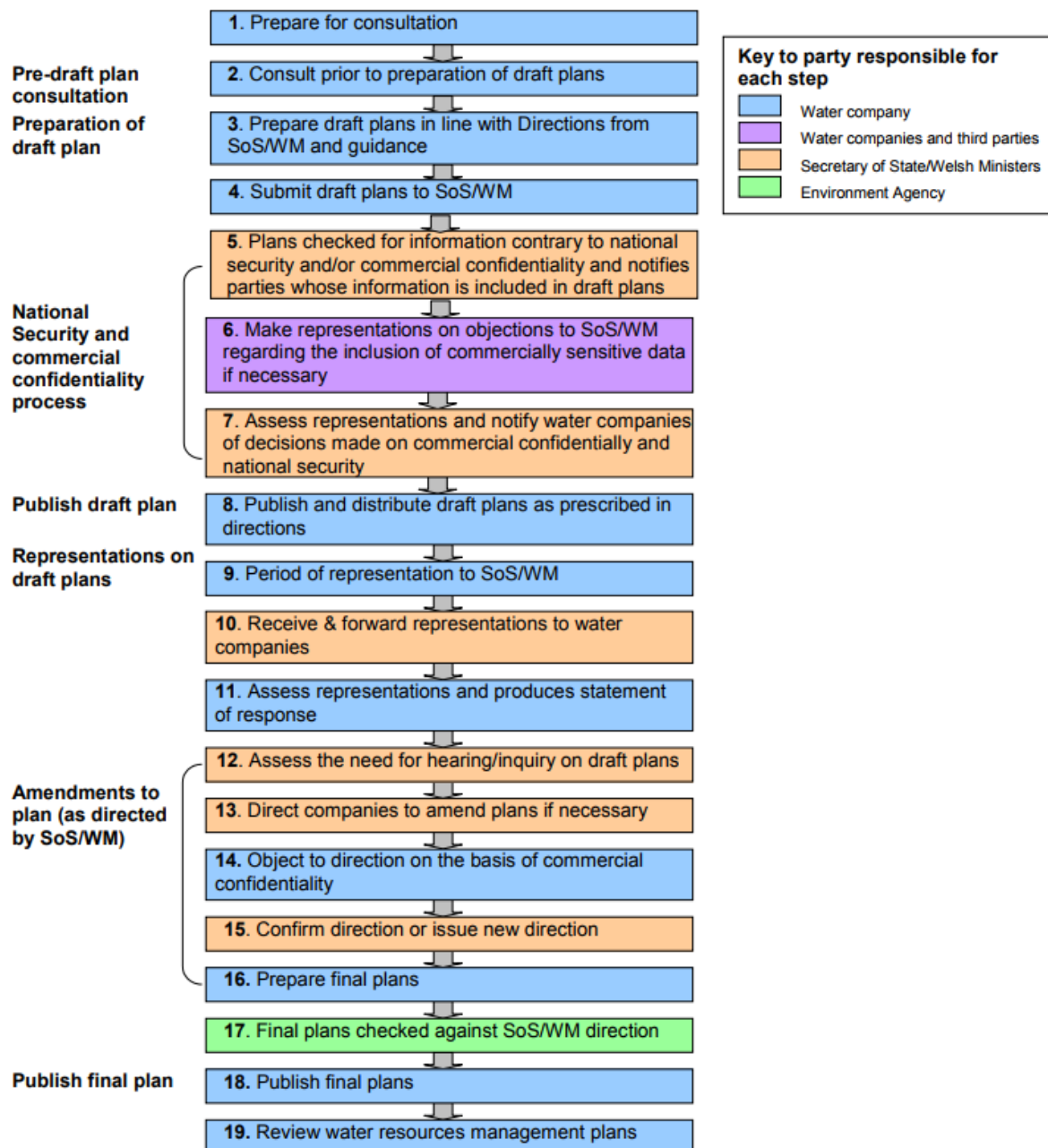
In developing its draft WRMP, Yorkshire Water has examined the supply/demand balance for each of its water resources zone (WRZ)³⁴ and determined how any deficits between demand and available supply should be addressed over the 25-year planning period 2020 to 2045. Section 2.2 provides an overview of the Yorkshire Water supply system and WRZs.

The planning process considers key issues which affect water supply and demand, such as:

- Population growth.
- Climate change.
- Potential reductions to water abstraction from sources identified as having a detrimental impact on the environment ('sustainability reductions').
- Raw water quality deterioration.

Figure 2.1, taken from the Environment Agency's WRP, shows the key elements in developing a WRMP.

³⁴ UKWIR/Environment Agency define a WRZ as: 'The largest possible zone in which all resources, including external transfers, can be shared, and hence, the zone in which all customers will experience the same risk of supply failure from a resource shortfall.'

Figure 2.1 Summary of the water resource planning process

Source: Environment Agency and Natural Resources Wales (2016) Final Water Resources Planning Guideline

2.2 Yorkshire Water's supply and resource system

Yorkshire Water's supply area is geographically bounded in the west and north by the Pennine Hills and the North York Moors respectively. The southern and eastern parts of the company's supply region are low lying and bounded by the North Sea to the East and the Yorkshire/Lincolnshire border to the south. Annual average rainfall in the region is highest in the Pennine areas, whilst low lying areas average less than half as much rainfall each year and with little seasonal variation.

Urban areas in the west and south of Yorkshire are principally supplied from reservoirs in the Pennines. Reservoirs located in the Pennines and the valleys of the River Don, Aire, Wharfe, Calder, Nidd and Colne provide the largest upland sources of water in the region. Yorkshire Water operates over 100 impounding reservoirs, of which two are major pumped storage reservoirs. The total storage capacity of all the supply reservoirs amounts to some 160,000 million litres (MI).

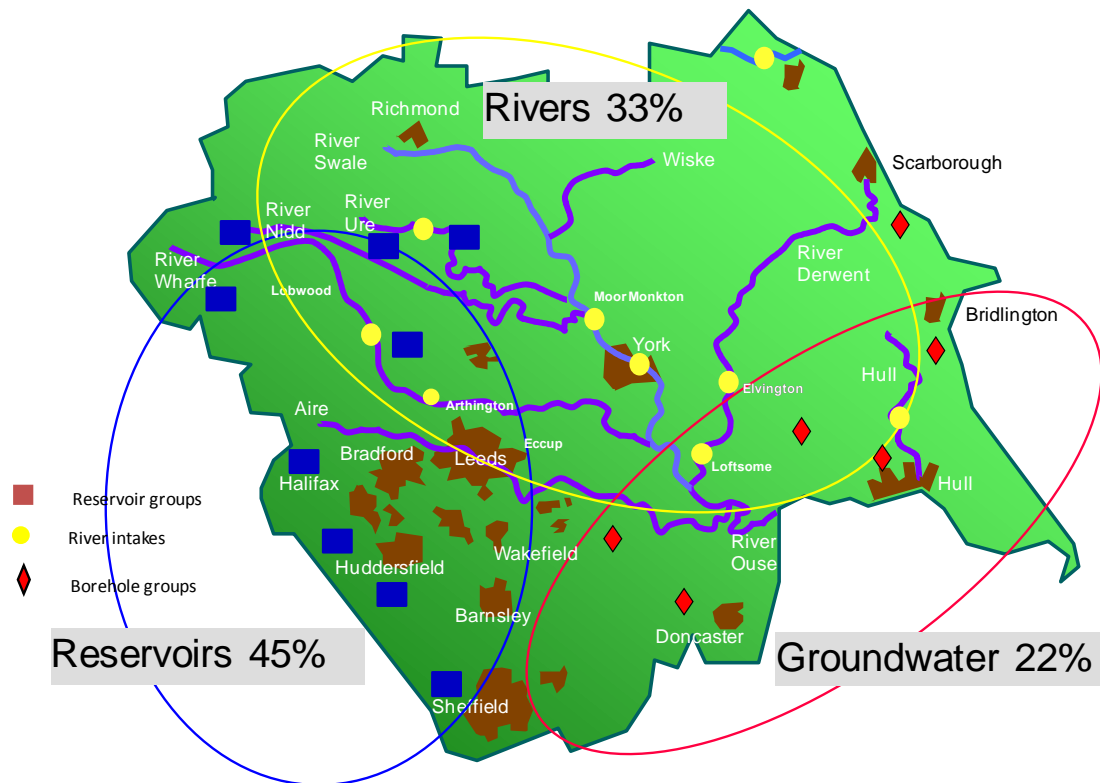
In the eastern and northern parts of the region, river and groundwater abstractions, chiefly from the rivers of the Yorkshire Dales/North York Moors and the Yorkshire Wolds respectively, are the major water sources.

Approximately 45% of supply is derived from impounding reservoirs, 22% from boreholes and 33% from rivers. This varies from year to year depending on weather conditions. Yorkshire Water has an agreement with Severn Trent Water to abstract up to 21,550 Ml per year from the Derwent Valley Reservoirs in Derbyshire for supply to parts of Sheffield, dependent on the control lines in the reservoirs. The majority of the company's water resources are connected together by a regional grid network. This enables highly effective conjunctive use of different water resources, which mitigates risk and allows optimal planning, source operation and resilient sources of supply both in drought and during floods.

The Yorkshire Water region is currently divided into two water resource zones for planning purposes (Figure 2.2). Each zone represents a group of customers who receive the same level of service for water supply reliability from either groundwater or surface water sources. The Grid Surface Water Zone (SWZ) represents a highly-integrated surface and groundwater zone that is dominated by the operation of lowland rivers and Pennine reservoirs (Figure 2.3). The East SWZ is supplied by a river abstraction and springs in the Whitby Area.

Figure 2.2 Yorkshire Water's water resource zones



Figure 2.3 Yorkshire Water Grid WRZ

2.3 Yorkshire Water's water resource management plan 2019

In line with regulatory requirements, Yorkshire Water has prepared a WRMP that is published alongside this Environmental Report. In developing its plan, there are several key future challenges faced by Yorkshire Water in providing a reliable and sustainable water supply over the next 25 years. These include potential effects of climate change, risks of raw water quality deterioration and measures to improve the environment by modifying the operation of some of its water sources ('sustainability reductions') to help achieve good ecological status or potential under the Water Framework Directive.

As a result of these various pressures, actions will be required to ensure that sustainable and secure supplies to customers continue to be maintained over the 25-year planning horizon. Full details are provided in the WRMP.

The spatial scope of the options considered for the WRMP extend beyond the boundaries of the supply area shown in Figure 2.2, as discussed further in later sections of this Environmental Report. The temporal scope of the plan covers a planning period of 25 years between 2019/20 and 2044/45. However, as WRMPs are required to be updated every five years, the schemes and programmes for balancing supply and distribution will be reviewed and subject to SEA, HRA and WFD assessment again during the period 2024-25. However, to meet the 40% leakage reduction target, distribution management options will commence in the last two years of AMP6 (2018-19), and continue throughout implementation of the WRMP.

2.3.1 Yorkshire Water's feasible list of WRMP options

Yorkshire Water investigated an unconstrained list of potential options to balance future supply and demand. Unconstrained options include all options that could technically be used to meet the deficit. To identify which of the options included in the unconstrained list should be investigated further, Yorkshire Water reviewed the technical, environmental, carbon and social attributes of each option at a high level. The technical attributes considered were yield increase/demand decrease; construction/delivery costs; time to implement; asset life of infrastructure; and resilience benefits. This resulted in a sub-set of the unconstrained list of options, which is referred to as the "feasible" list. A number of options were constrained out during this process, hence numbering of options in the feasible

list is not sequential. Options on the 'feasible' list were grouped according to the following four categories:

- Customer management options.
- Distribution management options.
- Production management options.
- Resource management options.

The individual options in each group are documented in Table 2.1. For each option, baseline information was collated to permit SEA, WFD and HRA assessments to be completed, focusing on:

- Analysis of the environmental and hydrological issues
- Strategic assessment of the residual environmental effects after mitigation (including construction/implementation and operational effects)
- Assessment of secondary, cumulative and synergistic effects
- Identification of potential monitoring requirements.

