The Keadby 3 Low Carbon Gas Power Station Project

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The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order

Land at and in the vicinity of the Keadby Power Station site, Trentside, Keadby, North Lincolnshire

Environmental Statement
Volume II - Appendix 12B: Water Framework Directive Assessment Report

The Planning Act 2008

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Applicant: Keadby Generation Limited

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GLOSSARY

Abbreviation	Description
AQAL	Air Quality Assessment Level
AEP	Annual Exceedance Probability
AEL	Associated Emission Level
BAT	Best Available Technique
BGL	Below Ground Level
BOD	Biochemical Oxygen Demand
BSI	British Standards Institute
Ca	Calcium
$CaCO_3$	Calcium Carbonate
CCGT	Combined Cycle Gas Turbine
CJEU	Court of Justice of the European Union
CCP	Carbon Capture and Compression Plant
COMAH	Control of major Accident Hazards Regulations 2015
COSHH	Control of Substances Hazardous to Health Regulations
DCC	Direct Contact Cooler
DDT	Dichlorodiphenyltrichloroethan
DEFRA	Department for Environment, Food and Rural Affairs
DEMP	Decommissioning Environmental Management Plan
DML	Deemed Marine Licence
DOC	Dissolved Organic Carbon
DrWPA	Drinking Water Protected Areas
ELV	Emission Limit Value
EQS	Environmental Quality Standard
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HBCDD	Hexabromocyclododecane

Abbreviation	Description
HRSG	Heat Recovery Steam Generator
HSE	Health and Safety Executive
HMWB	Heavily Modified Water Body
HP	Hight Pressure
HRA	Habitat Regulations Assessment
IDB	Internal Drainage Board
INNS	Invasive Non-Native Species
IoAaNNWLMB	Isle of Axholme and North Nottinghamshire Water Level Management Board
LBMEP	Landscape and Biodiversity Management and Enhancement Plan
LLFA	Lead Local Flood Authority
LWS	Local Wildlife Site
NH_3	Ammoniacal Nitrogen
NH_4	Ammonium Ion
NO_3	Nitrate
O_2	Oxygen
PBDE	Polybrominated diphenyl ethers
PCC	Power and Carbon Capture
PEC	Predicted Environmental Concentration
PFOS	Perfluorooctane sulphonate
RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SCR	Selective Catalytic Reduction
SiO_2	Silicon Dioxide
SO_4	Sulphate
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TON	Total Oxidised Nitrogen
WFD	Water Framework Directive
WwTW	Wastewater Treatment Works

Abbreviation	Description
ZoI	Zone of Influence

CONTENTS

TABLES

1.0 INTRODUCTION

1.1 Background

1.1.1 AECOM was commissioned by Keadby Generation Ltd ('The Applicant') to produce a Water Framework Directive (WFD) Assessment for the proposed Keadby 3 Low Carbon Power Station project (hereafter referred to as the 'Proposed Development'). The WFD Assessment Report has been provided as part of the Environmental Statement (ES) and specifically, as an Appendix to **Chapter 12:** Water Resources and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

1.1.2 New developments that have the potential to impact the current or targeted WFD status of a water body are required to assess their compliance against the WFD objectives of the potentially affected waterbodies. In accordance with the Planning Inspectorate's (PINS) Advice Note Eighteen (PINS, 2017) and the Environment Agency guidance for competing WFD assessments for coastal and transitional waters (Environment Agency, 2017), a three-stage approach may be adopted:

- **Stage 1:** WFD Screening;
- **Stage 2:** WFD Scoping; and
- **Stage 3:** WFD Impact Assessment.

1.1.3 This report presents the findings of Stages 1-3, which have been undertaken in relation to the Proposed Development.

1.2 The Proposed Development

1.2.1 The Proposed Development comprises the construction, operation (including maintenance) and decommissioning of a low carbon Combined Cycle Gas Turbine (CCGT) generating station equipped with carbon capture plant (CCP) to be located on land in the vicinity of the existing Keadby Power Station near Scunthorpe in North Lincolnshire (the Proposed Development Site).

1.2.2 A detailed description of the Proposed Development is set out in **Chapter 4:** The Proposed Development (ES Volume I - **Application Document Ref. 6.2**).

1.2.3 This Appendix should be read in conjunction with the following drawings:

- **Figure 3.1**: DCO Site Red Line Boundary (ES Volume III - **Application Document Ref. 6.4**);
- **Figure 3.3**: Indicative Areas Referred to in the Environmental Statement (ES Volume III - **Application Document Ref. 6.4**);
- **Figure 4.1**: Indicative Layout for the Proposed Power and Carbon Capture (PCC) Site (ES Volume III - **Application Document Ref. 6.4**);

- **Figure 12.1**: Surface Waterbodies and their Attributes (ES Volume III - **Application Document Ref. 6.4**); and
- **Figure 12.2**: Groundwater Bodies and their Attributes (ES Volume III - **Application Document Ref. 6.4**).

1.3 Structure of the Report

1.3.1 The remainder of this report is set out as follows:

- Section 2 provides a summary of the WFD requirements and screening process;
- Section 3 describes the assessment methodology;
- Section 4 describes the screening assessment;
- Section 5 provides the scoping assessment for the River Trent;
- Section 6 describes the results of the assessment and provides details of possible mitigation and monitoring options to alleviate adverse effects;
- Section 7 presents mitigation measures and an assessment against reasons for not achieving Good Status;
- Section 8 presents enhancement opportunities; and
- Section 9 presents the conclusions.

1.3.2 In addition, this assessment is supported by the following technical annexes:

- **Annex A** WFD Water Body Assessments Cycle 2;
- **Annex B** Baseline Conditions;
- **Annex C** Surface Water Quality Data for WFD waterbodies;
- **Annex D** Aquatic Ecology Baseline; and
- **Annex E** Water Resources Baseline.

2.0 OVERVIEW OF THE WATER FRAMEWORK DIRECTIVE

2.1 Legislative Context

2.1.1 The Water Framework Directive (WFD) aims to protect and enhance the quality of the water environment and is transposed into legislation in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended 2015 & 2016)[1]. It takes a holistic approach to the sustainable management of water by considering the interactions between surface water (including transitional and coastal waters, rivers, streams and lakes), groundwater and water-dependent ecosystems.

2.1.2 Under the WFD, 'waterbodies' are the basic management units, defined as all or part of a river system or aquifer. Waterbodies form part of a larger 'river basin district' (RBD), for which 'River Basin Management Plans' (RBMP) are used to summarise baseline conditions and set broad improvement objectives.

2.1.3 In England, the Environment Agency is the competent authority for implementing the WFD, although many objectives will be delivered in partnership with other relevant public bodies and private organisations (for example, local planning authorities, water companies, Rivers Trusts, large private landowners and developers). As part of its regulatory role and statutory consultee on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2010 (as amended), the Environment Agency must consider whether proposals for new developments have the potential to:

- cause a deterioration of a waterbody from its current status or potential; and/ or
- prevent future attainment of good status or potential where not already achieved.

2.1.4 In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the Environment Agency must also consider the conservation objectives of any Protected Areas (i.e. European sites or water dependent Sites of Special Scientific Interest (SSSI)) and adjacent WFD waterbodies, where relevant.

[1] Following the United Kingdom's referendum vote to leave the European Union, the requirements of the WFD remain applicable until such time as new legislation is passed either revoking or amending the current 2017 WFD Regulations.

2.2 Surface Water Body Status

2.2.1 Under the WFD, surface water body status is classified on the basis of chemical and ecological status or potential. Ecological status is assigned to surface waterbodies that are natural and considered by the Environment Agency not to have been significantly modified for anthropogenic purposes. The overall objective for natural surface waterbodies is to achieve Good Ecological Status and Good Chemical Status. Good Ecological Status represents only a small degree of departure from pristine conditions, which are otherwise known as High Ecological Status. All five status class definitions are provided in Table 1.

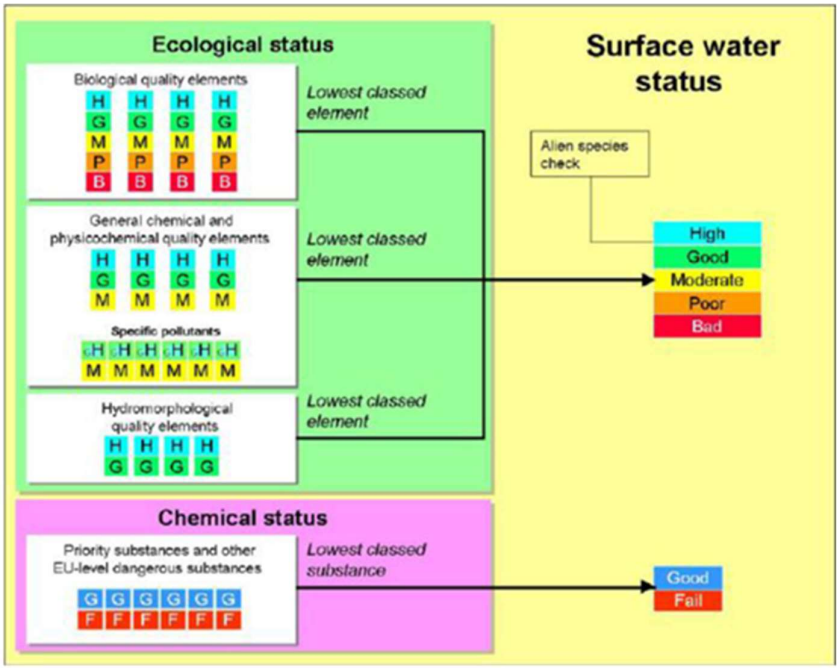
Table 1: Definition of status in the Water Framework Directive (Environment Agency, 2015a)

Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

2.2.2 Ecological potential is assigned to artificial and man-made waterbodies (such as canals), or natural waterbodies that have undergone significant modification; these are termed Heavily Modified Water Bodies (HMWB). The term 'ecological potential' is used as it may be impossible to achieve good ecological status because of modification for a specific use, such as navigation or flood protection. The ecological potential represents the degree to which the quality of the water body approaches the maximum it could achieve and depends on the classification of WFD parameters and the implementation of mitigation measures identified by the Environment Agency.

2.2.3 Ecological status of waterbodies is classified according to relevant biological, physico-chemical, and hydromorphological parameters on a five-point scale as either High, Good, Moderate, Poor or Bad Ecological Status. The classification system is based on a worst-case 'one-out all-out' system, meaning that the overall ecological status is based on the lowest individual parameter score. This general system is summarised below in **Plate 1**.

Plate 1: WFD classification elements for surface waterbody status (Environment Agency, 2015a)



Chemical Status

2.2.4 Chemical status is defined by compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances, in accordance with the Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 and the Environmental Permitting (England and Wales) (Amendment) Regulations 2016). Chemical status is assigned on a scale of good or fail. Surface waterbodies are only monitored for priority substances where there are known discharges of these pollutants; otherwise surface waterbodies are reported as being at good chemical status.

Ecological Status or Potential

2.2.5 Ecological status or potential is defined by the overall health or condition of the watercourse. This is assigned on a scale of High, Good, Moderate, Poor or Bad, and on the basis of four classification elements or 'tests' (Environment Agency, 2015a), as follows:

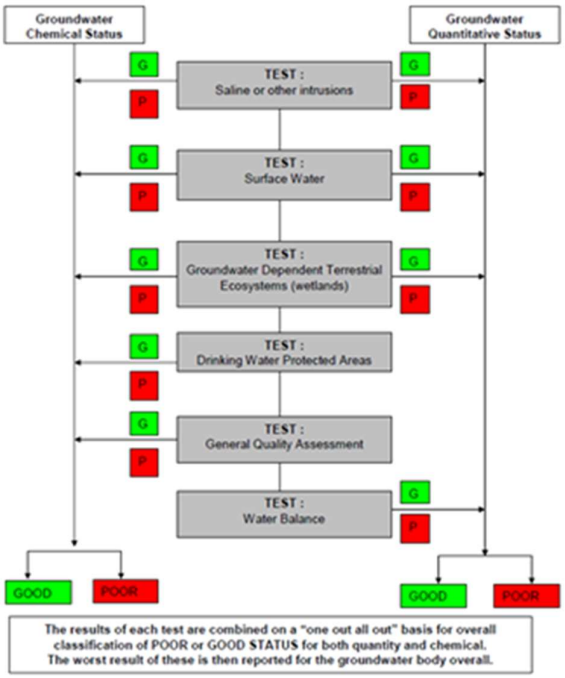
- **Biological:** This test is designed to assess the status indicated by a biological quality element such as the abundance of fish, invertebrates or algae and by the presence of invasive species. The biological quality elements can influence an overall water body status from Bad through to High.

- **Physico-chemical**: This test is designed to assess compliance with environmental standards for supporting physicochemical conditions, such as dissolved oxygen, phosphorus and ammonia. The physicochemical elements can only influence an overall water body status from Moderate through to High.
- **Specific pollutants:** This test is designed to assess compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic. As with the physico-chemical test, the specific pollutant assessment can only influence an overall water body status from Moderate through to High.
- **Hydromorphology:** For natural, non-HMWBs, this test is undertaken when the biological and physico-chemical tests indicate that a water body may be of High status. It specifically assesses elements such as water flow, sediment composition and movement, continuity, and structure of the habitat against reference or 'largely undisturbed' conditions. If the hydromorphological elements do not support High status, then the status of the water body is limited to Good overall status. For artificial or HMWBs, hydromorphological elements are assessed initially to determine which of the biological and physico-chemical elements should be used in the classification of ecological potential. In all cases, assessment of baseline hydromorphological conditions are an important factor in determining possible reasons for classifying biological and physico-chemical elements of a water body as less than Good, and hence in determining what mitigation measures may be required to address these failing waterbodies.

2.3 Groundwater Body Status

2.3.1 Under the WFD, groundwater body status is classified on the basis of quantitative and chemical status. Status is assessed primarily using data collected from the Environment Agency monitoring network; therefore, the scale of assessment means that groundwater status is mainly influenced by larger scale effects such as significant abstraction or widespread/ diffuse pollution. The worst-case classification is assigned as the overall groundwater body status, in a 'one-out all-out' system. This system is summarised in **Plate 2**.

Plate 2: WFD Classification Elements for Groundwater Body Status (Environment Agency, 2015b)



Quantitative Status

2.3.2 Quantitative status is defined by the quantity of groundwater available as baseflow to watercourses and water-dependent ecosystems, and as 'resource' available for use as drinking water and other consumptive purposes. This is assigned on a scale of Good or Poor, and on the basis of four classification elements or 'tests' as follows:

- **Saline or other intrusions**: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction, is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.
- **Surface water**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the ecological status of associated surface waterbodies.
- **Groundwater Dependent Terrestrial Ecosystems (GWDTE)**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE (with respect to water quantity).
- **Water balance**: This test is designed to identify groundwater bodies where groundwater abstraction exceeds the 'available groundwater resource',

defined as the rate of overall recharge to the groundwater body itself, as well as the rate of flow required to meet the ecological needs of associated surface waterbodies and GWDTE.

Chemical Status

2.3.3 Chemical status is defined by the concentrations of a range of key pollutants, by the quality of groundwater feeding into watercourses and water-dependent ecosystems and by the quality of groundwater available for drinking water purposes. This is assigned on a scale of Good or Poor, and on the basis of five classification elements or 'tests' as follows:

- **Saline or other intrusions**: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.
- **Surface water**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the chemical status of associated surface water bodies.
- **GWDTE**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE (with respect to water quality).
- **Drinking Water Protected Areas (DrWPA)**: This test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WFD or at risk of failing in the future.
- **General quality assessment:** This test is designed to identify groundwater bodies where widespread deterioration in quality has or will compromise the strategic use of groundwater.

3.0 ASSESSMENT METHODOLOGY

3.1 Overview

3.1.1 PINS Note Eighteen (PINS, 2017) and the Environment Agency guidance for competing WFD assessments for coastal and transitional waters (Environment Agency, 2017) suggest that a three-stage approach can be adopted:

- **Stage 1: WFD Screening** - Identification of the proposed work activities that are to be assessed and determination of which WFD waterbodies could potentially be affected through identification of a Zone of Influence (ZoI). This step also provides a rationale for any waterbodies screened out of the assessment.
- **Stage 2: WFD Scoping** - For each water body identified in Stage 1, an assessment is carried out to identify the effects and potential risks to quality elements from all activities. The assessment is made taking into consideration embedded mitigation (measures that can reasonably be incorporated into the design of the proposed works) and good practice mitigation (measures that would occur with or without input from the WFD assessment process).
- **Stage 3: WFD Impact Assessment** - A detailed assessment of the waterbodies and activities carried forward from the WFD screening and scoping stages. It involves:
  - the baseline conditions of the concerned waterbodies;
  - an assessment of the risk of deterioration (either in isolation or cumulatively);
  - a description of any additional mitigation that is required (if applicable) and how it will be implemented; and,
  - an explanation of any positive contributions to the RBMP objectives proposed, and how they will be delivered.

3.1.2 This report covers Stages 1-3 of the above assessment process.

3.2 Defining no Deterioration

3.2.1 No deterioration was defined by the Environment Agency in its Position Paper (Environment Agency, 2013a). Steps are required to prevent deterioration of the ecological status, ecological potential and chemical status of surface water and the qualitative status and quantitative status of groundwater.

3.2.2 Originally deterioration was defined by the Environment Agency as deterioration from one status class to a lower one, however following a ruling by the Court of Justice of the European Union (CJEU) in July 2015 (Case C-461/13 on the 1st July 2016 (Bund für Umwelt und Naturschutz Deutschland eV v Bundesrepublik

Deutschland) (Court of Justice of the European Union, 2015)), this has been redefined. The CJEU ruling clarified that:

- 'deterioration of the status' of the relevant water body includes a fall by one class of any element of the 'quality elements' even if the fall does not result in a change in the classification of the water body as a whole;
- 'any deterioration' in quality elements in the lowest class constitutes deterioration; and
- certainty regarding a project's compliance with the Directive is required at the planning consent stage; hence, where deterioration 'may' be caused, derogations under Article 4.7 of the WFD are required at this stage.

3.2.3 Whilst deterioration within a status class does not contravene the requirements of the WFD, (except for Water Supply (Water Quality) (Amendment) Regulations 2017 parameters in drinking water protected areas), the WFD requires that action should be taken to limit within-class deterioration as far as practicable. For groundwater quality, measures must also be taken to reverse any environmentally significant deteriorating trend, whether or not it affects status or potential.

3.2.4 The no deterioration requirements are applied independently to each of the elements coming together to form the water body classification as required by Appendix V of the Water Framework Directive and Article 4 of the Groundwater Daughter Directive. This is transposed into UK legislation by the Groundwater (England and Wales) Regulations 2009 (HMSO, 2009a).

3.2.5 For surface waters, to manage the risk of deterioration of the biological elements of surface waters, the no deterioration requirements are applied to the environmental standards for the physico-chemical elements, including those for the Moderate/Poor and Poor/Bad boundaries.

3.2.6 For groundwater, the no deterioration requirements are applied to each of the four component tests for quantitative status and the five component tests for chemical status. The no deterioration requirement may not apply to elements at High status and elements at High status may be permitted to deteriorate to Good status, provided that:

- the waterbody's overall status is not High;
- the RBMP has not set an objective for the water body of High status;
- the objectives and requirements of other domestic or European Community legislation are complied with; and
- action is taken to limit deterioration within High or Good status or potential classes as far as practicable.

3.2.7 The no deterioration baseline for each water body is the status that is reported in **Annex A**.

3.3 Surface Water Assessment

3.3.1 Table 2 presents the matrix used to assess the effect of a project on surface water status or potential class. It ranges from a major beneficial effect, a positive change in overall WFD status, through no effect, and down to deterioration in overall status class. The assessment considers all waterbodies that may be directly or indirectly affected (adjacent waterbodies). It has also considered any Protected Areas as defined by other European Directives such as Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and water dependent SSSIs. Where more stringent (than WFD) standards apply (such as conservation objectives) these have also been considered.

Table 2: Surface Water Assessment Matrix

Effect	Description / Criteria	Outcome
Major beneficial	Impacts that taken on their own or in combination with others have the potential to lead to the improvement in the ecological status or potential of a WFD quality element for the entire waterbody	Increase in status of one or more WFD element giving rise to a predicted rise in status class for that waterbody.
Minor / localised beneficial	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary improvement that does not affect the overall WFD status of the waterbody or any quality elements	Localised improvement, no change in status of WFD element
Green (no impact)	No measurable change to any quality elements.	No change
Yellow - Localised/ temporary adverse effect	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary deterioration that does not affect the overall WFD status of the waterbody or any quality elements or prevent improvement. Consideration will be given to mitigation measures such as habitat creation or enhancement measures.	Localised deterioration, no change in status of WFD element when balanced against mitigation measures embedded in the scheme.

Effect	Description / Criteria	Outcome
Orange - Adverse effect on class of WFD element	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the WFD status class of one or more biological quality elements, but not in the overall status of the waterbody. Consideration will be given to mitigation measures such as habitat creation or enhancement measures.	Decrease in status of WFD element when balanced against positive measures embedded in the scheme.
Red – Adverse effect on overall WFD class of waterbody	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the ecological status or potential of a WFD quality element, which then lead to a deterioration of status/potential of waterbody.	Decrease in status of overall WFD waterbody status when balanced against positive measures embedded in the scheme.

3.4 Groundwater Assessment

3.4.1 Table 3 presents the matrix used to assess the effect of a project on groundwater status class. It ranges from a beneficial effect, through no effect, and down to deterioration in overall status class.

Table 3: Groundwater assessment matrix

Magnitude of Impact of Scheme Element on WFD Element i.e. in individual cells	Effect on WFD Element within the assessment boundary i.e. at end of row	Effect on Status of WFD element at the Groundwater Body Scale
Impacts lead to beneficial effect	Combined impacts have the potential to have a beneficial effect on the WFD element.	Improvement but no change to status of WFD element
No measurable change to groundwater levels or quality.	No measurable change to WFD elements.	No change and no deterioration in status of WFD element
Impacts when taken on their own have the potential to lead to a minor localised or temporary effect	Combined impacts have the potential to lead to a minor localised or temporary adverse effect on the WFD element.	Combined impacts have the potential to lead to a minor localised or temporary effect on the WFD element. No change to status of WFD element and no significant deterioration at groundwater body scale.
Impacts when taken on their own have the potential to lead to a widespread or prolonged effect.	Combined impacts have the potential to have an adverse effect on the WFD element.	Combined impacts have the potential to have an adverse effect on the WFD element, resulting in significant deterioration but no change in status class at groundwater body scale.
Impacts when taken on their own have the potential to lead to a significant effect.	Combined impacts in combination with others have the potential to have a significant adverse effect on the WFD element.	Combined impacts in combination with others have the potential to have an adverse effect on the WFD element AND change its status at the groundwater body scale

3.5 Future Status Objectives

3.5.1 RBMP are used to outline water body pressures and the actions that are required to address them. The future status objective assessment considers the ecological potential of a surface water body and the mitigation measures that defined the ecological potential. Assessments undertaken for the Proposed Development should consider the mitigation measures defined in the 2015 RBMP. Information on WFD measures available from the Environment Agency Catchment Data Explorer website (accessed January 2021) has also been reviewed. The assessment considers whether a project has the potential to prevent the implementation or impact the effectiveness of the defined measures.

3.6 Article 4.7 Derogations

3.6.1 Article 4.7 of the WFD allows derogation from the Directive but only where new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or for deterioration from high to good status have occurred, and when the following four stringent tests have been met:

- Test (a): All practicable steps are to be taken to mitigate the adverse impacts on the water body concerned;
- Test (b): the reasons for modifications or alterations are specifically set out and explained in the RBMP;
- Test (c)(1): There is an overriding public interest in the Proposed Development and/or Test (c)(2) whereby its benefits outweigh the benefits of the WFD objectives (i.e. that the benefits of the project to human health, human safety or sustainable development outweigh the benefits of achieving the WFD objectives); and
- Test (d): The benefits of the project cannot be achieved by a significantly better environmental option (that are technically feasible and do not lead to disproportionate cost).

3.6.2 In addition, the Proposed Development must not permanently exclude or compromise achievement of the WFD objectives in other bodies of water within the same RBD and must be consistent with the implementation of other EU environmental legislation (Article 4.8). In applying Article 4.7, steps must also be taken to make sure that the new provisions guarantee at least the same level of protection as the existing EU legislation (Article 4.9).

3.7 Environment Agency Clearing the Waters for All Guidance

3.7.1 Within the PINS Advice Note 18 (PINS, 2017), PINS advise following the approach given in the Environment Agency's Clearing the Waters for All

guidance (Environment Agency, 2017). While developed for estuarine and coastal waters, PINS consider the staged approach equally suitable for rivers, lakes and groundwater projects in England and Wales.

3.7.2 The Environment Agency's guidance on Water Framework Directive assessment (Environment Agency, 2017) lists the following activities which can be screened out of assessment due to being of low risk:

- a self-service marine licence activity or an accelerated marine licence activity that meets specific conditions;
- maintaining pumps at pumping stations – if you do it regularly, avoid low dissolved oxygen levels during maintenance and minimise silt movement when restarting the pumps;
- removing blockages or obstacles like litter or debris within 10m of an existing structure to maintain flow;
- replacing or removing existing pipes, cables or services crossing over a waterbody – but not including any new structure or supports, or new bed or bank reinforcement; and
- 'over water' replacement or repairs to, for example bridge, pier and jetty surfaces – if you minimise bank or bed disturbance.

3.8 Flood Risk Activity Permit Exemptions

3.8.1 Certain activities on or near waterbodies are exempt from the requirement for Environmental Permits for Flood Risk Activities, and hence would unlikely require WFD assessments, as summarised in Table 4, below.

Table 4: Flood Risk Activity Exemptions

Activity	Type of Modification
Low impact maintenance activities (encourage removal of obstructions to fish/eel passage)	Re-pointing (block work structures)
	Void filling ('solid' structures)
	Re-positioning (rock or rubble or block work structures)
	Replacing elements (not whole structure)
	Re-facing
	Skimming/ covering/ grit blasting
	Cleaning and/or painting of a structure
Temporary works	Temporary scaffolding to enable bridge re-pointing
	Temporary clear span bridge with abutments set-back from bank top

Activity	Type of Modification
	Temporary cofferdam(s) (if eel/ fish passage not impeded)
	Temporary flow diversion (if fish/ eel passage not impeded) such as flumes and porta-dams
	Repair works to bridge or culvert which do not extend the structure, reduce the cross-section of the river or affect the banks or bed of the river, or reduce conveyance
	Excavation of trial pits of boreholes in byelaw margin
	Structural investigation works of a bridge/ culvert/ flood defence such as intrusive tests, non-intrusive surveys
Footbridges	Footbridge over a main river not more than 8m wide from bank to bank
	Bridge deck/ parapet replacement/ repair works
Service crossing	Service crossing below the river bed, installed by directional drilling or micro tunnelling if more than 1.5 m below the natural bed line of the river
	Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road
	Replacement, installation or dismantling of service crossing/ high voltage cable over a river
Other structures	Fishing platforms
	Fish/ eel pass on existing structure (where <2% water body length is impacted)
	Cattle drinks
	Mink rafts
	Fencing (if open panel/ chicken wire) in byelaw margin
	Outfall to a river ≤300 mm diameter

3.8.2 If the project or components of the project meet the above criteria, they may be screened out of any further assessment although agreement should also be sought from the Environment Agency.

3.9 General Approach and Assumptions

3.9.1 The following provides a description of the scope of works. The assessment is mainly qualitative and based on readily available data and information, including a site survey. It appraises the potential for non-compliance with the core WFD objectives of no deterioration or failure to improve, taking into account Protected Areas and adjacent waterbodies.

3.9.2 Data and information upon which this assessment is based is summarised below; for further details, please refer to **Chapter 12:** Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

Desk Study

3.9.3 A desk study has been undertaken to review:

- online aerial, historic and Ordnance Survey maps to review historical land uses, channel planform, notable morphological features and any changes to the channel;
- WFD classifications, Environment Agency investigation reports, and any mitigation measures proposed to meet Good Ecological Potential; and
- background water quality and biological data from online sources and provided directly by the Environment Agency, as well as water quality data collected to inform the baseline for the Proposed Development.

3.9.4 The desk study and site survey has been used as the basis for a qualitative review of the Proposed Development and to identify components requiring assessment of WFD compliance, or where mitigation or further investigation and assessment will be required. Full details of the desk study are provided in **Chapter 12:** Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

3.9.5 A site walkover has been undertaken to allow water receptors in the area to be assessed in terms of their character and morphology, and their connectivity to the Proposed Development to be considered in terms of the surrounding topography and adjacent receptors (e.g. nearby sites of ecological importance). More details are given below.

Source-Pathway-Receptor Approach

3.9.6 The impact assessment is based on a source-pathway-receptor model. For an impact on the water environment to exist the following is required

- an impact source (such as the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a water body);

- a receptor that is sensitive to that impact (i.e. waterbodies and the services they support); and
- a pathway by which the two are linked.

3.9.7 The first stage in applying the Source-Pathway-Receptor model is to identify the causes or 'sources' of potential impact from a development. The sources have been identified through a review of the details of the Proposed Development, including the size and nature of the development, potential construction methodologies and timescales. The next step in the model is to undertake a review of the potential receptors, that is, the water environment receptors themselves that have the potential to be affected. Waterbodies including their attributes have been identified through desk study and site surveys. The last stage of the model is, therefore, to determine if there is a viable exposure pathway or a 'mechanism' linking the source to the receptor. This has been undertaken in the context of local conditions relative to water receptors within the study area, such as topography, geology, climatic conditions and the nature of the impact (e.g. the mobility of a liquid pollutant or the proximity to works that may physically impact a waterbody).

3.9.8 The assessment of the likely significant effects is qualitative, and considers both construction and operation phases, as well as cumulative effects with other developments. This assessment has considered the risk of pollution to surface waterbodies directly and indirectly from construction activities. The risk of pollution from road runoff has also been considered such that appropriate measures (SuDS, proprietary treatment devices) could be incorporated into the design of the Proposed Development.

Rochdale Envelope Assumptions

3.9.9 The assessment contained herein makes use of the 'Rochdale Envelope' approach under the Planning Act (2008) (HMSO, 2008). The approach is employed where the nature of the Proposed Development means that some details of the whole project have not been confirmed when the application is submitted, and flexibility is sought to address the uncertainty.

3.9.10 Key principles in the context of the DCO application process are given in the PINS Advice Note Nine: Using the Rochdale Envelope (PINS, 2018). This includes the need to outline timescales associated with the flexibility sought, and that the assessment should establish those parameters likely to result in the maximum adverse effect (the reasonable worst-case scenario) and be undertaken accordingly to determine significant effects from the Proposed Development and to allow for the identification of necessary mitigation.

3.9.11 The following are the reasonable worst-case scenario assumptions (maximum parameters) for the purposes of the WFD screening assessment as outlined in **Chapter 12:** Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**):

- it is assumed that during construction the Contractor will as a minimum conform to all permit/ consent/ licence requirements and best practice measures to avoid, reduce and minimise the risk of water pollution or unacceptable physical impacts (without mitigation) on waterbodies. Details of this mitigation and best practice standards are described later in this report;
- cooling water will be required for heat rejection from the CCGT and CCP. The preferred solution for reasons of operational functionality and performance is hybrid cooling of both the CCGT and CCP using water abstracted from the Stainforth and Keadby Canal (Canal Water Abstraction Option). Should this option be selected, an intake structure would be constructed within the canal with equipment to comply with the Eels (England and Wales) Regulations 2009 (HMSO, 2009b) ('the Eels Regulations') which may comprise 2mm eel screens, baffles and fish return system (similar to that approved by the Environment Agency and that has been constructed for Keadby 2 Power Station) together with intake pipework, a wet well pumping station and chlorination plant. A pipeline would be constructed from this inlet into the Proposed PCC Site initially broadly following the route consented for Keadby 2 Power Station;
- in the event that this preferred option is not feasible, an alternative option would be to utilise the existing Keadby 1 Power Station cooling water abstraction infrastructure from the River Trent for the Proposed Development (River Water Abstraction Option). It is anticipated that this infrastructure is in a suitable condition for re-use with some refurbishment and additions (e.g. new pumps), although the existing River Trent water intake would be subject to modification either involving a new gravity or pumped intake system) to address silt issues and to comply with the Eels Regulations including accommodating new 2mm eel screens. As a worst-case scenario, the assessment considers both options to abstract from the River Trent or from Stainforth and Keadby Canal.
- as a worst case, it has been assumed that open-cut methods will be required for installation of any pipework across minor watercourses within the Proposed PCC Site. Where this is required, it is assumed that flow would be temporarily over-pumped, diverted around or flumed through the working area and the watercourse fully reinstated on completion of works, in keeping with standard construction practice and taking into account relevant internal drainage board) (IDB) (which is this case is the Isle of Axholme and North Nottinghamshire Water Level Management Board (IoAaNNWLMB)) byelaws. All other pipework crossings would use trenchless technologies, and at a sufficient depth below the bed to ensure that there is no risk of exposure.

