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Strategic Environmental Assessment (RAPID Gate Two)

South Lincolnshire Reservoir

November 2022

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1 Introduction

1.1 Overview

This appendix supports the Environmental Appraisal Report (EAR) that accompanies the gate two submission to the Regulatory Alliance for Progressing Infrastructure Development (RAPID) for the South Lincolnshire Reservoir (SLR). This appendix presents the findings of a Strategic Environmental Assessment (SEA) applied to the whole SLR scheme that has been assessed as part of Anglian Water's Water Resources Management Plan 2024 (WRMP24).

It should be noted that the SLR SEA is not a formal SEA under The Environmental Assessment of Plans and Programmes Regulations 2004 as it is a project not a plan/programme and is therefore, outside the scope of the SEA Regulations[1]. The SEA has been carried out as good practice and this report is not an Environmental Report under the Regulations and therefore, doesn't contain all of the information as set out in Schedule 2.

1.2 Background

A new strategic reservoir in Lincolnshire, referred to as the SLR, has been proposed for development as one of several nationally strategic water resource options required to address increasing deficits in public water supply. The scheme is being is promoted by Anglian Water and Affinity Water and is being progressed through the fast-tracked delivery framework overseen by RAPID.

The SLR has previously progressed through gate one in 2021, the first opportunity to check progress on investigations and development of solutions in the gated process and is now at gate two. Gate two is intended to look at solutions in more detail, with focus on ensuring that funding for continued investigation and development of solutions is aligned to water resources planning.

The SLR environmental assessments carried out as part of the gate one submission considered three potential scheme options, which were selected from a longer list of potential sites in consultation with stakeholders. The gate one assessments carried out included an informal Habitat Regulations Assessment (HRA), a Water Framework Directive (WFD) assessment, a SEA, an Invasive Non-Native Species (INNS) risk assessment, and an analysis of natural capital and Biodiversity Net Gain (BNG).

This assessment is a technical document prepared to support the gate two submission to the RAPID for the SLR strategic resource option.

[1] UK Government (2004). The Environmental Assessment of Plans and Programmes Regulations 2004. Available at: https://www.legislation.gov.uk/uksi/2004/1633/contents/made

2 Scheme Description

2.1 Scheme overview

The SLR scheme includes the development of a new embanked raw water reservoir for water storage for public water supply. It also comprises abstractions from the River Witham and River Trent, raw water transfers, treatment works, and distribution into supply.

Key scheme parameters include:

- River Trent maximum abstraction and transfer flow to River Witham: 300Ml/d (Megalitres per day)
- River Witham maximum abstraction and transfer flow to reservoir: 400Ml/d
- Reservoir total capacity: 55MCM
- Reservoir usable volume: 50MCM
- Treatment distribution flow [2]: 150Ml/d

2.1.1 Reservoir overview

The proposed reservoir site is shown in Figure 2.1, and is located approximately 7km southeast of the town of Sleaford, between the settlements of Swaton, Scredington and Helpringham in the North Kesteven District Council area. South Kesteven District Council's administrative boundary is approximately 100m south of the polygon, south of the A52 Holland Road. The Peterborough to Lincoln railway line runs along the north-eastern boundary with the North Beck watercourse situated just north of the site boundary.

An indicative concept plan has been developed for the scheme. This indicative concept has been established to provide reference for cost and carbon estimation in gate two. The summary provisional details are provided below, but much work is still required to develop the scheme and the final details would develop accordingly.

The provisional reservoir parameters are:

- At its greatest dimensions the reservoir is about 2.6km wide and 3.2km long to the embankment toe.
- The embankment crest is estimated at 26mAOD (above ordnance datum) making the embankment an average of 14m above the typical existing ground level at the toe. This is with approximate relative embankment elevations of maximum 19m and minimum of 5m above existing ground levels.
- The total perimeter length of the crest is about 8.5km and the estimated reservoir surface area is 4.8km^2.

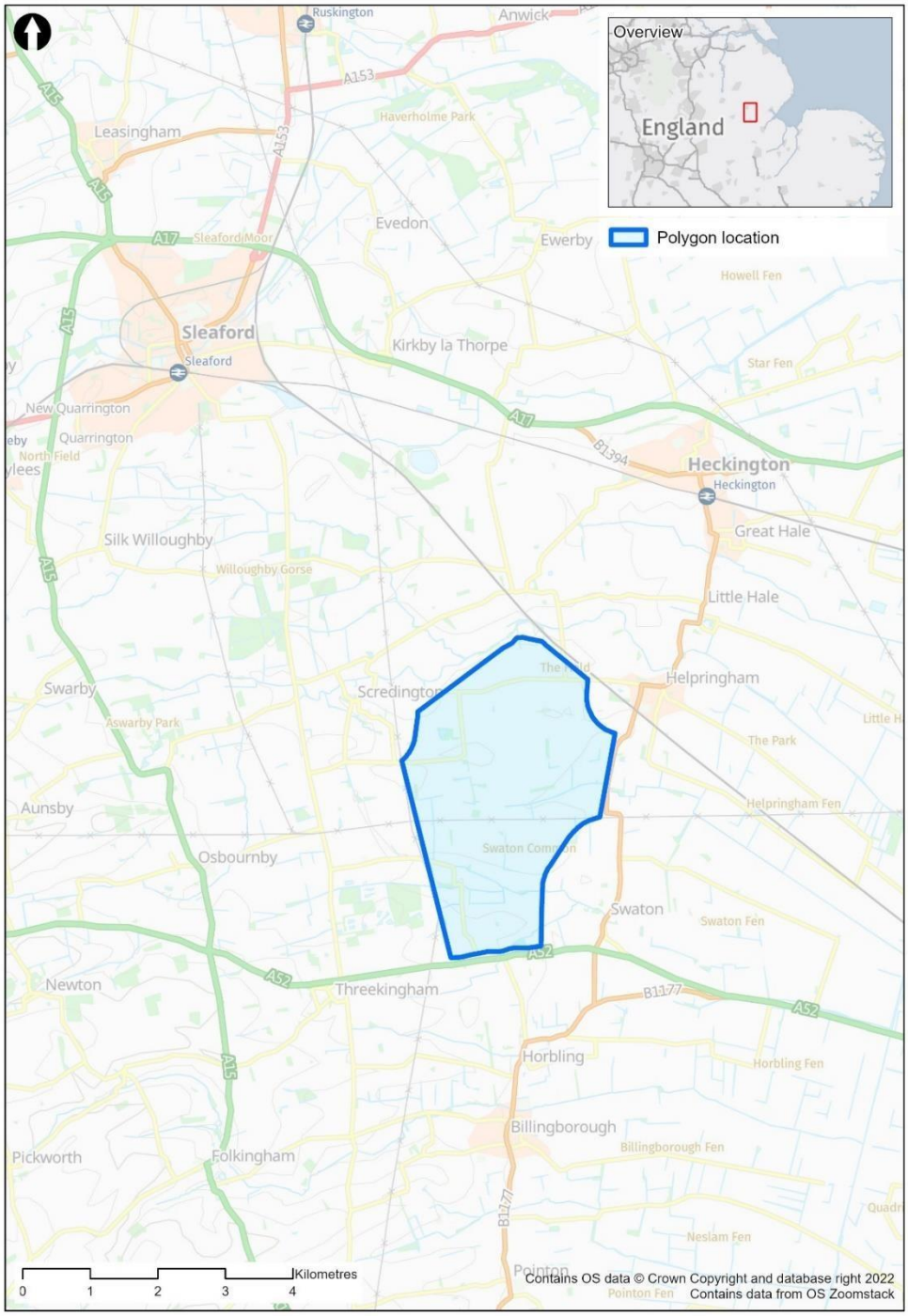
The reservoir would include key infrastructure necessary for its safe operation, including intake and outtake structures; drawdown facilities; a spillway and water sampling facilities. The reservoir would also be expected to provide benefits beyond public water supply. Opportunities to incorporate facilities to enable recreation (such as a visitor centre and parking), infrastructure to improve health and wellbeing (such as multi-use footpaths, quiet areas and leisure

[2] The proposed capacity of the water treatment works and transfer pipelines has been updated since this assessment was completed. The figures quoted in the gate two report include a scheme deployable output of 166Ml/d and works capacity up to 180Ml/d. These changes are not anticipated to have any material impact on the completed assessments.

opportunities) and careful design to enhance and encourage biodiversity are planned and would be developed further, with the features that would deliver these wider benefits being subject to

further assessment and consultation. Landscaping would be carefully designed surrounding the reservoir to minimise the visual impact of the reservoir whilst ensuring it sits within the existing landscape and delivers wider recreational and biodiversity benefits.

Figure 2.1 Site context map



2.1.2 Raw water, transfer and treatment

It is proposed that water would be abstracted from the River Witham. The abstraction location has currently been assumed, for indicative purposes, to be at an intake between Chapel Hill and Langrick Bridge. The precise abstraction location would be identified following further detailed work (including stakeholder engagement) for gate three. The current design includes the transfer of water into the reservoir by about 18km of 1600mm (millimetres) diameter steel pipeline.

However, the precise abstraction location would be identified following further detailed work (including stakeholder engagement) for gate three. The proposed abstraction rate from the River Witham is up to 400Ml/d when flows allow. This is subject to further assessment undertaken in collaboration with the Environment Agency (EA) to develop an abstraction rate which is licensable. The associated abstraction licence is expected to stipulate a minimum flow and minimum water level requirement at the point of abstraction below which it would not be possible to abstract. Abstraction to fill the reservoir would only be possible during high flow periods.

It is proposed that flows in the River Witham would be supported via a transfer from the River Trent. Up to 300Ml/d would be abstracted from the River Trent, with an intake currently assumed for indicative purposes to be located near Newark-on-Trent (although, as with the River Witham abstraction, the precise abstraction location would be identified following further detailed work for gate three) and transferred by about 10km of 1400mm diameter steel pipeline to the River Witham near Claypole. Without mitigation, there is a risk of INNS transferring between catchments (see EAR).

The current design includes the transfer of water into the reservoir by about 18km of 1600mm (millimetres) diameter steel pipeline. The potential for the raw water transfer to the reservoir from the River Witham into the South Forty Foot Drain (SFFD) and then into the reservoir, using open channel, to deliver additional benefits has been identified as an opportunity. This opportunity is being investigated further and would be confirmed during the next stage of project development.

Further work is planned for the next stage to confirm the locations of the abstraction points and routes for the transfers. This would involve landowner engagement, environmental surveys, and preliminary ground investigations. The information provided in this report and accompanying appendices are assumptions based on indicative locations only at this stage. The indicative transfer routes for are shown in Figure 2.2.

The abstraction facilities are expected to comprise an intake structure, a transfer pumping station (TPS) and pipeline.