Table 2.1 WRMP feasible list of options

Reference	Option name	Maximum resource value (Ml/d)
Customer management		
C1a-e	Domestic customer audits and retrofit	5
C2	Metering (domestic meter optants)	0.34
C4a-e	Metering on change of occupancy	24.89
C5a-d	Smart metering	31.69
C6a-e	Commercial water user audits and retrofit - Yorkshire Water funds	5
Distribution management		
D1a-D1j	Active leakage control: Increased Find and Fix	35.94
D4a-D4f	Customerside	1.37
D5a-D5f	Trunk main metering	5.23
D6a-D6f	DMA engineering & pressure management	53.98
D7a-D7d	Acoustic logging	18.84
D8a-D8f	Satellite technology	4.06
D10a-D10f	Smart networks	13.41
D11a-D11f	Service pipe renewal	3.87

Reference	Option name	Maximum resource value (Ml/d)
Production management		
P1	Reduction in Water Treatment Works (WTW) process losses - Holmbridge	0.42
P2	Reduction in WTW process losses - Ilton	1.52
P3	Reduction in WTW process losses - Kirkhamgate	1
P4	Reduction in WTW process losses - Longwood	2.75
Resource management		
R1a	River Ouse water treatment works extension	22
R2	Ouse Raw Water Transfer	60
R3	Increased River Ouse pump storage capacity	10
R5	Aquifer Storage and Recovery Scheme 1	10
R6	South Yorkshire Groundwater Option 1	12
R9	North Yorkshire Groundwater Option	2
R12	East Yorkshire Groundwater Option 1	8
R13	East Yorkshire Groundwater Option 2	6
R16	Reuse abandoned third party GW source option 1	1.26
R17	Reuse abandoned third party GW source option 2	2.5
R18	Reuse abandoned third party GW source option 3	1.27
R19	Reuse abandoned third party GW source option 4	1.29
R21	Dam Raising Option 1	0.28
R23	Dam Raising Option 3	0.05

Reference	Option name	Maximum resource value (Ml/d)
R24	Dam Raising Option 4	2
R29	Reservoir De-silting	11
R34	River Calder Abstraction option 1	9.29
R35	River Aire Abstraction option 1	9.29
R37	River Aire Abstraction option 3	46.44
R72	River Wharfe Licence Increase	0
R49	Supply Dales from the Tees - treated	15
R50	Supply Dales from the Tees - raw 1	15
R51	Supply Dales from the Tees - raw 2	15
R54	Tees - Ouse Pipeline Option 1	140
R56	Tees - Ouse Pipeline Option 2	140
R58	Transfer from UU Option 3	1
R59	Transfer from UU Option 4	1
R61	East Yorkshire coast desalination	20
R62	North Yorkshire rural distribution	2
R63	North Yorkshire Groundwater 2	2

3 Policy context

3.1 Introduction

In accordance with the SEA Directive, a review of relevant plans, policies and programmes is presented in Appendix C. A summary of key messages derived from the review is presented in Table 3.1.

Identifying other relevant plans, policies and programmes, as well as environmental protection and social objectives, is one of the first steps in undertaking SEA, forming part of Stage A of the SEA process. The review identifies how Yorkshire Water's WRMP might be influenced by other plans, policies, programmes and other objectives which the WRMP should consider. This information helps to identify and inform the objectives for the SEA process.

Relevant plans, policies and programmes were identified from the wide range that has been produced at an international, national, regional and local level. The emphasis is on 'relevant'. Plans and programmes that have no likely interaction with the WRMP (i.e. they are unlikely to influence the WRMP, or be influenced by it), have been excluded from the review.

The review and the key messages derived from it are documented in Appendix C. Alongside the current and future baseline information reviewed in Section 4, the key messages have been used to develop proposed objectives for the SEA (see Section 5).

3.2 Review of plans, policies and programmes

Table 3.1 summarises key policy messages derived from the review of plans, policies and programmes.

Table 3.1 Key policy messages derived from the review of plans, policies and programmes

SEA topic	Key messages
Biodiversity, flora and fauna	<ul style="list-style-type: none"> • Conservation and enhancement of the natural environment and of biodiversity, particularly internationally and nationally designated sites and priority habitats and species (NERC act S41³⁵ for England), whilst taking into account future climate change. • Promote a catchment-wide approach to water use to ensure better protection of biodiversity. • To achieve favourable condition for priority habitats and species in particular designated sites. • Avoidance of activities likely to cause irreversible damage to natural heritage. • Support well-functioning ecosystems, respect environmental limits and capacities, and maintain/enhance coherent ecological networks, including provision for fish passage and connectivity for migratory/mobile species. • Strengthen the connections between people and nature and realise the value of biodiversity. • Protection, conservation and enhancement of natural capital. Ecosystem services from natural capital contributes to the economy and therefore should be protected and, where possible, enhanced. • Avoidance of activities likely to cause the spread of Invasive Non-Native Species (INNS) • A need to protect the green infrastructure network.

³⁵ Natural Environment and Rural Communities (NERC) Act Section 41.

SEA topic	Key messages
Population and human health	<ul style="list-style-type: none"> Water resources play an important role in supporting the health and recreational needs of local communities and businesses. To ensure all communities have a clean, safe and attractive environment in which people can take pride. To ensure secure, safe, reliable, dependable, sustainable and affordable supplies of water are provided for all communities. Access to high quality open spaces and opportunities for sport and recreation can make an important contribution to the health and well-being of communities. Promotion of healthy communities and protection from risks to health and wellbeing. Promotion of a sustainable economy supported by access to essential utility and infrastructure services.
Material assets and resource use	<ul style="list-style-type: none"> Promote sustainable production and consumption whilst seeking to reduce the amount of waste generated by using materials, energy and water more efficiently. Consider issues of water demand, water supply and water quality in the natural environment and ensure a sustainable use of water resources. Contribute to a resource efficient, green and competitive low carbon economy. Maintain a reliable public water supply and ensure there is enough water for human uses, whilst seeking to maintain a healthy water environment. Minimise the production of waste, ensure waste management is in line with the 'waste hierarchy', and eliminate waste sent to landfill. Promote the sustainable management of natural resources.
Water	<ul style="list-style-type: none"> Promote sustainable water resource management, including a reduction in water consumption. Maintain and improve water quality and water resources (surface waters, groundwater and bathing water). Meet protected area targets related to water quality and flow in the Water Framework Directive. Expand the scope of water quality protection measures to all waters, surface waters and groundwater. Improve the quality of the water environment and the ecology which it supports, and continue to provide high levels of drinking water quality. Ensure appropriate management of abstractions and protect flow and level variability across the full range of regimes from low to high conditions. Prevent deterioration of water body status. Balance the abstraction of water for supply with the other functions and services the water environment performs or provides. Steer new development to areas with the lowest probability of flooding and manage any residual flood risk, taking account of the impacts of climate change.

SEA topic	Key messages
	<ul style="list-style-type: none"> Promote measures to enable and sustain long term improvement in water efficiency. Promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to water quantity and quantity. Develop a resilient and flexible water management approach to cope with changing climate, population and economic conditions. Reduce flood risk to people, residential and non-residential properties, community facilities and key transport links, as well as designated nature conservation sites and heritage assets and landscapes of value. Reduce risk of flooding from reservoirs.
Soil, geology and land use	<ul style="list-style-type: none"> Protect and enhance the quality and diversity of geology (including geological SSSIs) and soils, including geomorphology and geomorphological processes which can be lost or damaged by insensitive development. Ensure that soils will be protected and managed to optimise the varied functions that soils perform for society (e.g. supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity, as a platform for construction), in keeping with the principles of sustainable development. Promote catchment-wide approach to land management by relevant stakeholders, in order to benefit natural resources, reduce pollution and develop resilience to climate change. Promote mixed use developments, and encourage multiple benefits from the use of land in urban and rural areas, recognising that some open land can perform many functions. Encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value.
Air and climate	<ul style="list-style-type: none"> Reduce greenhouse gas emissions. Targets include: reduce the UK's greenhouse gas emissions by at least 80% (relative to 1990 levels) by 2050. Reduce the effects of air pollution on ecosystems. Improve overall air quality. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change. Build in adaption to climate change to future planning and consider the level of urgency of associated risks of climate change impacts accordingly. Need for adaptive measures to respond to likely climate change impacts on water supply and demand. Achieve and sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change.

SEA topic	Key messages
Archaeology and cultural heritage	<ul style="list-style-type: none"> • Built development in the vicinity of historic buildings and Scheduled Monuments could have implications for the setting and/or built fabric and cause damage to any archaeological deposits present on the site. • Ensure active management of the Region's environmental and cultural assets. • Ensure effects resulting from changes to water level (surface or sub-surface) on all historical and cultural assets are avoided. Consider effects on important wetland areas with potential for paleo-environmental deposits. • Promote the conservation and enhancement of the historic environment, including the promotion of heritage and landscape as central to the culture of the region and conserve and enhance distinctive characteristics of landscape and settlements. • Conserve and enhance the historic environment, heritage assets and their settings.
Landscape and visual amenity	<ul style="list-style-type: none"> • Protection and enhancement of landscape (including designated landscapes, landscape character, distinctiveness and the countryside) • Abstraction and low river flows could negatively affect landscape and visual amenity. • Enhance the value of the countryside by protecting the natural environment for this and future generations. • Improve access to valued areas of landscape character in sustainable ways to enhance its enjoyment and value by visitors and stakeholders.

4 Environmental baseline review

4.1 Introduction

Annex 1 of the SEA Directive requires the following specific baseline information to be included within the Environmental Report to identify the environmental characteristics of areas likely to be significantly affected by the WRMP:

- *“the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme*
- *the environmental characteristics of areas likely to be significantly affected*
- *any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC (the ‘Birds Directive’) and 92/43/EEC (the ‘Habitats Directive’).”*

An essential part of the SEA process is to identify the current baseline conditions and their likely evolution in the absence of WRMP2019. It is only with knowledge of baseline conditions that potential impacts of the WRMP2019 and its schemes can be identified, monitored, and if necessary mitigated. However, it is important to note that the future baseline is not a ‘do nothing’ option with respect to water resources planning. There will be elements of Yorkshire Water’s current WRMP (published in 2013) that will continue in the absence of the new 2019 plan (e.g. increased water metering, continuing leakage reduction and water efficiency measures to implement Yorkshire Water policy), which will act to alter the future baseline. Appendix D presents the future environmental baseline in the absence of WRMP2019 based on available information.

The temporal period covered by the WRMP is of a long duration (25 years) presenting uncertainties in considering the future baseline. The best available projections for environmental and social characteristics have been considered and summarised, but there is significant uncertainty which increases with time. A scenario approach has been adopted to test the sensitivity of the WRMP against the assessment of environmental and social effects based on known or likely changes. In this way, the resilience of options, programmes and the overall plan can be assessed and used to inform decision-making as well as future recommendations for monitoring of the effects of the plan to provide data for subsequent WRMPs and associated SEAs.

Baseline data have been drawn from a variety of sources, including a number of the plans, policies and programmes reviewed and summarised in Appendix C. Appendix D summarises the likely future trends in the environmental and social issues considered (where information is available to do so). The key issues arising from the review of baseline conditions are summarised in Table 4.1 and at the end of each sub-section in Appendix D.

4.2 Spatial extent of the SEA

The SEA study area comprises the entirety of Yorkshire Water’s supply area which is also considered to be the natural catchment of the water company’s operations. The study area also comprises an additional 10 km wide “corridor” of the Tyne and Tees to cover the potential development of river transfer and/or pipeline schemes to transfer water to the Yorkshire Water region. This corridor is within the Kielder SWZ which is included in the environmental baseline review. Work is continuing to review potential options for water transfer from other regions: should these options be considered feasible, the Environmental Report will include discussion of relevant baseline environmental information pertaining to these options as appropriate.

4.3 Temporal scope of the SEA

The temporal scope of the WRMP must cover a minimum statutory planning period of 25 years. This Environmental Report covers the full duration of the current WRMP, i.e. 2019/20-2044/45. The statutory process requires WRMPs to be produced every five years, as such, the schemes and programmes for balancing supply and demand for water will be reviewed again and subject to SEA in 2023-24. Future WRMP cycles will revisit options beyond the current plan's period and the SEA will be updated at that time.