General Assumptions and Limitations

3.9.12 The assessment has been undertaken using available data and Proposed Development design details at the time of writing in April 2021. It is also based on understanding of flow pathways as observed during the site walkover. Assumptions have been made regarding flow pathways for culverted sections of watercourses, based on Ordnance Survey mapping.

3.9.13 For the purposes of the assessment, it is assumed that a similar canal intake structure and layout as currently being constructed for the Keadby 2 Power Station intake will be used for the Proposed Development. As the existing screen installation is designed for 442 litres per second (L/s) and the maximum estimated hybrid cooling water demand for the Proposed Development is approximately 348 L/s , it is expected that the overall dimensions of the new inlet will be no larger than the Keadby 2 Power Station installation. Consultation is ongoing with the Environment Agency and CRT to define the parameters of any abstraction/ discharge, including the volume of water that could be abstracted or discharged per annum, and frequency/ rate.

3.9.14 It is assumed that wastewater from the cooling process will be discharged to the River Trent following treatment at a rate compliant with the discharge limits set by the Environment Agency within the Environmental Permit.

3.9.15 It is assumed that installation works will require use of a cofferdam in close proximity to the intake structure in the River Trent and/ or proposed intake structure location in the Stainforth and Keadby Canal. Water would be pumped out after any necessary fish rescue and at a suitable rate and way as to avoid any significant disturbance or scour of the river or canal bed. It is assumed that no dredging would be required.

3.9.16 Water supply for use on site for all activities with the exception of cooling water and process water (i.e. make-up to the steam/water cycle of the Proposed PCC Site) will be supplied by the relevant undertaker.

3.9.17 For the purposes of this assessment it has been assumed that all foul water from welfare facilities will be directed via the existing foul water sewer for Keadby 2 Power Station to the Severn Trent Water pumping station on Chapel Lane, and from there to the nearest wastewater treatment works (WwTW), and that given the relatively small volumes involved, that they will have adequate capacity to do so within current permit standards. This will be confirmed through ongoing consultation with Severn Trent Water. If the pipeline condition is not suitable for continued use, foul sewerage would instead be treated on site in a package treatment plant with the treated water directed to the River Trent via the water discharge connection.

3.9.18 The assessment assumes that prior to discharge to the River Trent, effluent treatment facilities will be provided on site for treatment of contaminants in the cooling tower blowdown, direct contact cooler (DCC) blowdown,

demineralisation plant and condensate polishing plant regeneration wastewater, Heat Recovery Steam Generator (HRSG) boiler blowdown and reject water (brine) from the desalination process.

3.9.19 Surface water drainage from the Proposed Development will be discharged to Keadby Common Drain subject to agreement from the IDB, potentially in combination with discharge to the Keadby 2 site cooling tower ponds and into the River Trent if the IDB cannot accept the full discharge. SuDS are to be provided in the form of ditches, swales and an attenuation pond as outlined in the conceptual drainage strategy (Section 5) of **Appendix 12A**: Flood Risk Assessment (ES Volume II – **Application Document Ref. 6.3**). It is assumed that bypass oil water separators will be provided for surface water runoff to the attenuation retention pond situated upstream of the main outfall from the Proposed Development Site within the Proposed PCC Site. It is assumed, as indicated in the conceptual drainage strategy, that pollution prevention measures considered will also include, i) oil interceptors; ii) separation of process water from surface water drainage, and iii) use of bunds in areas where spillages are likely to occur. The drainage strategy is subject to further development, in consultation with the Environment Agency and Lead Local Flood Authority (LLFA).

3.9.20 A fire water drainage strategy will be developed to ensure that should an incident occur, contaminated fire water would not enter the surface water drainage system or process water system, but rather be retained on-Site for a period and be disposed of safely.

3.9.21 Any crossings of watercourses to facilitate either construction access (e.g. to temporary laydown areas) or permanent access, including emergency egress for the Proposed Development will seek to minimise the length of bank affected and impacts to these watercourses.

3.9.22 Due to the proposed low volumes associated with the cooling water discharge and the minimal anticipated thermal uplift, a qualitative assessment of potential impacts to the River Trent has been undertaken. This takes into account the previous cooling water assessments undertaken for Keadby 1 Power Station and Keadby 2 Power Station operating simultaneously. As there is not a scenario whereby The Proposed Development and Keadby 1 Power Station and Keadby 2 Power Station would be operational together, (the Proposed Development is being designed to re-use some of Keadby 1 Power Station's infrastructure) the findings from the combined assessment for Keadby 1 Power Station and Keadby 2 Power Station have informed this qualitative assessment. It is expected that the Proposed Installation discharge would achieve the same (or more stringent) discharge conditions as Keadby 1 Power Station. Additional conditions have been assumed for water quality on any discharge from the Proposed Installation and these are set out in the Best Available Techniques (BAT) assessment for cooling technology which will accompany the Application

for an Environmental Permit, to be submitted following the DCO Application (anticipated quarter 2, 2021) for consideration by the Environment Agency.

3.9.23 As a contractor has not yet been appointed, construction method statements are not available at this time, and therefore reasonable assumptions have been made that all works will take place using best practice. Such measures are set out in the Framework CEMP (**Application Document Ref. 7.1**) submitted with the DCO Application.

3.9.24 No water quality monitoring has been undertaken specifically to inform this assessment. Background water quality has been determined from the nearest data available of the Environment Agency's Water Quality Archive website (Environment Agency, 2020a) and other assessments produced to inform the design of the Proposed Development (including preliminary water supply and wastewater discharge feasibility assessments).

3.9.25 If required, a cofferdam at the River Trent abstraction point on the western bank of the Trent is estimated to extend to a maximum of 22m into the watercourse. This is the maximum required area in order to ensure a safe and dry working area.

3.9.26 If the Canal Water Abstraction Option is selected, a smaller cofferdam would be expected in the Stainforth and Keadby Canal (likely extending approximately 10m from the canal bank). Cofferdam installation or removal would be timed to minimise ecological impacts from the structure (e.g. relating to fish migration in the River Trent), as described in **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**).

3.9.27 The expected treatment performance of different SuDS options is based on advice reported in CIRIA C753 - The SuDS Manual (CIRIA, 2015a) using the Simple Index Approach. Professional judgement has been used when deciding the example land use used, and what treatment a particular option may provide, taking into account the design of the SuDS feature and whether it is considered to be 'optimum' or 'sub-optimum' for the Proposed Development.

4.0 Screening Assessment

4.1 Overview

4.1.1 The waterbodies screened into the assessment have been selected based on the following criteria:

- all surface water and groundwater bodies that may potentially be directly or indirectly impacted by the Proposed Development; and
- the relevant waterbodies have been determined using a ZoI approach, which firstly requires the identification of all potential pathways to an effect on all quality elements, and secondly determination of the extent of the effect (i.e. the ZoI).

4.1.2 Reference has been made to **Chapter 4:** The Proposed Development and **Chapter 5**: Construction Programme and Management (ES Volume I - **Application Document Ref. 6.2**). All potential pathways to an effect and ZoI have been identified from this understanding of the Proposed Development. A description of the baseline WFD status for those waterbodies which are screened into the assessment via the ZoI approach is presented in Section 5. In accordance with Article 4.9 of the WFD, potential for effects on protected areas has also been considered with those WFD protected areas within 2km of the proposed works screened in for further consideration.

4.1.3 The proposed works are located within the catchment of the Humber RBMP (DEFRA, 2016). The first RBMP were published in 2009, and the first cycle of planning then took place between 2009 and 2015 when the second RBMP were published. The second cycle of planning is currently underway (2015 - 2021). The Humber RBMP published as part of the 2015 RBMP cycle has been considered in the summary baseline classification information which is presented in **Annex A** within this Appendix.

4.2 Relevant WFD waterbodies

4.2.1 Table 5 provides a summary of the baseline status/ potential of the various WFD waterbodies that have been identified within 1km of the Proposed Development boundary. Full WFD status classifications under Cycle 2 (2019) are shown in **Annex A** within this Appendix. Full baseline conditions for the study site are outline in **Annex B – Annex E**.

4.2.2 Table 6 summarises other waterbodies that have been identified within a 1km study area surrounding the Proposed Development and indicates how they are related to the WFD waterbodies outlined in Table 5.

Table 5: WFD surface waterbodies in the study area

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Humber Upper (GB530402609203)	Moderate Ecological Potential	Fail	Moderate (2015)	Heavily Modified	This section of the River Trent is designated from Owston Ferry to the south (approximately 13km upstream of Keadby) to its confluence with the River Ouse approximately 14.5km downstream of Keadby.
Site Observations: The Humber Upper waterbody (River Trent) was observed during the site visit from the western bank adjacent to Keadby Power Station, where it flows from the south to the north. Embankments line the river here for flood protection. At this point the waterbody is tidal and has a width of approximately 140m. The river is used for navigation with a wharf at Keadby and the nearest jetty approximately 600m upstream on the east bank near Gunners Wharf. Further details regarding hydrodynamics, tides and sediments are provided later in the baseline. Adjacent to Keadby village there are two existing discharge points into the River Trent from Keadby power station (SE 83536 11647 and SE 83655 12226), with trash screens and bollards to prevent collision from passing boats. The tide was low enough during the site visit to expose intertidal muddy sediments at the channel. **Protected Areas related to WFD Waterbody**: The river adjacent to Keadby is situated in the Humber Estuary SSSI, Humber Estuary SAC and Humber Estuary Ramsar Site. Nitrates Directive areas S653, S298, S281, S352. Habitats and Species Directive UK0030170 (SAC), Conservation of Wild Birds Directive area UK9006111 (SPA) and Urban Wastewater Treatment Directive area UKENRI130.					
Paupers Drain Catchment (trib of River Trent) (GB1040	Moderate Ecological Potential	Fail	Moderate (2015)	Artificial	Unusually, this waterbody consists of two separate designated watercourses, Warping Drain and Paupers Drain which both flow west to east between

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
28064300)					Crowle and the River Trent, totalling approximately 13km length and draining an area of around 32.04km^2.
Site Observations: Warping drain was observed from the B1392 at SE 83592 12125 where it crosses beneath the road. The watercourse is single thread and approximately 7m wide here and perfectly straight. There was no flow observed due to the tidal lock upstream of the River Trent. The watercourse was extremely turbid and so depth could not be ascertained. There was an algal bloom upstream of the tidal lock indicative of nutrient enrichment. The channel is incised with banks rising relatively steeply away from the channel bed. The banks and riparian zone was densely vegetated as would be expected in summer and provides something of a buffer strip to the arable fields beyond. **Protected Areas related to WFD Waterbody**: The drain is a designated Local Wildlife Site (LWS) as it supports a population of whorled water-milfoil (*Myriophyllum verticillatum*). The site is also designated for its wet reed beds with a large population of common reed (*Phragmites australis*). Nitrates Directive areas S653, S281, S349, S352 and S350. Habitats and Species Directive area UK0030170 (SAC).					
North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350)	Moderate Ecological Potential	Fail	Moderate (2015)	Artificial	This artificial drain is designated between Thorne and Keadby, where it meets Torne/Three Rivers shortly upstream of the River Trent. It is 26.4km in length and drains a catchment area of 55.641km^2
Site Observations: North and South Soak Drains were observed during the site visit at SE 82505 11545 and SE 82487 11450, respectively. Both were approximately 8 m wide and are straight, artificial drainage channels with steep banks, and are located either side of the Stainforth and Keadby Canal. Both were extremely turbid with phytoplankton such that depth could not be ascertained although is expected to a be several metres. There were clumps of algae on the surface and appear nutrient enriched. Fine sediment accumulations were apparent					

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
at channel margins in some locations. South Soak Drain is located approximately 3m lower in elevation than the adjacent canal, and the drain supports rich aquatic, emergent and marginal flora. **Protected Areas related to WFD Waterbody**: The site is a designated LWS for its swamp habitat which is dominated by common reed. Nitrates Directive area S351, S298, S281, S349, S342; Habitats and Species Directive area UK0012915 Thorne Moor.					
Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330)	Poor Ecological Potential	Fail	Good (2027)	Artificial	The designated reach consists of two branches, one rising at Old Cantley and the other near Tunnel Pits Farm. The two arms meet near the A18 at Bolton Grange and flow east to meet the Torne/Three Rivers at Pilfrey Bridge. The designated watercourse is 36.4km in length and drains a catchment of 120.2km^2.
Site Observations: This watercourse was not visited as part of the Water Environment walkover. **Protected Areas related to WFD Waterbody**: The watercourse is a designated LWS for a rich aquatic, emergent and marginal flora with a surrounding mosaic of neutral grassland and common reed swamp. Nitrate Directive areas S351, S298 and S352. Habitats and Species Directive UK0030166 (SAC).					
Torne/Three Rivers from Mother Drain to Trent (GB104028064340)	Moderate Ecological Potential	Fail	Good (2027)	Artificial	This watercourse includes the River Torne, South Engine Drain and Folly Drain. In total, it is designated from the north-east of Rossington and flows generally north-west to meet the River Trent at Keadby. In places the

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					drains move apart and flow parallel to each other. Their combined total length is 50.6km, and they drain a catchment of 85.3km^2.
Site Observations: Torne/Three Rivers from Mother Drain to Trent was not visited during the Water Environment walkover. **Protected Areas related to WFD Waterbody**: Three Rivers is a LWS designated for its three parallel canalised watercourses which support a rich aquatic, emergent and marginal flora. Similarly, the River Torne LWS is designated for supporting a rich aquatic, emergent and marginal flora. It is also designated for its surrounding neutral grassland, purple moor grass and rush pasture and marsh. Nitrates Directive areas S335, S653, S351, S352, S337. Urban Wastewater Treatment Directive area UKENRI99 and Habitats and Species Directive area UK30030166 (SAC).					
Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB704102810281)	Moderate Ecological Potential	Fail	Good (2015)	Artificial	The designated reach is 43.8km in length, extending from an offtake from the River Don in the centre of Doncaster to the south-west, to the River Trent immediately south-east of the Keadby 1 power station.
Site Observations: This watercourse was visited between the road crossing at SE 82494 11484 and the lock gates between the canal and River Trent at SE 83444 11423. The canal by its nature is artificial and so very straight. At this point it is a wide waterbody at approximately 30m width. There are four sets of lock gates separating the canal from the River Trent, managed by the Canal and River Trust. The canal appeared to be around 1.5m deep with the water being very clear at the time of the site visit. There was an abundance of submerged, floating and emergent macrophytes, and numerous fish were seen in the channel. The canal is used for navigation and water sports, and the towpath is popular for recreation.					

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
There is an existing abstraction point from the canal for Keadby 1 at SE 82997 11468, and a new abstraction point for Keadby 2 was being constructed behind a coffer dam during the site visit at SE 82769 11499. **Protected Areas related to WFD Waterbody**: The Stainforth and Keadby Corridor LWS is designated for a rich aquatic flora throughout its length. The canal is also designated for its mosaic of associated bankside habitats. Nitrates Directive Area S653.					
Lower Trent Erewash - Secondary Combined WFD Groundwater Body (GB40402G990300)	Good Quantitative Status	Good Chemical Status	Good (2027)	Not applicable	In relation to the Proposed Development, this waterbody spans the study area to the north of Keadby Common. The overall waterbody is large (1,924km^2) and extends from Ashby-de-la-Zouch to the south to the Humber Estuary to the north.
Protected Areas related to WFD Waterbody: Nitrate Directive areas Lincolnshire Limestone (G69), Nottinghamshire (G40), Burton (G34); Lower Trent Erewash – Secondary Combined Drinking Water Protected Area (UKGB40402G990300).					
Idle Torne - Secondary Mudrocks WFD Groundwater Body (GB40402G992200)	Good Quantitative Status	Good Chemical Status	Good (2015)	Not applicable	In relation to the Proposed Development, this waterbody spans the study area to the south of Keadby Common. The overall waterbody is large (320km^2) and extends from Bilsthorpe to the south to the Swinefleet to the north.
Protected Areas related to WFD Waterbody: Nitrates Directive area Nottinghamshire (G40); Idle Torn – Secondary Mudrocks Drinking Water Protected Area (UKGB40402G992200)					

Table 6: Other named watercourses in the study area that are not defined WFD waterbodies

Waterbody	Tributary of	Watercourse Description	Site Observations
Sewer Drain	River Trent	This drain flows as two connected parallel channels which are also parallel to the Warping Drain, approximately 30m and 330m to the north of Warping Drain between Keadby windfarm and the River Trent. Further upstream of the windfarm it is known as Old Sewer. Its approximate combined length is 3.5km.	This watercourse was not visited during the site visit as it is upstream of the Proposed Development and will not be impacted.
Keadby Boundary Drain/ Drain D3 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**).	Warping Drain	This drain is orientated north-south between North Pilfrey Farm to the south (adjacent to Stainforth and Keadby Canal) and north to Warping Drain. Its approximate length is 1.4km.	Field drain approximately 1m wide with spring water depth approximately 20cm deep. The channel was dominated by silt. Banks support semi-improved grassland and dense scrub. Common reed was the dominant plant species within the channel. Connected to the rest of the drains associated with Keadby Common.
South Moors Drain	Warping Drain	This drain is orientated north-south between the Stainforth and Keadby Canal between Ealand Warpings and North Pilfrey Farm to the south, extending north to Bonnyhale Moor Road. It is approximately 1.1km in length.	This watercourse was not visited during the site visit as it is upstream of the Proposed Development and will not be impacted.

Waterbody	Tributary of	Watercourse Description	Site Observations
North and South Cross Moors Road Drain	Warping Drain	This drain is orientated north-south between the Stainforth and Keadby Canal between Ealand Warpings to the south, extending north to Bonnyhale Moor Road. It is approximately 1.2km in length.	This watercourse was not visited during the site visit as it is upstream of the Proposed Development and will not be impacted.
Keadby Common Drain	Unnamed drainage ditch upstream of River Trent	This drain is orientated east-west between the residential properties to the north of Chapel Lane and Glew Drain. It is approximately 565m in length	The drain has been over-deepened, has steep banks, with bare earth in places. Elsewhere the banks are vegetated by rough grasses. The water is less than 0.5m deep, and channel width is less than 2m. The channel supports a limited diversity of aquatic and wetland plants typical of small drains. There is no shading from trees. The drain and its banks have clearly been affected by regular vegetation clearance works.

Waterbody	Tributary of	Watercourse Description	Site Observations
Kelsey Drain	Keadby Common Drain	This watercourse is orientated north-south between Chapel Lane and Trent Road, adjacent to the site entrance to Keadby 1 Power Station. It is approximately 180m in length.	Over-deepened watercourse with steep banks, which are bare earth in places. Artificially straight watercourse of approximately 2m width. There are deciduous trees around the southern extent of the watercourse which provide a degree of shading.
Pumping Drain	Unnamed drainage ditch upstream of River Trent	This watercourse is orientated north-south between Warping Drain and Chapel Lane, immediately north of Kelsey Drain. It is approximately 200m long.	Over-deepened watercourse with steep banks, which are bare earth in places. Artificially straight watercourse of approximately 2m width. The riparian zone to the west has several deciduous trees which provide a degree of shading.
Glew Drain / D1 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain flows along the northern boundary of Keadby Common between Keadby Boundary Drain and Keadby 1 Power Station. It has a ninety degree change in course to the north-east of the substation and flows north to Warping Drain. It is approximately 1.7km in length.	Field drain which is designated as a LWS. The drain is over-deepened and is subject to periodic dredging. The channel width is approximately 2m. Water depth is variable, but the average is around 50cm. The substrate within the drain is equal part clay to silt. Supports a moderately diverse flora.

Waterbody	Tributary of	Watercourse Description	Site Observations
Drain D2 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain runs along the southern boundary to Keadby Common adjacent to the laydown area for Keadby 2 Power Station. It is approximately 900m in length.	Field drain approximately 2m wide and 50cm deep at time of spring survey for the PEA. The channel was dominated by silt and the water surface was dominated by algae. Banks support semi-improved grassland and dense scrub. Common reed was dominant in the channel by July, except where overhung by scrub. Connected to other drains associated with Keadby Common.
Drain D4 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain runs through the centre of Keadby Common and is approximately 380m long.	Field drain with water approximately 10cm deep and approximately 1m wide. The channel was dominated by silt. Banks support improved grassland. Common reed, reed canary-grass and reed sweet-grass are all abundant. Connected to the rest of the drains associated with Keadby Common.

Waterbody	Tributary of	Watercourse Description	Site Observations
Drain D5 as **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	This drain runs along the eastern boundary to Keadby Common adjacent to the existing 400kV National Grid substation.	Field drain with water depth in spring of approximately 10cm. Channel 1m wide. The channel was dominated by silt. Banks support improved grassland. Reed canary-grass dominates the channel Connected to the rest of the drains associated with Keadby Common.
Drain D6 as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	River Trent	This drain runs along the eastern side of the field south of Trent Road. It is therefore within the Proposed Development Site but distant from the land required for construction of the Proposed Development.	Field drain with water depth approximately 50cm and 2m wide. Banks supported rank semi improved grassland and a hedgerow. Common reed present.
Drain D7a, b, c, as described in **Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)	Unnamed drainage ditch upstream of River Trent	Three arable field drains which are culverted under the existing access road.	Incised, straight watercourses of approximately 1m width.
Drain parallel to access road from the A18	Unnamed drainage ditch between Hatfield Waste Drain and South Soak Drain	This drain flows from immediately west of Mabey Bridge in a northerly direction to South Soak Drain alongside the existing access road for Keadby 2 Power Station.	Incised, straight watercourse of approximately 2m width. Beyond the road it is surrounding by arable fields on both sides, with a few trees in the riparian margin towards its northern extent.

4.3 Zone of Influence

4.3.1 WFD waterbodies have been screened into this assessment using a ZoI approach and on the basis of whether they are:

- a designated WFD water body within the ZoI; and
- a designated WFD water body indirectly affected by the ZoI.

4.3.2 Table 7 sets out the pathways to an effect, the extent of the ZoI and the waterbodies that are directly within the ZoI.

Table 7: ZOI and relevant WFD waterbodies

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
Construction works within, along the banks and across watercourses can be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the past industrial activities adjacent to the Proposed Development Site (i.e. Keadby 1 and Keadby 2). Works within watercourses would include any installation of pipe/ service crossings which may use open-cut techniques for the smaller drains (of 1-2m width).	All watercourses within and immediately adjacent to the Proposed Development Site or boundary could be impacted by runoff containing fine sediment during construction. These are all tributaries of the River Trent (including the Stainforth and Keadby Canal which is connected to the Trent via a series of locks). Given dilution and dispersal potential in the tidal River Trent, a ZoI up to 1km downstream of the Proposed Development in the River Trent (Humber Upper WFD waterbody) is appropriate.	Humber Upper WFD waterbody – i.e. River Trent Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody Paupers Drain Catchment (trib of Trent) WFD waterbody – this includes Warping Drain North Soak Drain Catchment (trib of Torne/Three Rivers) WFD waterbody Torne/Three Rivers from Mother Drain to Trent WFD waterbody Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) WFD waterbody A number of unnamed drainage ditches.	The Humber Upper WFD waterbody is adjacent to the Humber Middle WFD waterbody but is too far downstream to be of relevance. All other watercourses drain to the Humber Upper WFD waterbody.
The construction of a cofferdam in the River Trent **or** Stainforth and Keadby Canal for works to the abstraction point would	The ZoI for mobilised sediments in the River Trent is not expected to be greater than 1km downstream or upstream of the cofferdam location as a worst-	Humber Upper WFD waterbody – i.e. River Trent Sheffield and South Yorkshire Navigation (New Junction and	The Humber Upper WFD waterbody is adjacent to the Humber Middle WFD waterbody but is too far

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
cause some mobilisation of fine sediments during its installation and removal, and this may mobilise some fine sediment into the water column.	case, given the dynamic nature of this transitional water. The Stainforth and Keadby Canal is less dynamic, and so any mobilised sediment is likely to settle in closer proximity to the source. A 500m ZoI is considered appropriate as a reasonable worst case.	Stainforth and Keadby) WFD waterbody	downstream to be of relevance. Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody is connected to the Humber Upper WFD waterbody.
During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and / or used on Site. Leaks and spillages of these substances could pollute the nearby surface watercourses or groundwater if their use or removal is not carefully controlled and spillages enter existing flow pathways or waterbodies directly.	All watercourses or groundwater within or immediately adjacent to the Proposed Development Site or boundary could be impacted by accidental spillages during construction. These are all tributaries of the River Trent (including the Stainforth and Keadby Canal which is connected to the Trent via a series of locks). Given dilution and dispersal potential in the tidal River Trent, a ZoI up to 1 km downstream of the Proposed Development in the River Trent is appropriate.	Humber Upper WFD waterbody – i.e. River Trent Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody Paupers Drain Catchment (trib of Trent) WFD waterbody – this includes Warping Drain North Soak Drain Catchment (trib of Torne/Three Rivers) WFD waterbody Torne/Three Rivers from Mother Drain to Trent WFD waterbody	The Humber Upper WFD waterbody is adjacent to the Humber Middle WFD waterbody but is too far downstream to be of relevance. All other watercourses drain to the Humber Upper WFD waterbody

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
		Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) WFD waterbody A number of unnamed drainage ditches. Lower Trent Erewash - Secondary Combined WFD Groundwater Body Idle Torne - Secondary Mudrocks WFD Groundwater Body	
Excavations, cuttings or piling required during construction of the Proposed Development have the potential to intercept groundwater and may create a pathway for pollutants to be transferred to groundwater if not mitigated.	Groundwater bodies directly beneath the Proposed Development Site.	Lower Trent Erewash - Secondary Combined WFD Groundwater Body Idle Torne - Secondary Mudrocks WFD Groundwater Body	Idle Torne - Secondary Mudrocks WFD Groundwater Body Lower Trent Erewash - Secondary Combined WFD Groundwater Body
Physical modification of watercourse bed due to temporary use of a cofferdam in the River Trent **or** Stainforth and	The immediate footprint and environs (within which any scour affects would be expected to occur) of the cofferdam in the	Humber Upper WFD waterbody – i.e. River Trent Sheffield and South Yorkshire Navigation (New Junction and	Not applicable, this pathway relates to morphology of the Humber Upper bed only.

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
Keadby Canal for works to the abstraction point (including scour, deposition and habitat loss),	River Trent or Stainforth and Keadby Canal.	Stainforth and Keadby) WFD waterbody	
There could be morphological impacts to a limited number of drains which may require new crossings relating to connection corridors and access routes. Non-intrusive crossing methodologies will be used wherever reasonably practicable, but it is assumed that open-cut methods will be required in some instances for small watercourses (1-2m width).	The immediate footprint of pipe / service crossing, plus 20m upstream and downstream, based on professional judgement.	Unnamed drainage ditches (tributaries of the Humber Upper WFD waterbody, North Soak Drain Catchment (trib of Torne/Three Rivers) WFD waterbody and Paupers Drain Catchment (trib of Trent) WFD waterbody.	Not applicable, this pathway relates to morphology of the directly impacted watercourse only.
Surface water runoff from the Proposed Development Site could contain various diffuse pollutants given the	All surface water runoff is to be discharged to the River Trent or Keadby Common Drain, via attenuation for flows and water quality. The ZoI for the River Trent	Humber Upper WFD waterbody – i.e. River Trent	The Humber Upper WFD waterbody is adjacent to the Humber Middle WFD waterbody but is too far

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
industrial nature of the site. A drainage strategy will be in place to manage the rate and quality of the runoff (including the use of SuDS) prior to discharge to the River Trent or Keadby Common Drain.	is not expected to be greater than 1km downstream or upstream of the outfall location as a reasonable worst case, given the dynamic nature of this transitional water.	Keadby Common Drain (tributary of the Humber Upper WFD waterbody)	downstream to be of relevance.
Process water from the Proposed Development is to be discharged to the River Trent and will include water from: • neutralised effluent streams from the demineralisation plant; • blowdown from the Proposed PCC Site (CCP and CCGT); • treated effluent from the CCP; • uncontaminated surface water; • surface water incident on process areas, that	All treated process water runoff is to be discharged to the River Trent. The ZoI in the River Trent is not expected to be greater than 1km downstream of the outfall location as a worst case, given the dynamic nature of this transitional water.	Humber Upper WFD waterbody – i.e. River Trent	The Humber Upper WFD waterbody is adjacent to the Humber Middle WFD waterbody but is too far downstream to be of relevance.

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
may be contaminated with oils or amines; • river water treatment wastewater, including brine where relevant (the River Water Abstraction option is selected); or • canal water wastewater. Effluent derived from the above processes would be treated following Best Available Techniques (BAT) and regulated by the Environment Agency under an Environmental Permit, with discharge to a retention pond upstream of the River Trent outfall. There is potential for the thermal discharge to impact fish migration, as well as for chemical pollution should any contaminants not be suitably treated.			

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
Sections of Drain D4 on the Proposed Development Site expected to be lost beneath the footprint of the power station.	The ZoI will be the extent of the drains that are directly lost beneath the Proposed Development.	Drain D4 (tributary of the Humber Upper WFD waterbody).	Not applicable, this pathway relates to morphology of the impacted watercourse only.
Abstraction of water will be required for process operations. This is expected be from the River Trent or Stainforth and Keadby Canal depending on the outcome of consultation with the Environment Agency and Canal and River Trust with regard to environmental permitting and resource availability.	As ZoI is the waterbody scale.	Humber Upper WFD waterbody – i.e. River Trent Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody	The Humber Upper WFD waterbody is adjacent to the Humber Middle WFD waterbody. Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody is connected to the Humber Upper WFD waterbody.
Foul drainage from permanent welfare facilities would be directed to the local sewerage system , subject to the agreement with the local sewerage undertaker. The	Given that any treated effluent from a wastewater treatment works would be subject to an Environmental Permit, the ZoI should be small. A reasonable worst-case scenario would be 1km downstream from	Unknown at this stage, as it will depend on the Severn Trent Water treatment works that is utilised (subject to consultation). Alternatively, if foul water is treated on site it	Unknown at this stage, as it will depend on the Severn Trent Water treatment works that is utilised (subject to consultation). Alternatively, if

Potential pathway	ZoI and basis for determination	Relevant waterbodies	Adjacent waterbodies
existing foul sewer connection within the Keadby Site would be utilised if it is found to be fit for purpose for life of development. If this is not the case, a package treatment plant will be used which will discharge into the cooling water outfall.	the outfall in the receiving waterbody.	would be discharged to the River Trent.	discharged to the River Trent, the adjacent Humber Middle WFD waterbody is too far downstream to be of relevance.

4.4 Screening Outcome

4.4.1 The following waterbodies have been identified within the study area and are screened in on the basis of Table 7 for further consideration at Stage 2 (scoping – for transitional and coastal waterbodies only) and Stage 3 (assessment – all waterbodies):

- Humber Upper (GB530402609203);
- Paupers Drain Catchment (trib of Trent) (GB104028064300);
- North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350);
- Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330);
- Torne/Three Rivers from Mother Drain to Trent (GB104028064340);
- Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281);
- Lower Trent Erewash - Secondary Combined WFD Groundwater Body (GB40402G990300); and
- Idle Torne - Secondary Mudrocks WFD Groundwater Body (GB40402G992200).

4.4.2 In accordance with Environment Agency Clearing the Water guidance (Environment Agency, 2017), a scoping assessment is not required if the proposed activity meets any one of several criteria that indicate the activity is low risk (refer to Section 3.7). The Proposed Development does not meet any of the criteria assessed in Section 3.7, therefore a scoping assessment is required.

4.4.3 The Proposed Development can also be screened against the list of Flood Risk Activity exemptions detailed in Section 3.8. The following exemptions are relevant:

- *Temporary cofferdam(s) (if eel/ fish passage not impeded)* – while this may be exempt in the fluvial environment, given the sensitivity of the Trent Estuary, it is considered that it should not be screened out and is assessed further in the scoping and assessment stages;
- *Service crossing below the riverbed, installed by directional drilling or micro tunnelling if more than 1.5 m below the natural bed line of the river* – this may be relevant to the minor crossings of the Glew Drain for the 132kV connection to the Northern Powergrid Substation option, if required. As an exempt activity this is not assessed further;
- *Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road* – this may

be relevant to the minor crossings of the Glew Drain for the 132kV connection to the Northern Powergrid Substation option, if required and so it is considered appropriate that this exemption is applied where relevant. L*ow maintenance activities (e.g. replacing elements of structures but not entire structures)* – this may be relevant to the hand-based repair to the existing; and

- *Low maintenance activities (e.g. replacing elements of structures but not entire structures)* – this may be relevant to the hand-based repair to the existing Keadby Power Station water discharge outfall to the Trent. However, as this is in the estuarine environment and the extent of the works is not yet clear, this is considered by the assessment as a precautionary approach.