2.1.3 Water treatment and potable transfers

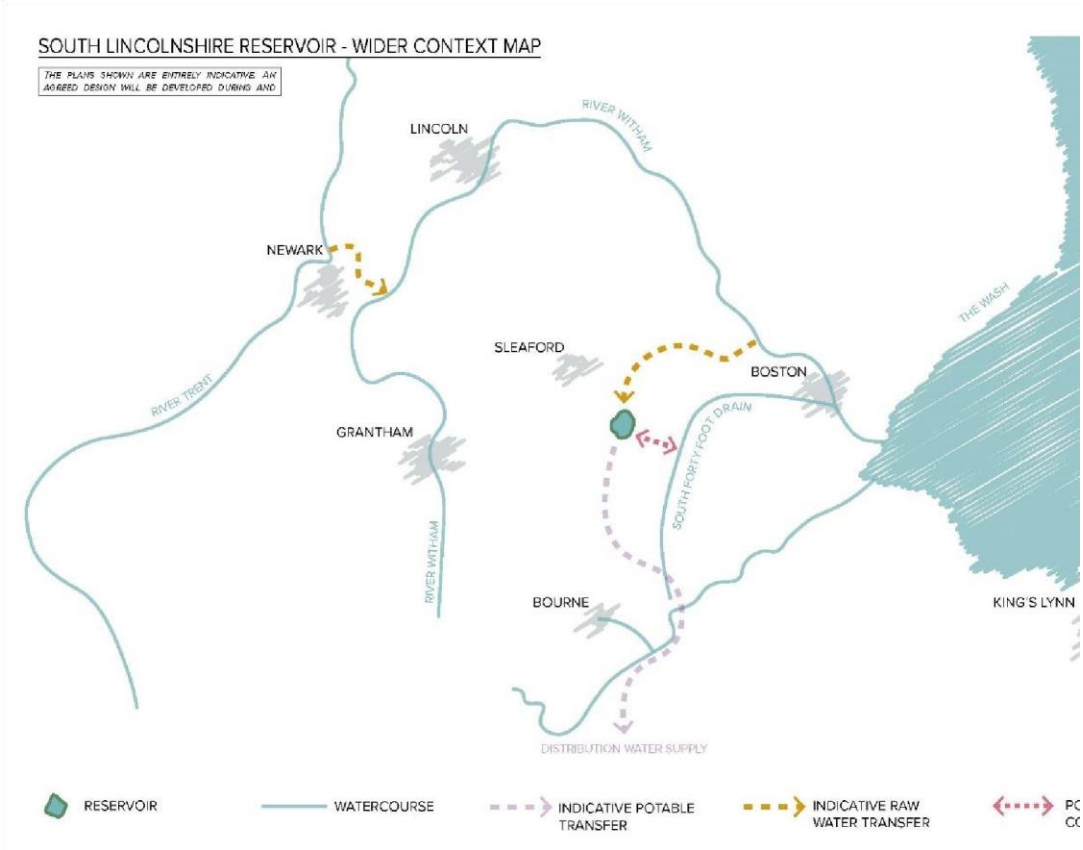
Stored water would subsequently be abstracted from the reservoir and treated to a potable quality. It is proposed that a WTW is located on land adjacent to the reservoir with a peak throughput capacity of 180Ml/d.

It is proposed that the treated water would be transferred by an approximate 37km 1100mm diameter steel pipeline into the potable supply network by an existing Anglian Water Service Reservoir. The reservoir is to supply over 500,000 homes in Lincolnshire and the south-west of the Anglian region.

Further work is planned for the next stage to confirm the routes for the transfers involving landowner engagement, environmental surveys, and preliminary ground investigations. The information provided in this report and accompanying appendices are assumptions based on indicative locations only at this stage.

See Figure 2.2 for an illustration of indicative proposed transfer corridor locations.

Figure 2.2 Proposed transfer corridors



2.1.4 Summary of operation and use

Development and operation of the reservoir would be subject to the Reservoirs Act 1975 (as amended by the Floods and Water Management Act 2010). The embankments and associated water retaining elements of the reservoir would need to be maintained and supervised in accordance with the Act to maintain public safety.

Provision of emergency drawdown must be designed in accordance with the Reservoirs Act. The preferred solution at this stage is to discharge to the SFFD, but this is to be further modelled and confirmed as part of the next stage of development. Although the risk of needing to fully drawdown the reservoir is very low, there is a need for regular testing and maintenance to confirm functionality. This would involve the opening and testing of relevant valves and gates. Test flows are envisaged to be held in a pond to avoid disruption and to enable water to be returned back to the reservoir.

The operation and maintenance of the water treatment works and the distribution water supply system inclusive of distribution pump stations are expected to be in constant regular use according to water supply demand. The water supply components would need regular inspections and maintenance activities in accordance with the requirements of the respectively installed equipment.

2.1.5 Associated features

It is proposed that there would be a need for associated infrastructure and other features such as environmental mitigation to minimise the impacts of the reservoir, as well as enhancement opportunities. The location and design of the additional infrastructure has not been established and would therefore need to be confirmed at the next phase of scheme development.

3 Methodology

3.1 SEA Process

3.1.1 SEA Objectives and assessment criteria

The methodology used for assessing the SLR was undertaken in accordance with the methodologies developed for WRMP24 and WRE regional plan. This methodology applied to all options considered for inclusion in the plans.

The SEA Process forms the basis for predicting and assessing the effects arising from the implementation of the SLR reservoir as part of the Anglian Water WRMP24 and the wider, Water Resources East (WRE) regional planning process. This report demonstrates that the SLR was considered along with other options to address the regional supply/demand balance. An overarching set of SEA objectives and assessment questions were developed using current guidance and stakeholder consultation to guide the assessment of all of the options considered for the regional plan and the WRMP24 as shown in Table 3.1. These are linked to the SEA Regulations topics. The results of the informal HRA, and WFD and INNS assessments have been incorporated into the SEA objectives on biodiversity and water, as outlined in Table 3.2. The EAR has also been used to inform the SEA.

The SEA assessment also considers the impacts on natural capital stocks that cannot be incorporated within the natural capital metric due to uncertainty in the accuracy of monetisation of benefits. These impacts have been assessed qualitatively and incorporated into the score for the relevant SEA objective.

The overarching objectives have also been used as a framework for WRMP24, where water companies can cross-reference the regional plan SEA objectives. This would allow for a consistent approach tailored to individual water companies where objectives could be scoped in or out of the WRMP process but also be aligned to the regional plan. It is recognised that certain objectives or sub-themes would involve water company wide considerations rather than just option specific, for example how water companies are sourcing power from renewables. This detail would be considered at the WRMP24 level and agreed assumptions used for the regional plan.

Table 3.1: SEA objectives and assessment criteria

SEA Topic	SEA Objective(s)	Assessment Questions / Sub-Themes
Biodiversity, Flora and Fauna	1. To protect designated sites and their qualifying features. 2. To protect and enhance biodiversity, priority species and vulnerable habitats such as chalk rivers. 3. To avoid and, where required, manage invasive non-native species (INNS). 4. To meet WFD objectives relating to biodiversity.	• Is the option likely to affect the conservation status of any Special Protection Area (SPA), Special Area of Conservation (SAC), Ramsar sites, Site of Special Scientific Interest (SSSI) or locally designated sites? Would the option protect and enhance aquatic and habitats and species, including freshwater fisheries and chalk rivers? Would the option affect the marine environment, habitats and species (including MCZs and MPAs)? Is the option likely to affect ancient woodland, Section 41 of the NERC act habitats and species of principal importance for the purpose of conserving biodiversity? Would the option affect any habitats that support legally protected species or species of conservation concern? Is there potential for contribution to achieving 'favourable' conservation status or for creation of new Section 41 of the NERC act habitats? Is the option likely to have an impact on a current or future Nature Recovery Network? Are there any opportunities for habitat creation or restoration? • Would the option contribute to the loss or gain in habitat connectivity? • Is there a possibility for INNS to be spread/introduced or for algal blooms to occur? • Is there an opportunity to improve biodiversity value through removal of INNS?

Population and Human Health	5. To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing. 6. To secure resilient water supplies for the health and wellbeing of customers. 7. To increase access and connect customers to the natural environment, provide education or information resources for the public.	• Does the option promote water efficiency and encourage a reduction in water consumption? • Would the option secure resilient water supplies for the health and wellbeing of customers? • Would the option allow for economic development? • Would the option allow for economic diversity? • Would the option have an effect on active lifestyles, such as impacts on active travel through disruption to pedestrian and cycle routes? • Would the option affect PRoW? • Would the option affect road or rail infrastructure? • Would the option minimise disturbance from noise, light, visual, and transport? • Would the local communities have been actively engaged to foster an inclusive environment and participate in decision making?
	8. Maintain and enhance tourism and recreation	• Would the option maintain or enhance tourism? • Does the option improve access to the natural environment for recreation, including those living within deprived areas? • Would the option have an effect on freshwater fisheries for recreational purposes? • Would the option have an effect on marine fisheries for recreational purposes?

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SEA Topic	**SEA Objective(s)**	**Assessment Questions / Sub-Themes**
Water	9. To reduce or manage flood risk, taking climate change into account.	• Is the option vulnerable to flood risk? • Would the option contribute to the risk of flooding?

	10. To enhance or maintain surface water quality, flows and quantity. 11. To enhance or maintain groundwater quality and resources. 12. To meet WFD objectives and support the achievement of environmental objectives set out in River Basin Management Plans.	• Would the option affect surface water quality or quantity? • Would the option affect ground water quality or quantity? • Is the option likely to contribute to or conflict with the achievement of WFD objectives? • Would the option affect bathing waters? • Would the option affect shellfish water protected areas? • Would the option affect chalk rivers and streams? • Would the option affect raw water quality? • Would the option reduce the flashy nature of surface waters? • Would the option slow the flow in upper catchments and reduce soil losses to river systems?
	13. To increase water efficiency and increase resilience of Public Water Supply (PWS) and natural systems to droughts.	• Does the option provide a reliable and sustainable water supply which meets changing demand? • Would the option protect and enhance the environmental resilience of the water environment to climate change, flood risk and drought?
Soil	14. Protect and enhance the functionality, quantity and quality of soils	• Would the option affect high grade agricultural land? • Would the option promote the efficient use of land? • Would the option prevent soil erosion and retain soil stocks as a natural resource? • Would the option promote soil health? • Would the option involve use of brownfield or greenfield land? • Would the option prevent mineral sterilisation? • Would the option affect soil contamination or involve remediation? • Is the option likely to affect geodiversity, including SSSIs of geological importance?
Air	15. To reduce and minimise air emissions during construction and operation.	• Is the option in an air quality management area (AQMA)? • Would the option affect local air quality?
Climatic Factors	16. To reduce embodied and operational carbon emissions.	• Would the option affect carbon or other greenhouse gas (GHG) emissions? • Is there potential for the option to incorporate climate mitigation measures to reduce its carbon footprint, such as lower embodied carbon or incorporating renewable energy?

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SEA Topic	**SEA Objective(s)**	**Assessment Questions / Sub-Themes**

		• Would the option affect carbon sequestration?
	17. To introduce climate mitigation where required and improve the climate resilience of assets and natural systems.	• Is the option vulnerable to climate change effects? • Does the option include climate resilience measures? • Would the option create catchment resilience to drought?
Historic Environment	18. To conserve, protect and enhance the historic environment, including archaeologically important sites.	• Would the option affect designated or non-designated historic assets, sites and features? • Would the option affect the setting and/or significance of a historic asset? • Would the option affect archaeology (including unknown archaeology)? • Would the option affect heritage assets at risk? • Would the option affect conservation areas or historic landscape/townscape areas?
Landscape	19. To conserve, protect and enhance landscape, townscape and seascape character and visual amenity	• Would the option have an effect on the character of the landscape, townscape or seascape, including tranquillity and views? • Would the option improve access to the countryside? • Would the option create or improve green infrastructure which contributes to access to the landscape? • Would the option protect and enhance designated landscapes and features?
Material Assets	20. To minimise resource use and waste production	• Would the option reuse existing infrastructure? • Would the option minimise the use of resources? • Would the option reduce the production of waste?
	21. Avoid negative effects on built assets and infrastructure	• Would the option affect built assets and infrastructure, including transport infrastructure?