In Appendix D, the current environmental and social baseline for the SEA study area is described, together with the likely future changes to this baseline as currently understood. This builds on the information gathered for the SEA of Yorkshire Water's WRMP13, providing an up to date environmental baseline. Over the long-term planning horizon of the WRMP, there is uncertainty as to how the future baseline will evolve. Consequently, it is sensible to adopt a scenario approach to test the sensitivity of the WRMP against the central assessment of environmental and social effects based on the known or likely changes to the baseline conditions. In this way, the resilience of the WRMP options, programmes and the overall plan can be assessed and used to inform decision-making as well as recommendations for future monitoring.

In considering this approach to the future environmental and social baseline, it is important to recognise that WRMP options for implementation beyond 2025 will be further assessed by Yorkshire Water through the next statutory WRMP. Due to be published in 2024; this plan will also be subject to SEA. This process is currently repeated every five years, and it is assumed this will continue into the future. This regular statutory update and review will ensure that actual changes to the baseline and updated forward projections can be considered in subsequent WRMPs and SEAs.

4.4 Limitations of the data and assumptions made

The principal data limitations concern the establishment of future environmental baseline where there are substantial differences in the availability and temporal resolution of robust projections across the various SEA topic areas: for example, whilst some water companies are planning up to 80 years ahead and climate change estimates extend to a similar horizon, regional population and housing forecasts rarely go beyond a 40 year horizon and forecasts of how the natural environment may change are very limited. This presents uncertainties in characterising the future baseline. As discussed above, a scenario based approach has therefore been adopted for the assessment to test central forecasts and 'best view' assumptions where forecasts are lacking or do not extend sufficiently far ahead.

The study area for the SEA is relatively large and covers a number of different geographical and political regions, which makes establishing a baseline at the sub-regional level challenging. There are also challenges around extrapolating information from data collated at differing spatial resolutions. Spatial data have been obtained for most of the SEA topics, and the baseline is presented graphically as mapped information where appropriate. In some instances, reporting cycles mean that available information is dated.

SEA is a high-level assessment aimed at identifying potential environmental concerns. The environmental data used in this assessment is readily available from existing sources, e.g. statutory organisations. No primary research or survey work has been carried out to inform the SEA, and therefore it is possible that at the individual option level, there may be additional environmental issues that could influence WRMP options. At a later stage during the implementation of WRMP options, major schemes that have the potential to give rise to significant environmental effects would likely be subject to EIA at a project level.

The baseline information presented in this report may not identify specific, localised issues that are not reflective of the general trends of the region. For example, this may include locally important sites for recreation or any localised differences in environmental quality.

Data have generally been sourced from national or regional bodies where information is collected for the Yorkshire region using consistent methods. This allows for a more effective comparison between the regional and national averages; however, reliance on these data sets has in some cases meant that information is a number of years old. National and regional data is sufficient for the SEA process, and local and/or site-specific data would be collected during the later EIA process where required.

4.5 Overview

The Yorkshire Water region has a varied landscape with the Pennines stretching to the west, the North York Moors in the north, and the low lying southern and eastern parts of the region. Annual average rainfall across the region varies. The highest rainfall is near the Pennines, whilst low lying areas average less than half that volume of rainfall each year, with little seasonal variation.

Urban areas in the west and south of Yorkshire are principally supplied from reservoirs in the Pennines. Reservoirs located in the Pennines and the valleys of the River Don, Aire, Wharfe, Calder, Nidd and Colne provide the largest upland sources of water in the region. Yorkshire Water operates over 100 impounding reservoirs of which two are major pumped storage reservoirs. The total storage capacity of all the supply reservoirs amounts to some 160,000 MI.

4.6 Key issues

The baseline was set out in the Scoping Report and has been updated based on feedback provided through consultation. The baseline is detailed further in Appendix D. Key issues arising from the review of baseline conditions for each of the SEA topics are summarised in Table 4.1. These key issues have been used to support the development of the SEA objectives in Section 5.

Table 4.1 Summary of key sustainability issues

SEA topic	Key issues
Biodiversity, flora and fauna	<ul style="list-style-type: none"> • The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation. • The need to avoid activities likely to cause irreversible damage to natural heritage. • The need to take opportunities to improve connectivity between fragmented habitats. • The need to control the spread of Invasive Non-Native Species (INNS). • The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services.
Population and human health	<ul style="list-style-type: none"> • The need to ensure water supplies remain affordable especially for deprived or vulnerable communities • The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas. • The need to ensure public awareness of drought conditions and importance of maintaining security of supply without the need for emergency drought measures. • The need to ensure water quantity and quality is maintained for other users including tourists, recreational users and other users such as farmers. • The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities local residents and tourists, including opportunities for access to recreation resources and the natural and historic environment. • The need to accommodate an increasing population. • Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.

SEA topic	Key issues
Material assets and resource use	<ul style="list-style-type: none"> • The need to minimise the consumption of resources, including water and energy • The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill. • Need to reduce leakage from the water supply system. • Daily consumption of water resources is higher than the national average in the area and there is a need to encourage more efficient use.
Water	<ul style="list-style-type: none"> • The need to further improve the quality of the regions river, estuarine and coastal waters taking into account WFD status targets. • The need to maintain the quantity and quality of groundwater resources taking into account WFD status targets. • The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface waters and groundwaters. • The need to ensure sustainable abstraction. • The need to ensure that people understand the value of water. • The need to reduce and manage flood risk.
Soil, geology and land use	<ul style="list-style-type: none"> • The need to protect geological features of importance and maintain and enhance soil function and health. • The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources). • The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region.
Air and climate	<ul style="list-style-type: none"> • The need to reduce air pollutant and greenhouse emissions and limit air emissions to comply with air quality standards. • The need to mitigate against climate change through the reduction in greenhouse gas emissions to contribute to risk reduction over the long term. • The need to adapt to the impacts of climate change for example through, sustainable water resource management, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities of climate change.
Archaeology and cultural heritage	<ul style="list-style-type: none"> • The need to conserve or enhance sites of archaeological importance and cultural heritage interest, particularly those which are sensitive to the water environment.
Landscape and visual amenity	<ul style="list-style-type: none"> • The need to protect and improve the natural beauty of the region's AONBs and other areas of natural beauty.

5 Assessment Methodology

This section outlines the SEA objectives and assessment framework that has been used to identify the environmental and social effects of the options identified in Yorkshire Water's WRMP2019. The framework builds on the SEA conducted for Yorkshire Water's WRMP13, and has been updated to reflect current best practice and changes to key messages in plans, policies and programmes and key baseline issues since then.

5.1 SEA objectives

The effects assessment of the options will be 'objectives-led': establishing assessment objectives is a recognised way of considering the environmental and social effects of a plan and comparing the effects of alternatives. SEA objectives are often derived from environmental and social objectives established in law, policy or other plans and programmes, or from a review of baseline information and environmental problems based on the SEA topics.

Assessment objectives have been developed based on:

- The key policy messages, social and environmental protection objectives identified in the review of policies, other plans and programmes (see Section 3). It is important that the assessment takes these objectives into account as this helps to highlight any area where the WRMP may help or hinder the achievement of the objectives of other plans (e.g. at local, national and international level).
- The current state of the environment in the area under consideration for the SEA (see Section 4) and the key environmental issues identified.

The SEA objectives are set out in Table 5.1 alongside the key messages identified from the review of policies, plans and programmes and the key issues highlighted from the review of baseline information. The following sections describe how Yorkshire Water have used the SEA objectives in the assessment of the environmental effects of the options, programmes and the WRMP. These SEA objectives are intended to reflect changes that contribute to sustainability. By assessing each option against the objectives, it is more apparent where there might be adverse effects and where options could be developed to provide beneficial effects.

As well as the overall SEA objectives, a number of key questions have been developed for each SEA topic. These key questions prompted the assessment and ensured that it considered all the relevant aspects. The assessment of each option, programme and WRMP required the following information:

- Details of the options involved: main components, location and/or population affected, and likelihood and predicted frequency of deployment.
- Construction (where applicable) and operational implementation.
- Amount of water provided or volume of water saved (taking uncertainty into account).
- Key elements of the condition of baseline environment where known, such as location of designated sites, priority habitats and species, and landscape areas or heritage assets.

5.1.1 Interactions between objectives

Annex 1 of the SEA Regulations requires that the inter-relationship between SEA issues should be explored. The matrix in Table 5.2 identifies potential interactions between the proposed SEA objectives. In most cases the interactions are identified as compatible, or no interactions occur. Exceptions comprise:

- Potential incompatibility between objectives 2.1 and 4.4, as efforts to increase water efficiency (e.g. smart meters) could affect vulnerable communities.
- Potential mixed interactions between objectives 4.2, 6.3 and 8.1, as actions to improve water resource management and climate change resilience (e.g. water management infrastructure) could be considered to enhance or detract from landscape quality.

Table 5.1 SEA objectives and indicator questions

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
Biodiversity, flora and fauna	<ul style="list-style-type: none"> Conservation and enhancement of the natural environment and of biodiversity, particularly internationally and nationally designated sites and priority habitats and species (NERC act S41 for England), whilst taking into account future climate change. Promote a catchment-wide approach to water use to ensure better protection of biodiversity. To achieve favourable condition for priority habitats and species in particular designated sites. Avoidance of activities likely to cause irreversible damage to natural heritage. Support well-functioning ecosystems, respect environmental limits and capacities, and maintain/enhance coherent ecological networks, including provision for fish passage and connectivity for migratory/mobile species. Strengthen the connections between people and nature and realise the value of biodiversity. Protection, conservation and enhancement of natural capital. Ecosystem services from natural capital contributes to the economy and therefore should be protected and, where possible, enhanced. 	<ul style="list-style-type: none"> The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation. The need to avoid activities likely to cause irreversible damage to natural heritage. The need to take opportunities to improve connectivity between fragmented habitats. The need to control the spread of Invasive Non-Native Species (INNS). The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services. 	<ul style="list-style-type: none"> To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within Yorkshire Water's supply and source area. To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy. To avoid introducing or spreading INNS. 	<ul style="list-style-type: none"> Will it avoid damage to aquatic, transitional and terrestrial species and habitats including fish populations (particularly migratory fish)? Will it enhance aquatic, transitional and terrestrial species and habitats? Will it protect the most important sites for nature conservation? Will it ensure the sustainable management of natural habitats, taking into account climate change adaptability? Will it affect WFD compliance e.g. good ecological potential/status? Will it protect natural capital and ecosystems from natural capital? Will it increase the spread of invasive species?

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
	<ul style="list-style-type: none"> Avoidance of activities likely to cause the spread of Invasive Non-Native Species (INNS) A need to protect the green infrastructure network. 			
Population and human health	<ul style="list-style-type: none"> Water resources play an important role in supporting the health and recreational needs of local communities. To ensure all communities have a clean, safe and attractive environment in which people can take pride. To ensure secure, safe, reliable, sustainable and affordable supplies of water are provided. Access to high quality open spaces and opportunities for sport and recreation can make an important contribution to the health and well-being of communities. Promotion of healthy communities and protection from risks to health and wellbeing. Promotion of a sustainable economy supported by universal access to essential utility and infrastructure services. 	<ul style="list-style-type: none"> The need to ensure water supplies remain affordable especially for deprived or vulnerable communities The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas. The need to ensure public awareness of drought conditions and importance of maintaining security of supply without the need for emergency drought measures. The need to ensure water quantity and quality is maintained for other users including tourists, recreational users and other users such as farmers. The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities local residents and tourists, including opportunities for access to recreation resources and the natural and historic environment. 	<ul style="list-style-type: none"> To protect and improve health and well-being and promote sustainable socio-economic development through provision of access to a resilient, high quality, sustainable and affordable supply of water over the long term. To protect and enhance the water environment for other users including recreation, tourism and navigation. 	<ul style="list-style-type: none"> Will it help to ensure access to a resilient and secure supply of drinking water? Will it help to promote healthy communities and protect from risks to health and wellbeing? Will it assist in provision of essential infrastructure and services to support health and well-being and a sustainable economy? Will it avoid negative effects on human health or quality of life, e.g. through noise, air quality or transport impacts? Will it protect or enhance opportunities for recreation, tourist activities and navigation?