5.0 SCOPING ASSESSMENT

5.1 Overview

5.1.1 A scoping assessment is required to determine whether any coastal and estuarine receptors may be impacted by the Proposed Development, and therefore need to be assessed in the WFD impact assessment (Stage 3). These receptors are defined in accordance with the Environment Agency Clearing the Waters Guidance (Environment Agency, 2017) and are based on the waterbody's quality elements; the receptors include:

- hydromorphology;
- water quality;
- biology – habitats;
- biology – fish;
- protected areas; and
- the scoping assessment also considers Invasive Non-Native Species (INNS).

5.1.2 As the scoping assessment outlined in the Clearing the Waters Guidance is designed for coastal and estuarine waterbodies it is applied here to the Humber Upper waterbody only. The fluvial and groundwater bodies have all been taken forward for further assessment on the basis of the screening assessment presented in Section 4.

5.2 Humber Upper WFD Waterbody

5.2.1 Small areas of the Proposed Development adjacent to the River Trent fall partially within the Humber Upper WFD waterbody, including some works directly within the estuary (i.e. at the existing water discharge outfall location and at the water abstraction intake should the River Water Abstraction Option be selected).

5.2.2 The Humber Upper waterbody is a HMWB that is currently at Moderate Ecological Potential. The Humber RBMP indicates that the priority river basin management issues to tackle in the Humber Estuary catchment are:

- coastal squeeze and intertidal habitat loss;
- tributyltin contamination in the inner estuary; and
- dissolved oxygen sag in the inner estuary during summer months.

5.2.3 The waterbody has an objective of Moderate Ecological Potential by 2015 (see **Annex A**). The Catchment Data Explorer website (Environment Agency, 2020b) indicates that the target is not higher due to an unfavourable balance of costs

and benefits, disproportionate burdens and the cause of adverse impact being unknown.

Hydromorphology

5.2.4 Hydromorphology refers to the physical characteristics of waterbodies. Hydromorphological quality elements include the size, shape and structure of the waterbody, and the flow and quantity of water and sediment. Impacts on hydromorphology include changes to morphological conditions (for example variation in the structure of the seabed and intertidal zone) and tidal patterns (for example dominant currents, freshwater flow and wave exposure). Hydromorphology is only a WFD quality element for high status waterbodies (see Table 1), but significantly influences other elements, particularly biological ones, and thus is an important part of the assessment.

5.2.5 The Proposed Development has the potential to affect hydromorphological quality elements in the Humber Upper waterbody through the potential refurbishment works to the existing abstraction intake during construction, should the River Water Abstraction Option be selected. A cofferdam would be required that would protrude 22m from the existing structure into the channel, with a worst-case footprint of 0.13ha.

5.2.6 These activities may temporarily impact the sediment dynamics of the estuary through release of excess fine sediment and have a localised impact on the morphology of the riverbed due to installation and removal of the cofferdam. The cofferdam could alter local flow properties to result in local bed or erosion and scour.

5.2.7 Works associated with any required refurbishment of the existing discharge outfall would be limited to hand-based maintenance using boats, and so would not have a hydromorphological impact.

5.2.8 The scoping assessment of the potential effects to hydromorphology is provided in Table 8, below.

Table 8: Scoping assessment of risks to hydromorphology

Risk	Requires Impact Assessment	Impact Assessment Not Required	Hydromorphology risk issue(s)
Could impact on the hydromorphology (e.g. morphology or tidal patterns) of a water body at high status		✓	N/A – waterbody is at Moderate Status overall, and 'Supports Good' for hydromorphology
Could significantly impact the hydromorphology (i.e. bed morphology and substrate) of any waterbody	✓		Proposed activities could adversely impact the morphology of the estuary bed and local sediment dynamics during potential refurbishment works to abstraction intake, including use of a cofferdam. Once complete no long term impacts are predicted.
Activity is in a water body that is heavily modified for the same use as your activity		✓	N/A

Water Quality – Physico-chemical Quality Elements

5.2.9 Impacts to ecological water quality relates to effects on any of the following: Water clarity, temperature, salinity, oxygen levels, nutrients, microbial patterns for longer than a spring neap tidal cycle (approximately 14 days). In addition to the above, if the water body has a history of harmful algae or a phytoplankton status of Moderate, Poor or Bad, this will need to be considered.

5.2.10 The potential refurbishment of the existing Keady 1 abstraction intake, if required for the Proposed Development could impact water quality temporarily through mobilisation of fine sediments into the water column. There is also potential for chemical spillages and runoff containing contaminants related to works on or close to the estuary during construction (e.g. installation and

removal of a cofferdam) and its upstream tributaries, several of which intersect the Proposed Development site.

5.2.11 During operation, changes in water quality could occur from operational discharges of treated process wastewater and water from the cooling system although these would be controlled under an Environmental Permit. Similarly, if not mitigated there could be impacts on the Humber Upper waterbody's chemical status from diffuse urban pollutants in surface water runoff, or as a result of accidental chemical spillages, which may be discharged via the outfall to the estuary (although the preferred option is currently to discharge to an IDB drain subject to consent).

5.2.12 Operational foul drainage from the Proposed Development Site may also be discharged to the waterbody via treatment at the existing Severn Trent Water treatment works on Chapel Lane and if so, would be controlled under Severn Trent Water's existing Environmental Permit conditions. If this is not practicable, foul drainage would instead be treated on site in a package treatment plant with the treated water directed to the River Trent via the water discharge connection, which could impact physico-chemical quality elements.

5.2.13 Phytoplankton Status is High for the Humber Upper waterbody. Biological survey data and WFD investigation reports were requested from the Environment Agency for the waterbody, and none related to phytoplankton was returned and so it is assumed that there is no monitoring of harmful algae, indicating that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment, summarised in Table 9, below.

Table 9: Scoping assessment of risks to physico-chemical quality elements

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	✓		Impacts from mobilisation of sediments, surface water runoff containing contaminants (including to tributaries of the water body) or as a result of accidental spillages.
Is in a waterbody with a phytoplankton status of moderate, poor or bad		✓	Phytoplankton is at High Status
Is in a waterbody with a history of harmful algae		✓	There is no known monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment.

Water Quality – Chemical Status

5.2.14 As for physico-chemical status, the potential refurbishment of the abstraction intake structure and associated use of a cofferdam could impact chemical status temporarily during construction through mobilisation of fine sediments containing contaminants into the water column. Similarly, there is also potential for chemical spillages and runoff containing contaminants from the use of a cofferdam and from upstream tributaries, which discharge to the waterbody and also intersect the Proposed Development Site. As noted above, operational process water and foul water is likely to be discharged to the estuary following treatment, and surface water runoff may also be discharged to the waterbody if the preferred rate of discharge to the IDB watercourse cannot be accommodated.

5.2.15 The scoping assessment for chemical status is summarised in Table 10, below.

Table 10: Scoping assessment of risks to Chemical Status

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		Potential for a range of chemicals to be discharged to Humber Upper waterbody from diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages
It disturbs sediment with contaminants above CEFAS Action Level 1	✓		Potential for sediment at the abstraction location to contain contaminants above CEFAS Action Level 1

Biology - Habitats

5.2.16 A number of habitats have been highlighted in the Environment Agency Clearing the Waters guidance (Environment Agency, 2017) as being of higher and lower sensitivity based on their resistance to, and recovery rate, from human pressures. Table 11 below outlines the higher and lower sensitivity habitats associated with the Humber Upper water body (based on the Environment Agency WFD waterbody summary table). These have the potential to be impacted during construction by physical disturbance associated with works associated with the cofferdam, should the River Water Abstraction Option be required, or water quality (e.g. by a sediment plume relating to abstraction intake

structure refurbishment, cofferdam installation and removal). Furthermore, changes in water quality could occur during operation through discharges from the outfall causing thermal plumes or chemical changes in water quality and deposition of air pollutants.

Table 11: Higher and Lower Sensitivity Habitats found in the Humber Upper waterbody

Higher Sensitivity Habitats	Area (ha)	Lower Sensitivity Habitats	Area (ha)
Saltmarsh	309.12	Intertidal soft sediment	232.38
		Subtidal soft sediment	231.42

5.2.17 Habitats should be included as part of the WFD impact assessment if the footprint of the activity is any of the following (Environment Agency, 2017), noting that this also includes the footprint of thermal or sediment plumes:

- 0.5 km^2 or larger in area within the estuarine or coastal water body;
- 1% or more of the waterbody's area; and
- Within 500 m of any higher sensitivity habitat or covering 1% or more of any lower sensitivity habitat area.

5.2.18 Magic Map (DEFRA) has been used to confirm the proximity of the noted sensitive habitats to the proposed works. The DCO Order Limits directly cross Higher Sensitivity Habitat (saltmarsh).

5.2.19 In accordance with the Environment Agency guidance and as shown in Table 12, the habitats outlined in Table 11 have been scoped into the WFD impact assessment on account of a potential sediment plume being produced by the installation/ removal of any cofferdam, as a worst-case scenario, and due to being within 500m of higher sensitivity habitat.

Table 12: Scoping assessment of risks to biological habitat

Footprint is:	Requires Impact Assessment	Impact Assessment Not Required	Biological habitat risk issue(s)
0.5 km^2 or larger	✓		Potential for a temporary sediment plume to be formed during installation or

Footprint is:	Requires Impact Assessment	Impact Assessment Not Required	Biological habitat risk issue(s)
			removal of the cofferdam. While this is unlikely to exceed 0.5 km2, this is scoped in as a worst-case scenario
1% or more of the water body's area		✓	Footprint of activity is not expected to be this large, with no new footprint on the estuary bed aside from the temporary cofferdam (0.13 ha surface area), which is <0.1% of the waterbody area. However, the sediment plume could cover a greater area.
Within 500 m of any higher sensitivity habitat	✓		Less than 500 m to nearest higher sensitivity habitat.
1% or more of any lower sensitivity habitat		✓	Footprint of activity (i.e. the cofferdam) would be less than 1% of any lower sensitivity habitat, although there is potential for a sediment plume to spread further into the estuary.

Fish

5.2.20 The Humber Upper waterbody is known to support several nationally and internationally protected migratory fish species (e.g. Atlantic salmon, European eel, river lamprey and sea lamprey). River lamprey and sea lamprey are protected species under Annex II of the Habitats Directive. Accordingly, the populations of these species are of international value. The River Trent at Keadby is of key functional importance for these two lamprey species as it is the route by which they access and leave the wider River Trent catchment.

5.2.21 The potential physical disturbance of the bed associated with works to install a cofferdam for the River Water Abstraction option, if selected, could affect fish within the waterbody. This could include impacts relating to habitat loss, water quality deterioration, changes in visual stimuli and underwater noise. Similarly, release of pollutants from runoff or spillages during construction could affect fish population health in the short term or longer term (spillages and routine discharges from the Proposed Development). The scoping assessment of risk to fish is provided in Table 13, below.

Table 13: Scoping assessment of risks to biological fish

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	✓		Proposed construction works could cause a chemical change in the waterbody through disturbance of fine sediment (e.g. during cofferdam installation and removal) that may be contaminated, generation of underwater noise, change in visual stimuli (such as artificial light), or from pollutants in operational surface water

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
			runoff or process and foul water discharge.
Could impact on normal fish behaviour like movement, migration, or spawning (e.g. creating a physical barrier, noise, chemical change or change in depth or flow)	✓		Proposed construction works could cause: a chemical change in the waterbody through disturbance of fine sediment that may be contaminated, generation of underwater noise, changes in visual stimuli (such as artificial light), release of a thermal discharge plume or pollutants in surface water runoff or discharge of process water effluent to the water body.
Could cause entrainment or impingement of fish	✓		This could occur during use of a cofferdam for refurbishment of the intake structure.

WFD Protected Areas

5.2.22 The location of the Proposed Development in relation to the following WFD Protected Areas has been considered:

- SAC;
- SPA;
- shellfish waters;
- bathing waters; and
- nutrient sensitive areas.

5.2.23 The outcome of the scoping assessment for WFD protected areas is shown in Table 14, below.

Table 14: Scoping assessment of WFD Protected Areas

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Activity is within 2 km of any WFD protected area	✓		Activity is within 2 km of WFD protected areas – i.e. it overlaps with Humber Estuary SAC and Ramsar.

Invasive Non-Native Species (INNS)

5.2.24 INNS harm the environment. They can be small and hard to spot so are easily spread on damp equipment and clothing. If the Proposed Development risks introducing or spreading INNS, this should be included in the WFD impact assessment. The risks of introducing or spreading INNS includes marine vessels, marine plant, construction materials or equipment being used that have come from, have been used in or have travelled through other waterbodies and activities that help spread existing INNS either within the immediate water body or to other waterbodies.

5.2.25 The scoping assessment of risks from INNS is summarised in Table 15, below.

Table 15: Scoping assessment of risks from INNS

Risk	**Requires Impact Assessment**	**Impact Assessment Not Required**	**INNS** issue(s)
Activity may introduce or spread INNS to a water body	✓		Marine plant, cofferdam and vessels may be required for refurbishment of the abstraction intake and to a lesser extent the discharge outfall, and so have the potential to introduce INNS to the Proposed Development site and wider water body as biofouling or from the discharge of ballast and bilge water.

Summary

5.2.26 A summary of the receptors and relevant WFD quality elements that have been scoped into the WFD impact assessment for the Humber Upper waterbody is shown in Table 16, below.

Table 16: Scoping outcome for the Humber Upper waterbody

Receptor	**Relevant WFD quality element(s)**	**Potential risk to receptor**
Hydromorphology	Hydromorphological elements	Proposed activities could impact the morphology of the estuary bed and local sediment dynamics due to use of a cofferdam, if required, in the River Trent for the

Receptor	Relevant WFD quality element(s)	Potential risk to receptor
		River Water Abstraction Option.
Water Quality	Physico-chemical and chemical water quality elements	Impacts from mobilisation of sediments, diffuse urban pollutants in surface water runoff during construction, diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which are discharged via the outfall the River Trent.
Biology: Habitats	Habitats and benthic invertebrates	Potential temporary sediment plume during construction or thermal plume during operation.
Biology: Fish	Fish	Fish behaviour could be affected by sediment plumes relating to cofferdam installation and removal, chemical or thermal change in the water body due to process effluent discharge, as well as changes in visual stimuli (such as artificial light), underwater noise and physical disturbance.
Protected areas	N/A	Activity is within 2 km of WFD

Receptor	Relevant WFD quality element(s)	Potential risk to receptor
		protected areas – Humber Estuary SAC, SSSI.

5.2.27 INNS will also be considered within the assessment.

6.0 WFD ASSESSMENT

6.1 No Deterioration Assessment

6.1.1 The first stage of the assessment is to consider the likely impact of the Proposed Development on WFD parameters and whether it is likely to cause deterioration of any WFD quality elements or prevent Environment Agency mitigation measures from being implemented.

6.1.2 The appraisal of these two WFD objectives is considered under the following sub-sections.

6.2 Potential Construction Phase Impacts

6.2.1 During the construction phase the following surface and groundwater environmental impacts may occur, if appropriate mitigation is not applied:

- temporary impacts on surface water quality due to deposition or spillage of soils, sediments, oils, fuels or other construction chemicals, or through mobilisation of contamination following disturbance of contaminants in sediments, ground or groundwater, or through uncontrolled site run off;
- temporary impacts on sediment dynamics and morphology in the Humber Estuary as a result of the potential installation of a cofferdam and other construction works associated with the refurbishment of the water abstraction intake structure;
- temporary impacts on sediment dynamics and morphology within watercourses and waterbodies, where new crossings are required due to construction works (e.g. construction access route and emergency vehicle access road) and installation of Water Connection Corridors and other pipelines;
- remedial works, including disturbance and/ or removal of the ground and groundwater which could potentially remove, relocate or mobilise potential existing contaminants (e.g. during foundation construction, earthworks and excavations);
- creation of new linkages (e.g. pile foundation construction through existing Made Ground into underlying natural soils or bedrock, pile foundation construction or excavation through an existing aquiclude (impermeable fine/ cohesive soils) into a groundwater aquifer; and
- changes to the hydrogeological regime (e.g. dewatering activities) may impact groundwater.

6.2.2 Prior to construction works commencing, a ground investigation will be completed, as described in **Chapter 13**: Geology, Hydrogeology and Land Contamination (ES Volume I – **Application Document Ref. 6.2**). This will be designed to target the potentially contaminative sources identified, including the

historical landfilling activities identified on the Proposed Development Site. Where risks are deemed to be significant, detailed remediation strategies will be developed accordingly, pursuant to the process set out by the planning authorities.

6.2.3 Construction activities such as earthworks, excavations, site preparation, levelling and grading operations result in the disturbance of soils. Exposed soil is more vulnerable to erosion during rainfall events due to loosening and removal of vegetation to bind it, compaction and increased runoff rates. Surface runoff from such areas can contain excessive quantities of fine sediment, which may eventually be transported to watercourses where it can result in adverse impacts on water quality, flora and fauna.

6.2.4 Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the previous industrial land-uses at the Proposed Development Site.

6.2.5 Other potential sources of fine sediment during construction works include water runoff from earth stockpiles, dewatering of excavations (surface and groundwater), mud deposited on site and local access roads, and that which is generated by the construction works themselves or from vehicle washing.

6.2.6 Generally, excessive fine sediment in runoff is chemically inert and affects the water environment through smothering riverbeds and plants, temporarily changing water quality (e.g. increased turbidity and reduced photosynthesis) and causing physical and physiological adverse impacts on aquatic organisms (such as abrasion, irritation). However, given the past industrial activity across the study area, there may also be the potential for acute and chronic toxic effects to aquatic organisms.

6.2.7 There is a requirement for works close to, and potentially within, the Humber Estuary although this is likely to be limited to hand based maintenance of the water discharge outfall. There is also likely to be works in close proximity to the Stainforth and Keadby Canal for the preferred abstraction point. Should this not be available, there may be works to the abstraction intake within the River Trent/ Humber Estuary although this is not the preferred option.

6.2.8 In addition, construction works and activity including vehicle movements are proposed in close proximity to (and in some cases over) Hatfield Waste Drain Catchment, North Soak Drain Catchment, and ditches within Paupers Drain Catchment. There would be the potential for conveyance of fine sediment, debris and any contamination during these construction works to any of these waterbodies or downstream waterbodies and receptors (e.g. Torne/Three Ricers from Mother Drain to Trent Catchment and Humber Upper WFD waterbodies).

6.2.9 During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and / or used on site. There may also be substantial volumes of stagnant water or other liquid/chemical substances within existing drainage and other redundant process infrastructure on the Site. Leaks and spillages of these substances could pollute the nearby surface watercourses if their use or removal is not carefully controlled and spillages enter existing flow pathways or waterbodies directly. Like excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within waterbodies.

6.2.10 To allow such substances to enter a watercourse could be in breach of the Environmental Permitting (England and Wales) Regulations 2016 (HMSO, 2016) and the Water Resources Act 1991 (as amended) (HMSO, 1991). Therefore, measures to control the storage, handling and disposal of such substances will need to be in place prior to and during construction.

6.3 Construction Phase Mitigation

6.3.1 For the purposes of this assessment, it is assumed that the measures set out below would be required of any contractors undertaking construction work in relation to the Proposed Development.

Surface Water

6.3.2 During construction, accidental water pollution may occur directly from spillages of polluting substances into waterbodies, or indirectly by being conveyed in runoff from hard standing, other sealed surfaces or from construction machinery. Fine sediment may also be disturbed in waterbodies directly or also wash off working areas and hard standing (including approach roads) into waterbodies indirectly via existing drainage systems or overland. This sediment may potentially contain contaminants that could be harmful to the aquatic environment. Plans to avoid, prevent and reduce adverse effects on the water environment and deal with any accidental pollution would be included within the CEMP prepared by the Contractor, prior to commencement of construction. A Framework CEMP accompanies the DCO Application (**Application Document Ref. 7.1**).

6.3.3 The CEMP will be reviewed and updated to ensure all relevant potential impacts and effects are considered and addressed as far as reasonably practicable, taking into account available good practice. The principles of the mitigation measures set out below are the minimum standards that the Contractor will implement, acknowledging that for some issues, there are multiple ways to address. Methods to deal with pollutant risk will be reviewed and adapted as construction works progress in response to different activities, weather conditions, and work locations.

6.3.4 It is envisaged that the final CEMP will contain a Water Management Plan (WMP) as a technical appendix which would provide relevant details regarding

mitigation to be implemented to protect the water environment from adverse impacts during construction, including, but not limited to the general mitigation measures outlined below.

Good Practice Guidance

6.3.5 The construction of the Proposed Development would be in accordance with good practice guidance. A series is in development, which provides updated good practice guidance to the UK. While this is not regulatory guidance in England where the UK government website outlines regulatory requirements, it remains a useful resource for best practice. The following relevant of Guidance for Pollution Prevention (GPP) have been released to date on the NetRegs website (Northern Ireland Environment Agency and Scottish Environment Protection Agency, 2020; NetRegs, 2020) and should be identified as good practice:

- GPP 1: Understanding your environmental responsibilities – good environmental practices;
- GPP 2: Above ground oil storage tanks;
- GPP 3: Use and design of oil separators in surface water drainage systems;
- GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;
- GPP 5: Works and maintenance in or near water;
- GPP 8: Safe storage and disposal of used oils;
- GPP 13: Vehicle washing and cleaning;
- GPP 19: Vehicles: Service and Repair;
- GPP 20: Dewatering underground ducts and chambers;
- GPP 21: Pollution Incident Response Planning;
- GPP22: Dealing with spills; and
- GPP26: Safe storage – drums and intermediate bulk containers.

6.3.6 Where new GPP are yet to be published, previous Pollution Prevention Guidance (PPG) documents (Environment Agency, 2001a) continue to provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, although they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. Construction phase operations would be carried out in accordance with guidance contained within the PPG (also available at NetRegs), including:

- PPG6: Working at construction and demolition sites;
- PPG7: Safe storage – the safe operation of refuelling facilities; and

- PPG18: Managing fire water and major spillages.

6.3.7 Additional good practice guidance for mitigation to protect the water environment can be found in a range of CIRIA documents and British Standards Institute (BSI) documents described in Section 12.3 of **Chapter 12**: Water Resources and Flood Risk (ES Volume I – **Application Document Ref. 6.2**) and in Framework CEMP (**Application Document Ref. 7.1**).

Management of Construction Site Runoff

6.3.8 The measures outlined below, which will be included in the CEMP, will be required for the management of fine sediment in surface water runoff as a result of the construction activities:

- Reasonably practicable measures will be taken to prevent the deposition of fine sediment or other material in, and the pollution by sediment of, any existing waterbody during construction taking into account relevant industry guidelines including CIRIA report 'C532: Control of water pollution from construction sites'. This may typically (CIRIA, 2001) include use and maintenance of temporary lagoons, tanks, seeding/ covering of earth stockpiles, earth bunds, straw bales and sandbag walls, other proprietary measures, fabric silt fences or silt screens and consideration of the type of plant used.
- A temporary drainage system will be developed to prevent runoff contaminated with fine particulates from entering surface water drains without treatment. This will cover all land drains and waterbodies within the Proposed Development Site that could be affected, taking measures to adequately protects using e.g. drain covers, sandbags, earth bunds, geotextile silt fences, straw bales, or proprietary treatment. Any discharge to waterbodies (directly or indirectly) will only be made with the consent of the Environment Agency (or relevant sewerage undertaker) and with any agreed treatment measures implemented.
- Where reasonably practicable, earth moving works will seek to avoid periods of very wet weather, to minimise the risk of generating runoff contaminated with fine particulates. However, it is likely that some working during wet weather periods will be unavoidable, in which case, mitigation measures will be implemented to control fine sediment laden runoff.
- To protect waterbodies from fine sediment runoff, topsoil/ subsoil will be stored a minimum of 20m from watercourses on flat lying land. Where this is not reasonably practicable and material is to be stockpiled for longer than two weeks, material will either be covered with geotextile mats or seeded to promote vegetation growth, with runoff from the stockpile prevented from draining to any watercourses, without prior treatment.
- Appropriately sized runoff storage areas for the settlement of fine particulates in runoff will be provided. It is anticipated that treated water may

be pumped under a temporary Water Activity Permit from the Environment Agency or agreed with Severn Trent Water to an existing WwTW.

- Mud deposits will be controlled, as far as reasonably practicable, at entry and exit points to the Proposed Development Site using wheel washing facilities and/ or road sweepers operating during earthworks activities or other times as considered necessary.
- Equipment and plant will be washed out and cleaned in designated areas within the Proposed Development Site compound where runoff can be isolated for treatment before discharge to under appropriate consent and/ or agreement with Environment Agency, IDB / or sewerage undertaker, or otherwise removed from the Proposed Development Site for appropriate disposal at a licensed waste facility.
- Debris and other material will be prevented from entering surface water drainage, through maintenance of a clean and tidy site, provision of clearly labelled waste receptacles, grid covers and the presence of site security fencing.
- The CEMP will include details of necessary water quality monitoring including visual observations, in situ testing using handheld water quality probes and periodic sampling for laboratory analysis.

Management of Spillage Risk

6.3.9 The measures outlined below will be implemented to manage the risk of accidental spillages and potential conveyance to nearby waterbodies via surface runoff or land drains. The measures relating to the control of spillages and leaks will be included in the CEMP and adopted during the construction works:

- fuel will be stored and used in accordance with the Control of Substances Hazardous to Health Regulations 2002 (HMSO, 2002), and the Control of Pollution (Oil Storage) (England) Regulations 2001 (HMSO, 2001);
- particular care will be taken with the delivery and use of concrete and cement as it is highly corrosive and alkaline;
- fuel and other potentially polluting chemicals will either be in self bunded leak proof containers or stored in a secure impermeable and bunded area (minimum capacity of 110% of the capacity of the containers);
- any plant, machinery or vehicles will be regularly inspected and maintained to ensure they are in good working order and clean for use in a sensitive environment. This maintenance is to take place off site if possible or only at designated areas within the Proposed Development Site compound. Only construction equipment and vehicles free of all oil/ fuel leaks will be permitted on site. Drip trays will be placed below static mechanical plant;

- all washing down of vehicles and equipment will take place in designated areas and wash water will be prevented from passing untreated into watercourses;
- all refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and watercourses, and away from drains as far as reasonably practicable. Vehicles will not be left unattended during refuelling;
- as far as reasonably practicable, only biodegradable hydraulic oils will be used in equipment working in or over watercourses;
- all fixed plant used on the Proposed Development Site will be self-bunded;
- mobile plant is to be in good working order with drip trays installed beneath oil tanks/ engines/ gearboxes and hydraulics, which would be checked and emptied regularly;
- a Pollution Prevention Plan will be prepared and included alongside the CEMP. Spill kits and oil absorbent material will be carried by mobile plant and located at high risk locations across the Proposed Development Site and regularly topped up. All construction workers will receive spill response training and toolbox talks;
- the Proposed Development Site will be secure to prevent any vandalism that could lead to a pollution incident;
- construction waste/ debris will be prevented from entering any surface water drainage or waterbody;
- suitable facilities for concrete wash water (e.g. geotextile wrapped sealed skip, container or earth bunded area) will be adequately contained, prevented from entering any drain, and removed from the Proposed Development Site for appropriate disposal at a suitably permitted waste facility; and
- Site welfare facilities will be appropriately managed, and all foul waste disposed of by a licensed contractor to a suitably permitted facility.

Management of Risks to Groundwater

6.3.10 Ground investigation will be undertaken before construction to inform the development of the preliminary and detailed design. The ground investigation will validate the assumptions made in the initial Conceptual Site Model and Preliminary Risk Assessment (**Appendix 13A:** Phase 1 Desk-based Assessment (ES Volume II - **Application Document Ref. 6.3**)) and provide site-specific data upon which to base a land contamination risk assessment. The ground investigation will be designed to target the potentially contaminative sources identified, including the historical landfilling activities identified on the Proposed Development Site. Where risks are deemed to be significant, detailed

remediation strategies will be developed accordingly, pursuant to the process set out by the planning authorities.

Preferred Abstraction Option: Use of a Cofferdam at the Abstraction Point (Stainforth & Keadby Canal)

6.3.11 As described in **Chapter 5**: Construction Management and Programme (ES Volume I - **Application Document Ref. 6.2**), the preferred source of cooling water is from the Stainforth and Keadby Canal and is the subject of ongoing technical evaluation including engagement with the Environment Agency and Canal and River Trust.

6.3.12 This will require use of a cofferdam in close proximity to the Keadby 2 intake structure, up to circa 10m into the canal. Installation would require permission from the Environment Agency and CRT. Maintaining a dry working area for any in-channel working using a cofferdam will reduce the overall channel disturbance and potential for mobilising fine sediment (and any contamination) into the water column. The installation and subsequent removal of the temporary cofferdam will be completed in accordance with the requirements of the relevant regulators.

6.3.13 Any works would be undertaken with due regard to the Eels Regulations which may require installation of an eel screen. A fish rescue would be required from the cofferdam before pumping out of water. All works would be undertaken in accordance with a Fish Management Plan, as described in **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**).

6.3.14 The cofferdam would be designed to minimise changes to the canal bed and bank erosion and toe scour. Pre-construction sediment contamination testing would be undertaken, and silt curtains used to minimise impacts on water quality.

6.3.15 Dewatering within the cofferdam area will be undertaken once any fine sediment has settled out such that it is consistent with the turbidity of the waterbody and following any necessary fish rescue. The rate and location of the discharge will be controlled and carefully chosen to avoid further erosion of any nearby soft sediments.

6.3.16 Whilst in-situ, the cofferdam will be regularly inspected and maintenance undertaken, where required, and any water entering the cofferdam(s) area via seepage will be disposed of appropriately (i.e. by pumping back into the waterbody).

Reserve Abstraction Option: Use of a Cofferdam at the Abstraction Point (River Trent)

6.3.17 Should the preferred cooling water source within the Stainforth and Keadby Canal not be feasible, the alternative River Water Abstraction Option would be used and the cofferdam within the River Trent would stretch up to circa 22m into the watercourse, being constructed in accordance with a Marine Licence from the MMO which is 'Deemed' within the DCO.

6.3.18 Relevant conditions would be adhered to regarding the timing of works (if relevant) outside the main migratory periods of noise and vibration sensitive fish species to minimise potential impacts on migrating fish as described in **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**).

Water Supply Connection Corridors

6.3.19 If the Canal Water Abstraction Option is selected, a pipeline would be constructed using open cut methods from the intake into the Proposed PCC Site as shown on **Application Document Ref. 4.9**. If the River Water Abstraction option is selected, some of the existing pipework that runs to the north of Trent Road is anticipated to be in a suitable condition to be re-used and would be extended to the Proposed PCC Site. Where upgrades to existing pipework are required, trenchless excavation methods ('sliplining') could be applied as described in **Chapter 5**: Construction Programme and Management (ES Volume I – **Application Document Ref. 6.2**). This technique involves the existing pipeline remaining in-situ and acting as a host pipe for a new smaller diameter carrier pipe. The space between the two pipes ('annulus') would then be grouted and the ends sealed.

6.3.20 Where open cut crossings of minor drains within the Proposed PCC Site are required (e.g. for Drain 2) to accommodate the water supply connection corridors (from either option), it is assumed that flow may be temporarily over-pumped, diverted around or flumed through the working area and the watercourse fully reinstated following completion of works.

6.3.21 Measures to reduce the potential adverse impacts considered would include:

- implementation of a temporary site drainage system;
- undertaking works in the typically drier periods of the year, where reasonably practicable;
- completing a pre-works survey to record waterbody form and condition prior to works commencing;
- any required pump intakes would be appropriately screened to prevent fish being drawn into the pipe/ pump (albeit they are unlikely to be present in these particular ditches);

- no plant would track through any channel where works are undertaken and would be confined to the banks;
- crossings would be perpendicular to the channel where reasonably practicable; and
- measures to control effects relating to bed substrate would also be developed including careful storage of sediment layers to enable typical pre-construction habitats and hydromorphological processes to quickly re-establish following the works.

6.3.22 In addition to cooling water connections, a connection would also be made within the Proposed PCC Site to provide a towns water connection including works to the existing towns water pipelines and connections to fire and raw water storage tank (refer to **Application Document Ref. 4.10**).

Water Discharge Corridors

6.3.23 It is proposed to re-use existing assets including the outfall and pipework for Keadby 1 Power Station for the discharge of cooling tower blowdown and treated effluent to the River Trent. A Water Discharge Corridor is included in the Proposed Development Site comprising the easement of the existing cooling water outfall corridor north-east from Keadby 1 Power Station, connecting with the River Trent.