Table 3.2: Overlap of SEA objectives with other environmental assessments

SEA Objective		Overlap with the other environmental assessments
1.	To protect designated sites and their qualifying features.	Results from the HRA are used for Natura 2000 sites but other designated sites such as SSSI and National Nature Reserves are also included under this objective and assessed under the SEA.
2.	To protect and enhance biodiversity, priority species and vulnerable habitats such as chalk rivers.	This objective is partially informed by the outputs of the assessment on the natural capital baseline, particularly priority habitat.
3.	To avoid and, where required, manage invasive and non-native species (INNS).	This objective uses the INNS risk assessment.
4.	To meet WFD objectives relating to biodiversity.	This objective uses the WFD assessment.
5.	To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing.	This objective is partially informed by the natural capital assessment on the impacts on green space.
6.	To maintain and enhance tourism and recreation.	This objective is partially informed by the natural capital assessment on the impacts on recreation and amenity value as defined by Outdoor Recreation Valuation (OrVAL) tool.
7.	To secure resilient water supplies for the health and wellbeing of customers.	Delivered through the WRMP and assessed through SEA.
8.	To increase access and connect customers to the natural environment, provide education or information resources for the public.	Delivered through the WRMP and assessed through SEA.
9.	To reduce or manage flood risk, taking climate change into account.	This objective is partially informed by the natural capital assessment under natural hazard regulation.
10.	To enhance or maintain groundwater quality and resources.	This objective is largely delivered through the results of the WFD assessment and natural capital assessment on the impacts on water purification.
11.	To enhance or maintain surface water quality, flows and quantity.	This objective is largely delivered through the results of the WFD assessment and natural capital assessment on the impact on water purification. The INNS assessment may also contribute.
12.	To meet WFD objectives and support the achievement of environmental objectives set out in River Basin Management Plans.	This objective uses the WFD assessment.
13.	To increase water efficiency and increase resilience of Public Water Supply (PWS) and natural systems to droughts.	This objective is partially informed by the natural capital assessment on the impacts on water regulation.
14.	To protect and enhance the functionality and quality of soils, including the protection of high-grade agricultural land, and geodiversity.	This objective is partially informed by the natural capital assessment on the impacts on food provision.
15.	To reduce and minimise air emissions during construction and operation.	This objective is partially informed by the natural capital assessment on the impacts on air pollutant removal.
16.	To introduce climate mitigation where required and improve the climate resilience of assets and natural systems.	Delivered through the SEA.

17.	To reduce embodied and operational carbon emissions.	This objective is partially informed by the natural capital assessment on the impacts on climate regulation (carbon sequestration).
18.	To conserve/protect and enhance historic environment and heritage assets, and their setting, including archaeologically important sites.	Delivered through the SEA.
19.	To conserve, protect and enhance landscape and townscape character and visual amenity.	Delivered through the SEA.

SEA Objective		**Overlap with the other environmental assessments**
20.	To minimise resource use and waste production.	Delivered through the SEA.
21.	To avoid negative effects on built assets / infrastructure.	Delivered through the SEA.

3.2 Scoring Criteria

+++	Major Positive
++	Moderate Positive
+	Minor Positive
0	Neutral
-	Minor Negative
--	Moderate Negative
---	Major Negative
?	Uncertain

The scoring key presented in Table 3.3 was used to qualitatively assess the SLR using a neutral and minor, moderate, major positive and negative scale. Each SEA objective had a defined set of datasets and scoring criteria as presented in Table 3.4. This was also used for the assessments for all options considered within the WRMP24 and the WRE regional plan.

Table 3.3: Scoring key

Effect	**Description**

Table 3.4: Scoring Criteria

SEA Topic	Datasets	Effect		Description
Biodiversity, flora and fauna	SPA SAC Ramsar site SSSIs MPA MCZ NNR Local Nature Reserve (LNR) Priority habitats and species Non-designated sites Terrestrial, aquatic and marine habitats, species and protected sites Green networks and corridors (e.g. foraging areas and commuting routes, migration routes, hibernation areas etc. at all scales)	+++	Major Positive	The option would result in a major enhancement on the quality of designated habitats due to changes in flow or groundwater levels, water quality or habitat quality and availability. The option would result in a major increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or large amounts of creation or enhancement of habitat, promoting a major increase in ecosystem structure and function.
		++	Moderate Positive	The option would result in a moderate enhancement on the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures. The option would result in a moderate increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or moderate amounts of creation or enhancement of habitat, promoting a moderate increase in ecosystem structure and function.
		+	Minor Positive	The option would result in a minor enhancement of the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures. The option would result in a minor increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or small amounts of creation or enhancement of habitat, promoting a minor increase in ecosystem structure and function.
		0	Neutral	The option would not result in any effects on designated or non-designated habitats and/or species).
		-	Minor Negative	The option would result in a minor negative effect on the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a minor decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or small losses or degradation of habitat leading to a minor loss of ecosystem structure and function.
		--	Moderate Negative	The option would result in a moderate negative effect on the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a moderate decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or moderate loss or degradation of habitat leading to a moderate loss of ecosystem structure and function.
		---	Major Negative	The option would result in a major negative effect on the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a major decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or large losses or degradation of habitat leading to a major loss of ecosystem structure and function.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Soil	Agricultural Land Classification Landfill sites – authorised and historic	+++	Major Positive	The option would result in a major enhancement on the quality of soils as a result of remediation.
		++	Moderate Positive	The option would result in a moderate enhancement on the quality of soils as a result of remediation.
		+	Minor Positive	The option is located on a brownfield site and has no effect on soils or existing land use. The option results in the remediation of contaminated land.
		0	Neutral	The option would not result in any effects on soils or land use.
		-	Minor Negative	The option is not located on a brownfield site and/or results in a minor loss of best and most versatile agricultural land or is in conflict with existing land use. The option results in land contamination.
		--	Moderate Negative	The option would result in a moderate loss of best and most versatile agricultural land or is in substantial conflict with existing land use.
		---	Major Negative	The option would result in a major loss of best and most versatile agricultural land or is in substantial conflict with existing land use. The option results in land contamination.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Water	Environment Agency Flood Defences Environment Agency Main Rivers Flood Zones 2 and 3 Surface Water Features WFD River Waterbody Catchments WFD River Waterbodies Cycle 2	+++	Major Positive	The option results in addressing failure of WFD Good Ecological Status / Good Ecological Potential.
		++	Moderate Positive	The option achieves savings through demand management and does not require abstraction to achieve yield. The option contributes to addressing failure of WFD Good Ecological Status / Good Ecological Potential.
		+	Minor Positive	The option achieves savings through demand management and does not require abstraction to achieve yield.
		0	Neutral	The option would have no discernible effect on river flows or surface/coastal water quality or on groundwater quality or levels.
		-	Minor Negative	The option would result in minor decreases in river flows. River and/or coastal water quality may be affected and lead to short term or intermittent effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not be avoided but could be mitigated. The option would result in minor decreases in groundwater quality or levels.

		--	Moderate Negative	The option would result in moderate decreases in river flows. River and/or coastal water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated.
	Bathing Waters (for desal options) Shellfish Waters (desal options) Source Protection Zones WFD Groundwater bodies			The option results in the likely deterioration of WFD classification. The option would result in moderate decreases in groundwater quality or levels
		---	Major Negative	The option would result in major decreases in river flows. River and/or coastal water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated. The option results in the deterioration of WFD classification. The option would result in major decreases in groundwater quality or levels
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Air	Air Quality Management Areas Air quality monitoring sites	+++	Major Positive	The option would result in a major enhancement of the air quality within one or more AQMAs
		++	Moderate Positive	The option would result in a moderate enhancement of the air quality within one or more AQMAs
		+	Minor Positive	The option would result in an enhancement of the air quality
		0	Neutral	The option would not result in any effects on Air Quality and AQMAs.
		-	Minor Negative	The option would result in a decrease of the air quality
		--	Moderate Negative	The option would result in a decrease of the air quality within one or more AQMAs
		---	Major Negative	The option would result in a major decrease in the air quality within one or more AQMAs
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Climate Factors	Option Carbon data UKCP18 climate data Sea level rise projections	+++	Major Positive	The option would reduce operational carbon emissions by more than 1,000 tonnes CO2e/year
		++	Moderate Positive	The option would result in a sustained decrease in greenhouse gas emissions and would increase resilience/decrease vulnerability to climate change effects. The option would reduce operational carbon emissions by between 100 and 1,000 tonnes CO2e/year
		+	Minor Positive	The option would result in a sustained decrease in greenhouse gas emissions and would increase resilience/decrease vulnerability to climate change effects. The option would reduce operational carbon emissions by up to 100 CO2e/year
		0	Neutral	The option would have no discernible effect on greenhouse gas emissions, nor would the option increase resilience/decrease vulnerability to climate change effects.
		-	Minor Negative	The option would have a minor impact on resilience/decrease vulnerability to climate change effects. The option would generate carbon emissions of between 100 and 500 tonnes CO2e during construction. The option would generate operational carbon emissions of between 100 and 500 tonnes CO2e/year.
		--	Moderate Negative	The option would have a moderate impact on resilience/significantly decrease vulnerability to climate change effects. The option would generate carbon emissions of greater than of between 500 and 1000 tonnes CO2e during construction. The option would generate operational carbon emissions of between 500 and 1000 CO2e/year.
		---	Major Negative	The option would have a major impact on resilience/significantly decrease vulnerability to climate change effects. The option would generate carbon emissions of greater than 1,000 tonnes CO2e during construction. The option would generate operational carbon emissions of more than 1,000 tonnes CO2e/year.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Landscape	Areas of Outstanding Natural Beauty National Character Areas Green Belt land	+++	Major Positive	The option results in new, above ground infrastructure that significantly enhances the local landscape, townscape or seascape.
		++	Moderate Positive	The option results in new, above ground infrastructure that has a moderate positive effect on the local landscape, townscape or seascape.
		+	Minor Positive	The option results in new, above ground infrastructure that has a minor positive effect on the local landscape, townscape or seascape.
		0	Neutral	The option would not result in any effects on the local landscape, townscape or seascape
		-	Minor Negative	The option results in new, above ground infrastructure that has a minor negative effect on the local landscape, townscape or seascape.
		--	Moderate Negative	The option would have a moderate negative effect on a designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a moderate negative effect on the local landscape, townscape or seascape.
		---	Major Negative	The option would have a negative effect on a designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Historic Environment		+++	Major Positive	The option would result in enhancements to designated heritage assets and/or their setting, fully realising the significance and value of the asset, such as: Securing repairs or improvements to heritage assets, especially those identified in the Historic England Buildings/Monuments at Risk Register; Improving interpretation and public access to important heritage assets.

	Listed buildings: Grade I listed structures; Grade II* listed structures; and Grade II listed structures Registered Parks and Gardens: Grade I Registered Parks and Gardens; Grade II* Registered Parks and Gardens; and Grade II	++	Moderate Positive	The option would result in enhancements to designated heritage assets and/or their setting. Improving interpretation and public access to important heritage assets.
		+	Minor Positive	The option would result in enhancements to non-designated heritage assets and/or their setting.
		0	Neutral	The option would have no effect on cultural heritage assets or archaeology.
		-	Minor Negative	The option would result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There would be limited damage to known, undesignated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
	Registered Parks and Gardens Protected Wreck Registered Battlefields Scheduled Monuments Conservation Areas World Heritage Sites	--	Moderate Negative	The option would result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. The option would diminish of significance of designated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected.
		---	Major Negative	The option would diminish the significance of designated heritage assets and/or their setting such as: Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register; Loss of public access to important heritage assets and lack of appropriate interpretation. There would be major damage to known, designated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Population, Human Health	Noise action important area Indices of Multiple Deprivation 2015 Functional site: Schools Medical facilities OS Greenspace dataset: Allotments Bowling green Cemetery Golf course Sports facility Play space Playing field Public park or garden Religious grounds Tennis courts Natural England - Country Parks National Parks Section 15 open access areas CRoW S4 Conclusive Registered Common Land Transport: Major roads – A roads Major roads – motorway Railway line National cycle route National trails	+++	Major Positive	The option leads to major positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits. The option creates new, and significantly enhances existing, recreational facilities within the operational area.
		++	Moderate Positive	The option leads to positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits. The option enhances existing, recreational facilities within the operational area
		+	Minor Positive	The option has a temporary positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits
		0	Neutral	The option would not result in any effects on human health and existing recreational facilities.
		-	Minor Negative	The option has a temporary effect on human health (e.g. noise or air quality). The option reduces the availability and quality of existing recreational facilities within the operational area.
		--	Moderate Negative	The option results in the permanent removal of existing recreational facilities within the operational area
		---	Major Negative	The option has a significant long-term effect on human health (e.g. noise or air quality). The option results in the removal of existing recreational facilities within the operational area.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
Material Assets	Option information from option database	+++	Major Positive	The option involves reducing leakage from the supply network or is a water efficiency option with a yield of >5 Ml/d.
		++	Moderate Positive	The option would re-use or recycle substantial quantities of waste materials and any new infrastructure would incorporate substantial sustainable design measures and materials. There would be no increase in energy consumption. The option involves reducing leakage from the supply network or is a water efficiency option with a yield of <5 Ml/d.
		+	Minor Positive	The option involves reducing leakage from the supply network or is a water efficiency option with a yield of <5 Ml/d.
		0	Neutral	The option would not result in any effects on material assets.