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
		<ul style="list-style-type: none"> • The need to accommodate an increasing population. • Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy. 		
Material assets and resource use	<ul style="list-style-type: none"> • Promote sustainable management of natural resources, sustainable production and consumption whilst seeking to reduce the amount of waste generated by using materials, energy and water more efficiently. • Consider issues of water demand, water supply and water quality in the natural environment and ensure a sustainable use of water resources. • Contribute to a resource efficient, green and competitive low carbon economy. Maintain a reliable public water supply and ensure there is enough water for human uses, as well as providing an improved water environment. • Minimise the production of waste, ensure waste management is in line with the 'waste hierarchy', and eliminate waste sent to landfill. • Promote the sustainable management of natural resources. 	<ul style="list-style-type: none"> • The need to minimise the consumption of resources, including water and energy • The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill. • Need to reduce leakage from the water supply system. • Daily consumption of water resources is higher than the national average in the area and there is a need to encourage more efficient use. 	<ul style="list-style-type: none"> • To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, encourage its re-use and eliminate waste sent to landfill. 	<ul style="list-style-type: none"> • Will it minimise the demand for water and/or increase efficiency in water use? • Will it minimise the use of energy and promote energy efficiency? • Will it minimise waste, and increase the proportion sent to reuse or recycling? • Will it make use of existing infrastructure? • Will it help to encourage sustainable design or use of sustainable materials (e.g. supplied from local resources)?

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
Water	<ul style="list-style-type: none"> • Maintain and improve water quality (surface waters and groundwater). • Improve the quality of the water environment and the ecology which it supports, and continue to provide high levels of drinking water quality. • Expand the scope of water protection to all waters, surface waters and groundwater. • Ensure appropriate management of abstraction and protect flow and level variability across the full range of regimes from low to high conditions. • Develop a resilient and flexible water management approach to cope with changing climate, population and economic conditions. • Balance the abstraction of water for supply with the other functions and services the water environment performs or provides. • Encourage more efficient use of water and promote awareness of water sustainability. • Steer new development to areas with the lowest probability of flooding and manage any residual flood risk, taking account of the impacts of climate change. • Promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to water quantity and quantity. 	<ul style="list-style-type: none"> • The need to further improve the quality of the regions river, estuarine and coastal waters taking into account WFD status targets. • The need to maintain the quantity and quality of groundwater resources taking into account WFD status targets. • The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface waters and groundwaters. • The need to ensure sustainable abstraction. • The need to ensure that people understand the value of water. • The need to reduce and manage flood risk. 	<ul style="list-style-type: none"> • To maintain or improve the quality of rivers, lakes, groundwater, estuarine and coastal waterbodies. • To avoid adverse impact on surface and groundwater levels and flows, and ensure sustainable management of abstractions. • To reduce and manage flood risk. • To increase awareness of water sustainability and efficient use of water. 	<ul style="list-style-type: none"> • Will it minimise risks of adverse effects on water quality? • Will it affect WFD compliance e.g. Good Environmental Status? • Will it affect bathing water compliance? • Will it avoid contamination of groundwater? • Will it help to minimise risks associated with unsustainable abstraction of ground and surface waters? • Will it abstract from a water resource with resource availability (with reference to CAMS status and WFD considerations)? • Will it affect river basin management plans? • Will it alter the flow or level regime or residence time of surface waters or groundwaters? • Will it enable flexible control over the level of abstraction at short notice in response to changing environmental conditions? • Will it avoid reducing flood plain storage, or provide opportunities to improve flood risk management?

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
	<ul style="list-style-type: none"> Develop a resilient and flexible water management approach to cope with changing climate, population and economic conditions. Reduce flood risk to people, residential and non-residential properties, community facilities and key transport links, as well as designated nature conservation sites and heritage assets and landscapes of value. Reduce risk of flooding from reservoirs. 			<ul style="list-style-type: none"> Will it enable a sustainable use of water resources that balances demand for water with environmental protection? Will it encourage efficient water use? Will it contribute towards improving the awareness of water sustainability and its true value?
Soil, geology and land use	<ul style="list-style-type: none"> Protect and enhance the quality and diversity of geology (including geological SSSIs) and soils, including geomorphology and geomorphological processes which can be lost or damaged by insensitive development. Ensure that soils will be protected and managed to optimise the varied functions that soils perform for society (e.g. supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity, as a platform for construction), in keeping with the principles of sustainable development. Promote catchment-wide approach to land management by relevant stakeholders, in order to benefit natural resources, reduce pollution and develop resilience to climate change. Promote mixed use developments, and encourage multiple benefits from the use of land in urban and rural areas, recognising that some open land can perform many functions. 	<ul style="list-style-type: none"> The need to protect geological features of importance and maintain and enhance soil function and health. The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources). The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region. 	<ul style="list-style-type: none"> To protect and enhance geology, geomorphology, and the quality and quantity of soils. 	<ul style="list-style-type: none"> Will it avoid damage to and protect geologically important sites? Will it avoid damaging the quality of agricultural land? Will it protect, maintain and enhance soil function and health? Will it avoid contributing to coastal erosion? Will it ensure efficient use of land (e.g. make use of previously developed land)? Will it contribute towards a catchment-wide approach to land management?

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
	<ul style="list-style-type: none"> Encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value. 			
Air and climate	<ul style="list-style-type: none"> Reduce greenhouse gas emissions. Targets include: reduce the UK's greenhouse gas emissions by at least 80% (relative to 1990 levels) by 2050. Reduce the effects of air pollution on ecosystems. Improve overall air quality. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change. Build in adaption to climate change to future planning and consider the level of urgency of associated risks of climate change impacts accordingly. Need for adaptive measures to respond to likely climate change impacts on water supply and demand. Sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change. 	<ul style="list-style-type: none"> The need to reduce air pollutant and greenhouse emissions and limit air emissions to comply with air quality standards. The need to mitigate against climate change through the reduction in greenhouse gas emissions to contribute to risk reduction over the long term. The need to adapt to the impacts of climate change for example through, sustainable water resource management, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities of climate change. 	<ul style="list-style-type: none"> To maintain and improve air quality. To minimise greenhouse gas emissions. To adapt and improve resilience to the threats of climate change. 	<ul style="list-style-type: none"> Will it reduce or minimise air pollutant emissions? Will it increase emissions to air in areas sensitive to emissions (e.g. in proximity to an AQMA or sensitive habitat)? Will it reduce or minimise transport or energy requirements, and associated air and greenhouse gas emissions? Will it reduce vulnerability to risks associated with climate change effects (e.g. reduce the adverse effects of droughts and floods)? Will it improve resilience/adaptability to likely effects of climate change, e.g. by increasing resilience of water supplies?

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
Archaeology and cultural heritage	<ul style="list-style-type: none"> Built development in the vicinity of historic buildings could have implications for the setting and/or built fabric and cause damage to any archaeological deposits present on the site. Ensure active management of the Region's environmental and cultural assets. Ensure effects resulting from changes to water level (surface or sub-surface) on all water dependent historical and cultural assets are avoided. Consider effects on important wetland areas with potential for paleo-environmental deposits. Promote the conservation and enhancement of the historic environment, including the promotion of heritage and landscape as central to the culture of the region and conserve and enhance distinctive characteristics of landscape and settlements. Conserve heritage assets in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations. 	<ul style="list-style-type: none"> The need to conserve or enhance sites of archaeological importance and cultural heritage interest, particularly those which are sensitive to the water environment. 	<ul style="list-style-type: none"> To conserve and enhance the historic environment, heritage assets and their settings, and protect archaeologically important sites. 	<ul style="list-style-type: none"> Will it avoid damage to and protect the historic environment, heritage assets and their settings, places and spaces that enhance local distinctiveness? Will abstraction alter the hydrological setting of water-dependent assets? Will it improve access, value, understanding or enjoyment of heritage assets and culturally/historically important assets in the region?
Landscape and visual amenity	<ul style="list-style-type: none"> Protection and enhancement of landscape (including designated landscapes, landscape character, distinctiveness and the countryside). 	<ul style="list-style-type: none"> The need to protect and improve the natural beauty of the region's AONBs and other areas of natural beauty. 	<ul style="list-style-type: none"> To protect and enhance designated and undesignated landscape, townscape and the countryside. 	<ul style="list-style-type: none"> Will it avoid adverse impacts and enhance designated landscapes? Will it improve access to valued areas of landscape character,

SEA topic	PPP key messages	Baseline key issues	SEA objectives	Indicator questions
	<ul style="list-style-type: none"> • Abstraction and low river flows could negatively affect landscape and visual amenity. • Enhance the value of the countryside by protecting the natural environment for this and future generations. • Improve access to valued areas of landscape character in sustainable ways to enhance its enjoyment and value by visitors and stakeholders. 			<p>e.g. the countryside and open space?</p> <ul style="list-style-type: none"> • Will it help to protect and improve non-designated areas of natural beauty and distinctiveness (e.g. woodlands) and avoid the loss of landscape features and local distinctiveness?

Table 5.2 SEA objective interaction matrix

1.1	To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within Yorkshire Water's supply and source area.																
1.2	To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy.	Compatible															
1.3	To avoid introducing or spreading INNS.	Compatible	Compatible														
2.1	To protect and improve health and well-being and promote sustainable socio-economic development through provision of access to a resilient, high quality, sustainable and affordable supply of water over the long term.	Compatible	Compatible														
2.2	To protect and enhance the water environment for other users, including recreation, tourism and navigation.	Compatible	Compatible	Compatible	Compatible												
3.1	To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, encourage its re-use and eliminate waste sent to landfill.		Compatible		Compatible	Compatible											
4.1	To maintain or improve the quality of rivers, lakes, groundwater, estuarine and coastal waterbodies	Compatible	Compatible	Compatible	Compatible	Compatible											
4.2	To avoid adverse impact on surface and groundwater levels and flows, and ensure sustainable management of abstractions.	Compatible	Compatible	Compatible	Compatible	Compatible		Compatible									
4.3	To reduce and manage flood risk.	Compatible	Compatible			Compatible											
4.4	To increase awareness of water sustainability and efficient use of water.	Compatible	Compatible		Incompatible	Compatible	Compatible		Compatible								
5.1	To protect and enhance geology, geomorphology, and the quality and quantity of soils.	Compatible	Compatible					Compatible	Compatible	Compatible							
6.1	To maintain and improve air quality.	Compatible	Compatible		Compatible	Compatible	Compatible		Compatible				Compatible				
6.2	To minimise greenhouse gas emissions.	Compatible	Compatible		Compatible	Compatible	Compatible		Compatible				Compatible	Compatible			
6.3	To adapt and improve resilience to the threats of climate change.	Compatible	Compatible		Compatible	Compatible	Compatible	Compatible	Compatible				Compatible	Compatible			
7.1	To conserve and enhance the historic environment, heritage assets and their settings and protect archaeologically important sites.	Compatible			Compatible	Compatible			Compatible	Compatible			Compatible		Compatible		
8.1	To protect and enhance designated and undesignated landscapes, townscapes and the countryside.	Compatible	Compatible		Compatible	Compatible		Mixed	Mixed	Compatible		Compatible			Mixed	Compatible	
SEA objective		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1

Compatible	
Incompatible	
Mixed	
No direct interaction	

5.2 Assessment framework

5.2.1 Primary assessment

An appraisal framework was used to assess each of the potential WRMP measures against the SEA objectives. The appraisal framework has been applied to test the performance of each of the alternative measures against the SEA objectives. The assessment has been used to inform the selection and phasing of measures for inclusion in Yorkshire Water's WRMP2019. An example appraisal framework matrix is provided in Table 5.3, and is summarised as follows:

- The first column of the framework lists the **SEA topics**.
- **SEA objectives** for each topic are presented in the second column.
- The third column identifies **indicator questions** for each SEA objective.
- The fourth column includes a **commentary** and evaluation of impacts associated with each option for the relevant SEA objective, with reference to the indicator questions set out in column three. The assessment assumes implementation of standard best practice in implementing the option, and any planned mitigation measures. This enables assessment of the significance of residual effects after mitigation, in-line with the ODPM Practical Guide and UKWIR SEA national guidance.
- The **scale** of effects is identified in the fifth column, and considers both geographical scale and population affected using ratings of low, medium and high. Table 5.4 provides further detail regarding criteria for the assessment of scale. Note that options that are widespread but have a very small footprint at many locations could be considered medium or small scale (e.g. distribution management options).
- The sixth column provides an evaluation of the **certainty** of the effect, using ratings of low, medium and high.
- The **duration** of effects is noted in the seventh column. Short-term impacts are defined as those that last for up to six months, medium term impacts are those that extend for six months to two years, and long-term impacts are those that continue for greater than two years.
- The **permanence** of effects is identified in the eighth column. Permanent effects include impacts associated with permanent infrastructure, abstractions and deployable output benefits. Temporary effects will largely concern impacts associated with option construction.
- The ninth column identifies the **magnitude** of the effect on a scale of low, medium and high; and includes consideration of impact scale, certainty, duration and permanence in compliance with criteria for determining the likely significance of effects specified in the SEA Directive Article 3(5) and Annex II, and the SEA Regulations Part 2, Regulation 9(2a) and Schedule 1.
- The **value and sensitivity** of the receptor(s) is identified in the tenth column, on a scale of low, medium and high.
- The **residual adverse and beneficial effects** (after application of best practice approaches and any appropriate and explicit mitigation measures) are identified in the eleventh and twelfth columns respectively. These are identified separately to avoid mixing adverse and beneficial effects, in line with SEA best practice. This enables adverse and beneficial impacts to be independently assessed, maintaining transparency throughout the WRMP decision-making process.