6.3.24 Interconnecting pipework would extend from Proposed PCC Site to connect to this infrastructure. As part of refurbishment and/ or replacement works within the Water Discharge Corridor, various ancillary works may be required. It is not envisaged that upgrades to pipework will be necessary, however, if minor upgrades are required, trenchless excavation methods ('sliplining') would be applied to the existing pipeline. There will be no open cut pipeline replacement along the existing pipeline easement.

6.3.25 It is anticipated that it will be possible to re-use the existing outfall and that any maintenance activities are likely to be minor and limited to inspection and hand-based maintenance. This may be either shore-led or supported by small specialist workboats, comparable to those which are periodically used for Keadby Power Station operation and maintenance activities.

6.3.26 The existing connection to the Keadby 2 Power Station foul sewer may also be used for the Proposed Development if it is in a suitable condition. The route of the foul sewer pipeline crosses land owned by the Applicant within Keadby Power Station, and via an existing easement towards the Severn Trent Water pumping station on Chapel Lane. If the pipeline condition is not suitable for continued use, foul sewerage would instead be treated on site in a package treatment plant with the treated water directed to the river Trent via the water discharge connection.

Mabey Bridge Replacement and Emergency Access Bridge over Drain 1

6.3.27 Early works will include the widening of the A18 and the replacement of Mabey Bridge over the Hatfield Waste Drain (Work 8A) to provide the permanent access into the Proposed Development Site. Replacement of Mabey Bridge will require disturbance to the banks of Hatfield Waste Drain under and immediately adjacent to the existing bridge. The existing bridge is single span and supported on metal girders. Installation of a new bridge of comparable design will require localised ground excavation to construct foundations for the replacement bridge, but these works will not affect the banks of the drain as the new foundations are set back from the existing foundations. They are also largely restricted to the footprint of the existing bridge. Both the A18 carriageway and Mabey Bridge will then be re-graded and re-surfaced. The works to the A18 are immediately parallel to the Hatfield Waste Drain to the north and North Engine Drain to the south, and the best practice mitigation measures outlined above and within the Framework CEMP (**Application Document Ref. 7.1**) will be implemented to prevent adverse impacts to these watercourses during construction.

6.3.28 An emergency access bridge is proposed over Drain 1 to the north of Keadby Common and the Proposed PCC Site. Initial site clearance will be undertaken including vegetation clearance. The channel beneath the proposed bridge crossing is likely to require lining to prevent vegetation growth as this area will no longer be accessible to machinery. Piling works, if required, would then take place before the main structure of the bridge is constructed. The width of the structure is anticipated to be 6.5m as is shown on the Emergency Access Bridge General Arrangement and Sections Plans (**Application Document Ref. 4.17**).

6.3.29 Works for the emergency access bridge would require consent of the IBD which has been consulted on the works and has noted that any proposed crossing should take into account relevant bylaws.

6.3.30 There may be a requirement for minor works to watercourse crossings relating to the temporary access roads for strengthening, maintenance or minor improvements. This could potentially impact Drain 6, Drain 7a and Drain 7b, and may require consent from the LLFA depending on the nature of the works required.

Land Drainage

6.3.31 Appropriate measures to minimise short-term and long-term impacts on land drainage will be agreed with the relevant landowner for those works affecting drains within the temporary construction and laydown areas (**Work No. 9A** - refer to **Chapter 5:** Construction Programme and Management (ES Volume I **– Application Document Ref. 6.2**)). Where land drains are under the control of the IDB, relevant bylaws will be adhered to or consent obtained for works affecting/ crossing drains within the Electrical Connection to the Northern

Powergrid Substation (**Work No. 3A**), if this option is selected, Water Discharge Corridor (**Work No. 5**) and emergency vehicle access route (**Work No. 8B**). These measures will be secured in the Final CEMP.

Water Quality Monitoring

6.3.32 During construction it is proposed to undertake a water quality monitoring programme to ensure that mitigation measures are operating as planned and preventing pollution. This is standard good practice for construction works of this type, and full details will be outlined in the WMP (accompanying the Final CEMP). The purpose of the monitoring programme will also be to ensure that should pollution occur it is identified as quickly as possible and appropriate action is taken in line with a Pollution Prevention Plan.

6.3.33 The water quality monitoring programme will be developed by the Principal Contractor in consultation with the Environment Agency and, where relevant, the Canal and River Trust (for the Canal Water Abstraction Option) or Marine Management Organisation (River Water Abstraction Option) during the process of obtaining environmental permits/ licenses for works affecting, or for temporary discharges to, watercourses within the Proposed Development Site.

6.3.34 The monitoring will include a combination of daily observations and monitoring using a calibrated handheld water quality probe at location upstream, within and downstream of the Proposed Development Site, and water quality sampling for laboratory analysis on a periodic basis or ad hoc depending on circumstances. To ensure that monitoring during construction is effective it will be necessary to carry out pre-construction monitoring. There is no guidance on how long or frequent this should be, but it is recommended that as a minimum there are six separate visits over a few months and taking in a range of flow conditions.

Fish Management Plan

6.3.35 A Fish Management Plan will be prepared and agreed with relevant stakeholders to specify the measures and supervision required to deliver legislative compliance during installation and drawdown of any cofferdam(s) for the Canal Water Abstraction Option on the Stainforth and Keadby Canal, or if this is not feasible, the upgrade of the River Water Abstraction Option. It is proposed that submission and approval of the Fish Management Plan will be secured by a Requirement of the draft DCO (**Application Document Ref. 2.1**).

6.3.36 The Fish Management Plan will include details of:

- appropriate timings to minimise potential for disturbance to migratory fish;
- provision for screening of pump intakes to prevent fish being drawn into the pipe/pump;
- supervision of dewatering of any cofferdam by an appropriately experienced ECoW to oversee fish welfare and to support the relocation of any stranded

fish or associated wildlife back to the main channel of the relevant watercourse outside the working area; and

- if appropriate, other specialist techniques to support the capture and relocation of fish to the main channel of the relevant watercourse outside the working area prior to drawdown.

Invasive Species Management Plan

6.3.37 A plant INNS survey will be undertaken prior to construction to determine the current location and extent of plant INNS. If determined as necessary through this survey and after consideration of other available plant and animal INNS data, an ISMP will be prepared to accompany the final CEMP and would be agreed with relevant stakeholders. The ISMP would specify the measures and supervision necessary during construction to prevent the spread of plant and animal INNS to new locations. It is proposed that submission and approval of the ISMP will be secured by a Requirement of the draft DCO **(Application Document Ref. 2.1**).

6.4 Construction Phase Assessment

Humber Upper Waterbody

Surface Water Quality – Suspended Fine Sediments

6.4.1 There would be no impact to the Humber Upper Waterbody in relation to surface water quality if the Canal Water Abstraction Option is used.

6.4.2 Taking into consideration the source-pathway-receptor approach, construction of a cofferdam in the River Trent (the receptor) for works to the abstraction point if this option is selected, would cause some mobilisation of fine sediments during installation and removal, and this may mobilise some fine sediment into the water column (the pathway). However, the volume of sediment will be relatively small and localised. Background data shows that concentrations of TSS are often quite high. Once any cofferdam has been installed, any fine sediment that has been mobilised will quickly dissipate through settling or dispersion and is unlikely to create a plume that may propagate into the wider waterbody. The purpose of the cofferdam is to allow a dry working area to be created, which in itself is a measure designed partly to reduce adverse impacts on water quality.

6.4.3 The cofferdam will be designed to minimise changes in riverbed and bank erosion and toe scour through keeping it to the minimum dimensions necessary to undertake the works and thereby reducing any constriction of the channel. Furthermore, this would reduce the extent of sediment mobilisation. The structure would not protrude significantly into the channel (i.e. up to circa 22m for the Trent), taking into account similar works within these watercourses for the purposes of Keadby Power Station.

6.4.4 There is a wealth of sedimentological data from both the Keadby power Station intake and outfall which has been obtained in order to fulfil the Marine Licence Application 'MLA/2014/00183/2' and associated mid-point sample returns.

6.4.5 The wastewater discharge from the Proposed Development is to re-use the existing Keadby Power Station outfall to the River Trent. It is anticipated that any maintenance activities are likely to be minor and limited to inspection and hand-based maintenance. This may be either shore-led or supported by small specialist workboats, comparable to those which are periodically used for Keadby Power Station operation and maintenance activities.

6.4.6 With the embedded mitigation measures (described in Section 12.5) in place, it is considered that there would be negligible impact to the River Trent from any cofferdam installation at the potential abstraction point and minor maintenance at the discharge outfall, given the scale of the watercourse and that preparatory dredging is not proposed. The tidal nature of the estuary here would quickly disperse any mobilised sediments. As such, no reduction in any WFD element would occur due to suspended fine sediments, nor any non-compliance with WFD objectives for the waterbody.

Surface Water Quality – Chemical Spillages

6.4.7 If appropriate mitigation measures are implemented as described in 'Construction Phase Mitigation' above, including water quality monitoring, then the risk of chemical spillages to the Humber Upper Waterbody would be minor. The main risk would result from working directly over and within the waterbody itself for installation of the cofferdam, should the River Water Abstraction Option be required, from which spillages of fuels, oils and other chemicals could occur. As previously described, the impact to the Humber Upper Waterbody would not occur if the Canal Water Abstraction Option is used.

6.4.8 There is an indirect risk of leaks and spillages of polluting substances during construction on the Proposed PCC Site potentially polluting nearby surface watercourses if their use or removal is not carefully controlled (source) and spillages enter existing flow pathways or waterbodies directly (pathway). Like excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within waterbodies (the receptor). The Proposed PCC Site is circa 1.3km from the River Trent. Overall, this impact is considered minor given the mitigation outlined above, including best practice measures in the CEMP, and the fact that Trent is a large capacity tidal watercourse with the ability to dilute and disperse minor releases of any pollutants. No reduction in any WFD element would therefore be anticipated from chemical spillages, or any prevention of future improvement.

6.4.9 As described above, minor maintenance and improvement works are proposed to be undertaken directly within the River Trent at the water discharge outfall and potentially more substantial works at the river water abstraction point, should this option be selected. Given the scale of the waterbody with significant

dilution potential and given the majority of the more significant works at the abstraction point would be undertaken behind a cofferdam with mitigation measures implemented (described in Section 6.3), including water quality monitoring, there would be a negligible impact on the River Trent with regard to spillages, and no deterioration in any WFD element classification or prevention of future improvement.

Morphological Effects relating to the use of a Cofferdam

6.4.10 The installation of a cofferdam, in the event that the River Water Abstraction Option is selected, will result in the localised loss of habitat on the bed of the River Trent beneath its footprint temporarily and may cause some scour. However, the cofferdam will be designed to minimise changes in riverbed and bank erosion through keeping it to the minimum dimensions necessary to undertake the works and thereby reducing any constriction of the channel as far reasonably practicable. Scour would not be expected to be significant given the large size of the watercourse which has capacity to absorb slight changes in width resulting from the cofferdam and given its dynamic nature. However, it is proposed that scour protection rock bags are used around the base of any cofferdam in the River Trent to minimise any residual risk. Overall, taking into account the temporary nature of the works and dynamic nature of the Trent which contains significant TSS concentrations, any impact on the estuary bed would be short-lived and would be expected to infill rapidly following removal of the cofferdam.

6.4.11 The area affected is negligible in the context of the size of the Humber Estuary and the extent of comparable intertidal mudflat habitats (worst-case estimate of 0.13ha (<0.01%) in the Proposed Development Site, compared to 9,384ha stated on the citation for the Humber Estuary SAC). As such, no deterioration or prevention of future improvement is anticipated for any WFD morphological element for the Humber Upper catchment.

6.4.12 Any works to the water discharge outfall to the River Trent would only involve minor refurbishment with hand tools. This may be either shore-led or supported by small specialist workboats and so there would be no morphological impacts to the waterbody.

Ecological Impact

Habitat Disturbance and Modification

6.4.13 The Proposed Development does not require any new land-take from European Sites. However, in the event that the preferred cooling water abstraction from the Stainforth and Keadby Canal is not available, localised and temporary in-channel and bank works may be required on the River Trent within the Humber Estuary SAC and Ramsar site on the basis that there would be a need to modify or repair the existing River Water intake (**Work No. 4B** on **Application Document Ref. 4.3**) for the purposes of installation (if relevant) of eel screens.

The maximum worst-case working areas for these upgrade activities, if required, is 0.13ha.

6.4.14 At the location of the relevant existing structures the River Trent is a large (approximately 150m wide) tidal watercourse. At the time of the surveys for the Proposed Development (April and July 2020), no aquatic higher plant species were observed within the channel of the river, with the exception of a few fronds of greater duckweed (*Spirodela polyrhiza*). No other in-channel higher plant species would reasonably be expected given this is a tidal reach of a very large river.

6.4.15 Along the margins of the River Trent (both banks), above the typical high tide water level, there are narrow strips of transitional vegetation dominated by common reed (*Phragmites australis*) with abundant to occasional hemlock water-dropwort (*Oenanthe crocata*), hedge bindweed (*Calystegia sepium subsp. sepium*), wild angelica (*Angelica sylvestris*), great willowherb (*Epilobium hirsutum*), reed canary-grass (*Phalaris arundinacea*) and cleavers (*Galium aparine*). At the base of this marginal vegetation but above the water line, the only plant species observed were New Zealand pigmyweed (*Crassula helmsii*) and creeping buttercup (*Ranunculus repens*). Below this zone is bare mud at low tide. This relatively species-poor vegetation is not considered an example of transitional saltmarsh, as it is not present in association with any other saltmarsh communities or typical saltmarsh flora. Therefore, the relevant habitat interest features for which the Humber Estuary SAC and Ramsar site is designated at the locations of the proposed construction works are:

- estuaries – encompassing the main river channel; and
- mudflats and sandflats not covered by seawater at low tide – encompassing the marginal mud banks exposed at low tide.

6.4.16 As explained in **Chapter 12**: Water Resources and Flood Risk (ES Volume I – **Application Document Ref. 6.2**), while a cofferdam may be used to create and maintain a temporary dry in-channel working areas, it will also be designed to minimise changes in riverbed and bank erosion and toe scour over the duration of its temporary use by extending the minimum distance possible into the channel, and by using scour protection rock bags. On that basis, there is no likely potential for adjacent and downstream habitats to be adversely affected (e.g. by erosion or smothering) through the use of a cofferdam.

6.4.17 Should sediment be generated during installation of a cofferdam, it is considered that this would not be ecologically damaging for the habitats present in the context of a highly turbid estuarine environment. Previous Water Framework Directive (WFD) assessments of dredging operations at the same locations concluded no likely significant adverse effects on water quality or water biodiversity. The MMO has also previously been involved in licensing for the Keadby 1 Power Station Intake & Outfall Dredging (MLA/2017/00312, covering a maximum volume of 25,000m^3) and concluded that disturbance to

bed sediments is not likely to impact water quality or biodiversity within the estuary. Natural England was also consulted on this licence and advised 'it can be excluded that the application will have a significant effect on any SAC, SPA or Ramsar site, either individually or in-combination with other plans or projects.' The proposed worst-case construction works are of broadly comparable extent and scale to these previous works and therefore the findings of these previous assessments remain valid for the Proposed Development. It is therefore considered that sediment generation, if this was to occur, would not adversely affect the extent or structure and function of in-channel habitats or the integrity of the Humber Estuary SAC and Ramsar site.

6.4.18 Whilst in use, any cofferdam will temporarily reduce the extent and quality of intertidal mudflat habitats in the immediate vicinity of any construction works through removal and/ or drying of sediments behind any cofferdam. However, the area of habitat affected is considered trivial ('de minimis') in the context of the size of the Humber Estuary and the extent of comparable intertidal mudflat habitats (worst-case estimate of 0.13ha (<0.01%) in the Proposed Development Site, compared to 9,384ha of mudflat habitat stated on the citation for the Humber Estuary SAC). In addition, any such small-scale loss of mudflat habitat would be temporary as natural tidal processes will rapidly reintroduce sediments and reinstate mudflats once any cofferdam is removed on the completion of works. No adverse temporary or permanent ecological effects, in terms of extent and structure and function of habitats, are therefore likely. The affected area of marginal mudflat/ estuary habitat would be expected to recover rapidly (within no more than 5-years from point of impact) from temporary disturbance through recharge with sediments naturally present in this highly turbid river reach once water levels are restored, and also through natural tidal scour and movement of sediments.

6.4.19 Given the scale, location and type of construction activities (if use of a cofferdam is required), any associated temporary and very minor habitat disturbances will not result in deterioration to any WFD ecological classifications or prevention of future improvement. Similarly, there would be no prevention of the Humber Estuary SAC and Ramsar site achieving their conservation objectives.

Visual and noise/ vibration disturbance

6.4.20 The need for any piling activities in the river is dependent on the choice of cooling water source. As such, the need for a cofferdam in the river would only be necessary should the volumes of cooling water required not be available from the Stainforth and Keadby Canal. **Appendix 11H**: Underwater Sound Effects on Fish (ES Volume I - **Application Document Reference 6.3**) provides an assessment of the effects of underwater sound on salmonids should the River Water Abstraction Option be selected. The effects of underwater sound on lamprey are considered in the Habitat Regulations Assessment (HRA) Screening Report (**Application Document Ref. 5.12**). **Chapter 11**: Biodiversity and Nature Conservation (ES Volume I – **Application Document Ref. 6.2**)

summarises the effects on all relevant species including the proposed restrictions on timing of any cofferdam installation/ removal (if required) in the River Trent to avoid significant effects.

6.4.21 If required, the extent of piling activities would be very limited relative to the size of the watercourse, extending into the river channel for up to 22m (focussed on a single intake structure) which is a relatively small distance in the context of a river channel that is circa 150m wide. The assessments conclude that on balance, it is considered that there are no grounds to anticipate an adverse effect on lamprey species as a result of temporary small-scale construction works (if required) to upgrade a water intake and structure within the River Trent. Furthermore, it is highly unlikely that mobile fish and life stages (e.g. eggs and larvae) would be exposed to sound pressure of sufficient intensity and time to result in mortality, recoverable injury and/ or Temporary Threshold Shift (TSS). Considering the localised, temporary and reversible nature of effects to all fish receptors from continuous underwater sound sources during construction, the magnitude of impact is predicted to be negligible. Thus, the overall effect would be **not significant.**

6.4.22 Considering all of the foregoing, visual and noise disturbance from construction works will not result in significant adverse impacts at the Humber Estuary SAC, SPA and Ramsar site or interfere with the ability of these sites to achieve their conservation objectives. No deterioration or prevention of future improvement in any WFD classification element is predicted from visual, noise or vibration disturbance.

Entrapment of Lamprey

6.4.23 River and sea lamprey are anadromous migratory species (i.e. migrate upstream to breed) and live their adult life in the estuarine or marine environment, feeding parasitically on the tissue and blood of other fish. After one to two years, lamprey become sexually mature and begin their upstream migration to reach suitable spawning grounds within stony and well oxygenated riffle habitat (Maitland, 2003).

6.4.24 Young larvae of all lamprey species are known as ammocoetes and when they emerge from their spawning gravels, they drift downstream and spend several years burrowing in silt and feeding (Maitland, 2003). Lamprey ammocoetes and their habitat is located in the headwaters of the catchment and this life stage is therefore not relevant to this assessment as they to do not occur in the ZoI of the Proposed Development. Ammocoetes metamorphosize into a ‘transformer’ stage (a pre-breeding sub-adult stage) after 3 to 5 years, and then migrate downstream to estuaries and coastal regions (Maitland, 2003).

6.4.25 All resident and migratory fish species, including but not restricted to river and sea lamprey, could potentially (if present at the time of installation) be trapped within any cofferdam installed to create a dewatered area during construction upgrade works (if required) at the River Water Abstraction Option on the River

Trent. These lamprey species are a qualifying feature of the Humber Estuary SAC and Ramsar site.

6.4.26 Should fish, including lamprey species become trapped within the cofferdam, then they would be at no immediate risk. Instead, the risk would arise during drawdown of water levels to create a dry working area for construction. The cofferdam would need to be installed in a manner that delivers legislative compliance with a deemed marine licence (DML) under Part 4 of the Marine and Coastal Access Act 2009, which is proposed to be secured as part of the Draft DCO (**Application Document Ref. 2.1**). The MMO is responsible for enforcing, post-consent monitoring, varying, suspending, and revoking any deemed marine licence(s) as part of the DCO. It must therefore be assumed that regulatory regimes will be properly applied and enforced by the relevant regulators. This together is sufficient to remove this potential pathway for an impact on all fish species. Put simply, the use of cofferdams is controlled through regulation and conditions of a DML must be met, so there is no likely scenario whereby non-compliant use of a cofferdam could occur to the detriment of fish. Consequently, there is no scenario whereby fish could become trapped and would not be appropriately addressed as part of the standard construction approach.

6.4.27 The committed good practice construction approach to cofferdam installation and dewatering, if the River Water Abstraction is proposed involves:

- use of screening on pump intakes to prevent all fish, including lampreys, being drawn into the pipe/ pump during dewatering; and
- supervision of dewatering by an appropriately experienced fish ecologist so that legally binding fish welfare requirements are met, and to relocate any stranded fish, which would include lampreys, back to the main channel of River Trent as soon as possible after capture.

6.4.28 Existing legal and regulatory regimes are sufficient to remove the potential pathway for impact on lampreys through entrapment. Given this, there would be no detriment or prevention of future improvement in any WFD classification element, and there will be no adverse impact on the Humber Estuary SAC and Ramsar site.

Introduction and Spread of Invasive Non-Native Species

6.4.29 INNS have the potential to out-compete native species with possible detrimental impacts to native habitats via species loss, modifications to ecosystems and the introduction of disease and pathogens leading to mortality.

6.4.30 The Preliminary Ecological Appraisal (PEA) of the Proposed Development (**Appendix 11C:** PEA Report (ES Volume II - **Application Document Ref. 6.3**)) identified invasive non-native plant New Zealand pigmyweed (*Crassula helmsii*) to be widely scattered along the banks of the River Trent at and immediately

downstream of the River Water Abstraction Option and the Cooling Water Discharge, within the boundary of the Humber Estuary SAC and Ramsar site. This species is already well established, and there are no barriers to the dispersal. Given this, construction works would not interact with these species in a manner that would pose a new threat to the Humber Estuary SAC and Ramsar site, and the Humber Estuary SPA located further downstream. The pathway for spread already exists, is uncontrolled, and these species are present where habitats are suitable for establishment.

6.4.31 Given the known presence of invasive species, and legal obligations in relation to this, the Framework CEMP (**Application Document Ref. 7.1**) for the Proposed Development includes general biosecurity measures to mitigate the risk of these known species being transferred from the construction site into the wider landscape. These committed measures will also be applied so that construction vehicles, plant, materials brought into the construction site from other locations do not serve as vectors for introduction of other INNS to the Proposed Development Site, including the River Trent. Therefore, it is considered that the potential for existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is very low and will not cause detriment or prevent future improvement of the WFD water body.

Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)

Surface Water Quality – Suspended Fine Sediments

6.4.32 Construction of a cofferdam in the Stainforth and Keadby Canal (the receptors) for works to the abstraction point would cause some mobilisation of fine sediments during installation and removal, and this may mobilise some fine sediment into the water column (the pathway). However, the volume of sediment will be relatively small and localised. The purpose of the cofferdam is to allow a dry working area to be created, which in itself is a measure designed partly to reduce adverse impacts on water quality.

6.4.33 As described for the River Trent above, the cofferdam will be designed to minimise changes in riverbed and bank erosion and toe scour through keeping it to the minimum dimensions necessary to undertake the works and thereby reducing any constriction of the channel. Furthermore, this would reduce the extent of sediment mobilisation. The structure would not protrude significantly into the channel (i.e. circa 10m for the Stainforth and Keadby Canal).

6.4.34 A (non-statutory) pre-construction sampling exercise may be required at the location of the Canal Water Abstraction Option ahead of cofferdam works. If needed, the CRT and Environment Agency would be consulted regarding specific sampling requirements for the Stainforth and Keadby canal prior to works.

6.4.35 Construction of the abstraction point behind a cofferdam in the Stainforth and Keadby Canal would have a minor adverse temporary impact given low flows mean any sediment disturbed in this waterbody will take some time to disperse. This minor adverse impact would be very localised and would not have an impact at the watercourse scale. It will be necessary to consider appropriate cofferdam installation in order to ensure no impact to the canal liner at the abstraction point, and this may include bolstering the liner with clay. Given appropriate cofferdam design, no reduction in any WFD element would occur due to suspended fine sediments, nor any non-compliance with WFD objectives for the water body.

Surface Water Quality – Chemical Spillages

6.4.36 The Stainforth and Keadby Canal would be worked within directly for the potential Canal Water Abstraction Option if it is taken forward. There is therefore a risk of spillage of fuels, oils and other chemicals from waterborne plant and equipment. Any impact relating to chemical spillages would be negligible given the implementation of best practice measures (see Section 6.3) and the use of a cofferdam to enable the majority of work to be undertaken in dry conditions. As such, no deterioration in any WFD element or prevention of future improvement is predicted.

Morphological Effects relating to the use of a Cofferdam

6.4.37 The installation of a cofferdam will result in the localised loss of habitat on the bed of the Stainforth and Keadby Canal beneath its footprint and has potential to cause some very localised scour. However, the cofferdam will be designed to minimise changes in riverbed and bank erosion through keeping it to the minimum dimensions necessary to undertake the works and thereby reducing any constriction of the channel as far as possible. Scour impacts in the Stainforth & Keadby Canal would be expected to be negligible given the low flow within the watercourse. Overall, some localised morphological impact will be unavoidable from the cofferdam's footprint, but this will be temporary and not significant at the waterbody scale, and so there would be no deterioration in any WFD element or prevention of future improvement.

Aquatic Ecology

6.4.38 Assuming this preferred canal abstraction option is selected, construction of the Proposed Development has only very limited potential to affect the designated biodiversity interest of the canal (and designated LWS) through small-scale temporary loss and disturbance of existing in-channel habitats of low floristic diversity and structural complexity within an area extending up to 10m into the channel, and associated dewatering. Given the temporary nature of the impact, there is not anticipated to be any deterioration in WFD classifications or prevention of future improvement when considered at the waterbody scale.

Introduction and Spread of Invasive Non-Native Species

6.4.39 The PEA of the Proposed Development (**Appendix 11C**: PEA Report (ES Volume II - **Application Document Ref. 6.3**)) identified several INNS plant and animal species present within the Stainforth and Keadby Canal. These include zebra mussel (*Dreissena polymorpha*) and Nuttall's waterweed (*Elodea nuttallii*). These species are already well established, and there are no barriers to the dispersal of these species between the canal and the River Trent. Given this, construction works would not interact with these species in a manner that would pose a new threat to the canal or the downstream Humber Estuary SAC and Ramsar site, and the Humber Estuary SPA located further downstream. The pathway for spread already exists, is uncontrolled, and these species are present where habitats are suitable for establishment.

6.4.40 Given the known presence of invasive species, and legal obligations in relation to this, the Framework CEMP (**Application Document Ref. 7.1**) for the Proposed Development includes general biosecurity measures to mitigate the risk of these known species being transferred from the construction site into the wider landscape. These committed measures will also be applied so that construction vehicles, plant, materials brought into the construction site from other locations do not serve as vectors for introduction of other INNS to the Proposed Development Site, including the Stainforth & Keadby Canal. Therefore, it is considered that the potential for existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is very low and will not cause detriment or prevent future improvement of the WFD water body.

Paupers Drain Catchment (trib of Trent)

Surface Water Quality – Suspended Fine Sediments

6.4.41 The construction of a new clear-span emergency access bridge over Drain D1 (tributary of the Paupers Drain Catchment WFD waterbody) will require works in the riparian margins and over the watercourse, with use of piling and other plant leading to the potential for mobilisation of sediment that could be conveyed into the watercourse given the immediate proximity of the works.

6.4.42 These works would be carried out in accordance with a final CEMP and the best practice measures outlined in Section 6.3 and given that no work would be required within the channels itself and that the foundations will be set back from the watercourse then any adverse impact would be minor and temporary. As such, no reduction in any WFD element would occur due to suspended fine sediments from the bridge installation, nor any non-compliance with WFD objectives for the waterbody.

6.4.43 There will be a probable open-cut crossing of drain D2 (tributary of the Paupers Drain Catchment WFD waterbody) to accommodate the water supply connection corridor (from either abstraction option) within the Proposed PCC

Site. The direct works to the channel could mobilise sediments and be directly transferred into the watercourse which could then also propagate further downstream if not mitigated. Given the very localised and temporary nature of the works for any open-cut crossings of this ephemeral drain, as well as restoration required upon completion, the magnitude of impact is considered minor, and largely mitigated through the measures outlined in Section 6.3. Again, no reduction in any WFD element nor any non-compliance with WFD objectives for the Paupers Drain Catchment would occur from these works.

6.4.44 There is the potential for further strengthening, maintenance or minor improvement works to existing watercourse crossings relating to the temporary access roads during construction. This may impact an existing temporary crossing of Drain D6 within the Additional AIL Route from the Waterborne Transport Offloading Area, which is a tributary of the Paupers Drain Catchment WFD waterbody. Until detailed design stage when the AIL strategy is confirmed, it is not possible to assess the extent of any works required, however, they are expected to be no more than minor alterations to the existing temporary structure that was put in place for AIL movements for Keadby 2 Power Station. As any improvement works would be immediately adjacent to, and/ or over this drain, there is potential for mobilisation and conveyance of fine sediments to the channel. Given implementation of the best practice mitigation measures outlined in the final CEMP (see Section 6.3), this impact would be minor and temporary, and would not cause reduction in any WFD element nor any non-compliance with objectives for the WFD waterbody.

Surface Water Quality – Chemical Spillages

6.4.45 A new clear span bridge is required for Drain D1 (tributary of Paupers Drain Catchment WFD waterbody) and this is expected to be pre-fabricated off site. Open-cut crossings of Drain D2 may be required for water connection corridors and there may be improvements made to an existing structure over drain D6. Plant will be required adjacent to the watercourses for these works, and potentially within the watercourse in the case of drain D2, thereby raising the risk of accidental chemical spillages. However, given the implementation of mitigation measures to be included within the final CEMP, any impact from chemical spillages to these watercourses is anticipated to be negligible, particularly when considered at the waterbody scale. Therefore, no deterioration or prevention of improvement is anticipated for any of the WFD element classifications as a result of chemical spillages.

Morphological Impacts

6.4.46 The new bridge over drain D1 is anticipated to have a minor localised impact on morphology as the channel beneath the bridge crossing may need to be lined to prevent vegetation growth from blocking the watercourse as this area will no longer be accessible to the IDB's machinery for maintenance. The bridge is of a clear span design with setback foundations and so would only impact the

channel for the spatial extent of the lining. There would be a very localised impact to the channel and riparian habitat, and a potential increase in channel shading. However, at the scale of the larger WFD waterbody the impact would be negligible.

6.4.47 Any minor improvement works required to the existing crossing of drain D6 is not expected to significantly alter the footprint of the structure, and any impact on morphology would again be negligible to very minor.

6.4.48 Drain D2 may require open-cut works for pipelines within the Proposed PCC Site. This watercourse is considered low importance for morphology, due to being artificially straight, lacking significant geomorphic and bedform features. For open-cut crossings, the pipe/ cables will be buried at sufficient depth to prevent exposure and the flow over-pumped or flumed during the works to minimise the risk of water pollution being carried downstream. However, there will unavoidably be short term, temporary adverse impacts on the watercourse bed, banks and riparian habitats, as well as the hydrological and sediment regimes during construction. These impacts would be very localised and short in duration, with the channel fully reinstated. Due to the short-term and localised nature of the work it would have negligible impact at the scale of the WFD catchment.

6.4.49 Overall, there would be no detrimental impacts on the morphological WFD designations for Paupers Drain Catchment, or prevention of future improvement.

Aquatic Ecology

6.4.50 Drain 1 within the Paupers Drain WFD Catchment supports an assemblage of aquatic invertebrates of county value, and is the only watercourse surveyed across the Proposed Development with a notable assemblage. This drain would be directly affected by construction of a bridge crossing for the proposed Emergency Vehicle Access Road (see **Figure 3.3** (ES Volume III – **Application Document Ref. 6.4**) and **Application Document Ref. 4.16**). The construction disturbance would be small-scale and temporary and is not likely to adversely affect the conservation status of the aquatic invertebrate assemblage associated with Drain 1.