-	Minor Negative	The option would require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. There are limited opportunities for sustainable design or the use of sustainable materials. The option results in a minor increase in energy consumption.
--	Moderate Negative	The option would require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. The option results in a moderate increase in energy consumption.
---	Major Negative	The option would require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials. The option results in a major increase in energy consumption
?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain

4 WRE and dWRMP24 SEA Findings

4.1 Overview

This chapter presents the outputs of the SEA for the SLR. The discussion of the effects and mitigation identified for each of the SEA topics is presented in Sections 4.2 to 4.9. The SEA scoring for each of the SEA objectives is summarised in Table 4.1 at the end of the chapter.

4.2 Biodiversity, flora and fauna

The HRA Stage 1 Screening, undertaken for the WRMP24 and regional plan, concluded that the scheme has Likely Significant Effects on the following European designated sites:

- The Wash SPA (UK9008021) (approximately 23km east of the Scheme)
- The Wash and North Norfolk Coast SAC (UK0017075) (approximately 23km east of the Scheme)
- The Wash Ramsar Site (UK11072) (approximately 52.5km north of the Scheme)
- Humber Estuary SPA (UK9006111) (approximately 52.5km north of the Scheme)
- Humber Estuary SAC (UK0030170) (approximately 52.5km north of the Scheme)
- Humber Estuary Ramsar Site (UK11031) (approximately52.5 km north of the Scheme)
- Baston Fen SAC (UK0030085) (approximately 2km south west of the Scheme)

This informal HRA Appropriate Assessment (AA) considered that the Scheme is located sufficiently distant from the designated sites at both The Wash and The Humber Estuary to exclude significant adverse effects as a result of noise, light, dust or other human disturbances during the construction phase assuming that best practices and proposed mitigation measures are implemented.

However, during the operation phase, the Scheme has the potential to adversely affect the integrity of The Wash and the Humber Estuary Designated Sites and functionally linked habitats used by their qualifying species, with residual adverse effects after mitigation remaining for all Designated Sites considered.

Mitigation measures are set out in the informal HRA report and include further assessment of the population present at risk of disturbance and sensitive timing of construction. The timeframes and measures indicated would require agreement with Natural England, which would require further consideration during detailed design.

Ultimately, a strong and robust evidence base would be required to conclude that there would be no adverse effects on the integrity of any designated site as a result of the construction or operation of the scheme. The level of detail available at this stage (which is considered proportionate) means that such effects cannot be ruled out at this stage. As a result, this would need further consideration and assessment as part of the next stages of design development to conclude what the effects (if any) of the scheme on designated sites would be and any further work required by the HRA process.

The proposed option may have additional impacts on nationally designated sites, ancient woodland and priority habitats which are also considered in relation to biodiversity, flora and fauna and may require mitigations to be implemented.

4.2.1 Reservoir and associated infrastructure

The Wash SPA, Ramsar Site and The Wash and Norfolk Coast SAC

The proposed location of the SLR is sufficiently distant from The Wash SPA, Ramsar and The Wash and Norfolk Coast SAC (located approximately 23km east of the Scheme) to exclude noise, light and dust effects during the construction phase of the new reservoir.

This site is hydrologically connected to The Wash SPA via the South Forty-Foot Drain (located 5 km from the Scheme construction area). However, considering the nature of these connections through a slow flowing ditch network and the distance to the construction area, it is unlikely that any pollution events during the construction phase would have any potential adverse effects as they would be contained and/or diluted before reaching the Designated Site assuming good practice and mitigation measures are implemented. Any effects of contamination during the construction phase are considered to be temporary and localised and not expected to affect the Designated Site.

Humber Estuary SPA, SAC and Ramsar

The proposed new reservoir is located is sufficiently distant from the Humber Estuary SPA (approximately 74.5km northeast of the site) to exclude adverse effects on all Designated Site qualifying species due to noise, vibration, visual or human disturbance during the construction phase of the new reservoir assuming best practice and mitigation measures are implemented. Additionally, there is no potential for the physical loss, degradation or fragmentation of supporting habitats, including functionally linked land used by qualifying species.

River and sea lamprey spawn in freshwater sites many kilometres upstream of the designated site. Therefore, activities during the construction of the reservoir may have adverse effects on functionally linked habitats used by these qualifying fish species. Further investigations are needed to identify key spawning areas in the ZoI of the scheme to better determine adverse effects for these designated species.

Nationally Designated Sites, Ancient Woodland and Priority Habitats

Desk-based baseline assessments indicated that there are no statutory designated sites within 2km of the site. No relevant SSSI Impact Zones (i.e., those that relate to the proposed development type) overlap with the proposed footprint of the site. Three Local Wildlife Sites (Horbling Line, Threekingham Road Verges and Aswarby Thorns) are located within 2km of the site. There are no Ancient Woodland or Tree Preservation Orders within 1km of the site.

Habitat mapping, inclusive of the site area with a 2km buffer, identified that the following habitats are present: arable; grassland (neutral, other); modified grassland; dense scrub; developed land and buildings; broadleaved woodland (small, discrete areas with little connectivity to other woodland blocks); and watercourses (rivers and streams). The habitats on site have the potential to support the following protected species: badgers; bats; breeding and overwintering birds; great crested newts; otters; water voles; widespread reptiles; notable plant species; aquatic and terrestrial invertebrates; macrophytes and fish; as well as INNS.

Of the habitats identified, broadleaved deciduous woodland is considered a priority habitat. Seven areas of broadleaved deciduous woodland are located within the site footprint, and a further 10 are within 1km of the site. They are generally small, discrete areas with little connectivity to other woodland blocks.

The transfer passes adjacent to and through small parcels of priority habitat including coastal and floodplain grazing marsh; arable; pastures; broadleaved, mixed and yew woodland; woodland; rivers; ponds & linear features. The option is expected to cause the loss of BNG units due to habitat clearance associated with construction. However, there would be a gain due to the creation of new open water habitat. The percentage change for SLR is +22.45%, subject to

further assessment for the construction of the service reservoir. Overall, moderate positive effects are identified.

A new reservoir has significant opportunities for benefits for ecology. There are no chalk rivers anticipated to be affected by the option.

4.2.2 Transfers and associated infrastructure

4.2.2.1 River Trent to Witham

The Wash SPA, Ramsar Site and The Wash and Norfolk Coast SAC

The Wash SPA is located approximately 23km from the transfer route with limited hydrological connectivity. Therefore, it is sufficiently distant to exclude adverse effects on this Designated Site and its qualifying species due to noise, light, visual or human disturbance during the construction phase of the transfer. Additionally, there is no potential for the physical loss, degradation or fragmentation of supporting habitats, including functional linked land for this Designated Site due to construction activities assuming best practice and mitigation measures are implemented.

Humber Estuary SPA, SAC and Ramsar

During operation, abstraction has the potential to result in habitat loss and degradation of the Designated Site and/or functionally linked land. Water quality downstream and feeding grounds of designated bird species may be affected. Abundant food resources attract wildfowl and waders to the site. Adverse effects could result in the habitat no longer being able to support the same size of populations for which the site is designated.

Additionally, changes to water levels and flows may cause disturbance to feeding, migration and spawning for the river lamprey and sea lamprey, while the new intake point may lead to mortality for designated fish species.

Level 2 WFD assessments indicate that A potential major adverse risk (risk of deterioration) to the Trent from Soar to Beck (ID: GB104028053110) was identified as a result of the new surface water abstraction. Abstraction rates are expected to be <10% of the total volume of the Trent catchment and the change in flow and velocity has the potential to impact biological elements. Further investigation is required to determine the full extent of the impacts.

Nationally Designated Sites

There are no SSSIs in proximity to the route, the closest site being Besthorpe Meadows SSSI approximately 5.5km to the north of the option. The proposed route is not located in any SSSI Impact Risk Zones (IRZ). Therefore, the proposed route is not considered to have an effect on nationally designated sites and their qualifying features.

Stapleford Wood Ancient Woodland is located between the proposed abstraction location and the discharge at the River Witham, approximately 950m from the proposed route. While the potential risk to this site is low, steps should be taken to ensure that potential effects are mitigated for. Devon Park Pastures LNR is located approximately 5km to the south of the proposed route. Approximately 0.59% of the proposed route is located within areas of priority habitat, 0.12% of which is coastal and floodplain grazing marsh, and 0.47% of which is deciduous woodland. These areas would be directly impacted by the proposals. There would be some minor permanent loss of priority habitat associated with the transfer and intake infrastructure. The affected priority habitat is not considered irreplaceable and with application of good practice construction measures and reinstatement of habitat, the overall effect of other designated sites comprises a minor environmental constraint to the development of the scheme.

Trenchless tunnelling to protect priority habitats should be further assessed and confirmed at detailed design. Further site-specific ecological assessments and discussions with regulators would be required to help inform the detailed design of the scheme. The option is expected to cause the loss of BNG units due to habitat clearance associated with construction. The percentage change is -19.68%. Note: Ancient Woodland has been excluded from calculations as this habitat is classed as irreplaceable once lost.

4.2.2.2 River Witham to SLR

The Wash SPA, Ramsar Site and The Wash and Norfolk Coast SAC

The Wash SPA is located approximately 23km from the transfer route with limited hydrological connectivity. Therefore, it is sufficiently distant to exclude adverse effects on this Designated Site and its qualifying species due to noise, light, visual or human disturbance during the construction phase of the transfer. Additionally, there is no potential for the physical loss, degradation or fragmentation of supporting habitats, including functional linked land for this Designated Site due to construction activities assuming best practice and mitigation measures are implemented.

Humber Estuary SPA, SAC and Ramsar

During operation, abstraction has the potential to result in habitat loss and degradation of the Designated Site and/or functionally linked land. Water quality downstream and feeding grounds of designated bird species may be affected. Abundant food resources attract wildfowl and waders to the site. Adverse effects could result in the habitat no longer being able to support the same size of populations for which the site is designated.

Additionally, changes to water levels and flows may cause disturbance to feeding, migration and spawning for the river lamprey and sea lamprey, while the new intake point may lead to mortality for designated fish species.

Level 2 WFD assessments indicate that A potential major adverse risk (risk of deterioration) to the Trent from Soar to Beck (ID: GB104028053110) was identified as a result of the new surface water abstraction. Abstraction rates are expected to be <10% of the total volume of the Trent catchment and the change in flow and velocity has the potential to impact biological elements. Further investigation is required to determine the full extent of the impacts.

There are no European designated sites and/or FLL within 5km of the proposed route, however The Wash & North Norfolk Coast SAC and The Wash SPA/Ramsar are situated approximately 15km downstream of the proposed intake point in the River Witham. Although this option is hydrologically linked to these sites, no likely significant effects are anticipated via hydrological impact pathways when taking in account the distance (15km) and implementation of good practice measures inherent in the scheme design which would prevent significant pollution events in the water environment. Overall, construction and operational effects on European designated sites and their qualifying features are considered to be a minor issue or constraint to the scheme.