Table 5.3 Example SEA appraisal matrix for the biodiversity, flora and fauna topic

SEA topics and objectives			Assessment of option								
Topic	SEA objective	Indicator questions	Potential residual effect on sensitive receptors: Commentary	Scale of effect: geographical/ population affected (low / medium / high)	Certainty of effect (low / medium / high)	Duration of effect (short-term / medium-term, long-term)	Permanence of effect (permanent / temporary)	Magnitude of effect (low / medium / high)	Value/ sensitivity of receptor (low / medium / high)	Residual adverse effect significance (negligible / minor / moderate / major)	Residual beneficial effect significance (negligible / minor / moderate / major)
Biodiversity, flora and fauna	To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within Yorkshire Water's supply and source area.	<p>Will it avoid damage to aquatic, transitional and terrestrial species and habitats including fish populations (particularly migratory fish)?</p> <p>Will it enhance aquatic, transitional and terrestrial species and habitats?</p> <p>Will it protect the most important sites for nature conservation?</p> <p>Will it ensure the sustainable management of natural habitats, taking into account climate change adaptability?</p> <p>Will it affect WFD compliance e.g. good ecological potential/status?</p>									

SEA topics and objectives			Assessment of option								
Topic	SEA objective	Indicator questions	Potential residual effect on sensitive receptors: Commentary	Scale of effect: geographical/ population affected (low / medium / high)	Certainty of effect (low / medium / high)	Duration of effect (short-term / medium-term, long-term)	Permanence of effect (permanent / temporary)	Magnitude of effect (low / medium / high)	Value/ sensitivity of receptor (low / medium / high)	Residual adverse effect significance (negligible / minor / moderate / major)	Residual beneficial effect significance (negligible / minor / moderate / major)
	To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy.	Will it protect natural capital and ecosystems from natural capital?									
	To avoid introducing or spreading invasive non-native species (INNS).	Will it increase the spread of INNS?									

Table 5.4 Criteria for assessment of impact scale

Type	Example SEA topics/receptors	Small scale effect	Medium scale effect	Large scale effect
Geographic: land	<ul style="list-style-type: none"> • Biodiversity, flora and fauna (e.g. habitat loss) • Soil, geology and land use (e.g. land take, loss of high quality soil) • Population and human health (nuisance) • Water (flood risk) • Archaeology and cultural heritage • Landscape and visual amenity 	<1ha	1-10ha	>10ha
Geographic: land for pipeline construction (mostly temporary)	<ul style="list-style-type: none"> • Biodiversity, flora and fauna • Soil, geology and land use • Population and human health • Archaeology and cultural heritage • Landscape and visual amenity 	<5km	5-10km	>10km
Geographic: hydrological effects	<ul style="list-style-type: none"> • Biodiversity, flora and fauna • Soil, geology and land use • Population and human health • Water • Archaeology and cultural heritage (e.g. water levels and setting) • Landscape and visual amenity (e.g. water levels and character) 	<10km surface water Local groundwater effects	10-50km surface water Sub-regional groundwater effects	>50km surface water Regional groundwater effects / multiple aquifers
Population	<ul style="list-style-type: none"> • Population and human health (secure access to resilient supply, nuisance effects, recreation effects) • Water (awareness, understanding) • Archaeology and cultural heritage (access and value) • Landscape and visual amenity (access and enjoyment) 	Local / within Lower Super Output Area (LSOA)	Beyond LSOA / Local Authority / sub-regional / single WRZ	Regional, multi WRZ, water company and beyond

The SEA appraisal framework is used to capture the assessment for each option (one matrix completed per option), alternative WRZ programmes, and the preferred plan as a whole.

Varying levels of uncertainty are inherent within the assessment process. The assessment has minimised uncertainty through the application of expert judgement. This includes the consideration of uncertainty surrounding the future evolution of the baseline. The level of uncertainty for each SEA objective will be reported in the appraisal matrices. Where there is significant uncertainty which precludes an effects assessment category being assigned for a particular option and SEA objective, an “uncertain” residual effects assessment label has been applied to that specific SEA objective.

The assessment of the options and the overall WRMP has been carried out using the significance matrix shown in Table 5.5. Scale, duration and permanence of effects are incorporated into the magnitude

rating. The definitions for effect significance are explained below Table 5.5. The colour coding shown in Table 5.5 has been used to complete the columns for residual effects in the SEA appraisal matrices. Draft matrices have been compared within and between option categories (e.g. customer, distribution, production and resource management) to ensure consistency in the assessments.

The effects assessment has taken account of any proposed mitigation measures incorporated into the option conceptual design and costs, i.e. it is the residual effects after the application of mitigation that has been assessed.

The resulting significance of effects has been considered in the prioritisation of options and programmes of options. Where major adverse residual effects are predicted, should the option/programme be included in the WRMP, measures envisaged to prevent, reduce and as fully as possible offset these effects on the environment (due to implementation of the WRMP) are outlined in Section 10 of this report as appropriate. These are in addition to any mitigation that has already been included in the conceptual design and costs of each alternative option. Mitigation may include additional provisions within the WRMP itself and/or measures to be applied during the WRMP implementation stage. It may also include proposals for changing other plans and programmes to address significant cumulative residual effects. Yorkshire Water will consider how any remaining significant residual effects identified are to be monitored to identify any unforeseen adverse effects and to enable appropriate remedial action to be taken.

Table 5.5 SEA significance matrix

Significance of effect		Value/sensitivity of receptor		
		High	Medium	Low
Effect magnitude	High	Major Beneficial Major Adverse	Major Beneficial Major Adverse	Moderate Beneficial Moderate Adverse
	Medium	Major Beneficial Major Adverse	Moderate Beneficial Moderate Adverse	Minor Beneficial Minor Adverse
	Low	Moderate Beneficial Moderate Adverse	Minor Beneficial Minor Adverse	Negligible

Significance levels identified in Table 5.5 are defined as follows:

- **Major** - effects represent key factors in the decision-making process. They are generally associated with sites and features of international, national or regional importance. If adverse, such resources/features are generally those which cannot be replaced or relocated.
- **Moderate** - effects are likely to be important considerations at a regional or district scale. If adverse, they are likely to be of potential concern.
- **Minor** - effects are not likely to be decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.

- **Negligible** - effects which are not perceptible, being within normal bounds of variation or the margin of forecasting error.

All options have been assessed to the same level of detail, in line with the SEA legislative requirements, national SEA guidance and the UKWIR SEA guidance. The level of detail for the environmental assessment of each option is consistent with the strategic nature of SEA. This is a high-level, strategic assessment, carried out without the detailed information which would be support an EIA. In the event that new options are introduced at a later stage (which may have less detailed information available) every endeavour will be made to ensure that the assessment is undertaken to a similar standard.

The assessment includes some quantitative analysis of environmental and social effects. The Options Appraisal undertaken by YWS included monetised costs associated with the environmental and social aspects where it is possible to derive costs, and carbon values. This has been taken into account during the production of the SEA, to ensure that there is no double counting of environmental, social and carbon costs within the qualitative and quantitative assessment of the monetised costs.

The analysis used a detailed suite of environmental and social datasets that are available at a consistent quality across the geographical footprint of all the options under consideration. The HRA and WFD assessments also informed the assessment at each key stage, with any adverse implications for Habitats Directive or Water Framework Directive compliance flagged during option assessments and used to inform decision-making at the programme appraisal stage. The conclusions of the HRA of the preferred plan are presented in section 6.

The assessment also considers effects on sites designated at a national and local level. The assessment of effects on SSSIs took account of conservation objectives established by Natural England, and SSSI Impact Risk Zone (IRZ) datasets. This is in line with the WRP which states that companies must “*ensure compliance with other legally binding environmental objectives (e.g. those for non-Natura 2000 SSSIs)*”. Effects on other designated sites set out in the WRP have also been assessed, comprising National Nature Reserves, Local Nature Reserves, Marine Conservation Zones, Scheduled Ancient Monuments, World Heritage Sites, National Parks and Areas of Outstanding Natural Beauty. Information on Local Wildlife Sites has been included in the assessment where data are available, however detailed assessment of impacts on Local Wildlife Sites would occur during project-level EIA preparation.

5.2.2 Secondary, cumulative and synergistic environmental effects

Schedule 2(6) of the SEA Regulations requires the assessment of “*The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects....*” These can be defined as follows:

- Secondary or indirect effects are effects that are not a direct result of the plan, (e.g. an abstraction that changes local groundwater levels and thus affects the ecology of a nearby wetland).
- Cumulative effects arise, for instance, where several nearby groundwater sources each have insignificant effects but together have a measurable effect on river flows; or where several individual effects of a water resource zone programme (e.g. traffic disruption) have a combined effect.
- Synergistic effects interact to produce a total effect greater than the sum of the individual effects. Synergistic effects often happen as habitats, resources or human communities get close to capacity. For instance, a wildlife habitat can become progressively fragmented with limited effects on a particular species until the last fragmentation makes the areas too small to support the species at all.

The term 'cumulative effects' is being adopted as the collective term to include secondary, cumulative and synergistic effects (as suggested by the Practical Guide).

5.2.2.1 Programme and WRMP level cumulative effects assessment

To meet the requirements of the SEA Directive, cumulative effects have been assessed within the preferred plan, and between the WRMP and other relevant plans, programmes or projects. These include Yorkshire Water's Drought Plan and neighbouring water companies' Drought Plans.

Cumulative effects with non-water resources related plans, programmes and projects have been considered where relevant, including existing completed projects, approved but uncompleted projects,

ongoing activities, plans or projects for which an application has been made and which are under consideration by consenting authorities and plans and projects which are reasonably foreseeable (i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects).

Sources of information for the cumulative effects assessment include the following:

- Land use and development plans to identify major development proposals (those which are likely to generate large scale construction or operational effects e.g. growth points, strategic centres).
- Transport and other infrastructure plans (e.g. flood risk management plans, energy, and other utilities).
- Local plans.

5.2.3 Consideration of reasonable alternatives

A wide range of alternative options were considered for the WRMP through the SEA process, including different customer, distribution, production and resource management options. In determining the preferred plan of options, Yorkshire Water has used the findings of the option-level SEA assessments (incorporating the HRA and WFD screening assessments) to inform the programme appraisal modelling, which has identified a short-list of alternative programmes for each water resource zone. These alternatives were assessed through the programme-level SEA to inform decisions on the preferred plan.