6.4.51 Worst-case construction requirements would affect no more than 10 - 15m stretches of drain bank and channel at the crossing location. Drain 1 is 150m long. Therefore, assuming a worst-case, construction would affect up to 10% of the total drain length, with the remaining 90% remaining suitable to support the aquatic invertebrate assemblage.

6.4.52 Other works would potentially be undertaken to Drain 2 and Drain D6, which do not have notable invertebrate assemblages. Overall, the localised and small-scale temporary construction impacts on aquatic invertebrates and their habitats

is not considered likely to affect the WFD classification element at the wider waterbody scale or prevent future improvement against WFD objectives.

Introduction and Spread of Invasive Non-Native Species

6.4.53 Nuttall's waterweed (*Elodea nuttallii*) was recorded within Drain 1 and Keadby Boundary Drain, which are upstream tributaries of this WFD waterbody. Given the known presence of invasive species, and legal obligations in relation to this, the Framework CEMP (**Application Document Ref. 7.1**) for the Proposed Development includes general biosecurity measures to mitigate the risk of these known species being transferred from the construction site into the wider landscape. These committed measures will also be applied so that construction vehicles, plant, materials brought into the construction site from other locations do not serve as vectors for introduction of other INNS to the Proposed Development Site. Therefore, it is considered that the potential for existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is very low and will not cause detriment or prevent future improvement of the WFD water body.

North Soak Drain Catchment (trib of Torne/Three Rivers)

Surface Water Quality – Suspended Fine Sediments

6.4.54 There are existing access route crossings of the North and South Soak Drain (both WFD designated as North Soak Drain Catchment), which will be maintained in their current form. However, there will be construction work in close proximity to these watercourses which could result in runoff of fine sediment towards them. There will also be works in close proximity to the unnamed drainage ditch alongside the access road from Mabey Bridge, which is also partly within this WFD catchment. Given the embedded mitigation measures described in Section 6.3, any adverse impact is expected to be minor, and would not adversely affect WFD classifications or objectives at the waterbody scale.

6.4.55 There is likely to be strengthening, maintenance or minor improvement works to existing watercourse crossings of Drain D7a and Drain D7b, which are within the North Soak Drain Catchment. At this stage it is not clear the extent of any works required; however, they are expected to be no more than minor alterations to the existing structures. As any improvement works would be immediately adjacent too, and/or over these drains, there is potential for mobilisation and conveyance of fine sediments to the channels. Given implementation of the best practice mitigation measures outlined in the CEMP, this impact would be minor and temporary, and would not cause reduction in any WFD element nor any non-compliance with objectives for the WFD waterbody.

Surface Water Quality – Chemical Spillages

6.4.56 The improvement works to crossings of drains D7a and D7b pose a risk of chemical spillage given works would occur immediately adjacent to and/ or over the channel. There may also be works close to the unnamed drainage ditch (including regular vehicular movements) that is adjacent to the access road from Mabey Bridge. There is therefore potential to receive spillages during construction, but given the mitigation measures described in Section 6.3, this would result in a temporary minor adverse impact to these drains, and which would be negligible at the larger WFD waterbody scale in terms of causing deterioration in element classifications or prevention of meeting future objectives.

Morphological Impacts

6.4.57 Any minor improvement works required to the existing crossings of Drain D7a and Drain D7b are not expected to significantly alter the footprint of the structures, and so any impact on morphology would be negligible to very minor. These drains are tributaries of the North Soak Drain Catchment WFD waterbody, and when considered at the WFD waterbody scale there would be no deterioration or prevention of future improvement in morphological classifications.

Aquatic Ecology

6.4.58 Drain D7a and Drain D7b are not known to have any particular aquatic ecology or biodiversity value. Any minor works to the existing crossings of these watercourses would be localised and small-scale temporary construction impacts and would not affect any WFD ecological classification at the wider waterbody scale or prevent future improvement against WFD objectives.

Introduction and Spread of Invasive Non-Native Species

6.4.59 Given the known presence of invasive species in the study area, and legal obligations in relation to this, the Framework CEMP (**Application Document Ref. 7.1**) for the Proposed Development includes general biosecurity measures to mitigate the risk of these known species being transferred from the construction site into the wider landscape. These committed measures will also be applied so that construction vehicles, plant, materials brought into the construction site from other locations do not serve as vectors for introduction of other INNS to the Proposed Development Site. Therefore, it is considered that the potential for existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is very low and will not cause detriment or prevent future improvement of the WFD water body.

Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)

Surface Water Quality – Suspended Fine Sediments

6.4.60 The construction of a replacement clear span bridge over Hatfield Waste Drain (Mabey Bridge) will require works in the riparian margin and over the watercourse, with piling and use of other plant leading to mobilisation of sediment that could be conveyed into the watercourses, in the absence of mitigation, given the immediate proximity of the works. Widening of the A18 would also require construction works in the immediate riparian margin of Hatfield Waste Drain and North Engine Drain (designated as part of the Hatfield Waste Drain WFD waterbody).

6.4.61 These works would be carried out in accordance with the final CEMP and the best practice measures outlined in Section 6.3 and given that no work would be required within the channels themselves and that the foundations will be set back from the watercourse then any adverse impact would be minor and temporary. As such, no reduction in any WFD element would occur due to suspended fine sediments, nor any non-compliance with WFD objectives for the water body.

Surface Water Quality – Chemical Spillages

6.4.62 Given works in close proximity to, and over (but not directly within), Hatfield Waste Drain for the replacement clear span bridge off the A18 and works adjacent to North Engine Drain for widening of the A18, there is potential for adverse water quality impacts from accidental chemical spillages. For the bridge replacement works, the anticipated construction sequence is shown on **Application Document Ref. 4.16**. Plant will be required adjacent to the watercourse for installation and piling foundations. However, given the implementation of mitigation measures within the final CEMP (see Section 6.3), any impact from chemical spillages to these watercourses is anticipated to be negligible and would not cause any deterioration in any WFD element or prevention of future improvement.

Morphological Impacts

6.4.63 No works are proposed within the Hatfield Waste Drain WFD waterbody with the replacement bridge to be of a clear span design with setback abutments. No works are planned within the North Engine Drain. As such, there are no morphological impacts requiring assessment for this waterbody.

Aquatic Ecology

6.4.64 The area of bank vegetation (species-poor grassland and stands of common reed) affected by the replacement of Mabey Bridge will be very small in the context of the WFD waterbody and designated LWS, the latter being 10.3km long and therefore has over 20km of associated bank habitat. The existing bank vegetation is already affected to a large extent by the existing bridge structure, which spans above and casts shade over the drain bank at the location where the replacement bridge will be constructed.

6.4.65 Any areas of bank temporarily disturbed during these works will be re-sown (if necessary) with a suitable grassland seed mixture to stabilise the banks after which other flora will colonise from immediately adjacent areas.

6.4.66 Once the replacement bridge is in place and habitat reinstatement has been completed, then the LWS would be expected to return to a condition consistent with the existing baseline conditions with circa 1 year. As such, there would be no deterioration in any WFD element or prevention of future improvement.

Introduction and Spread of Invasive Non-Native Species

6.4.67 Given the known presence of invasive species in the study area, and legal obligations in relation to this, the Framework CEMP (**Application Document Ref. 7.1**) for the Proposed Development includes general biosecurity measures to mitigate the risk of these known species being transferred from the construction site into the wider landscape. These committed measures will also be applied so that construction vehicles, plant, materials brought into the construction site from other locations do not serve as vectors for introduction of other INNS to the Proposed Development Site. Therefore, it is considered that the potential for existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is very low and will not cause detriment or prevent future improvement of the WFD waterbody.

Torne/ Three Rivers from Mother Drain to Trent

6.4.68 This WFD waterbody is within the 1km study area but would not be directly impacted by construction of the Proposed Development and is generally isolated from the Proposed Development by other watercourses that would prevent any pathway to impact. The exception is any impact to Hatfield Waste Drain (for works around the A18 and Mabey Bridge), which could propagate downstream to the Torne/ Three Rivers. However, as no significant impacts have been identified for Hatfield Waste Drain that would propagate downstream, there is no need for further assessment of this waterbody. There would be no impact on WFD classifications, and no prevention of future improvement that would prevent WFD objectives being met.

Idle Torne - Secondary Mudrocks Groundwater Body & Lower Trent Erewash - Secondary Combined Groundwater Body

6.4.69 The Idle Torne - Secondary Mudrocks Groundwater Body underlies the majority of the Proposed Development including the Proposed PCC Site, and encompasses the access road off the A18. The Lower Trent Erewash - Secondary Combined Groundwater Body is found located beneath the water connection corridor to the water discharge outfall to the Trent, and beneath the potential water abstraction corridor from the Trent.

6.4.70 During construction works there is the potential for impact to groundwater through the creation of new pathways, or exacerbation of existing pathways that may open or modify potential pollutant linkages (e.g. from drilling of piling foundations). Excavation of cuttings may liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits (sands, clays, gravels) that are intercepted. This liberated groundwater may not be suitable for discharge without treatment of contaminants. There is also potential for underlying groundwater to be contaminated from spillages associated with vehicles, construction materials and storage of fuels, oils and other chemicals.

6.4.71 It is assumed that all structures at the Proposed PCC Site will require piling. Direct/ indirect potential adverse impacts on groundwater quality within the Secondary A aquifer could therefore occur as a result of mobilisation of existing contaminants during construction. There will be a requirement to avoid creating flow paths between potentially contaminated soils and/ or groundwater in the underlying aquifer.

6.4.72 Appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the CEMP. This would also outline pollution control measures, such as the need for all fuel and chemical storage areas to be bunded. Foundations and services will be designed and constructed to prevent the creation of pathways for the migration of contaminants and will be constructed of materials that are suitable for the ground conditions and designed use. For example, below ground connection corridor pipelines would be designed in accordance with current good practice and applicable guidance to ensure pipes are protected from potential impacts associated with contamination. All waters removed from excavations by dewatering will be discharged appropriately, subject to the relevant licences being obtained.

6.4.73 The CEMP will set out procedures for dealing with unexpected soil or groundwater contamination that may be encountered. This would typically require affected works to stop to enable appropriate people to be notified, and further characterisation and risk assessment to be undertaken before remediation or mitigation proposals are agreed with all required stakeholders.

6.4.74 Piling options will be fully defined on conclusion of scheme specific ground investigation at the detailed design stage. Any piling works required would be planned in accordance with best practice guidance ‘Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention, EA National Groundwater & Contaminated Land Centre Report NC/99/73 (Environment Agency, 2001b). Any piling operations required would be subject to a works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements.

6.4.75 With the implementation of the mitigation measures to be described in the CEMP, **Chapter 13:** Geology, Hydrogeology and Land Contamination (ES

Volume I – **Application Document Ref. 6.2**), any residual impacts to the groundwater body would be temporary and minor and would not be significant at the water body scale. The Proposed Development is therefore compliant with the WFD objectives for these two waterbodies during construction.

6.5 Operation Phase Impacts

6.5.1 During the operation phase the following potential water environment impacts may occur, if appropriate mitigation is not applied:

- impacts on receiving waterbodies from diffuse urban pollutants in surface water runoff, or as a result of accidental spillages, with potential for subsequent adverse impacts on aquatic ecology;
- changes in water quality within the Humber Estuary waterbody from operational discharges from the Proposed Development including the discharge of treated process wastewater, water from the cooling system and potentially foul water discharge. This could have adverse impacts on aquatic ecology;
- potential nutrient enrichment of waterbodies from atmospheric deposition of nitrogen emitted from the Proposed Development (see **Chapter 8:** Air Quality and **Chapter 11:** Biodiversity (ES Volume I - **Application Document Ref. 6.2**); and
- impacts on morphology of waterbodies.

6.6 Operation Phase Mitigation

6.6.1 A number of mitigation features would be incorporated into the detailed design of the Proposed Development in order to avoid, minimise and reduce potential adverse impacts on water features and water resources. These features are described in the following sections.

Surface Water Drainage

6.6.2 A surface water drainage network and management system will be provided for the Proposed Development that will provide appropriate interception, conveyance, treatment, and attenuation of surface water runoff. Further details are provided in **Appendix 12A:** Flood Risk Assessment (including Section 5 – 6 - Conceptual Drainage Strategy (ES Volume II - **Application Document Ref. 6.3**).

6.6.3 Discussions have been undertaken with the IDB to determine the feasibility of the preferred method and rate of discharge for surface water runoff to the IDB network. The preferred option is to discharge into the IDB network (Keadby Common Drain) at the greenfield runoff rate. Refer to **Appendix 12A:** Flood Risk Assessment (including Section 5 – 6 - Conceptual Drainage Strategy (ES Volume II **- Application Document Ref. 6.3)** for details of the calculated

greenfield runoff rates and surface water volume attenuation requirements. The IDB has noted that they do not normally accept discharges higher than agricultural runoff rate (1.4l/s/ha) but is considering the Applicant's proposals including any mitigation measures that may be required in order for such a discharge to be accepted. However, if this is not possible, an alternative discharge route is also proposed, should this be required to meet the agricultural run-off rate. This is to attenuate runoff within the Proposed Development Site in the same way as proposed for the preferred discharge solution, but in addition (or as a hybrid solution in combination with the preferred solution), to discharge excess surface water via the Water Discharge Corridor at the greenfield runoff rate. The ultimate discharge location will be to the River Trent via the Water Discharge Corridor, which is via the existing Keadby 1 Power Station cooling water culvert and outfall, which is also proposed to be utilised for treated water from Keadby 2 Power Station, once operational.

6.6.4 Due to the nature of the Proposed Development, it is likely that a range of different diffuse pollutant types may be present in surface water runoff, with concentrations varying depending on many factors. This risk will be mitigated as far as reasonably practicable by providing suitable treatment measures and ensuring their maintenance.

6.6.5 The detailed drainage strategy will be developed further in continued consultation with the LLFA (North Lincolnshire Council (NLC)), IDB and other statutory agencies, if required. The proposed drainage system is to include the use of bypass oil water separators and SuDS in the form of swales and an attenuation pond within the Proposed PCC Site, to attenuate surface water flows due to increases in the impermeable area as a result of the Proposed Development. SuDS would also provide treatment of runoff to ensure potential adverse effects on water quality are avoided/ minimised, as far as reasonably practicable. SuDS and the treatment train have been selected and assessed with reference to the SuDS Manual (CIRIA, 2015a) and the Simple Index Approach contained therein.

6.6.6 The maintenance required for SuDS and drainage networks will be based on standard guidance and practice. Requirements for maintenance and management of vegetated drainage systems (e.g. ponds) are described in The SuDS Manual (CIRIA, 2015a) and DMRB CD 532 (Highways England, 2020).

6.6.7 Furthermore, as the Proposed Development will be an active industrial site controlled by an Environmental Permit and regulated by the Environment Agency, pollution control measures will be required to demonstrate BAT in order to prevent accidental discharge of pollutants such as hydrocarbons to surface water systems. Pollution prevention measures considered would include (but would not be limited to):

- silt/ oil alarms will be fitted on all interceptors and attenuation storage facilities to alert operators when they require emptying;

- foul flows and effluent arising from the Proposed Development operation will be kept separate from the surface drainage network; and
- areas which may have a higher risk pollutant spills to be isolated through the use of bunds.

Process Water Treatment

6.6.8 At this stage in the design process, preliminary water supply and wastewater discharge assessments have outlined what process wastewaters may be generated by the Proposed Development and how these may be treated with the application of BAT. These assessments indicate that wastewater contaminants will be generated from the following activities:

- cooling tower blowdown - blowdown from the power plant and carbon capture cooling towers are likely to contain total dissolved solids (TDS), with some suspended solids plus trace chemical and organics resulting from water treatment chemical addition. The composition of the cooling tower blowdown will be limited by the number of cycles of concentration that the water undergoes. It is proposed that this will be discharged via a dedicated pipeline connection to the existing infrastructure used by Keadby 1 Power Station to the River Trent. All discharges would be in accordance with an Environmental Permit required for the operation of the Proposed Development.
- DCC blowdown - DCC blowdown wastewater will be treated within the power island and CCP plant area. A number of Treatment processes are under consideration to enable the treated water to be recovered for cooling water make-up or discharged to the River Trent.
- Demineralisation Plant and Condensate Polishing Plant Regeneration - The wastewater from the demineralisation plant and possible steam condensate polishing plant will be treated prior to discharge to the River Trent.
- HRSG boiler blowdown - The HRSG boiler blowdown is likely to be treated prior to recovery for cooling water make-up or otherwise discharged to the River Trent following treatment.
- Water Treatment Works (WTW) Residuals - The quantity and quality of the wastewater discharge from the WTW is highly dependent upon the salinity of the source and the required level of salt removal (desalination) and so will vary depending on the chosen abstraction option.

6.6.9 Wastewater treatment will be provided for process effluent prior to discharge to the environment via the existing River Trent outfall.

6.6.10 It is anticipated that the wastewater environmental regulatory emission limit values (ELVs) that apply within the Environmental Permit shall be in-line with the target BAT Associated Emission Levels (AEL) from wastewater treatment plants treating effluent from chemicals sites, or processes as identified within

the BAT Reference Document for Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector (2016) (otherwise known as the CWW BREF) and its associated BAT Conclusions document. If the project Environmental Risk Assessment shows that significant impact could occur with the plant discharging at the BAT-AEL concentrations, tighter emission limits could subsequently be applied.

6.6.11 Following treatment, process water that is to be directed to the outfall would flow via the existing Keadby 1 Power Station cooling water culvert. As per the Environmental Permit for Keadby 2 Power Station, the emission limits would apply to the discharge point into the cooling water culvert rather than the eventual outfall in the River Trent. Water sampling facilities are to be provided for manual sampling of water prior to discharge. The frequency of testing and parameters to be tested will be agreed with the Environment Agency. In situ continuous monitoring of flow, temperature, total organic carbon (TOC) conductivity and pH measurement shall also be undertaken.

River Trent Outfall

6.6.12 In order to ensure safe system operation and not compromise performance of the Proposed Development, the outfall to the River Trent must take precautions to prevent aquatic life entering the system. Environment Agency guidance documents identify that the most vulnerable eels at outfalls are glass eels, elvers and yellow eels up to 30cm. It is proposed that the discharge from the outfall is kept in excess of the burst velocity of the yellow eels to prevent entry. By adopting suitable diameter pipes, this could be achieved by gravity (subject to a combined study of the Keadby 2 & 3 systems). If this is not possible then a pumped discharge system may have to be considered.

6.6.13 Cooling water will be discharged at a rate and with a chemical water quality compliant with the discharge limits set by the Environment Agency within the Environmental Permit, considering BAT for those discharges.

Canal Intake / River Trent Intake

6.6.14 For the purposes of the study, it is assumed that a similar intake structure and layout as currently being constructed for the Keadby 2 canal intake would be used for the Proposed Development if the preferred Canal Water Abstraction Option is selected. As the existing Aqseptence screen installation is designed for 442L/s, and the maximum hybrid cooling water demand for the Proposed Development is 348L/s, it is expected that the overall dimensions of the new inlet will be no larger than the Keadby 2 installation.

6.6.15 An eel screen (2mm mesh size) will be installed during the construction or upgrade (depending on the location selected) of water supply infrastructure to meet the specification advised by the Environment Agency to achieve compliance with the Eels (England and Wales) Regulations 2009 and other relevant legislation and regulatory requirements during operation of the

Proposed Development (refer to **Chapter 4**: The Proposed Development (ES Volume I – **Application Document Ref. 6.2**). The proposed screen mesh size, in combination with the proposed water intake velocity of less than 0.3m/sec, is suitable to protect all life stages of eel and therefore is also suitable to protect all other fish species including juvenile river and sea lamprey. A water intake velocity of less than 0.3m/sec allows even the most sensitive (weakest swimming) fish species (eel and lamprey juvenile life stages) to achieve 'escape velocity' when passing the location of the water intake.

Management of Hazardous Substances on Site

6.6.16 The use of the chemical products at the Proposed Development site will follow the product specific environmental guidelines, as well as the legislative requirements set out in the Control of Substances Hazardous to Health Regulations (COSHH (2002) (HMSO, 2002) and Control of Major Accident Hazards (COMAH) Regulations (2015) (HMSO, 2015).

6.6.17 A site Emergency Response Plan will be in place for dealing with emergency situations involving loss of containment of hazardous substances. This will detail how to contain and control incidents to minimise the effects and limit danger to persons, the environment and property. As described above, all aspects of the drainage system that have the potential to receive contaminants include containment provision to contain chemical spillage on Site and upstream of the site outfall to River Trent.

6.6.18 The Incident and Emergency Response Plan will set out the emergency spill control procedure that will include the following key actions adapted from the Health and Safety Executive's Emergency Response/ Spill Control Technical Measures Document (HSE, 2020) and would be implemented through the Proposed Development Site Environmental Management System (EMS), for example:

- spills involving hazardous materials should first be contained to prevent spread of the material to other areas. This may involve the use of temporary diking, sandbags, dry sand, earth or proprietary booms/ absorbent pads;
- wherever possible the material should be rendered safe by treating with appropriate chemicals;
- hazardous materials in a fine dusty form should not be cleared up by dry brushing;
- treated material should be absorbed onto inert carrier material to allow the material to be cleared up and removed to a safe place for disposal or further treatment as appropriate;
- waste should not be allowed to accumulate. A regular and frequent waste removal procedure should be adopted; and

- process specific emergency spill kits (acid, alkali, solvent, toxic, etc.) should be readily available with supporting procedures, and maintained on a regular basis, and staff regularly trained in their use.

6.6.19 Once a hazardous spillage has been contained, to prevent spread of the material to other areas, the material should be treated to render it safe. Acids and alkalis may be treated with appropriate neutralising agents. Due to differing properties of various groups of chemical products, an appropriate strategy with suitable treatment agents should be established in each case.

6.6.20 Once the material has been treated, the cleared-up area should be washed with large volumes of water. This should not be discharged from the Proposed Development Site outfall but disposed of offsite or sent to the sewers if practical (and agreed with the sewerage undertaker). The washing operation will represent an abnormal loading on the downstream treatment works, and so the treatment plant must be notified in advance so that appropriate measures can be adopted. This will include providing details of approximate quantity of hazardous material, composition of the material, physical properties of the material, and the state of the material (e.g. whether it has been neutralised). It is therefore important that the Site operator liaises closely with Severn Trent Water when developing the Site Incident and Emergency Response Plan.

6.6.21 Further guidance to be consulted upon in development of the Site Incident and Emergency Response Plan will include:

- HS(G)191 Emergency planning for major accidents. Control of Major Accident Hazards Regulations 1999 (HSE, 1999);
- HS(G)71 Chemical warehousing: the storage of packaged dangerous substances (HSE, 1992); and
- BS 5908: Fire and explosion precautions at premises handling flammable gases, liquids and dusts. Code of practice for precautions against fire and explosion in chemical plants, chemical storage and similar premises (BSI, 1990).

6.6.22 All products are to be labelled with their hazard ratings so that the user is aware of any potential risks to the environment. Provided they follow the label instructions, the risks are well controlled. Only well trained, certificated and staff experienced in the use of the various chemical products will be allowed access.

6.7 Decommissioning

6.7.1 The Proposed Development would be subject to decommissioning under the conditions of the Environmental Permit including conditions relating to chemical/ polluting material handling, storage and use and emergency procedures in line with BAT. A detailed Decommissioning Environmental Management Plan (DEMP) would be prepared to identify required measures to prevent pollution during this phase of the Proposed Development, based on the detailed

decommissioning plan. This is also secured by a requirement in Schedule 2 of the Draft DCO (**Application Document Ref. 2.1**).

6.7.2 The impact avoidance measures for decommissioning would be similar to those identified above for the construction phase. As above, measures would be in place to prevent pollution in accordance with the Environmental Permit.

6.8 Operation Phase Assessment

Humber Upper Waterbody

Surface Water Runoff and Accidental Spillages

6.8.1 Throughout its lifetime, the Proposed Development would be regulated by the Environment Agency through an Environmental Permit, which would include conditions relating to discharges to the Humber Upper Waterbody (i.e. the River Trent).

6.8.2 The Conceptual Drainage Strategy (**Appendix 12A**: Flood Risk Assessment (including Section 5 – 6 - Conceptual Drainage Strategy (ES Volume II - **Application Document Ref. 6.3**)) proposes to include SuDS in line with NLC's SuDS and Flood Risk Guidance Document (North Lincolnshire Council, 2017). This will enable attenuation of surface water flows due to increases in the impermeable area as a result of the Proposed Development. SuDS would also provide treatment of runoff to ensure potential adverse effects on water quality are avoided.

6.8.3 Using the source-pathway-receptor approach, the source of pollution would be potential contaminants on impermeable surfaces (e.g. metal from vehicles on roads) which are transferred by the pathway of surface water runoff to the River Trent (the receptor) via the existing Keadby 1 Power Station outfall and drainage infrastructure. The preferred discharge point would be to Keadby Common Drain, but the assessment of drainage to the River Trent is also included here should this alternative be required (in the event that IDB consent is not granted for Keadby Common Drain).

6.8.4 The Conceptual Drainage Strategy (**Appendix 12A**: Flood Risk Assessment (including Section 5 – 6 - Conceptual Drainage Strategy) (ES Volume II - **Application Document Ref. 6.3**)) indicates that SuDS attenuation for surface water runoff will be provided in the form of swales discharging into an attenuation pond prior to discharge to a watercourse (pond indicated on **Figure 4.1** (ES Volume III **- Application Document Ref. 6.4**)). In-line oil separators will also be installed, the locations of which are to be determined during detailed design. All surface water discharge leaving the site is to pass through an oil separator (with collected oil intermittently removed and disposed of off-site).

6.8.5 The SuDS Manual's Simple Index Approach (CIRIA, 2016) has been applied to assess the suitability of an assumed attenuation pond for surface water runoff

and spillages (from non-process areas). Refer to **Chapter 12:** Water Environment and Flood Risk (ES Volume I - **Application Document Ref. 6.2**).

6.8.6 On this basis of the proposed SuDS alone, the assessment failed to meet the required mitigation for hydrocarbons but passed the assessment for total suspended solids and metals. However, additional treatment is proposed to be provided using oil interceptors. Proprietary treatment systems such as these are not considered within the Simple Index Assessment as the performance varies between available products. The majority of available oil interceptors would provide sufficient treatment for hydrocarbons to ensure that the treatment train passes the Simple Index Assessment, however, the appropriateness of the chosen product for providing the additional treatment required for runoff will be confirmed through consultation with the Environment Agency, the LLFA and IDB.

6.8.7 The Drainage Strategy developed at the detailed design stage will ensure that suitable treatment is provided prior to discharge to any watercourse in order to not adversely impact water quality of receiving waterbodies.

6.8.8 Hazardous substances will be used on site. In each case the product will have a Material Safety Data Sheets providing guidance on safe disposal of waste chemicals. It is assumed that during operation of the facility, the disposal of product containers and chemical waste will adhere to this guidance, and the impact avoidance measures above.

6.8.9 Spillages on Site will be treated as per the pollution prevention measures described within the impact avoidance measures, and spilt substances collected and disposed of as per their individual requirements. Areas where pollutants are stored and spillages are likely will be bunded, and oil interceptors will be fitted with alarms. Penstocks will be provided to isolate any spills or firewater in the surface water drainage system and prevent its discharge to the environment. Should any spillage occur the Environment Agency would immediately be informed, or Severn Trent Water should it impact the foul water system.

6.8.10 A Surface Water Maintenance and Management Plan will be prepared during the detailed design phase post-DCO consent to describe the requirements for access and frequency for maintaining drainage infrastructure proposed on the Site. The maintenance regime must be fully implemented throughout the lifetime of the Proposed Development to avoid issues such as blockages which could lead to flooding, or failure of the spillage containment and pollution prevention systems.

6.8.11 Given that the Drainage Strategy will have to meet standards required by the environmental permit and the expected local policy requirements, and that measures will be in places for dealing with spillages and firewater then a negligible impact is predicted to the River Trent from surface water drainage, particularly given the large dilution capacity of the watercourse. As such, there

would be no deterioration or prevention of future improvement in any WFD element as a result of surface water drainage and accidental spillages on Site.

Surface Water Quality: Process Water Discharges

6.8.12 Cooling water from the Proposed Development Site (the source in the source-pathway-receptor approach) will discharge (the pathway) to the River Trent (the receptor) under an environmental permit. It is anticipated that the volume of discharge from the Proposed Development will be less than 1m^3/s and is likely to require discharge intermittently, in combination with the 0.016 m^3/s proposed to be discharged from Keadby 2 Power Station. As such it is considered that the Proposed Development will be operating well within the parameters of what was determined to be not significant for Keadby 1 Power Station, where the existing permit (EPR/YP3133LL) allows a maximum daily discharge of 15 m^3/s (average of 24-hour period).

6.8.13 Discharge of cooling water will require a permit from the Environment Agency, which will specify the effluent quality required to maintain the status of the receiving waters. Cooling water will be monitored prior to discharge in compliance with the conditions of this permit (as with Keadby 2 Power Station). It should be noted that as per the Keadby 2 Power Station Permit Variation that the effluent quality limits (and associated monitoring) will apply at the point of discharge within the Keadby 1 Power Station cooling water culvert, not at the River Trent outfall point.

6.8.14 On the basis of available data, it is considered that there will be negligible impact on temperature status of the River Trent, and the discharge would not prevent a barrier to migratory routes for fish. Engagement with the relevant stakeholders – principally the Environment Agency and MMO – has been undertaken to confirm the approach to assessment.

6.8.15 There is further potential for physico-chemical water quality impacts at the River Trent outfall, as discharged water is likely to include that from:

- Cooling Tower Blowdown – effluent from which may have elevated TDS concentrations, suspended solids concentrations, plus trace chemical and organics resulting from water treatment chemical addition. Chlorine is also likely to be elevated but will be treated through careful management of biocide addition during normal operation, and by timing shock chlorination dosing to align with plant shutdown operations to allow natural chlorine decay during outage periods;
- DCC Blowdown – effluent from which may include high concentrations of ammonia, dissolved carbon dioxide and other trace chemicals. Treatment options are being developed which may include air and thermal stripping of wastewater to achieve a preliminary 5 mg/L ammonia content;
- Demin Plant and Condensate Polishing Plant Regeneration - effluent will be high in salt content, with a TDS concentration typically in the region of 30,000

ppm. It is assumed at this stage that these wastewaters will be neutralised in a treatment pond and discharged to the River Trent.

- HRSG Boiler Blowdown - effluent is likely to be low in TDS but contaminated with a range of trace chemical additives. Limited treatment of this wastewater will be required before discharge to the River Trent via the existing outfall. Options also considered include recovery of this wastewater for cooling water make-up.
- WTW Residuals - effluent quantity and quality of the wastewater discharge from the WTW is highly dependent upon the salinity of the source and the required level of desalination. It is proposed to recover the wash water from the media filtration processes, along with sludge processing return liquors, to minimise waste discharge from the Proposed Development Site and to minimise water abstraction rates. The required WTW will vary depending on the cooling water option that is finally selected.

6.8.16 The discharge from the Proposed Development has not yet been fully characterised and information relating to which chemicals will be used and their concentrations in the discharge will be determined at the detailed design phase. The Humber Upper (River Trent) WFD waterbody currently has Good Physico-Chemical Status and Chemical Status is Failing. The Proposed Development must not lead to deterioration of this status or prevent future improvement. It will need to be demonstrated that the discharged effluent from the Proposed Development meets the required standards for a range of water quality indicators in order to obtain a Water Activity Permit (i.e. a consent from the Environment Agency to discharge).

6.8.17 An on-site effluent treatment plant would be provided following BAT for treatment of effluent derived from the above processes. This is then expected to discharge to a retention pond upstream of the River Trent outfall. Water sampling facilities are to be provided for manual sampling of water prior to discharge. The frequency of testing and parameters will be agreed with the permitting authority. In situ continuous monitoring of flow, temperature, conductivity and pH measurement shall also be undertaken, where appropriate as informed by consultation as part of the EIA and permitting process.

6.8.18 Given the requirements for the effluent from the Proposed Development to meet conditions of an environmental permit, it is considered that there is limited potential for pollution from the outfall, especially given the large capacity for dilution and dispersal offered by the Trent waterbody. As such, a negligible impact is predicted at this stage, with no changes likely to impact on WFD classifications for the larger waterbody.

Foul Water Discharge

6.8.19 As described in **Chapter 4**: The Proposed Development (ES Volume I - **Application Document Ref. 6.2**) foul drainage from permanent welfare

facilities would be directed to the local sewerage system, subject to agreement with the local sewerage undertaker. The existing foul sewer connection within the Keadby Site would be utilised if it is found to be fit for purpose for life of Proposed Development. It has been assumed that given the relatively small volumes involved, that Severn Trent Water will have adequate capacity to provide treatment within current permit standards. This will be confirmed through ongoing consultation with Severn Trent Water.