Nationally Designated Sites

The proposed route is not in close proximity to SSSIs. The closest site is Wilsford & Rauceby Warrens SSSI, approximately 8.75km west of the proposed route. Part of the proposed route, including the abstraction location at the Witham, is located within SSSI IRZs associated with Troy Wood, Tattershall Cars, Tattershall Old Gravel Pits and Fulsby Wood SSSI areas. Consequently, the local planning authority would be required to consult Natural England on likely risks from the transfer route. Given the distance of the proposed transfer route to these

SSSI sites, construction and operational effects on nationally designated sites and their qualifying features are considered to be a minor constraint to the scheme.

There are no areas of Ancient Woodland in proximity to the proposed route. There are no NNRs or LNRs in proximity to the proposed route. There is no direct impact on priority habitat from the proposed route. The abstraction location is approximately 75m from areas of priority habitat (deciduous woodland) on the opposite bank of the River Witham. An area of coastal and floodplain grazing marshes located approximately 25m from the proposed route, where the route crosses the A17. It is therefore envisaged that there would be no direct impact upon priority habitat during construction and operation. The overall effect of other designated sites comprises a minor environmental constraint to the development of the scheme.

The option is expected to cause the loss of BNG units due to habitat clearance associated with construction. The percentage change is -3.4%.

4.2.2.3 SLR to Anglian Water Service Reservoir (SR)

The proposed route is situated approximately 780m south west of Baston Fen SAC and 1.5km south west of Natural England's Goose and Swan Functional Land IRZ which represents land beyond the Nene Washes SPA/Ramsar boundary, which may provide important functional habitat for qualifying bird species, specifically geese and swans. Although this proposed option is hydrologically linked to Baston Fen SAC, Informal HRA Stage 1 screening concluded that there are unlikely to be any likely significant effects via hydrological impact pathways when taking in account the construction techniques (directional drilling) and implementation of good practice measures inherent in the scheme design which would prevent significant changes to water levels/flows and pollution events. Likewise, no potential impact pathways on Nene Washes SPA/Ramsar site were concluded following further detailed assessment at the screening stage when taking into account the distance (1.5km) from FLL.

Nationally Designated Sites

There are a number of SSSIs in proximity to the route. Cross Drain SSSI is located approximately 30m from the proposed route. Langtoft Gravel Pits SSSI is approximately 1km to the west of the proposed route. The proposal is partially located within SSSI IRZ's associated with several SSSI's in the surrounding area, including Cross Drain SSSI. Potential effects upon the SSSIs in proximity cannot be ruled out. Consultation with Natural England is likely to be needed. Standard mitigation measures can be utilised during construction to ensure that works do not encroach upon any SSSIs.

The proposed route is not in proximity to Ancient Woodland. A total of 0.29% of the proposed route is located within areas of priority habitat, 0.13% of which is coastal and floodplain grazing marsh, and 0.16% of which is deciduous woodland. These areas would be directly impacted by the proposals. There would be some minor loss of priority habitat associated with the transfer infrastructure. The affected priority habitat is not considered irreplaceable and with application of good practice construction measures and reinstatement of habitat, the overall effect of other designated sites comprises a minor environmental constraint to the development of the scheme. Trenchless tunnelling to protect priority habitats should be further assessed and confirmed at detailed design. Further site-specific ecological assessments and discussions with regulators would be required to help inform the detailed design of the scheme. The option is expected to cause the loss of BNG units due to habitat clearance associated with construction. The percentage change is -10.38%.

4.2.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- For protected species that could be present at the site, mitigation measures would likely be required, such as translocation preceded by creation of suitable habitat elsewhere in advance. Habitat creation associated with the site should tie closely to the Nature Recovery Network areas to the northwest and southeast, both of which focus on watercourses and associated riparian habitats. Habitat creation for translocation of protected species could be combined with opportunities for habitat creation/enhancement around Aswarby Thorns and towards the South Forty Foot Drain.
- Further mitigation of impacts on biodiversity has been considered through design of the site masterplan, prioritising avoidance of the permanent loss of important habitats. Key biodiversity assets identified included priority woodland habitat located in the centre and to the southwest of the site, broadleaved woodland located to the southwest of the site, and the drain across the centre of the site. Best practice construction practices would also be prescribed to reduce the habitat clearance required. Furthermore, areas around the north side of the reservoir have been identified as potential target areas for habitat enhancement, including riparian habitats and delivery of BNG.
- A Construction Environmental Management Plan (CEMP) must be developed prior to construction, including measures to ensure that the risk of uncontrolled discharges from construction is reduced (including sediment management) and detailing an Emergency Response Plan in the event of a pollution incident. This plan must be prepared for all works and include the industry good practice measures listed above and any targeted mitigation measures identified during the formal HRA.
- Monitoring would be carried out and appropriate mitigation measures would be implemented at the intake and outlet. Best practice methods to be implemented to minimise disturbance effects and habitat loss including refining transfer alignment to avoid sensitive habitats. Habitat to be reinstated on completion, or if unavoidable compensatory habitat to be considered to replace damaged or lost habitat. Ecological Method Statements and in person Ecological Clerk of Works (ECoW) surveys for operational effects.
- Review the HRA as the design progresses at gate three. Investigate opportunities for naturebased solutions and BNG such as creation of high value habitat, habitat creation or improvement works within habitat network zones to support nature recovery network and create wildlife corridors.
- Best practice methods are assumed to be implemented to minimise disturbance effects and habitat loss including refining transfer alignment or using trenchless techniques to avoid woodland habitat, in particular Ancient Woodland and priority habitat. Habitat to be reinstated on completion, or if unavoidable compensatory habitat to be considered to replace damaged or lost habitat.
- Schemes to identify area for the creation and/or reinstatement of high value natural capital assets.
- Ecology surveys would be required at future design stages to determine effects and mitigation required.
- Directional drilling to be used where possible to avoid loss of high value natural capital assets.
- BNG can be achieved via a new statutory biodiversity credits scheme. Credits can be bought by developers as a last resort when onsite and local offsite provision of habitat cannot deliver the BNG required. The price of biodiversity credits would be set higher than prices for equivalent biodiversity gain on the market and are expected to be purchased through a national register for net gain delivery sites.

There is also potential for nature conservation opportunities that have been identified in close proximity to the site, including:

- Enhancement of the Boston-Peterborough wetland corridor

- Enhancement of Swaton Fen
- Enhancement of river corridors, such as North Beck
- Association with water running on limestone which is alkaline and provides habitat for unique species assemblages
- Enhancement of drains for Swaton and Helpringham Fen to the east
- Connection to the Bourne-Sleaford corridor

4.2.4 INNS

The proposed raw river water transfer route within an approximately 1km radius already host a range of aquatic INNS. This includes two high impact shrimp species, three high impact aquatic plants and the high impact zebra mussel.

Abstraction from the River Trent and River Witham could potentially increase habitat suitability for several non-native species therefore it is critical potential mitigations measures be investigated to prevent further spread of INNS at the abstraction locations.

Creation and operation of the SLR carries a greater risk of creating a new pathway for INNS to spread, through personnel entering the water frequently and the use of recreational equipment. Biosecurity measures should be prioritised at these locations to prevent additional spread.

Moderate potential affects identified for construction and operation.

4.2.4.1 Mitigation

The highest confidence biosecurity measures for implementation within the reservoir are sitespecific operational equipment and thorough drying of equipment.

Implementation of measures would also beneficial prior to the abstracted water entering the reservoir, which would help to reduce the likelihood of further INNS spread from the reservoir. The highest confidence measures to be implemented within the transfer between the River Witham and the SLR are chlorination and chemical treatment.

Mitigation measures at the abstraction points on the River Trent and River Witham should also be fully investigated and implemented.

4.2.5 WFD objectives relating to biodiversity

4.2.5.1 Reservoir and Associated Infrastructure

A recent Hydroecology study, carried out by Mott MacDonald, indicates changes in flow because of the proposed option have the potential to impact water depths and velocities with potential impacts on aquatic ecology.

For aquatic communities, the impacts are pronounced at Claypole and gradually reducing in magnitude with distance from the discharge point. There is potential for a reduced impact on fish species further downstream of the discharge point as the results from the hydrological analysis suggest the increase in flow would be significantly reduced in comparison to the baseline.

The WFD Level 2 assessment indicates potential major adverse risk to the Swaton Drains, as a result of the reservoir footprint. This would result in loss of up to 2.5km of open channel, along with 28% of the catchment. The loss of catchment and open channel would lead to major adverse effects on habitat, flow and hydromorphology. Additionally, the WFD Level 2 assessment indicates potential adverse effects to biological status resulting from construction and operational activities to the following WFD water bodies: Witham – conf Cringle Bk to conf

Brant; Witham conf Brant to conf Catchwater Drain; Witham – conf Catchwater Drain to conf Bain; Lower Witham – conf Bain to Grand Sluice; and to South Beck.

4.2.5.2 Transfers and associated infrastructure

A high-level water quality assessment of the proposed transfer from the Trent to the Witham was conducted, it concludes there is an expected 69% increase in ammonia within the Witham – conf Cringle Bk to conf Brant (ID: GB105030056780) waterbody. As of the River Basin Management Plan (RBMP) Cycle 2 the status of ammonia is 'High', this increase in ammonia has the potential to cause a significant effect on the water quality. In combination with an increase in the other physico-chemicals, this has the potential to decrease the chemical status of this waterbody from 'Moderate' to 'Poor'.

A high-level water quality assessment concluded there is an expected 46% increase in phosphate levels by the time the newly discharged water reaches the downstream Witham – conf Brant to conf Catchwater Drain (ID: GB105030062370) and the Witham - conf Catchwater Drain to conf Bain (ID: GB205030062425) catchments. Within the catchments, phosphate levels are expected to be lower. However, further investigation is required to determine the predicted percentage change.

Given the early stages of design development it is recommended that an in-depth assessment of the potential impacts of the proposed scheme on ecological status is updated as the design develops. Given that not all potential impacts from the design have been assessed, it is recommended that the results of this assessment are amalgamated with all other activities associated with the design to ensure cumulative potential impacts are captured and the potential severity of which are appropriately determined.

4.2.5.3 Mitigation

Best practice construction methods and pollution prevention measures should be implemented for transfers. This could include the use of directional drilling or other trenchless technique where the transfer crosses watercourses. In the short term there is potential for effects. With mitigation, no effects are predicted as a result of construction.

4.3 Soil

4.3.1 Reservoir and associated infrastructure:

The reservoir is located on Grade 2 agricultural land would result in permanent loss of soil during construction, therefore major negative constraint identified.

There are no geological SSSIs within 1km of the reservoir site. The main impacts of construction of the SLR scheme would be associated with the temporary disturbance of soil during construction, including during enabling works (such as access roads and compounds), and permanent loss of agricultural (and notably, BMV) land during construction of the reservoir. The magnitude of impact in the temporary phase would be dependent on the adoption of appropriate soil management practices to reuse soils where possible. A further impact could be the loss of stored carbon from the soils during construction.

Construction of the WTW would result in permanent loss of soil, including Grade 3 agricultural land.

There are no historic or authorised landfill sites in proximity to the proposed reservoir site.

4.3.2 Transfers and associated infrastructure:

4.3.2.1 River Trent to Witham

There are no geological SSSIs within 1km of the route. No likely effects are considered, and this is a neutral environmental constraint to the development of the scheme.

All of the of the proposed route is located within Grade 3 agricultural land. There would be permanent loss of Grade 3 agricultural land where permanent limited infrastructure is developed, however, this would be of a minor scale There would be temporary loss of Grade 3 agricultural land, however, the potential effects on these soils would be temporary and reversible with the application of best construction practices. Overall, construction and operational effects on agricultural land is considered to be minor constraint to the scheme.