5.3 Limitations of the study

SEA is a high-level assessment aimed at highlighting potential environmental concerns. The environmental data used in this assessment are based on that which is readily available from existing sources. Difficulties encountered in undertaking this SEA included the requirement to rely on varying levels of detail in design specifications of schemes, many of which are at conceptual or outline design stage only. Assessment of impacts is necessarily limited when, for example, pipeline routes are at an indicative stage only.

Where particular limitations or outstanding issues are known, these are briefly described in the SEA appraisal tables for the relevant option concerned. Detailed assessments of options will be conducted in project-level EIA closer to the time of option implementation.

6 Habitat Regulations Assessment

This section summaries the HRA Screening that was undertaken in parallel with, and which informed, the SEA. The screening assessment considered the potential for any likely significant effects (LSEs) on the integrity of European sites arising from schemes included in the feasible options list in the WRMP2019. The results of screening the feasible list are presented in the HRA report. The outcomes of this were considered in the selection of schemes and options included in the WRMP2019 preferred plan. The conclusions of the HRA on the preferred plan are discussed below.

Following the selection process, the WRMP2019 preferred plan includes primarily distribution management options. It has been determined that the distribution management schemes included in the preferred plan will reduce demand for water and consequently reduce the need for additional abstraction in the future. The selected distribution management schemes typically involve relatively small-scale and temporary activity and are largely concentrated within urban and suburban areas. As a result of this, they are unlikely to be in close proximity to a European site and impacts will be small-scale and geographically confined at the point of delivery. Impacts resulting from the distribution management options, both alone and in-combination, are therefore assessed as unlikely to have a significant effect on qualifying features of any European sites.

Only two resource management schemes have been considered in the plan. These schemes are related to groundwater schemes and include scheme R9 (North Yorkshire Groundwater Option) and R13 (East Yorkshire Groundwater Option 2). Both schemes have been included in the WRMP2019 for resilience purposes only. They are both dependent on Yorkshire Water meeting Environment Agency licensing requirements whilst the East Yorkshire Groundwater Option 2 scheme will also be within any constraints imposed following WINEP investigations. The North Yorkshire Groundwater Option scheme will only be required by 2022 while the East Yorkshire Groundwater Option 2 scheme will only be required by 2025.

The HRA has determined that the East Yorkshire Groundwater Option 2 scheme is unlikely to have a significant effect on qualifying features of any European sites, either alone, in-combination with other schemes within the WRMP2019 or with plans, projects and developments in neighbouring areas.

Stage 1 HRA screening has indicated that likely significant effects on the North Pennine Dales Meadows SAC could not be ruled out as a result of the implementation of North Yorkshire Groundwater Option. HRA Guidance indicates that the Plan making authority (in this case Yorkshire Water) shall adopt, or otherwise give effect to the Plan, only after having ascertained that it will not adversely affect the integrity of a European site. As such, a Stage 2 HRA was required to determine whether the implementation of the North Yorkshire Groundwater Option could impact on the conservation objectives or the qualifying features of the North Pennine Dales Meadows SAC. Analysis of geological and borehole data indicate that the SACs are above the groundwater water table level and that the SACs are designated for non-water dependant features. As such, it is concluded that abstraction from the proposed North Yorkshire Groundwater Option will not have a significant adverse effect on the qualifying features of the North Pennine Dales Meadows SAC.

Potential in-combination effects with WRMPs and drought plans currently available from the following water companies were considered: Severn Trent Water Limited, United Utilities Water PLC, Northumbrian Water Limited and Anglian Water Services Limited. It was concluded that in-combination effects were unlikely given the distance from other water company options and the lack of hydrological connectivity.

7 Assessment of options

Options appraisal is an overarching term for the identification and assessment of options under consideration for the WRMP. Through this process, options which are found to have unacceptable adverse effects have been identified through the SEA options assessment to inform the programme appraisal modelling. The findings of the HRA screening and WFD compliance assessments informed the SEA assessment.

The assessment of each of the WRMP options has been undertaken in accordance with the methodology set out in Section 5. Appraisal framework tables have been completed for each individual option and are provided in Appendix E. A summary of the likely significant effects for each option is provided in this section and is presented as a colour-coded visual evaluation matrix.

7.1 Customer management options

Table 7.1 provides a summary of the SEA evaluation for each of the customer management options in the WRMP. The detailed appraisal framework tables for each option are provided in Appendix E.

The customer management options are unlikely to have any major adverse effects on any of the SEA objectives. Minor adverse effects have been identified in relation to the air and climate objectives regarding reduction of air pollutant and greenhouse gas emissions. Most of the options will have an impact on air emissions through the increased number of vehicle journeys made to fit water meters, take meter readings or carry out audits.

Moderate to minor beneficial effects have been identified for the customer management options in relation to sustainable and efficient use of water resources. Water savings brought about by these options would may reduce the need for additional abstraction depending on the supply-demand balance. In turn, this would help to leave more water in the aquatic environment.

Table 7.1 Visual evaluation matrix summary for customer management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C1a-e Domestic customer audits and retrofit	Adverse																
	Beneficial																
C2 Metering – domestic meter optants	Adverse																
	Beneficial																
C4a-e Metering on change of occupancy	Adverse																
	Beneficial																
C5a-d Smart metering	Adverse																
	Beneficial																
C6a-e Commercial water user audits and retrofit	Adverse																
	Beneficial																

Note: See Section 5.1 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial

7.2 Distribution management options

Table 7.2 provides a summary of the SEA evaluation for each of the distribution management options in the WRMP. The detailed appraisal framework tables for each option are provided in Appendix E.

The distribution management options are unlikely to have any major adverse effects on any of the SEA objectives. Minor adverse effects are assessed in relation to the following SEA objectives:

- The population and human health objective regarding protecting and improving health and well-being. Construction activities may result in localised nuisance effects associated with traffic, noise, dust and vibration when sited close to areas of population density. However, these will be short term at any one location (likely to be urban) and assuming best practice construction methods, effects will be minimal.
- The material assets and resource use objective to minimise the generation of waste, encourage re-use and eliminate waste sent to landfill. The options will typically require use of materials such as pipework for repairs, and excavated material may need to be sent to landfill depending on whether it is contaminated and/or can be efficiently recycled.
- The air and climate objectives to maintain and improve air quality and minimise greenhouse gas emissions. All distribution management options may result in temporary and localised intermittent increases in air pollutants, dust and greenhouse emissions arising from vehicle movements and construction activities necessary for implementation.









Major to minor beneficial effects have been identified for the distribution management options in relation to sustainable and efficient use of water resources. Water savings brought about by these options may reduce the need for additional abstraction, depending on the supply-demand balance. This would help to leave more water in the aquatic environment, support population health and economic development, and improve climate change resilience.

Table 7.2 Visual evaluation matrix summary for distribution management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
D1 Active leakage control: increased find and fix	Adverse																
	Beneficial																
D4 Customerside	Adverse																
	Beneficial																
D5 Trunk main metering	Adverse																
	Beneficial																
D6 DMA engineering & pressure management	Adverse																
	Beneficial																
D7 Acoustic logging	Adverse																
	Beneficial																
D8 Satellite technology	Adverse																
	Beneficial																
D10 Smart networks	Adverse																
	Beneficial																
D11 Service pipe renewal	Adverse																
	Beneficial																

Note: See Section 5.1 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial

7.3 Production management options

Table 7.3 provides a summary of the SEA evaluation for each of the production management options in the WRMP. The detailed appraisal framework tables for each option are provided in Appendix E.

The four production management options involve reduction of water treatment works (WTW) process losses at specific sites. The sites are sufficiently distanced from designated sites for habitats and landscapes for any adverse effects of construction. Physical improvements at the treatment works to reduce losses are likely to be small-scale within the existing site footprint. The options will not involve increased abstraction. Minor adverse impacts on population and human health, and air quality and greenhouse gas emissions have been identified for all options.

The production management options would have negligible to minor beneficial effects on water efficiency and sustainable water use, considering that the volumes of water saved are small (0.4 to 2.7Ml/d). The increases in yield may also lead to minor beneficial impacts on population and human health, biodiversity, and improving resilience to the threats of climate change. Minor beneficial impacts have been identified regarding resource efficiency due to use of existing infrastructure.

Table 7.3 Visual evaluation matrix summary for distribution management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
P1 Reduction in WTW process losses 1	Adverse																
	Beneficial																
P2 Reduction in WTW process losses 2	Adverse																
	Beneficial																
P3 Reduction in WTW process losses 3	Adverse																
	Beneficial																
P4 Reduction in WTW process losses 4	Adverse																
	Beneficial																

Note: See Section 5.1 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial

7.4 Resource management options

Table 7.4 provides a summary of the SEA evaluation for each of the resource management options in the WRMP. The detailed appraisal framework tables for each option are provided in Appendix E.

A wide variety of options have been assessed, leading to a range of environmental effects being identified. These reflect the scale of abstraction and/or the location of the option in relation to sensitive environments (aquatic and terrestrial). As may be expected, the smaller scale options generally have the lower environmental effects, but differences do occur between such options due to their environmental setting. Many of the options have no greater than minor adverse effects. However, some options may have moderate or major adverse effects for some of the SEA objectives, as discussed in the following paragraphs.

The Ouse Raw Water Transfer (R2) is anticipated to have three moderate adverse effects on biodiversity, greenhouse gas emissions, and archaeology and cultural heritage due to the construction of the abstraction and new pipeline. However, two major beneficial effects were identified, related to population and human health and climate change resilience due to a yield of 60MI/d, therefore maintaining the supply-demand balance.

There is a potential moderate adverse impact on archaeology relating to the pipeline of the Increased River Ouse pump storage capacity (R3). There are four Grade II listed buildings that are potentially at risk of suffering from adverse impacts from construction and may require modification of the route in dialogue with the property owners and Historic England to avoid short-term and long-term effects.

The dam raising options (Options R21, R23, R24) have the potential for adverse effects on European sites (e.g. special areas of conservation (SAC) and special protection areas (SPA)). Further investigation as to the revised surface area of the reservoir in relation to designated habitats is required, particular those supporting designated bird species. There is potential for both adverse and beneficial on the landscape and visual amenity. The increased surface water area may be seen as having beneficial effect, but this could be offset by minor inundation of other landscape features.

The reservoir desilting option (Option R29) relates to 26 separate reservoirs, some of which could lead to adverse effects on European sites depending on the method of desilting that is adopted in the detailed design stage. It is therefore currently assessed as having a major adverse effect on biodiversity. If desilting requires extensive drawdown of the reservoirs, there will also likely be temporary moderate adverse effects on landscape and visual amenity given the setting of these reservoirs, some of which are located within or in visual proximity to the Peak District and Yorkshire Dales National Parks, as well as Nidderdale AONB. Desilting works have the potential to temporarily adversely affect water quality both within the reservoir and in the downstream watercourses due to elevated turbidity in the compensation flow release water. This will be mitigated by best practice methods (e.g. settling pools and use of straw bales to filter out sediments), but some minor impacts are likely. Desilting would only occur following careful planning and further investigations, and that the list of reservoirs included in the option may decrease if unacceptable environmental impacts are identified. However, an increase of 11MI/d in deployable output will likely lead to moderate beneficial effects on population and human health and adapting to climate change.

Option R34 (River Calder Abstraction option 1) has the potential for moderate adverse effects on population and human health, and archaeology and cultural heritage. A large proportion of the pipeline route will pass through heavily built areas, leading to temporary adverse effects from noise, dust and vibration and temporary adverse impacts on a range of recreational facilities and historical assets.

There is also one possible moderate adverse effect for the River Aire Abstraction option 1 (R35), relating to archaeology and cultural heritage due to the pipeline route potentially passing through a World Heritage Site (WHS). It will however provide a 10MI/d yield on most days, contributing to moderate beneficial impacts.

The River Wharfe Licence Increase (R72) would provide water for public supply which would deliver minor beneficial impacts on population and human health due to the minor deployable output and continued water supply for economic activity. The option will deliver beneficial impacts with regard to sustainable water supply. The option utilises existing infrastructure and so would have minor beneficial impacts on material assets and resource use, as no construction is required.