6.8.20 If this is not the case, a package treatment plant will be used which will discharge into the cooling water outfall) under the conditions of an Environmental Permit.

6.8.21 For the purposes of this assessment, it has been assumed that the Severn Trent Water WwTW or the on-site package treatment plant will treat foul water prior to discharge to any waterbodies in accordance with requirements to not cause deterioration or prevent improvement under the WFD. On this basis, no deterioration or prevention in future improvement in any WFD element classification is anticipated from foul water discharge.

Water Abstraction

6.8.22 The preferred water abstraction source for the Proposed Development would be the Stainforth and Keadby Canal. The Canal and River Trust has a licence to abstract water from the canal to supply cooling water for the Keadby 2 Power Station, once operational. Licensing discussions are ongoing between the Canal and River Trust and the Environment Agency to determine the feasibility of supply for the Proposed Development.

6.8.23 If consent cannot be granted, then the abstraction would be from the River Trent, subject to the appropriate consents. Based on initial discussions with regulators, it appears that water will be available for abstraction from the River Trent.

6.8.24 Given that Keadby Power Station currently holds two abstraction licences, (the canal and River Trent), it is anticipated that the Proposed Development would potentially be able to adopt an existing licence for water abstraction. Alternatively, a new licence could be required, or the water requirement may be achieved through licence trading which would follow the same approach as applying for a new licence.

6.8.25 Given that there is sufficient water supply available from the waterbody and that any abstraction would be licensed by the Environment Agency, a negligible impact is predicted on water availability from these sources and no adverse impact is predicted to water quantity or quality in the worst-case scenario that this abstraction point is used.

Atmospheric Deposition

6.8.26 Deposition of air pollutants released from point source emissions can be deposited into the marine or freshwater environment either by wet or dry deposition processes. Deposition of air pollutants, particularly nitrogen and sulphur compounds can cause direct disturbance to habitats and species through acidification.

6.8.27 **Chapter 8:** Air Quality (ES Volume I – **Application Document Ref. 6.2**) assesses potential impacts from atmospheric deposition on waterbodies. The potential pollutant concentrations resulting from the emissions arising from the Proposed Development have been predicted using atmospheric dispersion modelling techniques where appropriate, which enabled the assessment of the impacts associated with the Proposed Development on the identified sensitive receptors. The assessment methodology for each type of emission is provided in the accompanying technical appendices (**Appendix 8A**: Air Quality - Construction Phase, **Appendix 8B**: Air Quality - Operational Phase and **Appendix 8C**: Assessment of Amine Degradation Products (ES Volume II – **Application Document Ref. 6.3**)).

6.8.28 The impact of point source emissions at ecological receptors has been determined from isopleth figures of pollutant dispersion and maximum model output at the discrete receptor locations. The maximum daily and annual mean predicted concentrations have been compared with the relevant Air Quality Assessment Levels (AQAL). The full results for each receptor are provided in **Appendix 8B**: Air Quality – Operational Phase, Tables 14 - 15 (ES Volume II **– Application Document Ref. 6.3**) with depositional impacts presented in Tables 16 - 17.

6.8.29 The dispersion modelling includes a number of conservative assumptions to provide a representative worst-case. Annual average impacts of NO_x at the worst-affected receptor (Humber Estuary Ramsar/ SAC/ SSSI) are considered to have a negligible adverse impact and therefore effects are considered to be not significant. This is because emissions are under the threshold to be determined as not significant (70%). This is also the case for the annual mean NH_3 impacts for the worst-affected ecological receptor (Humber Estuary Ramsar/ SAC/ SSSI) that is assigned the higher NH_3 critical load value. Here, the annual average impact of NH_3 is also below the 70% threshold and therefore effects can be considered not significant. As such, no deterioration or prevention of future improvement of any WFD element is anticipated as a result of atmospheric deposition. Refer to **Chapter 8:** Air Quality and **Chapter 11**: Biodiversity (ES Volume I – **Application Document Ref. 6.2)** for further detail.

Ecological Impact

Habitat Disturbance and Modification

6.8.30 The outflow of cooling water into the River Trent could, if not appropriately regulated, cause scour and erosion of intertidal mudflat habitats within the Humber Estuary SAC and Ramsar site. However, this is not likely to occur given existing regulatory and permitting regimes which apply to such discharges. The outfall of cooling water will replace the existing consented discharge from Keadby 1 Power Station regulated by the Environment Agency under Environmental Permit YP3133LL, originally issued in April 2006. There is no evidence that the existing operational discharge from Keadby 1 Power Station is having an effect on habitats within the River Trent. Examination of the setting of the existing outfall structure during ecological surveys in 2020 found no evidence of erosion other than that consistent with the natural tidal rise and fall of the river. The banks of the river were well vegetated by common reed, and marginal mudflats are apparent downstream of the outfall at low tide.

Visual and Noise/ Vibration Disturbance

6.8.31 During operation, the only direct interaction of the Proposed Development with European Sites will relate to the discharge of cooling water to the River Trent, which is part of the Humber Estuary SAC and Ramsar site; and potentially abstraction if cooling water is taken from the River Trent. However, operation of this infrastructure would be consistent with the usage of the same structures for Keadby 1 Power Station and consented used for Keadby 2 Power Station. Similarly, the wider Proposed Development is not likely to result in noise levels that could affect these European Sites.

6.8.32 It is likely that the water intake and outfall structures will need periodic maintenance during the operational life of the Proposed Development. However, the potential for disturbance associated with periodic maintenance activities at both structures would be directly comparable to, or less than, those assessed under construction. Accordingly, no adverse noise/ vibration levels from maintenance activities are considered likely.

Cooling Water Discharge

6.8.33 As outlined above with regard to surface water quality impact from process water, it is considered that the Proposed Development will be operating well within the parameters of what was determined to be not significant for Keadby 1 Power Station (existing permit EPR/YP3133LL).

6.8.34 It is considered that there will be negligible impact on temperature status of the River Trent, and the discharge would not prevent a barrier to migratory routes for fish. Prior modelling of the greater thermal discharge from Keadby 1 Power station concluded that there would be no impact to the overall status of fish populations as a result of temperature-related mortality or thermal barriers to migratory fish movements (including consideration of lamprey species). It was also considered that this finding confirmed a previous conclusion reached by the Environment Agency that it is unlikely that thermal discharge of the level

assessed would have any significant impact on the migration of river and sea lamprey between the river and the Humber Estuary (APEM, 2011).

6.8.35 Cooling water could, if not adequately treated and monitored prior to discharge, contain potential pollutants, including residual biocides and other blowdown products. However, the discharge of cooling water will be subject to existing pollution control and environmental protection regulation and permitting regimes, which it is reasonable to assume will be properly applied and enforced by the relevant regulators including the Environment Agency.

6.8.36 Cooling water will only be discharged at a rate (velocity) and with a chemical and thermal water quality compliant with the discharge limits set by the Environment Agency within the Environmental Permit. Furthermore, cooling water will need to be monitored prior to discharge in compliance with the conditions of the relevant permit(s). Given these substantial regulatory controls, it is not likely that discharged water will contain pollutants, including biocides, at concentrations which could impact on aquatic ecology, and cause deterioration against any WFD elements or prevention of future improvement.

Entrapment of lampreys

6.8.37 If the River Trent Water Abstraction Option is used, then there is a potential pathway for injury and mortality of migrating lamprey species through impingement (the capture and trapping of organisms on intake screens) and entrainment (the passing of small organisms through screens and the transfer of these into the main cooling water transfer system).

6.8.38 In relation to entrainment, it should be noted that compliance with current legislative regimes for European eel (*Anguilla anguilla*) (The Eels Regulations) requires screening of water intakes (so called 'eel screens') and typically a maximum screen mesh size of 2mm is required by the regulator (Environment Agency). The design for the Proposed Development assumes this mesh size for legal compliance purposes. Consequently, because the Proposed Development has been designed to protect European eel, entrainment of lamprey species could not occur. This potential impact pathway can therefore be discounted. The minimum likely size of the smallest life stage (transformer) of the smaller of the two lamprey species (river lamprey) at point of entry into estuary systems averages about 10cm in length, so could not pass through an eel screen of 2mm mesh size.

6.8.39 Impingement is also not a relevant consideration in relation to the passage and conservation status of adult lampreys as they are strong swimmers that can orientate themselves away from the margins of the river channel (Lucas & Bracken, 2010). Therefore, bankside water in-takes are not likely to interact with adult lampreys and where present they would be able to escape the pull of water into the intake. Impingement is therefore very unlikely, and adult lamprey are too large to pass through standard fish/ eel screens. Additionally, their anguilliform body shape and burrowing behaviour mean that they are well-

protected from collision and abrasion if rare impingement events occur (Teague and Clough, 2014). The potential impact from impingement to adult lamprey during operation can therefore be classified as trivial (de minimis).

6.8.40 In contrast, lamprey transformers migrate primarily through drifting downstream and consequently are at much higher risk of impingement because they are not strong swimmers, with a maximum escape velocity of 0.3m/s (Environment Agency, 2005). Acknowledging the potential risk of impingement of transformer lampreys, in reality this pathway does not exist as it is constrained by regulatory and permitting regimes. The Environment Agency has advised that, should the water intake on the River Trent be required, the water abstraction velocity should not exceed 0.25m/s at the lowest possible level at which maximum abstraction can take place i.e. the lowest astronomical tide level of -0.81m above ordnance datum (AOD). Therefore, the abstraction would be operated at a velocity that is below the maximum escape velocity for lamprey species.

6.8.41 Given the commitment to appropriate screening at the water intake, should the River Water Abstraction be required and to operate the abstraction at or below the maximum permittable velocity, it is therefore concluded that impacts on European Sites from impingement or entrainment of lamprey at the potential water intake location on the River Trent will not result in any adverse impacts against WFD ecological classifications, or prevention of future improvement.

Introduction and Spread of Invasive Non-Native Species

6.8.42 The PEA of the Proposed Development (**Appendix 11C**: PEA Report (ES Volume II – **Application Document Ref. 6.3**)) identified the presence of zebra mussel (*Dreissena polymorpha*) and Nuttall's waterweed (*Elodea nuttallii*) within the Stainforth and Keadby Canal. Should the canal be used as the water supply for the Proposed Development, then there is a theoretical pathway for dispersal of propagules of these species to the Humber Estuary SAC and Ramsar site via the cooling water discharge into the River Trent.

6.8.43 While acknowledging the theoretical impact pathway for dispersal of INNS, this is not likely given the implications of these species for effective operation of the Proposed Development. Zebra mussel in particular has the potential to settle and proliferate within water supply infrastructure such that without intervention, it would have the potential, ultimately, to cause a failure of this infrastructure. Accordingly, screening will be used at the water intake to exclude plant material and animals above 2mm size from the water supply, and approved biocide treatments will be used to control smaller life stages and propagules. As such, the design and operational parameters for the Proposed Development preclude potential for dispersal of viable propagules of INNS to the River Trent.

6.8.44 It should also be noted that currently there are no existing barriers for the dispersal of the above species from the canal to the River Trent, as the existing lock structure at the point of junction between these two waterbodies allows for partial mixing of waters and is therefore permeable to INNS.

6.8.45 Given the design and operational parameters and other relevant considerations, operation of the Proposed Development is not likely to result in the spread of INNS.

Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)

Water Abstraction

6.8.46 As described in Section 6.8.23, the preferred water abstraction source for the Proposed Development is the Stainforth and Keadby Canal. An abstraction license has been granted to Keadby 2 Power Station to abstract water from the Stainforth and Keadby canal. However, there will be insufficient capacity within the new Keadby 2 abstraction licence (MD/028/0083/0014) to support a combined abstraction for Keadby 2 Power Station and the Proposed Development, but there may be potential for an additional new abstraction of raw water to be made available for use by The Proposed Development. The feasibility of an abstraction from the canal is subject to ongoing discussions with regulators, with a formal pre-application being made by Canal and River Trust to the Environment Agency in respect of the preferred abstraction.

6.8.47 If the Environment Agency concludes that there is sufficient water supply available from the Stainforth and Keadby Canal, any abstraction would be licensed by the Environment Agency and a negligible impact would be predicted on water availability from these sources. No adverse impact on water quantity or quality of the Stainforth and Keadby Canal is therefore predicted as a result of the Proposed Development.

Other Impacts

6.8.48 No further impacts are predicted to this water body given that there would be no discharges made to this waterbody. All operational surface water runoff and process water discharges are directed to the Keadby Common Drain (Paupers Drain Catchment WFD waterbody) or the River Trent (Humber Upper WFD waterbody). As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Paupers Drain Catchment (trib of Trent)

Surface Water Quality: Routine Runoff and Accidental Spillages

6.8.49 The preferred option for surface water drainage is to discharge at the greenfield runoff rate to Keadby Common Drain, following water quality treatment using SuDS and oil interceptors. Keadby Common Drain is an upstream tributary of the Paupers Drain WFD waterbody.

6.8.50 Details of the Conceptual Drainage Strategy are provided in Section 6.6 (River Trent waterbody), given that the River Trent is an alternative discharge location

should IDB consent not be granted for flows above the agricultural runoff rate for surface water to Keadby Common Drain.

6.8.51 The assessment for River Trent applies equally to Keadby Common Drain, in that water will be treated using SuDS and the oil interceptors prior to discharge to any watercourse. The Conceptual Drainage Strategy will be developed at the detailed design stage following consultation with the LLFA; this would ensure that no receiving watercourse would be adversely impacted. This will include details of surface water maintenance and management required throughout the lifetime of the Proposed Development in order to maintain drainage infrastructure.

6.8.52 Spillages will be treated as per the pollution prevention measures previously described (refer to Section 6.6.18). Given that the Drainage Strategy will have to meet standards required by the environmental permit and the expected local policy requirements, and that measures will be in place for dealing with spillages and firewater, a negligible impact is predicted to the Keadby Common Drain (and hence Paupers Drain) from surface water drainage. As surface water quality would not deteriorate there would similarly be no adverse impact on ecological receptors within Keadby Common Drain. As such, there would be no deterioration or prevention of future improvement in any WFD element as a result of surface water drainage and accidental spillages at the Proposed Development Site.

Physical Effects: Loss of Drain 4

6.8.53 Construction of the Proposed PCC Site would result in the loss of one minor field drain (Drain D4 – tributary of Paupers Drain Catchment WFD waterbody) which would be infilled and built over. This artificial drain is straight, 400m long, approximately 1m wide and 10cm deep (depths noted at time of the spring survey for the PEA (**Appendix 11C**: PEA Report (ES Volume II **- Application Document Ref. 6.3**)). The channel is dominated by silt and largely overgrown with a very limited diversity of aquatic and wetland macrophyte species in the summer. It lacks hydromorphic bedform features (e.g. riffles, pools, localised meanders) and is not known to be of any significant biodiversity, social, or economic value.

6.8.54 Given the limited existing morphological or biodiversity value of this drain, it is considered that the impact arising from habitat loss can be readily compensated through sensitive design of the surface water attenuation infrastructure required by the Proposed Development, which includes a series of swales and an attenuation pond. Furthermore, there will be habitat enhancement works to ditches surrounding Keadby Common (discussed further in Section 8) which would further mitigate for this impact. This minor ditch is not under the jurisdiction of the IDB but is hydrologically linked to IDB maintained watercourses (i.e. Drain 1).

6.8.55 While there will be an unavoidable loss of this ditch, when considered in the context of the larger WFD waterbody and given enhancements to other ditches, there would be no deterioration or prevention of future improvement in any WFD classification element for Paupers Drain Catchment.

North Soak Drain Catchment (trib of Torne/Three Rivers)

6.8.56 No impacts are predicted to this water body given that it does not have any direct hydrological connection to the Proposed Development once it is operational. All operational surface water runoff and process water discharges are directed to the Keadby Common Drain (Paupers Drain Catchment WFD waterbody) or the River Trent (Humber Upper WFD waterbody). As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)

6.8.57 No impacts are predicted to this water body given that it does not have any direct hydrological connection to the Proposed Development once it is operational, other than for road drainage. The design of the A18 junction improvement has been informed by a CCTV drainage survey and the requirements for detailed drainage design are provided in **Application Document Ref. 4.6**. The detailed drainage design would include appropriate water quality treatment provision given potential for road runoff to contain pollutants and fine sediment. Works would be subject to agreement with NLC as highway authority and LLFA.

6.8.58 All operational surface water runoff and process water discharges are directed to the Keadby Common Drain (Paupers Drain Catchment WFD waterbody) or the River Trent (Humber Upper WFD waterbody). As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Torne/ Three Rivers from Mother Drain to Trent

6.8.59 **Chapter 8:** Air Quality (ES Volume I – **Application Document Ref. 6.2**) assesses potential impacts from atmospheric deposition on waterbodies. The assessment is described further above in relation to the Humber Estuary WFD waterbody. An assessment was made of impacts to the Three Rivers LWS as a worst-affected ecological receptor (see **Chapter 8:** Air Quality (ES Volume I – **Application Document Ref. 6.2**)). The impacts of daily NO_x on the Three Rivers LWS has been assessed as a medium magnitude of impact. The PEC indicates that an exceedance of the daily critical level (75µg/m^3) is very unlikely. It is therefore considered that the effect of this is not significant, given that the Environment Agency guidance states that where the short or long term maximum process contributions at LWS is <100% of the critical level, there are unlikely to be significant effects due to changes in air quality (refer to paragraph 8.3.53).

6.8.60 At the Three Rivers LWS, the predicted ammonia dose can be considered insignificant. In addition, the assessment of nitrogen deposition confirms that the contribution of ammonia, in combination with other nitrogen sources, will not result in a nitrogen dose at the LWS that exceeds the threshold for insignificance.

6.8.61 No deterioration or prevention of future improvement in any WFD classification element is anticipated as a result of atmospheric deposition.

6.8.62 No other impacts are predicted to this water body given that it does not have any direct hydrological connection to the Proposed Development once it is operational. All operational surface water runoff and process water discharges are directed to the Keadby Common Drain (Paupers Drain Catchment WFD waterbody) or the River Trent (Humber Upper WFD waterbody). As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Lower Trent Erewash - Secondary Combined Groundwater Body & Idle Torne - Secondary Mudrocks Groundwater Body

6.8.63 There are no planned discharges to groundwater during operation. There is some potential for leaks, spillages and contamination from storage of chemicals and use of fuels that could affect groundwater. However, any fuel and chemical storage areas would be bunded to prevent spread of spillages and to allow rapid clean up and removal for off-site disposal. Given that the majority of spillages would be directed to the surface water drainage system (including treatment and isolation potential), and that storage areas would be adequately bunded, negligible impacts on these WFD groundwater bodies are predicted during operation of the Proposed Development. The Proposed Development would therefore be compliant with all WFD objectives for these waterbodies.

7.0 MITIGATION MEASURES/ REASONS FOR NOT ACHIEVING GOOD STATUS ASSESSMENT

7.1.1 No mitigation measures have been provided by the Environment Agency for the WFD waterbodies assessed herein. As such, consideration has been given to the potential impact of the Proposed Development on the pressures and reasons for not achieving Good Status/ Potential that can be viewed on the Environment Agency's Catchment Data Explorer Website (see Tables 17 to 21, below). As the two WFD groundwater bodies are already at Good Ecological Potential, no pressures are listed for these waterbodies. There are also no pressures listed for the Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby).

7.1.2 With the available information about the pressures and reasons for not being at Good Ecological Status or Good Ecological Potential no potential non-compliance with the WFD objective 'failure to prevent improvement' is predicted.

Table 17: Humber Upper water body – assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Dissolved oxygen	Water Industry	Sewage discharge (continuous)	As explained in paragraph 3.9.17, foul water from welfare facilities will be directed via the existing foul water sewer for Keadby 2 Power Station to the Severn Trent Water pumping station on Chapel Lane, and from there to the nearest wastewater treatment works (WwTW), and that given the relatively small volumes involved, that they will have adequate capacity to do so within current permit standards. Severn Trent Water is responsible for ensuring no deterioration or prevention of improvement in the receiving waterbody from their treatment works. Consultation will continue with Severn Trent Water as the scheme develops to ensure there is sufficient

Classification element affected	Pressure Type	Activity	Appraisal
			capacity to take foul water from the Proposed Development. If the pipeline condition is not suitable for continued use, foul sewerage would instead be treated on site in a package treatment plant with the treated water directed to the River Trent via the water discharge connection. These discharges would be subject to the conditions of an Environmental Permit and there would be negligible impact on this existing pressure.
Dissolved oxygen	Flow	Surface Water Abstraction	The preferred abstraction point is within the Stainforth & Keadby Canal. Should the Trent have to be used as the back up option, then the abstraction would be subject to a license from the Environment Agency, with conditions in place that would manage pressure on the river water quality appropriately.
Dissolved oxygen	Agriculture	Poor Nutrient Management	Not applicable – related to other parts of the catchment (i.e. agricultural areas)
Mitigation Measures	Physical Modification	Unknown	No new structures are proposed relating to the operation of the Proposed Development, with only refurbishment of the existing water drainage outfall and abstraction intake point needed (if the River Trent abstraction option is required). The latter would require a temporary cofferdam. No

Classification element affected	Pressure Type	Activity	Appraisal
			impact on the mitigation measures classification from physical modification associated with the Proposed Development is predicted.
Angiosperms	Natural	Natural conditions	This is a natural unspecified pressure, and so cannot be assessed further.
Angiosperms	Flood protection - structures	Physical Modification	No new structures are proposed relating to the operation of the Proposed Development, with only refurbishment of the existing water drainage outfall and abstraction intake point needed (if the River Trent abstraction option is required). The latter would require a temporary cofferdam. No impact on the angiosperm WFD classification from physical modification associated with the Proposed Development is predicted.

Table 18: Paupers Drain Catchment (trib of Trent) waterbody – assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Phosphate	Water Industry	Sewage discharge (continuous)	Foul water from welfare facilities will be directed via the existing foul water sewer for Keadby 2 Power Station to the Severn Trent Water pumping station on Chapel Lane, and from there to the nearest wastewater treatment works

Classification element affected	Pressure Type	Activity	Appraisal
			(WwTW), and that given the relatively small volumes involved, that they will have adequate capacity to do so within current permit standards. Severn Trent Water is responsible for ensuring no deterioration or prevention of improvement in the receiving waterbody from their treatment works. Consultation will continue with Severn Trent Water as the scheme develops to ensure there is sufficient capacity to take foul water from the Proposed Development. If the pipeline condition is not suitable for continued use, foul sewerage would instead be treated on site in a package treatment plant with the treated water directed to the River Trent via the water discharge connection. As such, there would be no increase on this pressure for Pauper's Drain.
Phosphate	Agriculture	Poor Nutrient Management	Not applicable – related to other parts of the catchment (i.e. agricultural areas)
Fish	Agriculture	Land Drainage	
Fish	Agriculture	Poor Soil Management	
Ammonia	Agriculture	Poor Nutrient Management	
Fish	Physical Modification	Barriers – ecological discontinuity	There would be no new barriers in the watercourse resulting from the Proposed Development. The existing Keadby 2 outfall would be used to discharge treated surface

Classification element affected	Pressure Type	Activity	Appraisal
			water runoff to Keadby Common Drain, an upstream tributary of the Paupers Drain Catchment.

Table 19: North Soak Drain Catchment (trib of Torne/Three Rivers) – assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Mitigation Measures Assessment	Agriculture	Other – no details given	Not applicable – relates to other parts of the catchment
Dissolved Oxygen	Agriculture	Land drainage	Not applicable – relates to other parts of the catchment

Table 20: Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) - assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Invertebrates, Macrophytes, Fish, Phosphate, Ammonia,	Water Industry	Sewage Discharge - continuous	There are no discharges to Hatfield Waste drain from the Proposed Development to impact on this pressure.
Dissolved oxygen, invertebrates	Water Industry	Land drainage – operational management	There are no discharges to Hatfield Waste drain from the Proposed Development to impact on this pressure.
Phosphate, Macrophytes	Urban & Transport	Transport Drainage	Existing road drainage from the A18, where

Classification element affected	Pressure Type	Activity	Appraisal
& Phytobenthos			relevant, will continue to discharge to the drain. There will be a replacement of Mabey Bridge over Hatfield Waste Drain, but this would have no impact on water quality following implementation of best practice measures from the CEMP during construction, and no operational impact given adoption of an appropriate drainage strategy including water quality treatment at the detailed design stage. The replacement bridge would not have an impact on macrophytes when considered at the catchment scale.
Ammonia	Domestic General Public	Misconnections	Not applicable – relates to other catchment pressures.
Hydrological regime	Agriculture	Surface Water Abstraction	There are no discharges to Hatfield Waste drain from the Proposed Development nor abstractions from it, and so these pressures would not be impacted.
Fish	Agriculture	Poor Soil Management	
Fish	Agriculture	Barriers – ecological continuity	
Fish	Agriculture	Land drainage (physical modification)	
Hydrological Regime	Water Industry	Groundwater Abstraction	There is no abstraction from the Hatfield Waste Drain catchment (surface

Classification element affected	Pressure Type	Activity	Appraisal
			water or groundwater) relating to the Proposed Development, and so this pressure will not be impacted.

Table 21: Torne/Three Rivers from Mother Drain to Trent - assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Mitigation Measures Assessment	Agriculture	Physical Modification	No new structures are proposed in this catchment relating to the operation of the Proposed Development, and so there is no impact on physical modification
Dissolved Oxygen	Land Drainage – operational management	Physical Modification	No new structures are proposed in this catchment relating to the operation of the Proposed Development, and so there is no impact on physical modification
Phosphate, Dissolved oxygen, Ammonia	Water Industry	Sewage discharge - continuous	There are no new discharges to this WFD waterbody or any of its tributaries from the Proposed Development, and so there is no impact on this pressure.
Phosphate, Macrophytes & Phytobenthos	Urban & Transport	Transport Drainage	There are no new structures or discharges to this WFD waterbody or any of its tributaries from the Proposed

Classification element affected	Pressure Type	Activity	Appraisal
			Development, and so there is no impact on this pressure.
Phosphate, Ammonia	Agriculture	Poor Nutrient Management	Not applicable – relates to other catchment pressures.

8.0 ENHANCEMENT OPPRORTUNITIES

8.1 Attenuation Pond

8.1.1 The design of the surface water drainage system including attenuation pond is proposed to be agreed as a requirement of the draft DCO (**Application Document Ref. 2.1**). The pond will be designed so that it is also suitable for freshwater and/ or wetland flora and fauna. It will therefore complement the main habitat enhancement approach described in the Landscape and Biodiversity Management and Enhancement Plan (LBMEP) provided as **Application Document Ref. 5.10** of the DCO Application.

8.1.2 To achieve biodiversity enhancement the attenuation pond will be designed to:

- avoid linkages to foul water drainage and requirements for importation of topsoil, as these sources may result in additions of nutrients to the pond;
- provide (subject to confirmation of sufficient water availability) a variable water depth with shallow and gradual marginal areas and a deeper area (of up to 1m maximum depth); and
- retain permanent standing water in most years while not preventing seasonal drawdown (pond drying) given this is ecologically beneficial.

8.1.3 Aquatic vegetation will be left to establish primarily through natural colonisation to reduce the risk of incidental introduction of invasive non-native plant species. Prior professional experience indicates that planting of ponds is generally unnecessary as flora will start to arrive (e.g. through wind dispersal and with water birds) within the first season and a diverse flora is likely to establish within 3 years. In support of this approach, it is noted that the nearby Glew Drain (Drain 1) represents a suitable nearby seed source for colonisation of the pond.

8.1.4 The pond will not be stocked with fish as this would conflict with biodiversity objectives.

Drains within Keadby Common

8.1.5 The final LBMEP, to be secured through Requirement of the draft DCO (**Application Document Ref. 2.1**), will include details of a programme of field drain enhancement works to re-instate areas with open water more suitable to support a greater range of aquatic biodiversity, including water vole. The target drains are those on the southern, eastern and western boundaries of Keadby Common (800m total length/ 0.08ha).

8.1.6 The programme of enhancement works will commence before construction to provide enhanced habitat suitable for occupation by any water voles present at that time within the field drain to be infilled during construction.

8.1.7 The works would be planned to avoid any water vole burrows present at that time. Updated surveys and Clerk of Works would be undertaken as necessary to achieve this. Given existing survey data the sub-optimal habitat conditions currently present, water voles are not anticipated to be a significant constraint at the time of these works.

8.1.8 The following specific actions will be included in the final strategy:

- removal of excess silt and emergent (swamp) vegetation to re-instate open water conditions;
- cutting back of overhanging trees to reduce over-shading, in support of the successful establishment of aquatic vegetation suitable to sustain a more diverse faunal assemblage, including water vole;
- details of any possible tie-in with the surface water drainage scheme for the Proposed Development to improve water supply; and
- sowing of adjacent land, as described above, with species-rich wildflower grassland.

8.1.9 While these enhancements would not be of a scale to improve WFD classifications for Paupers Drain Catchment WFD waterbody at the catchment scale, they represent significant localised improvements to habitat quality and the water environment.

9.0 CONCLUSION

9.1.1 The WFD assessment indicates that, based on the current understanding of the Proposed Development, that no significant adverse impacts to WFD relevant waterbodies will occur provided that the outlined mitigation measures are implemented and therefore the Proposed Development is compliant with the WFD objectives for:

- the Humber Upper (GB530402609203);
- Paupers Drain Catchment (trib of Trent) (GB104028064300);
- North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350);
- Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330);
- Torne/Three Rivers from Mother Drain to Trent (GB104028064340);
- Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281);
- Lower Trent Erewash - Secondary Combined WFD Groundwater Body (GB40402G990300); and
- Idle Torne - Secondary Mudrocks WFD Groundwater Body (GB40402G992200).

9.1.2 The mitigation measures proposed include best practise to be adopted during construction to manage all pollution risks, and which will be implemented by the Contractor using a WMP prepared as part of a final CEMP. They also include measures to treat surface water runoff, process water, and to manage the risk of future spillages or pollution incidents occurring on the Proposed Development Site.

9.1.3 A number of permissions will be required from the Environment Agency, Internal Drainage Board, Marine Management Organisation and/ or Canal and Rivers Trust (unless these are disapplied by the DCO and replaced with alternative agreements in agreement with the relevant regulator) and these will provide an additional check on the proposed works. Prior to construction this will include consents related to discharges of any 'unclean' runoff during construction, and for any activity within 8m of the bank of a main river or culvert on a main river. Works close to ordinary watercourses would need consent from the LLFA and in some cases the IDB. A marine licence for regulated activities below the Mean High Water Spring Tide level would also be required, e.g. in the event that the abstraction from the River Trent is required.

9.1.4 Appropriate licences and permits will be obtained from the Environment Agency and Marine Management Organisation (where applicable) with regards to the operational discharges to the River Trent (process water and potentially surface

water runoff), and abstraction if required. It is preferred that the water abstraction will be from the Stainforth and Keadby Canal requiring a water abstraction licence from the Environment Agency , and surface water drainage will preferably be discharged to Keadby Common Drain, subject to agreement with the IDB.

9.1.5 Consultation with Severn Trent Water will continue to confirm capacity to accept foul water from the Proposed Development.