The proposed option is not located in proximity to authorised or historic landfill sites. This constraint can therefore be considered to be neutral or minor.

4.3.2.2 Witham to SLR

There are no geological SSSIs within 1km of the route. This constraint can therefore be considered to be neutral or minor.

The proposed route is partially located in Grade 2 agricultural land (52.21%), with the remaining part of the route located within Grade 3 agricultural land (47.79%). There would be permanent loss of Grade 2 agricultural land where permanent limited infrastructure is developed, however, this would be of a minor scale The footprint would be minimised where possible to reduce potential effects upon agricultural land. There would be temporary loss of Grade 2 and 3 agricultural land, however, the potential effects on these soils would be temporary and reversible with the application of best construction practices. Overall, construction and operational effects on agricultural land is considered to be minor constraint to the scheme.

There are no historic or authorised landfill sites in close proximity to the proposed option. The closest historic landfill site is a former refuse disposal site at Star Fen, Heckington, approximately 750m to the south of the proposed route. Due to the site's proximity, it is unlikely that there would be impacts associated with hazardous or contaminated waste. This constraint can therefore be considered to be neutral or minor.

4.3.2.3 SLR potable water pipeline

There are no geological SSSIs within 1km of the route. This constraint can therefore be considered to be neutral or minor. The proposed route is partially located within Grade 2 agricultural land (83.46%), with the remaining part of the proposed route located within Grade 3 agricultural land (16.54%). There would be permanent loss of Grade 3 agricultural land where permanent limited infrastructure is developed, however, this would be of a minor scale. The permanent loss footprint would be minimised where possible to reduce potential effects upon agricultural land. There would be temporary loss of Grade 2 and 3 agricultural land, however, the potential effects on these soils would be temporary and reversible with the application of best construction practices. Overall, construction and operational effects on agricultural land is considered to be minor constraint to the scheme.

Chimney Farm historic landfill site is located approximately 115m to the north-west of the proposed route. Due to the site's proximity, it is unlikely that there would be impacts associated with hazardous or contaminated waste. This constraint can therefore be considered to be neutral or minor.

4.3.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Reduce damage to agricultural land through design to reduce the amount of land permanently taken or temporarily disturbed
- Ground would be reinstated where possible, therefore long-term residual effects on agricultural soils as a result of pipeline construction are unlikely
- Best practice techniques to prevent disturbance of contaminated material during construction

4.4 Water

4.4.1 Flood Risk

4.4.1.1 Reservoir and associated infrastructure

The reservoir is expected to capture 5.6ha of local sub-catchment which would reduce the flows into Helpringham Eau, Helpringham South Beck and Swaton Eau. The Flood Risk Assessment (FRA) concludes there would be a widespread reduction in peak water levels throughout these watercourses. This reduction in peak water levels would reduce the pressure on the flood defences and reduce the risk of a breach of the defences in this area.

Investigations into flood risk indicate the majority of the scheme components are not considered to be at risk from the 0.1% Annual Exceedance Probability (AEP) flood event with the exception of the access road that is required to cross the flood zones as critical infrastructure access to the WTW. The construction phase is considered to be at a low risk of flooding. Hydraulic modelling has been undertaken as part of the FRA to assess the flood risk impacts of an emergency drawdown with an assumed 50% AEP event within the South Forty Foot Drain Model. Model results indicate that the peak modelled water level within the South Forty Foot Drain would increase due to the drawdown flows and bank raising and careful flow management via the outfalls would be required to pass flow to the sea. However, more assessment at gate three would be required to confirm this.

4.4.1.2 Transfers and associated infrastructure

River Trent to Witham

Around 29% of the proposed route is located within Flood Zone 2 and Flood Zone 3. There would also be some limited direct permanent land take from these flood risk zones from the construction of the limited infrastructure near the abstraction site. Further mitigation measures would be defined as part of applications for environmental permits, as required when working in close proximity to main rivers. If groundwater table levels are high, then dewatering may be required to enable construction in these areas. With limited permanent works and the majority of construction effects being temporary, this proposed development is considered a minor environmental constraint to the development of the scheme.

Witham to SLR

Around 59.5% of the proposed route is located within Flood Zone 2 and Flood Zone 3. There would also be some limited direct permanent land take from these flood risk zones from the construction of the limited infrastructure near the abstraction site. Further mitigation measures would be defined as part of applications for environmental permits, as required when working in close proximity to main rivers. If groundwater table levels are high, then dewatering may be required to enable construction in these areas. With limited permanent works and the majority of construction effects being temporary, this proposed development is considered a minor environmental constraint to the development of the scheme.

SLR potable water pipeline

Around 68.6% of the proposed route is located in Flood Zone 2 and Flood Zone 3. Further mitigation measures would be defined as part of applications for environmental permits, as required when working in close proximity to main rivers. If groundwater table levels are high, then dewatering may be required to enable construction in these areas. With limited permanent works and the majority of construction effects being temporary, this proposed development is considered a minor environmental constraint to the development of the scheme.

4.4.1.3 Mitigation

Measures to reduce the impact on flooding during the construction phase. Flood risk during construction may still occur so short term flood risk effects may remain.

There is a residual risk of flooding if the proposed reservoir embankments were to fail in an uncontrolled manner. The probability of such a failure is very low in a non-impounding reservoir because the risk from a dam breach is managed by the design, maintenance, and emergency plan.

4.4.2 Surface water quality, flows and quantity

4.4.2.1 Reservoir and associated infrastructure

The WFD concludes a potential risk of deterioration to the Trent from Soar to Beck waterbody, as a result of the new surface water abstraction. A risk of deterioration to the Witham – conf Cringle Bk to conf Brant was identified as a result of the discharge from the Trent from Soar to Beck.

The water flows downstream for approximately 60km, through the Witham conf Brant to conf Catchwater Drain and the Witham – conf Catchwater Drain to conf Bain. Transferring water from the River Trent to the River Witham to support flow and abstraction in the River Witham results in higher orthophosphate concentrations at the Langrick Bridge abstraction point. A potential risk of deterioration was identified to both Witham conf Brant to conf Catchwater Drain and the Witham – conf Catchwater Drain watercourses an expected 46% increase in phosphate by the time it reaches both catchments.

A potential risk of deterioration to the Lower Witham - conf Bain to Grand Sluice was identified as a result of changes in water quality due to the discharge from the River Trent into the upstream River Witham waterbody (Witham – conf Cringle Bk to conf Brant).

A potential risk of deterioration was also identified (Lower Witham - conf Bain to Grand Sluice) for biological status elements.

Qualitative assessment of the unmitigated predicted impacts on the provision of water purification indicate the provision of water purification services would likely be reduced due to construction of option.

4.4.2.2 Transfers and associated infrastructure

River Trent to Witham

The proposed route crosses one main river, Slough Dyke, between abstraction locations at the Trent and Witham. Trenchless crossing techniques are to be used at this location. There are three WFD classified water bodies along the route, including:

- Slough Dyke Catchment (tributary of Trent) Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements

- The Fleet Upper Catchment (tributary of Trent) Water Body - bad ecological status, failing chemical status, supports good hydromorphological supporting elements
- Witham - conf Cringle Bk to conf Brant Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements

Qualitative assessment of the unmitigated predicted impacts on the provision of water purification and water flow regulation indicate the provision of water purification provided by the ecosystem services stock would likely be reduced due to the option.

Witham to SLR

The proposed route crosses two main rivers in between each abstraction location, Car Dyke and Scredington North Beck. There are two WFD classified water bodies along the route, including:

- Black Sluice IDB draining to the South Forty Foot Drain Water Body - moderate ecological status, failing chemical status, supports good hydro morphological supporting elements
- South Beck Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements

The proposed route is not located within a WFD Groundwater body. The closest groundwater body to the proposed route is the Cornbrash waterbody approximately 6km to the west. At this stage of project development waterbodies and main rivers are to be crossed using trenchless techniques.

Qualitative assessment of the unmitigated predicted impacts on the provision of water purification and water flow regulation indicate the provision of water purification provided by the ecosystem services stock would likely be reduced due to the option.

SLR potable water pipeline

The proposed route crosses five main rivers, including Ouse Mere Lode, Rippingdale Running Dike, River Glen, River Welland and Maxey Cut. There are nine WFD classified water bodies along the route, including:

- Swanton Drains Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements
- Ousemere Lode Water Body - poor ecological status, failing chemical status, supports good hydromorphological supporting elements
- Billingborough Lode Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements
- Black Sluice IDB draining to the South Forty Foot Drain Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements
- Pointon Lode Water Body - poor ecological status, failing chemical status, supports good hydromorphological supporting elements
- Vernatt's Drain Water Body - moderate ecological status, failing chemical status, supports good hydromorphological supporting elements

There are sites which are dependent on groundwater, including the Baston and Thurlby Fens SSSI Ground Water Dependent Terrestrial Ecosystem (GWDTE), Cross Drain SSSI GWDTE. Langtoft Gravel Pits SSSI is also likely to have some groundwater dependency. Where the proposed route is in proximity to groundwater dependent SSSIs, mitigation measures should be identified that prevents damage to groundwater dependent habitats and plant species. Like-forlike mitigation is required for irreplaceable habitat/plants should there be any permanent loss.

Qualitative assessment of the unmitigated predicted impacts on the provision of water purification and water flow regulation indicate the provision of water purification provided by the ecosystem services stock would likely be reduced due to the option.

The results of the WFD Level 1 assessment identified the maximum impact scores for all identified WFD Regulation surface waterbodies are less than two and therefore a more detailed Stage 2 WFD assessment is not required at this stage. Once a more detailed design is available the assessment should be re-visited to ensure impact scores are accurate and based on the most up to date information.

4.4.2.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Best practice construction methods and pollution prevention measures to be implemented
- Approaches to mitigation could include standoff zones during construction, and the specific monitoring of sites. Consultation with Natural England would be required
- At this stage of project development, WFD waterbodies and main rivers are assumed to be crossed using trenchless techniques. At the next stages of the project, further surveys would dictate whether more watercourses can be crossed via trenchless methods. Other techniques such as coffer dams can also be utilised. A geomorphology walkover should be undertaken at future project stages to understand the status of each watercourse, so as to provide suitable mitigation. For watercourses not being crossed via trenchless techniques, measures should be identified to ensure there would be no impact on downstream waterbodies. All potential mitigation measures need to be relevant to the conditions of the individual watercourses. For watercourses not being crossed via trenchless techniques, measures should be identified to ensure there would be no impact on downstream waterbodies. All potential mitigation measures need to be relevant to the conditions of the individual watercourses.

4.4.3 Groundwater quality and resources

4.4.3.1 Reservoir and associated infrastructure

The reservoir footprint intersects Source Protection Zone (SPZ) 1, SPZ2 and SPZ3. Construction of reservoir may impact on quality or ground water sources.

4.4.3.2 Transfers and associated infrastructure The

transfer intersects SPZ1, SPZ2 and SPZ3.

There are three WFD ground water bodies that are intersected by the pipelines these are: Lower Trent Erewash - Secondary Combined; Witham Lias U; and Cornbrash. The WFD Level 1 assessment has identified that the WFD Regulation groundwater bodies in which the proposed scheme interacts are not adversely impacted by the activities and the impact assessment. Therefore, no further assessment is required at this stage.

4.4.3.3 Mitigation

Best practice construction methods and pollution prevention measures to be implemented. With mitigation, no effects are predicted as a result of construction of pipelines.

4.4.4 WFD objectives and objectives set out in River Basin Management Plans.

4.4.4.1 Reservoir and associated infrastructure

The WFD assessment identified no activities that would assist attainment of waterbody objectives.

Potential compromise to waterbody objectives were identified for the following water bodies: Swaton Drains, Witham – conf Cringle Bk to conf Brant, Witham conf Brant to conf Catchwater Drain, Witham – conf Catchwater Drain to conf Bain, Lower Witham – conf Bain to Grand Sluice.