Six of the options that involve raw water transfers (R51, R54, R56, R58, R59 and R62) have a variety of minor to major adverse impacts due to the scale of construction needed. Major adverse effects

include impacts on designated sites for habitats (R54 and R56). Moderate adverse effects include impacts on designated habitats (R62), resource use (R51, R54, R56, R59 and R62), water (R54 and R56), local air quality (R62) cultural heritage (R51, R54 and R56) and landscape (R59). Beneficial impacts range from minor to major, as the options contribute water supply ranging from 15Ml/d to 140Ml/d.

The two transfer options to import water from United Utilities Integrated Resource Zone (R58 and R59) vary in impacts. Option R58 only anticipates minor adverse impacts since it utilises existing assets. Option R59 may lead to moderate adverse impacts on resource use and landscape due to the use of construction materials and temporary impacts on an AONB. Both options would provide a yield of 1Ml/d, leading to minor beneficial impacts on population and human health, resource use and resilience to climate change.

The East Yorkshire coast desalination (R61) has the potential for major adverse effects on biodiversity as it may impact on the Humber Estuary SAC/SPA/Ramsar, and intersects the impact zone of several SSSIs. In addition, major adverse effects are associated with the significant amount of resource use and energy required to operate this option.

Table 7.4 Visual evaluation matrix summary for resource management options

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R1a River Ouse water treatment works extension	Adverse																
	Beneficial																
R2 Ouse Raw Water Transfer	Adverse																
	Beneficial																
R3 Increased River Ouse pump storage capacity	Adverse																
	Beneficial																
R5 Aquifer Storage and Recovery Scheme 1	Adverse																
	Beneficial																
R6 South Yorkshire Groundwater Option 1	Adverse																
	Beneficial																
R9 North Yorkshire Groundwater Option	Adverse																
	Beneficial																
R12 East Yorkshire Groundwater Option 1	Adverse																
	Beneficial																
R13 East Yorkshire Groundwater Option 2	Adverse																
	Beneficial																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R16 Reuse abandoned third party GW source 1	Adverse																
	Beneficial																
R17 Reuse abandoned third party GW source 2	Adverse																
	Beneficial																
R18 Reuse abandoned third party GW source option 3	Adverse																
	Beneficial																
R19 Reuse abandoned third party GW source option 4	Adverse																
	Beneficial																
R21 Dam Raising Option 1	Adverse																
	Beneficial																
R23 Dam Raising Option 3	Adverse																
	Beneficial																
R24 Dam Raising Option 4	Adverse																
	Beneficial																
R29 Reservoir De-silting	Adverse																
	Beneficial																
	Adverse																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R34 R. River Calder Abstraction option 1	Beneficial																
R35 River Aire Abstraction option 1	Adverse																
	Beneficial																
R37 River Aire Abstraction option 3	Adverse																
	Beneficial																
R72 River Wharfe Licence Increase	Adverse																
	Beneficial																
R49 Supply Dales from the Tees - treated	Adverse																
	Beneficial																
R50 Supply Dales from the Tees - raw 1	Adverse																
	Beneficial																
R51 Supply Dales from the Tees - raw 2	Adverse																
	Beneficial																
R54 Tees - Ouse Pipeline Option 1	Adverse																
	Beneficial																
R56 Tees - Ouse Pipeline Option 2	Adverse																

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial																
R58 Transfer from UU Option 3	Adverse																
	Beneficial																
R59 Transfer from UU Option 4	Adverse																
	Beneficial																
R61 East Yorkshire coast desalination	Adverse																
	Beneficial																
R62 North Yorkshire rural distribution	Adverse																
	Beneficial																
R63 North Yorkshire Groundwater 2	Adverse																
	Beneficial																

Note: See Section 5.1 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial

8 Assessment of the Yorkshire Water WRMP 2019 preferred plan

8.1 The preferred plan

Whilst the initial primary criterion in selecting a programme of schemes to meet the supply-demand deficit over the planning period is whole-life cost (including any monetised values for environmental and social costs), the Environment Agency's Water Resources Planning Guideline (WRPG) and other WRMP guidance requires that other criteria should also be considered, including non-monetised environmental and social impacts, climate change and other risks and uncertainties.

As described in the WRMP, Yorkshire Water reviewed its initial least-cost plan against the SEA findings, including ensuring that the environmental and social impacts were not 'double-counted' in both the monetisation process and the SEA, as this could potentially skew the options and programme appraisal process.

The preferred plan has been selected in accordance with Yorkshire Water's goal to use distribution management and leakage reduction to meet the predicted supply-demand deficit as far as possible. This is also in line with guidance from Ofwat and Defra, and preferences expressed by Yorkshire Water customers. Whilst the WRMP optimisation model delivers a least cost solution, this does not consider regulatory and customer preferences. Yorkshire Water has selected 40% leakage reduction, delivery of which will commence in the last year of AMP6 and continue through to AMP11. The preferred plan also includes resilience options at North Yorkshire Groundwater Option and East Yorkshire Groundwater Option 2, which will help to reduce outages. Implementation of these options will be dependent on meeting Environment Agency licensing requirements, and East Yorkshire Groundwater Option 2 will be within any constraints imposed following Water Industry National Environment Programme (WINEP) investigations.

The water supply-demand deficit identified for the Grid Surface Water Zone is 6.49MI/d in 2035/36, rising to 33.97MI/d by 2044/45. Investigations indicate there is no deficit for the East SWZ. The preferred plan to address the deficit for the Grid SWZ is presented in Table 8.1. This includes a 40% leakage reduction, which is driven by other (non-WRMP) factors. It also includes investment in resilience options at North Yorkshire Groundwater Option and East Yorkshire Groundwater Option 2. Implementation of this plan will result in no deficit in the 25-year period of the WRMP.

A visual summary of SEA findings for each of the schemes included in the preferred plan is provided in Table 8.2.

Table 8.1 WRMP2019 preferred plan

Reference	Option	Implementation	Yield benefit (MI/d)
D1a-D1j	Active leakage control: find and fix	2019-2044	35.94
D4a-D4f	Customerside	2019-2044	1.37
D5a-D5f	Trunk main metering	2019-2044	5.23
D6a-D6f	DMA engineering & pressure management	2019-2044	53.98
D7a-D7d	Acoustic logging	2019-2044	18.84
D8a-D8f	Satellite technology	2019-2044	4.06
D10a-D10f	Smart networks	2019-2044	13.41

Reference	Option	Implementation	Yield benefit (Ml/d)
D11a-D11f	Service pipe renewal	2019-2044	3.87
R9	North Yorkshire Groundwater Option	2022	2.00
R13	East Yorkshire Groundwater Option 2	2025	6.00
25-year deficit		33.97	
Total leakage benefit		136.70	
Total benefit all options		144.70	

8.2 Alternative plans

A least cost solution for the Grid SWZ was also identified, the details of which are provided in the WRMP.

A preferred solution to address a more extreme climate change scenario is also identified in the WRMP.

Table 8.2 Visual evaluation matrix summary for options within the preferred plan

Option	Impact	SEA objective															
		1.1	1.2	1.3	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
D1 Active leakage control: increased find and fix	Adverse																
	Beneficial																
D4 Customerside	Adverse																
	Beneficial																
D5 Trunk main metering	Adverse																
	Beneficial																
D6 DMA engineering & pressure management	Adverse																
	Beneficial																
D7 Acoustic logging	Adverse																
	Beneficial																
D8 Satellite technology	Adverse																
	Beneficial																
D10 Smart networks	Adverse																
	Beneficial																
D11 Service pipe renewal	Adverse																
	Beneficial																
	Adverse																

R9 North Yorkshire Groundwater Option	Beneficial																
R13 East Yorkshire Groundwater Option 2	Adverse																
	Beneficial																

Note: See Section 5.1 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial

8.3 Option-level cumulative assessment

The cumulative assessments presented in this section have been carried out in line with the methodology described in Section 5.2.2 based upon the preferred plan of options discussed and presented in Section 8.1.

The matrix in Table 8.3 illustrates potential incompatibility and cumulative impacts between the options included in the preferred plan. SEA objective numbers (e.g. as indicated in Table 8.2) have been added to the matrix where applicable, to indicate the nature of the cumulative effect. There would be benefits associated with implementation of each option in parallel, i.e. increasing the overall volume of water savings made or water provided for supply. There is a small risk that simultaneous implementation of the distribution management schemes could lead to cumulative adverse impacts, whereby effects on human health, resource use, and air and greenhouse gas emissions could increase due to supply network repair and enhancement activities. However, any such cumulative impacts would be minor, as most of these activities would be localised and small in scale, and could be effectively mitigated through careful project management and best practice construction methods.

There is no potential for cumulative impacts between the two resource management options included in the preferred plan, as they abstract from different aquifers. North Yorkshire Groundwater Option abstract from the confined Millstone Grit Group aquifer, while East Yorkshire Groundwater Option 2 would target the Sherwood Sandstone Group aquifer.

Table 8.3 Cumulative impacts matrix: Preferred Plan

D1	Active leakage control: find and fix										
D4	Customerside	2.1, 3.1, 6.1, 6.2, 6.3									
D5	Trunk main metering	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3								
D6	DMA engineering & pressure management	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3							
D7	Acoustic logging	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3						
D8	Satellite technology	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3					
D10	Smart networks	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3				
D11	Service pipe renewal	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3	2.1, 3.1, 6.1, 6.2, 6.3			
R9	North Yorkshire Groundwater Option	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3		
R13	East Yorkshire Groundwater Option 2	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	2.1, 6.3	
		D1	D4	D5	D6	D7	D8	D10	D11	R9	R13

Key:

	No cumulative effects as option cannot be cumulatively implemented with itself
	Potential adverse effects if options operated simultaneously
	Potential adverse and beneficial effects if options operated simultaneously
	Potential beneficial effects if options operated simultaneously
	No adverse cumulative effects between options

8.4 Programme-level cumulative assessment

Cumulative effects of the WRMP with other relevant plans, programmes and projects have been considered. These include the following:

- Yorkshire Water's Drought Plan
- Neighbouring water companies' drought plans
- Neighbouring water companies' WRMPs (these are to be assessed when published)
- Environment Agency Drought Plans
- Canal and River Trust Management Plans
- Local Development Frameworks
- National Policy Statements and National/Regional Infrastructure Plans
- Major projects.

8.4.1 Yorkshire Water's Drought Plan

There are two options in the WRMP2019 preferred plan that also appear in the Yorkshire Water draft Drought Plan 2019 i.e. North Yorkshire Groundwater Option (R9) and East Yorkshire Groundwater Option 2 (R13). As both of these schemes are more or less identical to schemes in the Drought Plan, no cumulative impacts will arise as they will be mutually exclusive - either the scheme will be developed as a permanent scheme under the WRMP and therefore no longer a Drought Plan option; or it will be a temporary scheme available, if required, in a drought prior to it becoming a permanent scheme in later years under the WRMP.

The Yorkshire Water draft Drought Plan 2019 also includes a distribution management option for increased leakage detection and repair activity. Simultaneous implementation of the WRMP distribution management schemes could lead to cumulative adverse impacts with leak detection and repair activity associated with the Drought Plan, however as described in Section 8.3, any such impacts are likely to be no more than minor.

8.4.2 Neighbouring water companies' WRMPs and Drought Plans

The draft WRMPs and drought plans from the following water companies were considered for potential cumulative effects:

- Severn Trent Water Limited
- United Utilities Water PLC
- Northumbrian Water Limited
- Anglian Water Services Limited

The two resource management options (North Yorkshire Groundwater Option East Yorkshire Groundwater Option 2) in the WRMP2019 preferred plan were reviewed for potential cumulative effects with resource options in the plans of neighbouring water companies. The options are sufficiently distanced from other resource options for cumulative construction effects to be highly unlikely. During operation, no cumulative adverse effects are anticipated as the options will draw from aquifers that are not hydrologically connected to any surface or groundwater bodies that would be subject to other water companies' options.

The distribution management options that make up the rest of the preferred plan were also reviewed for potential cumulative effects with other water company WRMPs. The adverse effects associated with these options do not extend beyond Yorkshire Water's supply area and as such cumulative effects are unlikely.