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ANNEX A WFD WATERBODY BASELINE STATUS 2019

Table A1: Surface Water Body Classification Details (2019)

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
RBMP	Humber	Humber	Humber	Humber	Humber	Humber
Waterbody ID	GB530402609203	GB104028064300	GB104028064350	GB104028064330	GB104028064340	GB70410281
Water Body Type	Transitional; Heavily Modified	Artificial	Artificial	Artificial	Artificial	Artificial
Area (km^2)	-	32.041	55.641	120.158	85.295	-
Length (km)	12.332	13.287	26.44	36.482	50.603	43.815
Overall Ecological Potential / Status	**Moderate Ecological Potential**	**Moderate Ecological Potential**	**Moderate Ecological Potential**	**Poor Ecological Potential**	**Moderate Ecological Potential**	**Moderate Ecological Potential**
Chemical Status	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Mitigation Measures Assessment	**Moderate or Less**	**Good**	**Moderate or Less**	**Moderate or Less**	**Moderate of Less**	**Good**
Biological Quality Elements	**Moderate**	**Bad**	**Moderate**	**Poor**	**Good**	**-**
Angiosperms	Moderate	-	-	-	-	-
Fish	Good	Bad	-	Poor	Good	-
Macroalgae	High	-	-	-	-	-
Phytoplankton	High	-	-	-	-	-
Invertebrates	-	Good	Moderate	Moderate	Good	-
Macrophytes and Phytobenthos combined	-	Good	-	Moderate	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Hydromorphological Supporting Elements	**Supports Good**	**Supports Good**	**Supports Good**	**Supports Good**	**Supports Good**	**-**
Hydrological Regime	Supports Good	Supports Good	Supports Good	Does Not Support Good	Supports Good	-
Physico-Chemical Parameters	**Good**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**-**
Acid Neutralising Capacity	-	-	High	-	High	-
Ammonia (phys-chem)	-	Poor	High	Moderate	Good	-
Biochemical Oxygen Demand (BOD)	-	-	-	High	-	-
Dissolved Oxygen	Good	High	Bad	Moderate	Poor	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
pH	-	High	High	High	High	-
Phosphate	-	Poor	High	Poor	Moderate	-
Temperature	-	High	High	High	High	-
Specific Pollutants	High	-	Moderate	-	High	-
Chlorothalonil	High	-	-	-	-	-
Pendimethalin	High	-	-	-	-	-
Triclosan	High	-	-	-	-	-
Manganese	-	-	High	-	-	-
Chromium (VI)	High	-	-	-	-	-
2,4-dichlorophenol	High	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
2,4-dichlorophenoxyacetic acid	High	-	-	-	-	-
Arsenic	High	-	-	-	-	-
Copper	High	-	-	-	High	-
Diazinon	High	-	-	-	-	--
Dimethoate	High	-	-	-	-	-
Iron	High	-	Moderate	-	-	-
Linuron	High	-	-	-	-	-
Mecoprop	High	-	-	-	-	-
Permethrin	High	-	-	-	-	-
Phenol	High	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Toluene	High	-	-	-	-	-
Zinc	High	-	Fail	-	-	-
Chemical	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**
Priority Substances	**Fail**	**Good**	**Does not require assessment**	**Good**	**Good**	**Good**
1,2-dichloroethane	Good	-	-	-	-	-
Atrazine	Good	-	-	-	-	-
Benzene	Good	-	-	-	-	-
Alachlor	Good	-	-	-	-	-
Chlorpyrifos	Good	-	-	-	-	-
Cypermethrin (Priority hazardous)	Fail	Good	-	Good	Good	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Octylphenol	Good	-	-	-	-	-
Dichlorvos (Priority)	Good	-	-	-	-	-
Aclonifen	Good	-	-	-	-	-
Chlorfenvinphos	Good	-	-	-	-	-
Cybutryne (Irgarol®)	Good	-	-	-	-	-
Terbutryn	Good	-	-	-	-	-
Dichloromethane	Good	-	-	-	-	-
Diuron	Good	-	-	-	-	-
Fluoranthene	Good	Good	-	Good	Good	Good
Isoproturon	Good	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Lead and Its Compounds	Good	-	-	-	-	-
Napthalene	Good	-	-	-	-	-
Nickel and Its Compounds	Good	-	-	-	Good	-
Pentachlorophenol	Good	-	-	-	-	-
Simazine	Good	-	-	-	-	-
Trichlorobenzenes	Good	-	-	-	-	-
Trichlorobenzenes	Good	-	-	-	-	-
Other Pollutants	**Good**	**Does not require assessment**	**Does not require assessment**	**Does not require assessment**	**Does not require assessment**	**Does not require assessment**
Aldrin, Dieldrin, Endrin & Isodrin	Good	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Carbon Tetrachloride	Good	-	-	-	-	-
DDT Total	Good	-	-	-	-	-
para - para DDT	Good	-	-	-	-	-
Tetrachloroethylene	Good	-	-	-	-	-
Trichloroethylene	Good	-	-	-	-	-
Priority Hazardous Substances	**Fail**	**Fail**	**Fail**	**Fail**	**Good**	**Fail**
Anthracene	Good	-	-	-	-	-
Polybrominated diphenyl ethers (PBDE)	Fail	Fail	Fail	Fail	Fail	Fail

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Perfluorooctane sulphonate (PFOS)	Good	-	Good	Good	Fail	Good
Benzo (b) and (k) fluoranthene	-	-	-	-	-	-
Benzo(a)pyrene	Good	-	Good	Good	Good	Good
Cadmium and Its Compounds	Good	-	-	-	Good	-
Dioxins and dioxin-like compounds	Good	Good	Good	Good	Good	Good
Benzo(b)fluoranthene	Fail	-	-	-	-	-
Benzo(g-h-i)perylene	Fail	-	-	-	-	-

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Benzo(k)fluoranthene	Fail	-	-	-	-	-
Heptachlor and cis-Heptachlor epoxide	Good	Good	Good	Good	Good	Good
Hexabromocyclododecane (HBCDD)	Good	Good	Good	Good	Good	Good
Quinoxyfen	Good	-	-	-	-	-
Di(2-ethylhexyl)phthalate (Priority hazardous)	Good	-	-	-	Good	-
Endosulfan	Good	-	-	-	-	-
Hexachlorobenzene	Good	-	Good	Good	Good	Good

RBMP Parameter	Humber Upper	Paupers Drain Catchment (trib of Trent)	North Soak Drain Catchment (trib of Torne/Three Rivers)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers)	Torne/Three Rivers from Mother Drain to Trent	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)
Hexachlorobutadiene	Good	-	Good	Good	Good	Good
Hexachlorocyclohexane	Good	-	-	-	-	-
Mercury and Its Compounds	Fail	Fail	Fail	Fail	Fail	Fail
Nonylphenol	Good	-	-	-	Good	-
Tributyltin Compounds	Fail	-	-	-	Good	-
Trifluralin (Priority hazardous)	Good	-	-	-	-	-

Table A2: Groundwater Body Classification Details (2019)

RBMP Parameter	Idle Torne - Secondary Mudrocks	Lower Trent Erewash - Secondary Combined
RBMP	Humber	Humber
Waterbody ID	GB40402G992200	GB40402G990300
Water Body Type	Groundwater	Groundwater
Area (km^2)	320.9	1924.4
Overall Status	**Good**	**Good**
Quantitative	**Good**	**Good**
Quantitative Saline Intrusion	Good	Good
Quantitative Water Balance	Good	Good
Quantitative GWDTE test	Good	Good
Quantitative Dependent Surface Water Body Status	Good	Good
Chemical GW	**Good**	**Good**
Chemical Status Element	Good	Good
Chemical Drinking Water Protected Area	Good	Good
General Chemical Test	Good	Good
Chemical GWDTE test	Good	Good
Chemical Dependent Surface Water Body Status	Good	Good
Chemical Saline Intrusion	Good	Good

ANNEX B BASELINE CONDITIONS

B.1.1 The relevant baseline physical characteristics of the study area and the water features present are described in this section and with reference to **Figure 12-1:** Surface Waterbodies and their attributes (ES Volume III - **Application Document Ref. 6.4**).

Land Use, Topography and Rainfall

B.1.2 The Proposed Development Site and a 1km study area surrounding this lies within the extensive floodplain of the River Trent within the Isle of Axholme. Land is generally low lying at elevations below 10m Above Ordnance Datum (mAOD) and with very shallow gradients. Beyond the area associated with the current (operational) Keadby 1 Power Station, land use is almost entirely arable farming, used mainly to grow wheat and sugar beets. The land is particularly fertile due to its history of annual flooding from the Trent and peat soil.

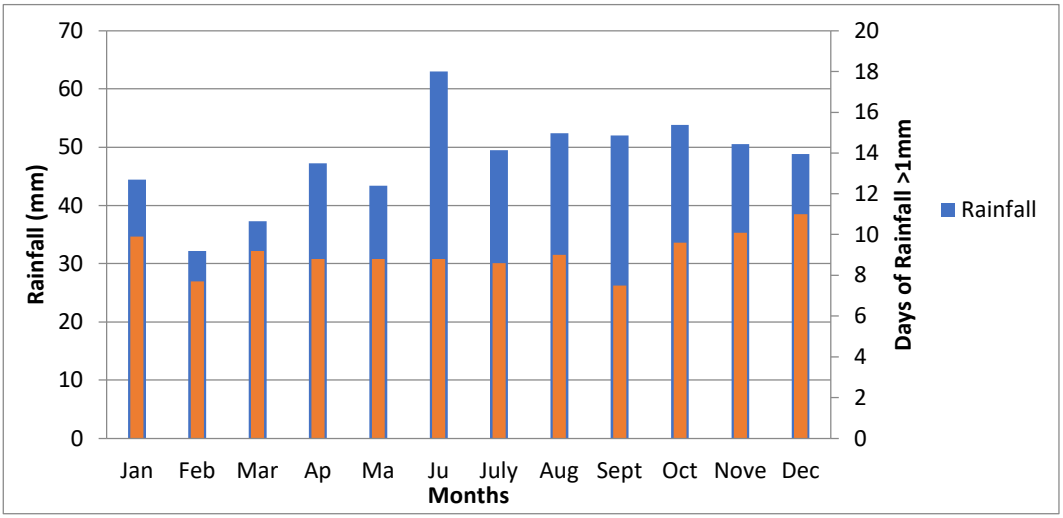
B.1.3 The Water Connection Corridors extend eastwards and north-eastwards from the Proposed Development Site towards the village of Keadby, and the Proposed Development Site construction and operational access route extends to the south-west, crossing numerous watercourses including the Sheffield and South Yorkshire Navigation – Stainforth and Keadby Canal (herein referred to as 'the Stainforth and Keadby Canal'), North Soak Drain, South Soak Drain and Hatfield Waste Drain.

B.1.4 The study area has a complex surface water hydrology and a long history of land drainage. The Proposed Development Site and land north of the Stainforth and Keadby Canal is within the Isle of Axholme and North Nottinghamshire Water Level Management Board (IoAaNNWLMB) area.

B.1.5 The nearest weather station on the Met Office website with historical data is located at Robin Hood Doncaster Sheffield Airport, approximately 21km south-west of the Proposed Development Site, at NGR SK 65933 98500. Based on the average climate data (for the period 1981 to 2010) for this weather station, the study area experiences an average of 574mm of rainfall per year, with it raining more than 1mm on around 109 days per year. This is a relatively low level of rainfall when compared to the average for England.

B.1.6 Plate B1 illustrates this data to show how the average rainfall varies throughout the year, with the wettest period being in the mid to late summer to autumn, and driest in late winter to early spring. Average monthly rainfall is generally less than 60mm throughout the year, except in July when it rises to 63mm. February is the driest month with an average of approximately 32mm between 1981 and 2010.

Plate B1 Robin Hood Doncaster Sheffield Airport Weather Station - Average rainfall per month (1981-2010) and average days per month with >1mm of rainfall (1981-2010)



Groundwater, Geological Features and Soils

B.1.7 **Chapter 13:** Geology, Hydrogeology and Land Contamination (ES Volume I - **Application Document Ref. 6.2**) describes the geology and groundwater at the Proposed Development Site, summarised here.

B.1.8 The British Geological Society (BGS) Geoindex viewer (BGS, 2020) indicates that the entire study area is underlain by bedrock of the Mercia Mudstone Group. Above this, superficial deposits consist mainly of Warp (sand and silt) with Alluvium (clay, sand, silt, and gravel) along the course and immediate margins of the River Trent. Warp is artificially induced alluvium that was created when agricultural warping[2] was practiced.

B.1.9 According to the MAGIC online map (DEFRA, 2020) the bedrock beneath the Proposed Development Site is classed as a Secondary B aquifer ('predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of former non-aquifers') whilst the superficial deposits across the Proposed Development Site are classed as a Secondary A aquifer ('permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers').

[2] Warping is the process of allowing turbid river water to flood agricultural land to deposit a layer of sediment to improve fertility before the water was allowed to drain away.

B.1.10 Levels within the historical borehole records (BGS, 2020) indicate generally shallow groundwater levels within the superficial geology of between 0.9m and 3.0m below ground level (bgl). Occasionally, deeper groundwater strikes were recorded between 5.4m and 6.9m bgl. There is insufficient information to conclude at this stage whether these levels are representative of true groundwater levels across the wider area.

B.1.11 According to the Environment Agency's online Catchment Data Explorer website (Environment Agency, 2020b) groundwater beneath the Proposed Development Site and north of the Stainforth and Keadby Canal is designated under the WFD as waterbody GB40402G990300 (Lower Trent Erewash - Secondary Combined) of the Humber RBMP. This groundwater body has a surface area of approximately 1924km^2 and is currently at Good Overall Status. To the south of the Stainforth and Keadby Canal, the WFD groundwater body is the 'Idle Torne - Secondary Mudrocks' (GB40402G992200). This waterbody is a Good overall status. The WFD groundwater bodies are shown in **Figure 12.2**: Groundwater Bodies and their Attributes (ES Volume III - **Application Document Ref. 6.4**).

B.1.12 Information obtained from Cranfield Soil and AgriFood Institute (CSAI) Soilscapes website (CSAI, 2020) describes the soils on the Proposed Development Site to be loamy and clayey soils of coastal flats with naturally high groundwater[3]. Land within this soil type is described as generally draining to local groundwater and mostly drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients, pesticides and wastes that may be applied to the land.

B.1.13 According to the Landmark Information Group Envirocheck report (Landmark, 2020), Natural England reports the Agricultural Land Classification (ALC) to be Grade 2 for the majority of the Proposed Development Site. This is classed as soil of 'very good quality'. This land is further described as having only minor limitations which affect crop yield, cultivations or harvesting. It can support a wide range of agricultural and horticultural crops but there can be some reduced flexibility on land within the grade, which causes difficulty in the production of more demanding crops e.g. winter harvested vegetables and arable root crops. In areas of the Proposed Development Site south of the Stainforth and Keadby Canal, some parts are classified as Grade 1 (excellent quality). Further information is provided in **Chapter 3**: The Site and its Surroundings (ES Volume I - **Application Document Ref. 6.2**).

Water Features

B.1.14 A Site Walkover was undertaken on 31 July 2020 in sunny, dry conditions. Using observations taken on this visit, data from OS mapping and the Environment Agency Catchment Data Explorer website (Environment Agency, 2020b) the

[3] Soilscape identification description number 21

surface waterbodies listed in Table B1 were identified within the study area. **Figure 12-1** (ES Volume III - **Application Document Ref. 6.4**) illustrates the location and WFD status of these waterbodies.

Table B1: Summary of waterbodies in the study area including WFD status

Waterbody	Type of Waterbody	WFD designation or associated WFD waterbody (where applicable)
River Trent	Transitional Waterbody (main river)	Humber Upper (GB530402609203)
Paupers Drain (includes Warping Drain and Eastoft Moors Drain)	Watercourse (ordinary) – maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
North Soak Drain (and South Soak Drain)	Watercourse (main river)	North Soak Drain Catchment (trib of Torne/Three Rivers) (GB104028064350)
Hatfield Waste Drain (includes North Engine Drain)	Watercourse (main river)	Hatfield Waste Drain Catchment (trib of Torne/Three Rivers) (GB104028064330)
Torne/Three Rivers (includes South Engine Drain and Folly Drain)	Watercourse (main river)	Torne/Three Rivers from Mother Drain to Trent (GB104028064340)
Eastoft Moors Drain	Watercourse (ordinary) – maintained by IoAaNNWLMB	Tributary of Humber Upper (GB530402609203)
Sewer Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Humber Upper (GB530402609203)
Keadby Boundary Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Paupers Drain Catchment (trib of Trent) (GB104028064300)

Waterbody	**Type of Waterbody**	**WFD designation or associated WFD waterbody (where applicable)**
South Moors Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Paupers Drain Catchment (trib of Trent) (GB104028064300)
North and South Cross Moors Road Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Tributary of Paupers Drain Catchment (trib of Trent) (GB104028064300)
Sheffield and South Yorkshire Navigation – Stainforth and Keadby Canal	Watercourse (Canal)	Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) (GB70410281)
Keadby Common Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Kelsey Drain	Watercourse (ordinary)	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Pumping Drain	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Glew Drain / Drain D1 (as named in **Appendix 11C**: PEA Report (ES Volume II – **Application Document Ref. 6.3**))	Watercourse (ordinary) - maintained by IoAaNNWLMB	Paupers Drain Catchment (trib of Trent) (GB104028064300)
Ubiquitous unnamed drainage ditches (including those named in **Appendix 11C**: PEA Report (ES Volume II – **Application**	Watercourse (ordinary) – generally maintained by private landowners	Tributaries of the various WFD waterbodies listed above

Waterbody	Type of Waterbody	WFD designation or associated WFD waterbody (where applicable)
Document Ref. 6.3) as drains D2-D6)		
Five small ponds west of the River Trent (four immediately east of Keadby Boundary Drain, one south of Boskeydyke Farm)	Stillwater	Situated within the Paupers Drain Catchment (trib of Trent) (GB104028064300)
One small pond east of the River Trent within the study area, off Neap House Road	Stillwater	Situated within the Humber Upper (GB530402609203) catchment
Idle Torne – Secondary Mudrocks	Groundwater	WFD designation (GB40402G992200)
Lower Trent Erewash – Secondary Combined	Groundwater	WFD designation (GB40402G990300)

Surface Waterbodies

B.1.15 The Environment Agency's Catchment Data Explorer website (Environment Agency, 2020b) confirms that the transitional waterbodies in the study area (i.e. River Trent) are contained within the:

- the Humber River Basin District;
- Humber Transitional and Coastal (TraC) Management Catchment; and
- Humber Estuary TraC Operational Catchment.

B.1.16 The fluvial waterbodies are contained within:

- the Humber River Basin District;
- Trent Lower and Erewash, and Idle and Torne Management Catchments; and

- Trent and Trib, and Isle of Axholme Operational Catchments.

B.1.17 There are six WFD designated surface waterbodies within the study area, described in Table 5 of the WFD Assessment Report, with full baseline classifications given in **Annex A**. Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses. The WFD waterbodies include one transitional waterbody (Humber Upper transitional waterbody), four rivers (Paupers Drain Catchment (trib of Trent), North Soak Drain Catchment (trib of Torne/Three Rivers), Hatfield Waste Drain Catchment (trib of Torne/ Three Rivers) and Torne/ Three Rivers from Mother Drain to Trent) and one canal (Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby)). **Figure 12-1** (ES Volume I - **Application Document Ref. 6.4**) illustrates these waterbodies.

B.1.18 Within the identified WFD catchments, there are also a number of named watercourses shown on Ordnance Survey mapping, and these are described in Table 6: Other named watercourses in the study area that are not defined WFD waterbodies of the WFD Assessment Report, based on the site visit and walkover details also described in **Appendix 11C:** PEA Report (ES Volume II - **Application Document Ref. 6.3**).

B.1.19 In addition to the watercourses described in Table 5 and Table 6: Other named watercourses in the study area that are not defined WFD waterbodies of the WFD Assessment Report, there are numerous small drains and ditches across the wider 1km study area. These are predominantly related to drainage of agricultural land. In general, they are artificial, straight, embanked watercourses that are likely to be nutrient enriched due to runoff of fertilisers and other farming products. They are generally expected to have minimal biodiversity value with many likely to be ephemeral (i.e. flowing for only part of the year or only after storms), with few geomorphic bedforms (e.g. riffles and pools).

B.1.20 There are five small ponds west of the River Trent in the study area. The largest is south of Boskeydyke Farm (SE 83703 12940) and is approximately 2.0km^2. There are four immediately east of Keadby Boundary Drain, at SE 81311 12482, SE 81199 12003, SE 81373 11953 and SE 81275 12021. These are offline ponds, not connected to other watercourses in the study area. There is also a small pond to the east of the River Trent at SE 84410 12362, but this is not considered further as it is upstream of the Proposed Development.

River Trent – Tidal Cycle

B.1.21 The Preliminary Water Supply and Discharge assessment undertaken by the Applicant for the Proposed Development indicates that the estuary of the River Trent is characterised by a semi-diurnal tide (i.e. a cycle which has two high and two low tides a day). There is approximately 24 hours 50 minutes between two tidal crests (for example, high– low –high–low–high) and so one tidal cycle (that is, high–low–high) has a period of approximately 12 hours 25 minutes. In this regime, the two high tide levels are commonly unequal.

B.1.22 A complete tidal cycle from high tide to low tide to high tide comprises two distinct elements – the flood tide (the incoming tide when water levels are rising) and the ebb tide (the outgoing tide when water levels are falling).

B.1.23 There are two key variations in tides which occur over a 29-day cycle (i.e. spring and neap tides), with two spring and two neap tides occurring over this period. During neap tides, the tidal range is significantly reduced compared with that experienced during spring tides (that is, high tide levels are lower and low tide levels are higher). The maximum spring and neap tides occur approximately 1.5 days after new/ full Moon or first/ last quarter. These two variations have a significant influence on the range of impact on water quality and suspended sediment.

B.1.24 The tides experienced in the River Trent estuary have very pronounced spring and neap tides. In addition, the tidal cycle seen in the River Trent estuary is not perfectly symmetrical (i.e. flood and ebb portions of the cycle are of unequal lengths). This is due to frictional resistance between oncoming and reflected tidal waves within the irregular coastline of the Humber estuary. In the River Trent, the time between ebb slack and flood slack is approximately three hours, while the difference between flood slack and ebb slack is approximately nine hours. This gives rise to a very rapid rise in tide level followed by a slow decline in the tide level. These times are subject to natural variation, particularly due to weather and flow within the River Trent itself.

B.1.25 Adjacent to the operational Keadby 1 Power Station, the typical mean tidal range is 4.7m (i.e. -0.4 mAOD to +4.3 mAOD) with a maximum astronomical tide range of 7.62m (i.e. - 0.81 mAOD to +5.81 mAOD).

B.1.26 The tidal limit of the River Trent is 70km upstream of the Proposed Development area at Cromwell Weir, shortly downstream of Newark-on-Trent.

River Trent - Hydrology

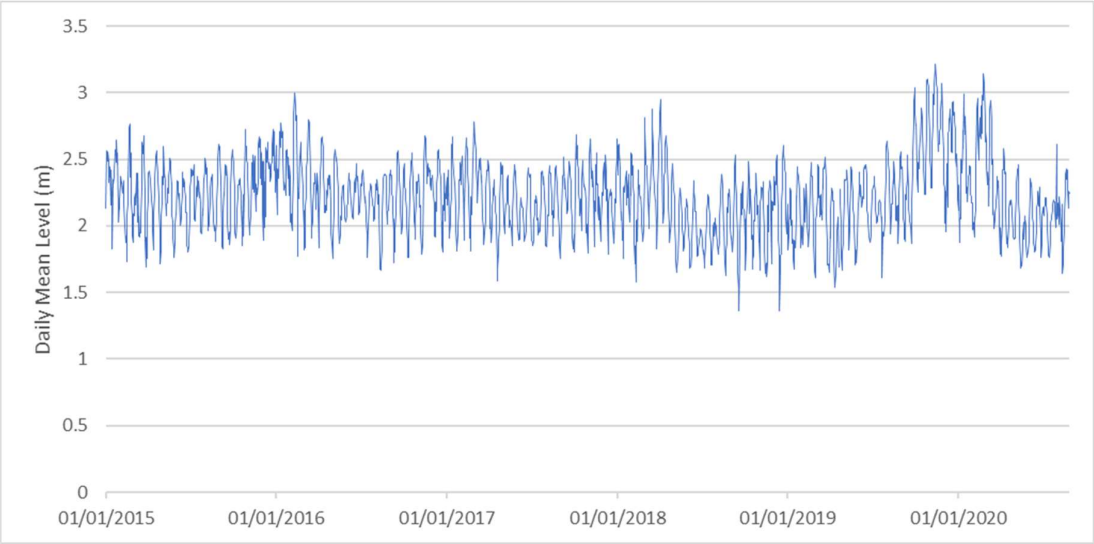
B.1.27 The area draining to the River Trent at Keadby comprises almost the whole of the Trent basin. The Trent's channel is entrained between primary flood defences at Keadby, with land on both sides of the river being very low-lying marsh at approximately 2mAOD. Over the last 170 years, the artificial component of total freshwater flows has increased due to the import of water for public supply from the Severn basin with subsequent discharge to the Trent catchment. At low flows, it is reported that the artificial component can make up half of the total flow (National Rivers Authority (now Environment Agency), 1994).

B.1.28 The long-term average mean daily flow from the Trent to the Humber Estuary was 7,590 megalitres per day (Ml/d) for the period 1969-92, mean summer flow (April-September) was 5,290Ml/d and mean winter flow was 9,910Ml/d. The flow which is exceeded for 95% of the time (Q95) was 2,340Ml/d for the same period (National Rivers Authority (now Environment Agency), 1994).

B.1.29 The Environment Agency has provided mean daily level data for the Keadby gauge at SE 08354 01131. The data for 2015-2020 is shown in Plate B2. This indicates that highest levels (and hence flows) in this period have been recorded in the winter and spring of 2019-2020, peaking at a mean daily level of 3.2m on 14/11/19.

B.1.30 The UK Government's river levels website indicates that at the same Keadby gauging station, the typical water level range is 0.61m to 6.60m. The highest level on record was 7.23m recorded on 5/12/2013.

Plate B2: Mean Daily Level (m) for the River Trent at the Environment Agency's Keadby gauge.



B.1.31 No other river levels are available for watercourses in the study area on the National River Flow Archive website (CEH, 2020) or the UK Government river levels website. The Environment Agency also provided no further level of flow data for watercourses in the study area.

River Trent – Sedimentology

B.1.32 A review of available sampling analysis for neighbouring Marine Licence applications (MLA), as advocated by the International Maritime Organisation (IMO) sampling guidelines, has been undertaken.

B.1.33 The sediment characteristics of The River Trent adjacent to the Proposed Development Site have been considered as part of preliminary water supply and wastewater discharge feasibility assessments for the Proposed Development. Initial findings suggest that the suspended solid concentration and particle size distribution varies considerably from hour to hour, from season to season, and climatically as a result of tidal conditions, floodwater, degree of saline mixing, turbulence due to river traffic and dredging activities.

B.1.34 The results of particle size analysis undertaken at the Keadby 1 Power Station cooling water intake (John Brown Engineering Ltd, 1996) are shown in Table B2, below.

Table B2: River Trent Water Particle Size (<10µm)

Particle Size	Minimum Concentration (%)	Maximum Concentration (%)	Mean Concentration (%)
<10 µm	42	90	59

B.1.35 Analysis of the dredged material removed annually from between the Keadby 1 Power Station intake and outfall locations identified the dredged material as silty clay (i.e. 31.3 - 62.5 µm particle size) with a specific gravity of 2.7 (CEFAS, 2017a). Analysis of the dredged material was undertaken in 2017 for trace metals, organotins (tributyltin, dibutyltin) and polyaromatic hydrocarbons (PAH) (CEFAS, 2017b). Trace metal results show slightly elevated levels of determinands cadmium, chromium, nickel, lead and zinc. These determinands were found to be above Cefas Action Level 1[4] however, in the context of the River Trent, they are not unusual (noting that sample results were reported to be 'within the expected range for the River Trent and Humber Estuary and therefore are not a cause for concern' (Cefas/ MMO, 2017).

B.1.36 The results for organotins showed that the levels were below limits of detection. However, the PAH results did show elevated levels for a number of determinands above Cefas Action Level 1. Cefas and the MMO noted that whilst PAH levels above Action Level 1 required further investigation, it was noted that levels had dropped since previous sampling in 2014.

B.1.37 Limited sample analysis of the River Trent at a point approximately 3.8km upstream of the intake was carried out in 1996 and 1997. The results from the two sets of sample analysis identified that the mean particle size varied from between 10 µm - 50 µm, indicating the variability of particle size distribution and the large quantity of fines in the sediment bed and wash load.

[4] Cefas action levels are non-statutory, but provide a method used to help determine the suitability of material prior to disposal to sea. Whilst it is focused on informing a decision on licensing of disposal activities, Action Levels can also be used to help inform wider considerations of potential environmental (marine) risk. Generally, material at/ below Action Level 1 is suitable for disposal to sea; material at/ above Action Level 2 may not be suitable for disposal to sea without prior treatment.

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ANNEX C BASELINE SURFACE WATER QUALITY INFORMATION AND DATA

C.1 Surface Water Quality

C.1.1 The Humber Upper Transitional WFD waterbody is at Fail Chemical Status under the WFD Cycle 2 classifications (2019), due to failures for certain priority substances (cypermethrin) and priority hazardous substances (polybrominated diphenyl ethers (PBDE), benzo(b)fluoranthene, benzo(g-h-i)perylene, benzo(k)fluoranthene, mercury and tributylin compounds. All specific pollutants and other pollutants are at Good status or higher.

C.1.2 The Paupers Drain Catchment WFD waterbody is also at Fail Chemical Status under the WFD Cycle 2 classifications (2019) due to failures for certain priority hazardous substances (PBDE and mercury). All priority substances, and other pollutants are at Good status or higher.

C.1.3 The North Soak Drain Catchment WFD waterbody is at Fail Chemical Status under the WFD Cycle 2 classifications (2019) due to failures for certain priority hazardous substances (PBDE and mercury). All priority substances, and other pollutants are at Good status or higher. Of the specific pollutants, iron is at Moderate status and zinc is at Fail status.

C.1.4 The Hatfield Waste Drain WFD waterbody is at Fail Chemical Status, due to failing priority hazardous substances (PBDE and mercury). Priority substances and specific pollutants are at Good status while other pollutants do not require assessment.

C.1.5 The Torne/Three Rivers from Mother Drain to Trent is at Fail Chemical Status, due to failing priority hazardous substances (PBDE, perfluorooctane sulphonate (PFOS) and mercury). Priority substances and specific pollutants are at Good status while other pollutants do not require assessment.

C.1.6 The Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) is at Fail Chemical Status, due to failing priority hazardous substances (PBDE and mercury). Priority substances and specific pollutants are at Good status while other pollutants do not require assessment.

River Trent Water Quality at Keadby

C.1.7 The Water Supply and Wastewater Discharge Study (SSE, 2020) summarises water quality data collected from four locations close to the study area, namely:

- The Keadby 1 intake (Sampling Programme 1) - SSE site data which is limited to periodic river temperature monitoring over the period 2003-2015 and four spot samples taken over the period Nov 2005-July 2006;
- Keadby Bridge (Sampling Programme 2) - monthly water sampling undertaken by the Environment Agency at a point approximately 1.1km

upstream of the intake over the period February 2004 – February 2015 (SSE, 2020);

- Burringham (Sampling Programme 3) - This sample location is approximately 3.8km upstream of Keadby 1 intake. Limited water quality sampling was taken as part of a study into the Particle Size Distribution in an Estuarine Turbidity Maximum Region (Mitchell and West, 2020);
- Burringham Drain (Sampling Programme 4) - approximately 4.1km upstream of the Keadby 1 intake. Limited sampling was carried out by the Environment Agency as part of a study into the implications on water quality and sedimentation from the provision of fish access at water-level management structures over a spring and neap tidal cycle in November - December 2011 (Environment Agency, 2013b).

C.1.8 The results of the four sampling programmes were combined in the following Table C1.