The following risk of deterioration resulting from construction of reservoir were identified:

- A potential major adverse risk to the Swaton Drains has been identified. Within the reservoir footprint over 2.5km of open channel would be lost, along with 28% of the catchment. The loss of open channel would impact on habitat, flow and hydromorphology in this waterbody. Potential to compromise waterbody objective is moderate.

The following risk of deterioration resulting from operation of reservoir were identified:

- A potential major adverse risk to the Witham – conf Cringle Bk to conf Brant (ID: GB104028053110) has been identified as a result of the discharge from the Trent from Soar to Beck. A high-level water quality assessment of the proposed transfer was conducted, it concludes there is an expected 69% increase in ammonia. As of the River Basin Management Plan (RBMP) Cycle 2 the status of ammonia is ‘High’, this increase in ammonia has the potential to cause a significant effect on the water quality. In combination with an increase in the other physico-chemicals, this has the potential to decrease the chemical status from ‘Moderate’ to ‘Poor’. It is recommended additional water quality modelling analysis should be undertaken to assist in determining proportionate mitigation measures. Potential to compromise waterbody objective is moderate.
- Potential major adverse risk to the Witham – conf Brant to conf Catchwater Drain (ID: GB105030062370) and the Witham - conf Catchwater Drain to conf Bain (ID: GB205030062425) have been identified as a result of the discharge from the Witham – conf Cringle Bk to conf Brant (ID: GB205030062426). A high-level water quality assessment concludes there is an expected 46% increase in phosphate by the time it reaches both catchments. Within the catchments, phosphate levels are expected to be lower. However, further investigation is required to determine the predicted percentage change. It is recommended additional water quality modelling analysis should be undertaken to assist in determining the proportionate mitigation measures. Potential to compromise waterbody objective is moderate.

4.4.4.2 Transfers and associated infrastructure

The WFD Level 1 assessment identified maximum impact scores for all identified WFD Regulation surface waterbodies are less than two and therefore a more detailed Level 2 assessment is not required at this stage. Minor impacts identified from the following activities during construction phase: trenching and laying of pipelines involving watercourse crossings; river restoration; Sustainable Urban Drainage Systems (SUDS); construction or modification of a new pumping station and/or intake from raw water (river or coastal waters); and trenching and laying of pipelines involving watercourse crossings.

Once a more detailed design is available the assessment should be re-visited to ensure impact scores are accurate and based on the most up to date information. WFD Level 1 assessments also identified that the WFD Regulation groundwater bodies in which the proposed scheme interacts are not adversely impacted by the activities and the impact assessment. Therefore, no further assessment is required at this stage.

4.4.4.3 Mitigation

Indicative detailed mitigation is included in WFD document 421065060MMD-XX-XXRP-Z-0009 SLR RAPID Gate Two WFD Assessment.

If this proposed site is taken forward, it is likely that an exemption would need to be sought under Regulation 19 of the Water Environment (Water Framework Directive) (England & Wales) Regulations 2017 (WFD Regulations 2017). A Regulation 19 exception can be sought for strategic resource options, if the individual scheme may cause a deterioration in status or failure to achieve good status, but an overriding public interest can be proven.

Proposed mitigation measures have been identified at this stage. The proposed mitigation measures should be considered and where feasible embedded into the scheme design. These are subject to further detailed design development and may include:

- Channel modifications should seek to offer the change to incorporate environmental gain by widening drains to allow fringe vegetation to be retained or berms to be constructed, subjection to financial burdens during construction, land take and maintenance
- Considerations to avoid deterioration to hydromorphological determinants including how the flow and quantity of water changes over time
- Measures should be put in place to ensure the free movement of living organisms to avoid barriers to fish migration and sediment between the reservoir and this waterbody
- INNS treatment for the transfer from the River Trent to the River Witham
- Industry good practice measures including Pollution Prevention Guidance (PPG)

4.4.5 Water efficiency and resilience of Public Water Supply (PWS) and natural systems to droughts.

During normal operation, this option could combat the effect of extreme temperatures and drought on water resilience by providing an additional reservoir to supply drinking water, where water has been taken from strained water resources prior to drought conditions. Positive effects are identified.

The source of water for the new reservoir would be a pumped water transfer from two sources: the River Trent and the River Witham. The reservoir would be vulnerable to longer drought situations where lower flows in the rivers mean the reservoir cannot be filled/topped up, with two potential sources there is less vulnerability.

The option may assist in managing resilience of surrounding flora and fauna to drought.

4.5 Air

4.5.1 Reservoir and associated infrastructure

There are no AQMA's in proximity to the proposed option. There may be some minor air quality effects during construction associated with dust, minor negative effects identified. There may be some operational effects associated with the new WTW, however this is anticipated to be low therefore neutral effects identified for operation phase.

4.5.2 Transfers and associated infrastructure

There are no AQMAs in proximity to the proposed option routes. There may be some minor air quality effects during construction associated with dust, minor negative effects identified.

4.5.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Best practice mitigation measures implemented during construction such as communication and site management, monitoring, preparing and maintaining the site.

4.6 Climatic Factors

4.6.1 Reservoir and associated infrastructure

The site selection carbon appraisal identified that emissions associated with creation of the reservoir are likely to be dominated by earthworks activities. The total capital carbon emissions for earthworks activities at the site was estimated as 86,937 tonnes of carbon dioxide equivalent (CO_2e). A further 15,794 tCO_2e of capital carbon emissions was estimated for enabling works, and 7,375 tCO_2e for roads and ancillary works.

The site selection carbon appraisal estimated the capital carbon emissions associated with the WTW and finishing works as 987 tCO_2e.

Peaty soils are present at the reservoir site, and carbon emissions from disturbed peat have been considered as operational emissions.

Emissions of greenhouse gases would be associated with materials used to construct the reservoir (embodied carbon), construction activities, and operation of the reservoir.

4.6.2 Transfers and associated infrastructure:

The site selection carbon appraisal provisionally estimated the capital carbon emissions associated with the transfers (for the site presented in this EAR) as 171 tCO_2e (0.2% of the total capital carbon).

4.6.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Investigate use of renewables during construction and operation for energy supply and use of materials with lower embodied carbon
- Carbon footprint study could help identify areas for carbon savings or alternative materials. As the electricity grid is decarbonised, greener energy would be available •

Opportunities to offset the net loss of natural capital stock(s) (ecosystem service)

4.6.4 Climate resilience of assets and natural systems.

The option is unlikely to affect the local environment's resilience to hazards such as flood risk, temperature extremes, storms, and gales, but may assist in managing resilience of surrounding flora and fauna to drought.

Qualitative assessment of the unmitigated predicted impacts on the provision of water flow regulation indicate the loss of contributing stocks has the potential to impede water flow on site. The addition of a reservoir would regulate flows, control water movement and maintain water supplies in dry periods, enabling a resilient supply of water to consumers.

4.6.4.1 Mitigation

Opportunities to offset the net loss of natural capital stock(s) (ecosystem service).

4.7 Landscape

4.7.1 Reservoir and associated infrastructure

The reservoir site falls within the east of the Southern Lincolnshire Edge National Character Area (NCA) profile (NCA 47) close to the boundary with The Fens NCA profile (NCA 46) and Keveston Uplands (NCA 75). No statutory landscape designations were recorded. The reservoir itself and above ground infrastructure associated with the new WTW, visitor centres, pumping stations and vehicle access bridges have potential to negatively affect the landscape character and result in a reduction in tranquillity. Excavation of reservoir would permanently alter the landscape. Major negative constraint identified.

4.7.2 Transfers and associated infrastructure

There are no Areas of Outstanding Natural Beauty (AONB) or National Parks located in the vicinity of the proposed transfer routes. The proposed routes do not pass through any greenbelt designated land. This constraint can therefore be considered to be neutral or minor.

4.7.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Best practice measures would likely be implemented to minimise effects during construction and operation such strategic planting and other landscaping between to soften the visual impact, however minor and temporary impacts may remain
- Adjust transfer route to avoid vegetation removal, retain vegetation where possible and replace removed vegetation, and avoid construction of permanent structures on undeveloped land
- Land reinstated upon completion where possible

4.8 Historic Environment

4.8.1 Reservoir and associated infrastructure

There are no designated heritage assets within the reservoir site, but 19 designated assets have been identified within 1km. These comprise:

- Four scheduled monuments (all high value)
- One Grade I Listed Building
- One Grade II* Listed Building
- 12 Grade II Listed Buildings (all high value) • One conservation area (medium value).

In addition to those identified within 1km, further heritage assets have been identified within 5km Zone of Theoretical Visibility (ZTV) of the site, including:

- 10 Grade I Listed Buildings of high value
- One Grade II* Listed Buildings of high value
- 101 Grade II Listed Buildings of high value
- 14 scheduled monuments of high value
- One Grade II Registered Park and Garden of high value

- Four conservation areas of medium value

There are also 17 non-designated heritage assets recorded on the HER within the site, and two within 100m of the boundary. They range in date from the Bronze Age to the post-medieval period and range from negligible to medium value. The greatest potential is for remains of the Iron Age, Roman, medieval and post-medieval periods.

The scheduled monument of 'Medieval moated site, settlement and cultivation remains, postmedieval park and garden, Thorpe Latimer' is adjacent to the proposed reservoir site. The construction of the reservoir would result in the destruction of the rural farmland and wellpreserved ridge and furrow to the west of the scheduled monument and entail the construction of large embankments. This would destroy the ridge and furrow that, as a surviving part of the medieval landscape, have a group value with the scheduled monument. The destruction of the agricultural landscape would also result in a substantial change of setting of the scheduled monument through the alteration to both the form and land use of the landscape. This would reduce the ability to understand the historic context of the scheduled monument, diminishing its heritage value therefore major effects have been identified.

There is also high potential for archaeological remains within the site. The heritage value of these remains is unknown but have the potential to be of low to high value depending upon the nature, extent and preservation of the remains. The construction of the reservoir would truncate and remove archaeological remains which at present, are not fully understood.

The reservoir and associated built infrastructure have the potential to permanently and adversely alter the setting of historic assets, through visual intrusion. There may also be operational impacts resulting from increased noise pollution, traffic and potential tourism that may impact the setting of historic assets. Minor operational effects have been identified.

4.8.2 Transfers and associated infrastructure

4.8.2.1 River Trent to Witham

Listed buildings across the proposed option are sporadically located in populated areas including North Muskham, Langford, Winthorpe, Barnby and Beckingham.

The closest scheduled monument is an iron age settlement approximately 350m to the south of the abstraction location at the River Trent. There are likely to be no adverse effects upon scheduled monuments during construction of the route. In addition, Coddington and Barnby in the Wouldows are Conservation Areas, 550m west and 225m south respectively. The operation of the transfer would not affect statutory designated heritage assets as it would be below ground level with the ground reinstated following completion of works. Construction and operational effects on statutory designated heritage assets are considered to be a minor constraint to the scheme.

There are no registered parks and gardens, registered battlefields, located in the vicinity of the route. This constraint can therefore be considered to be neutral or minor.

4.8.2.2 River Witham to SLR

Listed buildings are sporadically located across the study area, with clusters in the Heckington and Ewerby areas. The nearest scheduled monument is a Settlement site 650yds (600m) E of Holme House, approximately 2km to the south of the proposed route, at Heckington Fen. The Heckington and Hecklington station are conservation areas, approximately 2km to the southeast of the proposed route. Construction and operational effects on statutory designated heritage assets are considered to be a minor constraint to the scheme.

There are no registered parks and gardens, registered battlefields, located in the vicinity of the route. This constraint can therefore be considered to be neutral or minor.

4.8.2.3 SLR potable water pipeline

There are a large number of listed buildings sporadically located across the proposed route, including clusters in Market Deeping, Etton, Maxey, Bourne and Billingborough. There are a number of scheduled monuments in the wider study area, the closest of which is “Maxey Castle: a moated site with associated enclosures and a fishpond” approximately 550m to the west of the proposed route.