8.4.3 Environment Agency drought plans

Assessment of the potential for cumulative impacts of the preferred plan with drought options listed in the Draft Environment Agency Yorkshire and North-East Drought Plan 2012 has been undertaken. The information used to carry out these assessments is the most up to date information available at time of writing, but the assessments should be reviewed at the time of option implementation to ensure that no

changes to the Environment Agency Drought Plan have been made in the intervening period, and that the assessment therefore remains valid.

Drought actions and triggers are given in the Environment Agency's Drought Action Plan. Actions described include communications (internal and external), monitoring and potential drought order applications to protect the environment. Of these actions, those which are applicable for cumulative assessment with Yorkshire Water's preferred plan are external communications and potential environmental drought orders.

External communications will have positive cumulative effects with Yorkshire Water's media/water efficiency campaign, as drought communication messages may reinforce each other, thereby resulting in increased water savings and greater recognition by the public to use water wisely.

Environment Agency environmental drought order actions have the potential to have cumulative impacts with Yorkshire Water's WRMP options. However, no specific potential drought order applications are defined in the Environment Agency's plan, although the situation should be checked in the event of a drought in case any specific need for a drought order application is being considered.

In summary, no cumulative impacts of options in Environment Agency DPs and Yorkshire Water's WRMP options are anticipated. However, due to the uncertainties of potential locations, and potential revisions to the Environment Agency's plan, this should be considered further at the time of any potential application for drought permits/orders by Yorkshire Water.

8.4.4 Canal and River Trust Management Plans

The Canal and River Trust (formerly British Waterways) is responsible for operating a number of reservoirs in the Yorkshire Water region to supply their navigation systems in Yorkshire, as well as managing the various navigable waterways and canals in the county. Liaison with the Trust about future water resource management actions would be useful. However, implementation of the WRMP is unlikely to have cumulative impacts on navigable waterways, as the preferred plan does not include any options that involve abstractions from such waterways.

8.4.5 Local Development Frameworks

The Richmondshire Local Plan³⁶ has been identified as having potential in-combination impacts with North Yorkshire Groundwater Option (R9). The plan sets out a proposed upgrade of Catterick Central Junction and housing development in Catterick Garrison. However, proposed development within the Local Plan is unlikely to have adverse effects on groundwater, as such, no in-combination effects with the operation of the scheme have been identified.

East Yorkshire Groundwater Option 2 (R13) has been identified as having potential in-combination impacts with the Selby District Local Plan³⁷. However, the new borehole would be within an existing site and makes use of existing infrastructure. Therefore, proposed development set out in the Local Plan is not anticipated to have any in-combination effects with the construction of a new borehole at East Yorkshire Groundwater Option 2.

8.4.6 National Policy Statements and National/Regional Infrastructure Plans

No in-combination effects have been identified with national policy statements or with national or regional infrastructure plans (including gas and electricity).

8.4.7 Major projects

The potential for cumulative effects with other major projects has been considered. These include existing completed projects, approved but uncompleted projects, ongoing activities, plans or projects for which an application has been made and which are under consideration by consenting authorities and plans and projects which are reasonably foreseeable (i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects).

The following major projects have been identified for the purposes of this assessment: Humber Estuary Port Development, River Humber Gas Pipeline Replacement Project, North Killingholme Power Project,

³⁶ Richmondshire District Council 2012, Local Plan 2012-2028, Core Strategy Adopted 9 December 2014

³⁷ Selby District Council 2013, Selby District Core Strategy Local Plan Adoption Version 22 October 2013

Knottingley Power Project, Ferrybridge Multifuel 2 Power Station, Robin Hood Airport expansion, Highways Agency motorway enhancements, and the High Speed 2 rail link to Leeds. In-combination effects for these projects are not considered likely as the zones of influence largely do not overlap with the WRMP options due to differing construction periods, or otherwise the impacts have been identified as small-scale and geographically distributed.

9 Mitigation and enhancement

9.1 Overview

Key stages of the SEA process comprise Task B5: Mitigating adverse effects and Task B6: Proposing measures to monitor the environmental effects of plan or programme implementation. The sections below describe how these tasks have been addressed and how Yorkshire Water intends to ensure that mitigation measures are implemented for any adverse effects that are identified and the means by which the environmental performance of the WRMP can be assessed.

9.2 Mitigation measures

Consideration of mitigation measures has been an integral part of the SEA process. The assessment has assumed the implementation of standard best practice mitigation measures and identified any additional measures as shown in the option SEA matrices (see Appendix E). The significance of effects identified in the matrices relates to residual effects after mitigation.

Certain assumptions have been made regarding this:

- Where suitable mitigation measures are known and identified, these have been taken into account and reported, such that the resultant residual impact has been determined.
- In line with recommendations made in the UKWIR SEA Guidance, the SEA appraisals have assumed the implementation of reasonable mitigation, such as the use of best practice construction methods.

9.3 Residual Effects

The SEA process has identified potential residual impacts of the WRMP preferred plan after mitigation measures have been taken into consideration. Proposals to attenuate the residual negative impacts of the preferred plan are set out below.

Table 9.1 summarises the residual effects attributable to the preferred plan for the Yorkshire Water WRMP2019. Mitigation of both construction and operation components for each option are presented.

The mitigation measures would, in some cases, potentially be implemented through option-level planning applications. In other cases, best practice design requires consideration of mitigation measures at an early stage along with consultation with potentially affected parties. In this way, effective mitigation plans can be developed to minimise many of the residual adverse effects currently identified in the SEA appraisals.

Table 9.1 Residual adverse impacts of options within the preferred plan for the WRMP2019

Ref	Option	Construction	Operation
D1	Active leakage control: find and fix	No significant effects	No significant effects
D4	Customerside	No significant effects	No significant effects
D5	Trunk mains metering	No significant effects	No significant effects
D6	DMA engineering & pressure management	No significant effects	No significant effects
D7	Acoustic logging	No significant effects	No significant effects
D8	Satellite technology	No significant effects	No significant effects

Ref	Option	Construction	Operation
D10	Smart networks	No significant effects	No significant effects
D11	Service pipe renewal	No significant effects	No significant effects
R9	North Yorkshire Groundwater Option	No significant effects	No significant effects
R13	East Yorkshire Groundwater Option 2	Biodiversity, flora and fauna	Water resources

9.3.1 Biodiversity, flora and fauna

The new East Yorkshire Groundwater Option 2 would be located next to an existing reservoir, which is surrounded by Ancient Woodland, a lowland acid oak woodland with ornithological interest. There is existing access to the site. The construction of the new borehole would be likely to cause temporary impacts related to noise, vibration and dust; however, it is expected that these impacts on the neighbouring woodland would be mitigated through best practice construction and timing the construction to avoid adverse impacts on bird populations.

The exact route of the pipework connecting the new borehole to the water treatment works and reservoir is unknown and there is a risk of adverse impact on the ancient woodland through disturbance to root structure during excavation activities. Further investigations during design could identify mitigation measures that would avoid impacts on the ancient woodland.

9.3.2 Water Resources

Water resources were identified as an adverse operational impact of the East Yorkshire Groundwater Option 2. Abstractions will be subject to licensing and may only be allowed to take place at times of high groundwater or river flows. Although abstraction would be within existing licence limits, the increase in actual abstraction could have a moderate adverse effect, although not sufficient to lead to deterioration in WFD status to 'bad'. The previous abstraction abstracted the same quantities as this proposed option. Therefore, it is unlikely to affect the water balance on a groundwater body scale, however further investigation is required.

9.4 Mitigation of cumulative impacts with other plans and programmes

Section 8 explains the potential cumulative impacts with other plans. Potential water resource impacts that could arise due to future, as yet, unknown new abstractions from common sources would be assessed and considered by the Environment Agency as informed by detailed environmental assessment work as part of the abstraction licensing and water resources planning processes.

Liaison with local planning authorities will also be essential to assess any required mitigation measures from any identified cumulative effects on development plans and projects as discussed in Section 8.

10 Monitoring proposals

10.1 Overview

A key stage of the SEA process with regard to monitoring is Stage E: Monitoring the significant effects of the plan or programme on the environment. The sections below describe how these tasks have been addressed and how Yorkshire Water proposes to monitor the effects of implementation of the WRMP.

10.2 Monitoring Requirements

Monitoring will be required to track the residual environmental effects to show whether they arise as anticipated in the SEA appraisal, to help identify any adverse impacts and trigger deployment of any of the mitigation measures.

Monitoring for options identified in the preferred plan is set out in Section 10.3. These monitoring recommendations are based on the current understanding of the scheme design. As options are brought forward for development, further monitoring requirements may be set out in planning applications, borehole drilling and pump test consents, or in Yorkshire Water voluntary best-practice monitoring plans accompanying scheme development. This will be discussed with relevant key regulatory bodies and stakeholders. In practice, close dialogue should occur between Yorkshire Water, Environment Agency, Natural England and any affected third parties to agree the appropriate scale and duration of such scheme-specific monitoring activities proportionate to the assessed environmental risks.

10.3 Proposed Monitoring

Table 10.1 lists the potential impacts that may arise from implementation of the WRMP preferred plan and which require monitoring in accordance with the SEA Regulations.

Key monitoring parameters at the strategic WRMP level will be those relating to the abstraction of water and the effects that this may have on waterbodies and their functions as habitats (Table 10.1). There are also direct potential impacts on humans, the built environment, terrestrial habitats, the atmosphere, landscape and heritage assets, which may arise from construction activities and/or option operation (Table 10.1). These parameters should, therefore, be included within the monitoring programme where it is practicable to do so. Extensive primary data collection is neither feasible nor appropriate for this programme level of monitoring, and use should be made where possible of existing datasets and monitoring regimes.

Site-specific monitoring requirements for the two resource options included in the preferred plan (R9 and R13) will be developed during the planning process closer to the time of implementation.

Table 10.1 Proposed SEA monitoring parameters – strategic WRMP monitoring

Impacted receptor	Proposed strategic indicators
Water resources, water quality, biodiversity	Proportion of surface waters and groundwater waterbodies at 'Good' WFD status, surveys to understand potential changes to WFD status, and species and habitats surveys as required.
Climate Factors	Net greenhouse gas emissions per million litres (MI) of treated water (kg CO ₂ equivalent emissions per MI) for Yorkshire Water supply area
Transport	Transport fleet fuel consumption, emissions and business mileage, as monitored by Yorkshire Water

Impacted receptor	Proposed strategic indicators
Nuisance/ Community/ Local Economy	<p>Scheme level community disruption of capital works would be monitored through an Environmental Monitoring Plan if required.</p> <p>Complaints logged with Yorkshire Water and Local Authority EHOs.</p> <p>Responses gauged through Yorkshire Water customer satisfaction surveys.</p> <p>Community investment, employee volunteering and match funding by Yorkshire Water.</p>
Air Quality	<p>Scheme related issues of capital works would be monitored through an Environmental Monitoring plan if required.</p> <p>Changes in air quality are monitored by the Automatic Urban and Rural Network³⁸ administered by Bureau Veritas, and this data would be available if required to inform a baseline</p>
Cultural Heritage	<p>Condition of buried archaeology would be monitored during construction e.g. through appropriate archaeological investigations and watching briefs as required.</p> <p>Consultation with relevant stakeholders to ensure impacts are minimised, e.g. to water level dependent assets.</p> <p>Historic England monitor parameters such as Listed Buildings and Scheduled Monuments, in order to maintain a 'Heritage at risk' register.</p>

The SEA Directive states that monitoring must enable appropriate remedial action to be taken. For the monitoring programme to be effective, there must therefore be a mechanism in place to detect trends and to ensure that action is taken where trends are progressively adverse.

Five-yearly assessment of monitoring and any measures taken would be included within the SEA for the subsequent draft WRMP development. Through the proposed monitoring and analysis of the results obtained over the five-year period, the SEA will inform and influence the development of the WRMP for future periods.

³⁸ Accessed at <http://www.bv-aurisiteinfo.co.uk/>

Appendices

Appendix A	Statutory consultee responses to the SEA Scoping Report
Appendix B	Quality assurance checklist
Appendix C	Review of policies, plans and programmes
Appendix D	Environmental baseline review
Appendix E	Option assessment matrices



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