Langtoft, Maxey, Etton, Market Deeping and Billing borough are also conservation areas, the closest of which is Etton, which is immediately adjacent to the route. Through the application of best construction practice construction and operational effects on statutory designated heritage assets are considered to be a minor constraint to the scheme.

There are no registered parks and gardens, registered battlefields, located in the vicinity of the route. This constraint can therefore be considered to be neutral or minor.

4.8.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Consider the route of the transfer and re-route to avoid the Registered Park and Garden and conservation area; however, if this is not possible then careful construction and reinstatement to its original condition with no detrimental effect on the character, appearance, or design of the RPG or conservation area should be implemented
- Best practice measures to be implemented to minimise setting effects for other heritage assets during construction
- Incorporate measures to reduce setting impact of the reservoir and embankment (for example, planting of trees as screening and reducing the height of any embankment). However, although design features would likely reduce the setting impact, there may be residual effects
- Further work likely to be required to determine significance of effect, depending on the presence or absence of buried archaeology. Residual effects may remain due to potential loss of archaeological remains

4.9 Population and Human Health

4.9.1 Reservoir and associated infrastructure

The reservoir footprint intersects farm land and a B road. Land take of private land would be required for construction of the reservoir. There are several community facilities including schools and churches within 1km of the proposed site. There is potential for disturbance impacts during construction. There may also be a change in environmental conditions during operation for residential and private properties and businesses in proximity to the proposed location as a result of a combination of noise, air quality, visual impacts or presence of Heavy Goods Vehicles (HGV) and an increase in tourism. There may be minor benefits to local community as reservoir may generate jobs.

The WTW is likely to ensure that disease is not transmitted from any water sources to customers drinking water supplies. It is unlikely therefore that this option would affect disease transmission during its operation.

The construction period would involve construction of the reservoir and therefore would have no benefits in the short term in increasing access and connecting customers to the natural environment. However, the reservoir has the potential to have a positive effect in the medium to long term.

There are no national cycle routes (NCR) or national/promoted trails in proximity or dissecting the proposed reservoir site. There are no areas of Registered Common Land under the Countryside Rights of Way Act 2000, or areas of open access land, in direct proximity to the proposed reservoir site. As the site is located predominantly on private farmland, it is unlikely to have negative effects on tourism during construction or operation. Operation of reservoir may provide new recreational opportunities.

4.9.2 Transfers and associated infrastructure

4.9.2.1 River Trent to Witham

The proposed route is located within 500m of local communities including North Muskham, Langford, Danethorpe, Coddington, and Barnby. There would be no loss of property, recreational or community assets. The closest Noise Important Area is approximately 750m to the north of the route at its closest point. Overall, there is the potential for the health and wellbeing of local people and communities to be temporarily affected during construction, through noise and dust pollution, as well as the temporary use of agricultural land used by landowners. However, the overall impact is considered to be minor given the sporadic proximity of these built up areas. There is potential for economic opportunities for local communities through increased local employment and utilisation of local facilities.

There would be no disruption to any country parks. The route does not pass through any greenbelt designated land. The proposed route dissects an on-road section of the NCR which may need to be temporarily diverted or closed during construction. The route crosses several local footpaths and bridleways, which may need to be temporarily closed or diverted during construction. Measures would be made to avoid temporary closure of public right of ways with diversions being provided where needed. Any PRoW or open access land affected during construction would be reinstated following completion of works, thus effects during operation would be negligible.

4.9.2.2 River Witham to SLR

The proposed route is not in proximity to or within large urban areas. The main residential locations across the route include Ewerby and Heckington. Sleaford is further to the north west. The route largely dissects rural agricultural land. Overall, there is the potential for the health and wellbeing of local people and communities to be temporarily affected during construction, through noise and dust pollution, as well as the temporary use of agricultural land used by landowners. However, the overall impact is considered to be minor given the sporadic proximity of these built-up areas. There is potential for economic opportunities for local communities through increased local employment and utilisation of local facilities.

There are no NCRs or national/promoted trails in proximity or dissecting the proposed route. There are no areas of Registered Common Land under the Countryside Rights of Way Act 2000, or areas of open access land, in direct proximity to the proposed route. Measures would be made to avoid temporary closure of public right of ways with diversions being provided where needed. Any PRoW or open access land affected during construction would be reinstated following completion of works, thus effects during operation would be negligible. Overall, the level of constraint to the development of the scheme from recreational activities and tourism is considered to be a minor constraint.

4.9.2.3 SLR potable water pipeline

This proposed route is mainly located through rural agricultural land, with a number of residential areas in proximity, the closes of which is Etton approximately 10m to the west of the proposed route. As the proposed route runs south, the area becomes more constrained, passing through a corridor either side of more residential areas, including businesses.. Overall, there is the potential for the health and wellbeing of local people and communities to be temporarily affected during construction, through noise and dust pollution, as well as the temporary use of agricultural land used by landowners. The overall impact is considered to be moderate given the route passes through a constrained corridor at Market Deeping There is potential for economic opportunities for local communities through increased local employment and utilisation of local facilities.

The proposed route dissects a cycle route which may be temporarily closed or diverted during construction. The route crosses several local footpaths and bridleways, which may need to be temporarily closed or diverted during construction. Measures would be made to avoid temporary closure of public right of ways with diversions being provided where needed. Any PRoW or open access land affected during construction would be reinstated following completion of works, thus effects during operation would be negligible. The proposed route is not located in proximity to registered common land or open access land under the Countryside Rights of Way Act 2000. There are no national or promoted trails located in proximity to the proposed route. Overall, the level of constraint to the development of the scheme from recreational activities and tourism is considered to be a minor constraint.

4.9.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Best practice mitigation measures such as community engagement, air quality management, noise management to be implemented to minimise effects during construction
- The above ground assets should have landscaping, air quality and noise mitigation included in their design, in order to limit the potential indirect impacts from noise and air pollution on properties
- There could be potential to enhance the cycleways as part of the works (for example, during re-instatement)
- Incorporate education and information resources within the reservoir design such as trails and information boards, amongst others
- Direct land take of recreational sites to be avoided where possible and land to be reinstated
- Potential to incorporate recreational activities such water-based activities into reservoir design

4.10 Material Assets

4.10.1 Reservoir and associated infrastructure

New infrastructure is required for the option which would use materials and generate waste. Large quantities materials are required for the reservoir embankment. A moderate constraint is therefore identified.

Direct land take from roads may be required. Road replacement is to be built so effects are temporary, but may cause increased congestion on nearby roads.. There may be construction and operational effects to roads that would connect the reservoir, with an increase in HGVs from

deliveries and potential increase in traffic from visitors. There is potential for disruption to these assets during the construction phase, including closures and diversions.

4.10.2 Transfers and associated infrastructure

New infrastructure is required for the option which would use materials and generate waste.

The route of the proposed scheme is largely rural in nature, with limited interactions with built assets and infrastructure. Where major roads are being crossed by the scheme, trenchless techniques would likely be used, however some minor roads may be disrupted temporarily during construction, thus affecting infrastructure and local people who use them. Should any sensitive noise receptors be identified at the next stages of the project, mitigation options would be considered further. Approved traffic routes for construction traffic would also likely be identified during detailed design work to minimise impacts on local roads. Overall, the effects on built assets and infrastructure from the construction and operation of this option are considered a minor constraint.

4.10.3 Mitigation

Proposed mitigation measures have been identified at this stage. These are subject to further detailed design development and include:

- Best practice measures including a Traffic Management Plan implemented to minimise disturbance during construction
- Trenchless techniques can be adopted where appropriate to reduce major effects.

4.11 SEA scoring summary

A summary of the scoring for each of the SEA objectives is presented in Table 4.1. The table shows the pre and post mitigation scoring for the construction and operational phases against each of the SEA objectives. Sections 4.2 to 4.9 present the narrative of the effects and mitigation identified for each of the SEA objectives.

Table 4.1: SEA Scoring Summary

		Pre-mitigation				Post-mitigation			
		Construction		Operation		Construction		Operation	
SEA Topic	**SEA Objective(s)**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Biodiversity, flora and fauna	To protect designated sites and their qualifying features.	0	--	+	---	0	--	+	--
	To deliver BNG, protect biodiversity, priority species and vulnerable habitats such as chalk rivers.	0	--	++	0	0	--	++	0
	To avoid spreading and, where required, manage invasive and nonnative species (INNS).	0	--	0	--	0	-	0	-
	To meet WFD objectives relating to biodiversity.	0	---	0	--	0	---	0	--
Soil	To protect and enhance the functionality and quality of soils, including the protection of highgrade agricultural land, and geodiversity.	0	--	0	0	0	--	0	0
Water	To reduce or manage flood risk, taking climate change into account.	0	-	0	--	0	-	0	-
	To enhance or maintain surface water quality, flows and quantity.	0	---	0	0	0	---	0	0
	To enhance or maintain groundwater quality and resources.	0	---	0	---	0	--	0	--
	To meet WFD objectives and support the achievement of environmental objectives set out in River Basin Management Plans.	0	--	0	--	0	--	0	--

	To increase water efficiency and increase resilience of water supplies and natural systems to droughts.	0	0	+	-	0	0	+	-

		Pre-mitigation				Post-mitigation			
		Construction		Operation		Construction		Operation	
SEA Topic	**SEA Objective(s)**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Air	To reduce and minimise air emissions during construction and operation.	0	-	0	0	0	-	0	0
Climatic Factors	To minimise/reduce embodied and operational carbon emissions	0	-	0	-	0	-	0	-
	To introduce climate mitigation where required and improve the climate resilience of assets and natural systems.	0	-	+	0	0	-	+	0
Landscape	To conserve, protect and enhance landscape and townscape character and visual amenity.	0	---	0	0	0	--	0	0
Historic Environment	To conserve/protect and enhance historic environment and heritage assets, and their setting, including archaeologically important sites.	0	--	0	-	0	--	0	-
Population and Human Health	To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing.	+	-	+	0	+	-	+	0
	To secure resilient water supplies for the health and wellbeing of customers.	0	0	0	0	0	0	0	0

	To increase access and connect customers to the natural environment, provide education or information resources for the public.	0	0	+	0	0	0	+	0
	Maintain and enhance tourism and recreation	0	--	+	0	0	--	+	0

		Pre-mitigation				**Post-mitigation**			
		Construction		**Operation**		**Construction**		**Operation**	
SEA Topic	**SEA Objective(s)**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Material Assets	Minimise impact on built infrastructure Minimise resource use and waste production	0	--	0	0	0	-	0	0
	To avoid negative effects on built assets / infrastructure.	0	--	0	--	0	--	0	--

4.12 Cumulative effects assessment

An initial SEA cumulative assessment and initial in-combination HRA and WFD assessments have been undertaken as part of the gate two process. These assessments are presented in the Environmental Appraisal Report. It is understood that if the scheme is selected as an option in the WRE Regional Plan and Anglian Water WRMP24 and Affinity Water WRMP24 it would be subject to further in-combination effects assessments with the other selected options, neighbouring water company plans and neighbouring regional plans. Until the WRE Best Value Regional Plan has been developed and agreed, it is not known when the scheme would be implemented, and therefore which other developments it could act in-combination with.

Assumptions were therefore made about other plans, programmes and projects that could act in-combination with the SLR scheme, and the following were considered within the incombination effects assessments these assumptions were based on scale, type of development or plan, and temporal and spatial location:

- Other SROs – FR
- Local Development Frameworks
- Development Consent Orders (DCOs) for Nationally Significant Infrastructure Projects
- Hybrid Bills
- Relevant Transport and Works Act Orders
- Relevant planning applications (only where there is the potential for cumulative effects on the future baseline).

Please refer to the Environmental Appraisal Report which presents the cumulative and incombination assessments in full.

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