Table C1: Summary Water Quality Data for the River Trent at Keadby

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
pH	-		2	154	7.1	7.4	7.9	8.3	9.0
			1	4	7.7	7.7	7.9	8.2	8.2
Temperature of Water	°C		2	154	0.1	4.2	12.0	19.5	24.6
Biochemical Oxygen Demand (BOD)	mg/L		2	93	1	1	2	4	8
Ammoniacal Nitrogen (NH_3 as N)	mg/L		2	129	0.01	0.02	0.11	0.25	0.39
Ammonium Ion (NH_4)	mg/L		1	4	0.021	0.021	0.052	0.095	0.101
Total Oxidised Nitrogen (TON) as N	mg/L		2	154	4	6	8	11	12
Ammonia NH_3 as N	mg/L	0.021	2	129	0.0001	0.0003	0.0016	0.0040	0.0060
Nitrate as NO_3	mg/L		1	4	31.9	32	35	38	39
Dissolved Organic Carbon (DOC)	mg/L		2	154	0.2	4	6	8	11

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
Total Organic Carbon (TOC)	mg/L		1	4	6	6	7	8	9
Aluminium	µg/l		1	4	5	235	2,454	4,951	5,300
Cadmium	µg/l	0.2	2	130	0.08	0.10	0.24	0.53	1.25
Cadmium, Dissolved	µg/l		2	97	0.04	0.05	0.10	0.15	0.21
Chromium	µg/l		2	154	0.8	1.8	15.8	55.1	73.6
Chromium, Dissolved	µg/l		2	46	0.5	0.6	1.3	3.1	3.6
Lead	µg/l	1.3	2	153	0.8	4.0	34	124	242
Lead, Dissolved	µg/l		2	91	0.1	0.1	0.4	1.0	6.1
Zinc	µg/l	6.8 (plus ambient background)	2	154	8	18	73	220	370
Zinc, Dissolved	µg/l		2	154	5	7	11	16	33
Nickel	µg/l	8.6	2	152	3	3	13	36	55
Nickel, Dissolved	µg/l		2	138	3	3	6	10	13
Iron	µg/l	1.000	2	152	376	860	7,588	24,790	39,800
			1	4	94	914	8,489	16,565	17,600
Iron, Dissolved	µg/l		2	24	32	34	160	586	785

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
			1	4	7	10	47	100	110
Copper	µg/l	3.76	2	154	1	4	14	39	57
			1	4	1.2	3	23	39	39
Copper, Dissolved	µg/l		2	154	2	3	5	8	15
			1	4	1.2	2	4	5	5
Calcium	mg/L		1	4	1.1	20	100	143	146
Magnesium	mg/L		1	4	0.3	4	20	29	30
Potassium	mg/L		1	4	0.08	1.3	7	10	10
Orthophosphate as P	µg/l		1	4	323	332	498	705	732
Fluoride	µg/l		1	4	220	240	343	400	400
Sulphate as SO_4	mg/L		1	4	110	118	157	186	190
Sodium	mg/L		1	4	1.2	6	34	55	56
Chloride	mg/L		2	154	29	44	138	286	3,080
			1	4	56	59	143	310	348
			4		303				606
			3		303				4,849
Salinity	ppt		2	158	0.05	0.07	0.23	0.47	5.08

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
			4		0.5				1.00
			3		0.5				8.00
			1	4	0.09	0.10	0.24	0.51	0.57
Silica Reactive as SiO_2	mg/L		1	4	0.6	1.3	6.3	9.9	10.1
Solids, Suspended @ 105°C	mg/L		2	154	3	33	406	1,407	2,380
			1	4	264	319	1,875	5,079	5,840
			4	43	400				9,200
			2	106	490	N/D	3,347	10,002	14,562
Total Dissolved Solids @ 180°C	mg/L		1	4	429	458	747	1,201	1,300
Conductivity	µS/cm		1	4	591	633	1,034	1,640	1,770
Turbidity	NTU	>300 = very turbid; 100-300 = turbid; 10 = clear	1	4	>20	>20	>20	>20	>20
			3		200				1,100
Calcium Hardness as $CaCO_3$	mg/L		1	4	2.7	30	189	285	286

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
Magnesium Hardness as $CaCO_3$	mg/L		1	4	1.2	10	64	103	105
Total Hardness as $CaCO_3$	mg/L		1	4	3.9	40	253	383	384
Oxygen, Dissolved % Saturation	%		2	154	50	68	87	102	148
Oxygen, Dissolved as O_2	mg/L		2	154	5	6	9	13	15

C.1.9 According to the WFD Standards and Classification (HMSO, 2017), Table C1 indicates that the River Trent at Keadby is circum-neutral with high electrical conductivity as would be expected for a transitional water. It is a very turbid river with an average total suspended particulate matter of >300 mg/L based on values of 406mg/L, 1,875mg/L and 3,347mg/L during the three sampling programmes for this determinand.

C.1.10 Based on the data in Table C1, dissolved oxygen (mg/L) falls within the WFD Good classification based on 5th percentile and High classification based on the mean. This was calculated using formulae within the WFD Standards and Classification document (HMSO, 2017) for transitional waterbodies with a salinity of <35ppt.

C.1.11 Sanitary pollutants (e.g. Biochemical Oxygen Demand (BOD) and ammonia) are present at low concentrations and are presumably heavily diluted given the scale of the waterbody. Nitrate concentration is high (mean 35mg/L) and likely reflects the largely agricultural land use of the surrounding catchment, with use of fertilisers which run off to watercourses draining to the River Trent.

C.1.12 Certain metals such as copper and zinc are elevated, and may surpass WFD EQS, although their bioavailability would need to be determined through further data collection to confirm this. This may be derived from road runoff to watercourses across the catchment which is then directed towards the River Trent.

Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby Canal) – Water Quality

C.1.13 The Water Supply and Wastewater Discharge Study (SSE, 2020) summarises water quality monitoring data for the Stainforth & Keadby Canal undertaken by SSE/ Siemens. The following table (Table C2) summarises the water quality data obtained from the sampling programme over the period 20/1/15-18/1/16. The programme was undertaken to identify the Keadby 2 CCGT water quality specification (Mitchell and West, 2020). No location for the sampling point has been detailed, but it assumed to be local to the existing Keadby 1 Demineralisation Plant abstraction point.

Table C2: Stainforth & Keadby Canal Water Quality Data

Parameter	Units	No. Samples	Minimum	Mean	Maximum
pH	pH Units	102	6.95	8.02	9.48
Ammoniacal Nitrogen as NH_4	mg/L	102	0.01	0.1	4

Parameter	Units	No. Samples	Minimum	Mean	Maximum
Total Organic Nitrogen (TON) as NH_3	mg/L	102	2.94	20.33	59.65
Barium	µg/l	102	10.7	15.62	75.3
Nitrite as NO_2	mg/L	102	0	0.08	0.286
Nitrate as NO_3	mg/L	102	2.82	19.87	59.58
Total Organic Carbon (TOC)	mg/L	102	1.8	5.57	7.2
Aluminium	µg/l	102	9.16	40.15	136
Iron	µg/l	102	31.2	107.2	357.8
Iron, Dissolved	µg/l	102	21.3	46.04	127
Copper	µg/l	102	5.07	7.5	37.25
Copper, Dissolved	µg/l	102	5.07	6.41	13.8
Strontium	mg/L	102	0.1	0.13	0.18
Magnesium	mg/L	102	7.69	19.48	24.6
Potassium	mg/L	102	2.28	8.34	11.2
Orthophosphate as P	mg/L	102	0.16	0.5	1.25
Fluoride	µg/l	102	261	650.5	11,800
Sulphate as SO_4	mg/L	102	70.8	122.14	160
Sodium	mg/L	102	15.4	70.3	96.2
Chloride	mg/L	102	47.97	88.21	152.3
Salinity (Calculated)	ppt	102	0.08	0.15	0.25
Silica Reactive as SiO_2	mg/L	102	0.16	2.76	7.7
Solids, Suspended @ 105°C	mg/L	102	2	5.87	20*
Total Dissolved Solids @ 180°C	mg/L	102	280	436	630

Parameter	Units	No. Samples	Minimum	Mean	Maximum
Conductivity	µS/cm	102	482	678	835
Turbidity	NTU	102	0.32	1.83	10.2
Total Hardness as Ca	mg/L	102	63.36	84.79	102.76

C.1.14 Table C2 is assumed to be representative of the water quality at the abstraction point for the Proposed Development which is currently assumed to be located locally to the Keadby 2 abstraction point (recently constructed).

C.1.15 pH is weakly alkaline, and the watercourse has moderate electrical conductivity. Turbidity is low, reflecting conditions noted on the site visit where the water was very clear. Nitrate and orthophosphate concentrations are very high as would be expected given the surrounding agricultural land uses. Several metals are elevated (e.g. dissolved copper), which maybe driven from runoff from the road and railway crossings.

Keadby Warping Drain – Water Quality

C.1.16 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, 2021) for Keadby Warping Drain. Ten samples were taken between 2016 and 2018, see Table C3.

Table C3: Summary of water quality data for Keadby Warping Drain 2016-2018 (Environment Agency)

Parameter	Units	WFD Standards	Mean	Max	Min	90th%ile	10th%ile
Alkalinity to pH 4.5 as $CaCO_3$	mg/L	-	277.2	358	189	354.1	190.3
Ammonia un-ionised as N	mg/L	-	0.00171	0.00675	0.00043	0.006437	0.000441
Ammoniacal Nitrogen as N	mg/L	High <0.3 Good <0.6 (90th%ile)	0.1291	0.501	0.03	0.4776	0.03
Conductivity at 25 ºC	µS/cm	-	1228	1581	587	1571.3	626.4

Parameter	Units	WFD Standards	Mean	Max	Min	90th%ile	10th%ile
Nitrate as N	mg/L	-	2.0635	12.8	0.186	11.938	0.187
Nitrite as N	mg/L	-	0.0214	0.0695	0.004	0.06714	0.004
Nitrogen, Total Oxidised as N	mg/L	-	2.08	12.8	0.2	11.945	0.2
Orthophosphate, reactive as P	mg/L	-	0.0463	0.194	0.01	0.1824	0.01
Oxygen, Dissolved as O_2	mg/L	-	9.224	13.8	1.6	13.71	2.028
Oxygen, Dissolved, % Saturation	% sat.	High >70 Good >60 (10th%ile)	81.83	114.2	15.9	114.13	20.17
pH	pH Units	High & Good >=6 to <=9	7.916	8.37	7.53	8.349	7.531
Temperature of Water	ºC	High <20 Good <23 (98th%ile)	11.06	17.4	5.1	17.31	5.23

C.1.17 Table C3 indicates the Keadby Warping Drain is slightly alkaline in nature with an average pH of 7.916 and falls within the WFD High classification based on the ten samples considered here.

C.1.18 A 10th percentile dissolved oxygen saturation of 20.17% falls within Poor classification (<45%). In combination with supersaturated recordings this suggests the waterbody is extremely vulnerable to large fluctuations of dissolved oxygen and may be the result of nutrient rich water with an abundance of macrophytes.

C.1.19 Ammonia levels are classified as Good which suggests pollution from organics such as a sewage materials are unlikely to be having a detrimental impact on the waterbody.

C.1.20 Nitrate and orthophosphate values are somewhat elevated and indicate probably pressure from the surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse.

Keadby Pumping Station Drain – Water Quality

C.1.21 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, 2021) for Keadby Pumping Station Drain. Fourteen samples were taken between 2018 and 2020, see Table C4.

Table C4: Summary of water quality data for Keadby Pumping Station Drain 2018-2020 (Environment Agency)

Parameter	Units	WFD Standards	Mean	Max	Min	90th%ile	10th%ile
Alkalinity to pH 4.5 as $CaCO_3$	mg/L	-	188.43	210	170	206	172.5
Ammonia un-ionised as N	mg/L	-	0.003	0.0053	0.0010	0.0050	0.0012
Ammoniacal Nitrogen as N	mg/L	High <0.3 Good <0.6 (90th%ile)	0.28	0.762	0.03	0.699	0.048
Biological Oxygen Demand (BOD)	mg/L	High <4 Good <5 (90th%ile)	1.93	4.84	1	4.29	1
Conductivity at 25 ºC	µS/cm	-	921.50	1278	565	n/a	n/a
Nitrate as N	mg/L	-	6.87	12.2	2.66	11.25	2.92
Nitrite as N	mg/L	-	0.07	0.19	0.015	0.165	0.020
Nitrogen, Total Oxidised as N	mg/L	-	6.95	12.3	2.7	11.35	2.96
Orthophosphate, reactive as P	mg/L	-	0.03	0.05	0.01	n/a	n/a

Parameter	Units	WFD Standards	Mean	Max	Min	90th%ile	10th%ile
Oxygen, Dissolved as O_2	mg/L	-	8.86	13.6	2.99	12.4	4.99
Oxygen, Dissolved, % Saturation	% sat.	High >70 Good >60 (10th%ile)	82.99	145.6	33.8	122.1	48.5
pH	pH Units	High & Good >=6 to <=9	7.82	8.64	7.22	8.40	7.29
Solids, Suspended @ 105°C	mg/L	-	12.19	27.3	4	25.41	4.21
Temperature of Water	ºC	High 20 Good 23 (98th%ile)	12.72	21.4	3.1	21.3	3.7

C.1.22 Table C4 indicates the Keadby Pumping Station Drain is very slightly alkaline in nature with an average pH of 7.82 and falls within the WFD High classification based on the 14 samples considered here.

C.1.23 A 10th percentile dissolved oxygen saturation of 48.5% falls within Moderate classification, with poor being less than 45%. In combination with supersaturated recordings this suggests the waterbody is vulnerable to large fluctuations of dissolved oxygen and may be the result of nutrient rich water with an abundance of macrophytes.

C.1.24 Ammonia levels are classified as Moderate (<1.1mg/L) which suggests pollution from organics could be having a detrimental impact on the waterbody. However, BOD falls within the Good WFD classification, suggesting the slightly elevated ammonia levels are not from sewage materials.

C.1.25 Nitrate and orthophosphate values are somewhat elevated and indicate probably pressure from the surrounding agricultural land uses through use of fertilisers and other products which may runoff to the watercourse.

C.2 References

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Keadby 2-CCGT Water Specification, Sched Pt 4 Att 004,SSE Engineering Centre.

SB Mitchell and JR West (2002) Particle Size Distribution in an Estuarine Turbidity Maximum Region, Fine Sediment Dynamics in the Marine Environment, Proceedings In Marine Science 5.

C.2.1 SSE (2020) Keadby 3 Low Carbon Power Project: Water Supply & Wastewater Discharge Study.

ANNEX D AQUATIC ECOLOGY BASELINE

D.1.1 Full details regarding aquatic ecology and riparian mammals within the study area are provided in **Appendix 11F:** Riparian Mammal Survey Report and **Appendix 11G:** Aquatic Ecology Survey Report (ES Volume I - **Application Document Ref. 6.3**) and summarised in **Chapter 11:** Biodiversity and Nature Conservation (ES Volume I - **Application Document Ref. 6.2**). A brief summary is provided below.

Protected and Notable Species

Water Vole

D.1.2 Surveys were undertaken of the Main Site (Drains 1, 2, 3, 4 and 5) and the connected Keadby Common Drain. Given that all these surveyed waterbodies are located in close proximity to each other and are connected, they have been evaluated together.

D.1.3 Fields signs were found in a number of discrete locations, indicating that there is only a small and perhaps (at least in the case of the Main Site) transitory population of water voles associated with the drains within the Proposed Development Site (likely to be less than 14 territories and individuals). It is possible that the sub-optimal drains of the Main Site in particular support animals displaced from more optimal waterbodies elsewhere, and that there is a high turnover of water voles within the Main Site drains year to year.

D.1.4 Lincolnshire is a stronghold for water vole, supporting a successful and widespread population, and sightings or their associated field signs can be expected in most suitable waterbodies throughout the county. The desk study undertaken for the PEA identified a large number of similar drains in the local area, which when considered with the number of desk study records, suggests that this species is relatively common in the wider landscape surrounding the Proposed Development Site. The small numbers of water voles recorded indicates the relevant sections of drain are of less than county value for the species. The small numbers of water vole recorded are likely to make a minor contribution to the wider population, especially given the habitat conditions present indicate that the territories on the Main Site may not be sustainable over the long-term.

D.1.5 Given the above it is considered that drains within the Proposed Development Site in isolation support a water vole population of local value.

Otter

D.1.6 The surveys found no evidence of otter associated with the Proposed Development Site.

D.1.7 It is assumed that otters are moving and foraging along the River Trent and the Stainforth and Keadby Canal habitat corridor, and potentially the other

waterbodies associated with the Proposed Development Site. However, there is no evidence that habitats within the Proposed Development Site are of specific importance for otter and there is no evidence that otter currently uses the habitats associated the Proposed Development Site for breeding or resting.

D.1.8 Otter is not considered to be a constraint to the Proposed Development, so further assessment is not required. However, top-up surveys are likely to be required in future years to reconfirm the status of the species and the suitability of the habitats present.

Great Crested Newt

D.1.9 Based on desk studies and AECOM surveys in 2010 and 2017, no Great Crested Newts have been identified within the study area. In addition, surveys undertaken in 2012 and 2015, by SKM and Jacobs respectively, waterbodies within the adjacent Keadby Wind Farm were surveyed, and GCNs were not found. They have been scoped out of the Biodiversity assessment.

White Clawed Crayfish

D.1.10 There are no records of white-clawed crayfish in the desk study area and it is not expected to encounter these species within any of the watercourses associated with the Proposed Development. They are not present in this part of Lincolnshire and so were scoped out of the Biodiversity assessment.

Fish Surveys

D.1.11 Significant fish species known to be present include river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) which migrate through the estuary to breed in the rivers of the Humber catchment. River lamprey and sea lamprey are protected species under Annex II of the Habitats Directive. Accordingly, the populations of these species are of international value. The River Trent at Keadby is of key functional importance for these two lamprey species as it is the route by which they access and leave the wider River Trent catchment.

D.1.12 The populations of Atlantic salmon (*Salmo salar*) and European eel (*Anguilla Anguilla*) associated with the River Trent are considered to be of regional value, given this is the main river catchment within the region.

D.1.13 All of the other fish species recorded make use of the River Trent either as part of the wider habitat resource of the Humber Estuary, or incidentally e.g. occasional use by species more typically associated with freshwater habitats located upstream of the tidal limit at Keadby. All of these species widespread and relatively common, and accordingly each species is considered to be of local nature conservation value.

D.1.14 According to the Environment Agency's Ecology and Fish Data Explorer website a fish sample was taken on the River Trent at Burringham approximately 3.5 km

upstream of the Proposed Development Site in May 2016 (NGR: SE 83281 08649). Here, five species were recorded during a single catch sample. This was predominantly roach, but with 3-spined stickleback (*Gasterosteus aculeatus*), European eel (*Anguilla anguilla*), chub (*Leuciscus cephalus*) and perch (*Perca fluviatilis*) also recorded. None of the surveyed species fall within Annex II of the Habitats Directive.

D.1.15 The Environment Agency provided details of a fish survey on the Three Rivers watercourse at Pilfrey Bridge (NGR: SE 80540 09928) in 2004. Five species were recorded, dominated by common bream (*Abramis brama*) and roach (*Rutilus rutilus*). None of the surveyed species fall within Annex II of the Habitats Directive.

Macroinvertebrates

D.1.16 No records of rare or protected aquatic macroinvertebrate species were returned during the desk study within the study area. The Environment Agency has undertaken macroinvertebrate sampling within Keadby Warping Drain on two occasions within the last 10 years (2013 and 2016). This drain is 320m north of Proposed Development Site and is designated as a LWS for its aquatic flora and habitats. Four species were recorded during the surveys in 2013, while a total of 28 were recorded in 2016. These results indicate that the drain supports a typical assemblage of aquatic macroinvertebrates for the habitats present including a range of beetle, caddisfly, dragonfly and truefly taxa.

D.1.17 Only a single non-native species record was identified from Keadby Warping Drain; the amphipod *Crangonyx pseudogracilis/ floridanus*.

D.1.18 Records also indicate that in 2007, the Environment Agency recorded the presence of non-native Dreissenidae mussels within the Stainforth and Keadby Canal, approximately 500m downstream of the Potential Canal Water Abstraction Option that is the preferred cooling water source for the Proposed Development. The only British members of this group of mussels are the INNS zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena bugensis*). The species present in the canal was not determined.

D.1.19 Further surveys have been undertaken of Drain 1-5, the Stainforth and Keadby Canal and Keadby Boundary Drain to inform the Proposed Development baseline:

Drain 1

D.1.20 A moderate/ high diversity of aquatic macroinvertebrates was recorded (45 taxa, 26 identified to species) and the community is considered fairly typical for the conditions present i.e. a small, heavily modified, slow flowing drain. The assemblage was dominated by a range of snail, crustacean, beetle and truefly taxa, and the drain is of fairly high conservation value. The majority of the species present are of occasional to very common status. The exceptions to this were:

- white-lipped ramshorn snail (*Anisus leucostoma*). This is classified as being of local status. More recent information on the status of this snail establishes that it remains widespread within its native range and it is not currently considered threatened.
- the water beetle (*Rhantus suturalis*). This is classified as notable. However, it is of favourable status and appears to be increasing in range.
- the diving beetle (*Rhantus exsoletus*). This is classified as being of local status.

D.1.21 Two non-native species were recorded. The amphipod (*Crangonyx pseudogracilis/ floridanus*) and the New Zealand mud snail (*Potamopyrgus antipodarum*). The New Zealand mud snail was first introduced to the UK in 1852 and is now naturalised, widespread and common in many areas.

D.1.22 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 1.6), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (Biological Monitoring Working Party (BMWP): 97.3, ASPT: 4.2). Only a single pollution-sensitive taxon was recorded (the beetle *Gyrinus substriatus*), with the drain supporting a range of taxa defined as having a moderate tolerance to pollution.

Drain 2

D.1.23 A moderate diversity of aquatic macroinvertebrates was recorded (37 taxa, 14 identified to species) and the community is considered fairly typical of a small, heavily shaded, slow flowing drains. The assemblage was dominated by a range of snail, crustacean, beetle and truefly taxa, and the drain is of moderate conservation status. All of the species present are of common to very common conservation value. The only exception to this was the white-lipped ramshorn snail which, as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened.

D.1.24 The New Zealand mud snail was the only non-native species recorded.

D.1.25 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 76.1, ASPT: 4). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Drain 3

D.1.26 A low/ moderate diversity of aquatic macroinvertebrates was recorded (22 taxa, nine identified to species) and the community is considered fairly typical of a small, slow flowing drain. The assemblage was dominated by a range of snail, beetle and truefly taxa, and the drain is of moderate conservation value. All of the species present are of frequent to very common status. The only exception to this was the white-lipped ramshorn snail, which as highlighted above for Drain

1, remains widespread within its native range and it is not currently considered threatened. No non-native species were recorded.

D.1.27 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 49.3, ASPT: 4.1). No pollution-sensitive taxa were recorded, but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Drain 4

D.1.28 A low diversity of aquatic macroinvertebrates was recorded (19 taxa, six identified to species) and the community is considered fairly typical of a small, slow flowing field drain. The assemblage was dominated by a range of snail, crustacean, caddisfly, beetle and truefly taxa, and the drain is of moderate conservation value. All of the species present are of very common status. The only exception to this was the white-lipped ramshorn snail, which as highlighted above for Drain 1, remains widespread within its native range and it is not currently considered threatened. No non-native species were recorded.

D.1.29 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (BMWP: 37.2, ASPT: 4.1). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Stainforth and Keadby Canal

D.1.30 The site sort identified that the canal supported a typical assemblage of aquatic macroinvertebrate found within canals including snails (Viviparidae, Lymnaeidae, Planorbidae), caddisflies (Limnephilidae) and mayflies (Baetidae).

D.1.31 The following INNS species were identified. None of these species recorded are listed on Schedule 9 of the WCA.

- zebra mussel (*Dreissena polymorpha*). Although this species is not listed on Schedule 9 of the WCA, it is highly invasive. It is unlike all other native mussel species in that it colonises and grows on hard substrates which can lead to a number of potential impacts including the clogging of water intake pipework and screens. The survey confirms this species to be well established within the canal. Large numbers of live animals were found during sampling, and there were also large numbers of old shells visible on the canal bed;
- demon shrimp (*Dikerogammarus haemobaphes*). This species was first recorded in the UK in 2012 and has spread rapidly. It is a highly efficient predator altering the diversity and abundance of other aquatic macroinvertebrates species;

- caspian mud shrimp (*Corophium curvispinum*). This species was first recorded in Britain in 1935 and now widespread in the south-east and midlands of England; and
- new Zealand mud snail.

Keadby Boundary Drain

D.1.32 A moderate diversity of aquatic macroinvertebrates was recorded (30 taxa, 17 identified to species) and the community is considered fairly typical of a small, heavily modified, slow flowing drain. The assemblage was dominated by a range of snail and beetle species, and the drain is of fairly high conservation value. The majority of the species present are of frequent to very common status. The exceptions to this were:

- the water beetle (*Anacaena bipustulata*). This is classified as regionally notable within the Community Conservation Index (CCI). However, it is of favourable status (see Table 3 in **Appendix 11G**: Aquatic Ecology Report – ES Volume II - **Application Document Ref. 6.3**), therefore while it requires due regard, it is not as notable as implied by the CCI;
- white-lipped ramshorn snail. This is classified as being of local status within the CCI. More recent information on the status of this snail establishes that it remains widespread within its native range and it is not currently considered threatened (Seddon et al., 2014); and
- two non-native species were recorded the amphipod *Crangonyx pseudogracilis/ floridanus* and the New Zealand mud snail.

D.1.33 All of the aquatic macroinvertebrate species present are tolerant of fine sediments (PSI: 0), as would be expected for a slow flowing drain of the type sampled. The biological quality of the drain is moderate (WHPT: 70, ASPT: 3.7). No pollution-sensitive taxa were recorded but the drain supported a range of taxa defined as having a moderate tolerance to pollution.

Macrophytes

D.1.34 Surveys undertaken for the Proposed Development in April and July 2020 did not identify aquatic plant species within the channel of the River Trent, with the exception of a few fronds of greater duckweed (*Spirodela polyrhiza*). No other in in-channel higher plant species would reasonably be expected given this is a tidal reach of a very large river.

D.1.35 Along the margins of the River Trent (both banks), above the typical high tide water level there are narrow strips of transitional vegetation dominated by common reed (*Phragmites australis*). These strips are very species-poor and comprised of common plant species, thus have a negligible nature conservation value. In addition, this vegetation is not considered an example of transitional saltmarsh, as it is not present in association with any other saltmarsh communities. Below the low tide water level only bare mud was visible.

D.1.36 The most recent macrophyte survey for which data has been provided by the Environment Agency was undertaken at North Soak Drain (NGR: SE 78099 11037) in 2016. 16 No. species were recorded, dominated by *Glyceria maxima* (reed grass) and *Phragmites australis* (common reed).

D.1.37 Further surveys have been undertaken of Drain 1-5, the Stainforth and Keadby Canal and Keadby Boundary Drain to inform the Proposed Development baseline:

Drain 1

D.1.38 Drain 1 supported 23 aquatic plant species (excluding algae) which included a range of submerged, floating and emergent species. No rare or notable species were present, and the assemblage is considered fairly diverse for the habitat conditions present.

D.1.39 A single non-native plant species was recorded, Nuttall's waterweed (*Elodea nuttallii*) which was abundant along the length of the drain. This is a controlled weed species listed under Schedule 9 of the WCA, as such it is an offence to cause it to spread in the wild.

Drain 2

D.1.40 Drain 2 supported six aquatic plant species. Species diversity was limited by the combination of heavy shading from trees and the dominance of common reed (*Phragmites australis*). Where this species was dominant, it excluded other flora and occurred as mono-specific stands. No rare or notable species were recorded, and the assemblage present is considered typical of the habitat conditions. No non-native plant species were recorded.

Drain 3

D.1.41 Drain 3 supported nine aquatic plant species. Species diversity was limited by the shading of the channel by trees and the dominance of common reed. Where common reed was dominant, it excluded other flora and occurred as mono-specific stands. No rare or notable species were recorded, and the assemblage present is considered typical of the habitat conditions. No non-native plant species were present.

Drain 4

D.1.42 Drain 4 supported four aquatic plant species. The only species recorded were tall emergent species which dominated the channel. This in combination with the shallow water depth limited the species diversity present. No rare or notable species were recorded, and the assemblage present is considered typical of an arable field drain. No non-native plant species were recorded.

Stainforth and Keadby Canal

D.1.43 Eighteen aquatic plant species were present. The dominant submerged plant species was Nuttall's waterweed, which formed dense beds over most of the visible channel. Nuttall's waterweed is a controlled weed species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Other species were mostly either limited to the margins of the canal and/ or were present at low cover.

D.1.44 Filamentous green algae was also present at a relatively high cover within the canal. The presence of such algae may be indicative of poor water quality, particularly nutrient enrichment, when found at high abundances.

Keadby Boundary Drain

D.1.45 The LWS supported 32 aquatic plant species (excluding algae). The assemblage is considered diverse for the habitat conditions and supported a range of submerged, floating and emergent species. Two notable species were recorded:

- Whorled water-milfoil is a species of calcareous freshwaters with good water clarity. It has declined substantially nationally and is of unfavourable status (Red Data List (RDL) Vulnerable). It was recorded as occasional during the survey and the LWS was judged to support a healthy viable population.
- Water-violet (Hottonia palustris) is of patchy distribution in Britain. It has declined substantially nationally and is of unfavourable status (RDL Vulnerable). It was recorded as occasional during the survey and the LWS was judged to support a healthy viable population.

D.1.46 A single non-native plant species, Nuttall's waterweed, was recorded and was abundant along the length of the drain. This is a controlled weed species listed under Schedule 9 of the WCA, as such it is an offence to cause it to spread in the wild.

Invasive Non-Native Species

D.1.47 One species listed on Schedule 9 of the Wildlife and Countryside Act (WCA) was recorded from the Proposed Development Site, this being Nuttall's waterweed (*Elodea nuttallii*). This species was recorded from Drain 1, Keadby Boundary Drain LWS and Stainforth and Keadby Canal. The Act makes it illegal to cause the spread of this species in the wild.

D.1.48 Although not listed on Schedule 9 of the WCA, the presence of zebra mussel (*Dreissena polymorpha*) (combined with the dominance Nuttall's waterweed) within the Stainforth and Keadby Canal may lead to issues relating to the clogging of water supply pipework and intake screens for the Proposed Development in the event that the preferred Canal Water Abstraction option is selected as this could affect the operation of the Proposed Development, as well as increase the frequency and cost of essential maintenance and repairs. Given this, the implications arising from the presence of zebra mussel should

be considered further during detailed design to mitigate the potential risk to the effective operation of the Proposed Development.

D.1.49 The other non-native species recorded are also not listed on the Schedule 9 of the WCA but are considered a significant design constraint. It is possible that species such as the demon shrimp (*Dikerogammarus haemobaphes*) may further compound the blocking of pipework, as they are known to occur at high densities but if steps are taken to overcome the issues relating to the zebra mussel and Nuttall's waterweed, this is likely to mitigate the potential risk posed by this species.

D.1.50 It is important to highlight that given the number of INNS recorded within Stainforth and Keadby Canal, this demonstrates that there are a number of existing pathways (but particularly boat traffic) that have facilitated the spread and establishment of these aquatic INNS in the local area. Given this, there is likely to be an ongoing risk of other INNS becoming established which may further impact operation of the preferred Canal Water Abstraction Option on the Stainforth and Keadby Canal. Such INNS might include high risk species such as quagga mussel (*Dreissena bugensis rostrigormis*) and floating pennywort (*Hydrocotyle ranunculoides*), both of which can also block pipework). Therefore, it is recommended that the detail design also consider this risk so that the Proposed Development is resilient to potential additional INNS risks.

D.2 Sites of Ecological Importance

Humber Estuary Designations

D.2.1 The Humber Estuary is a European 2000 site, recognised as being of international importance and classified as a Special Area of Conservation (SAC) and Special Protection Area (SPA) under the Habitats Directive, an international important wetland under the Ramsar Convention and nationally designated as a SSSI.

D.2.2 Nationally important habitats including Atlantic salt meadows and a range of sand dune types in the outer estuary, together with Sandbanks which are slightly covered by sea water all the time, extensive intertidal mudflats, Salicornia and other annuals colonising mud and sand, and Coastal lagoons.

D.2.3 The site is also of national importance for the geological interest at South Ferriby Cliff (Late Pleistocene sediments) and for the coastal geomorphology of Spurn. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent.

D.2.4 The range of salinity, substrate and exposure to wave action influences the estuarine habitats and the range of species that utilise them. Therefore, it supports nationally important numbers of wintering waterfowl and passage waders, in addition to a nationally important assemblage of breeding birds of lowland open waters and their margins.

D.2.5 The Humber Estuary is also nationally important for a breeding colony of grey seals (*Halichoerus grypus*), river lamprey (*Lampetra fluviatilis*), and sea lamprey (*Petromyzon marinus*). It supports a diverse vascular plant assemblage and rare amphibians such as the natterjack toad (*Bufo calamita*).

D.2.6 The River Trent forms part of the Humber Estuary SSSI and SAC designations. Tidal reaches of the River Trent, including the reach where the Site is located, are within these designations. Upstream (and north of) Althorpe Station the River Trent is also included within the Humber Estuary Ramsar, SAC and SSSI.

D.2.7 There are 189 SSSI Units within the Humber Estuary and 92.21% are categorised as Unfavourable-Recovering.

Other Ecologically Designated Sites

D.2.8 Approximately 2km to the south-west of the Proposed Development Site, south of the canal lies the Crowle Borrow Pits SSSI and the Hatfield Chase Ditches SSSI sites.

D.2.9 The Crowle Borrow Pits SSSI lies either side of the embankment of a disused railway line and supports a mosaic of habitats including alder (*Alnus glutinosa*) carr, scrub, fen and several small ponds in which several locally uncommon plant species occur. This SSSI comprises four units, three of which are in a Favourable condition, however Unit 3 is categorised as Unfavourable-Recovering. The condition threat risk is High for all units.

D.2.10 The Hatfield Chase Ditches SSSI is an area of former marsh and wetland which has been extensively drained, but these ditches make up the majority of nature conservation interest in an insensitively farmed area. They hold water throughout the year and have a range of water depths, Furthermore, the ditches support a rich assemblage of aquatic and emergent plants, nationally scarce invertebrates (reed beetles), and water vole (*Arvicola amphibius*). This SSSI comprises fifteen units, twelve of which are categorised as Unfavourable-Declining due to a number of reasons, including poor species richness and diversity, and % cover of non-natives and algae. Units 12, 14 and 15 are categorised as Favourable due to good water quality. The condition threat risk is High for all units.

Local Wildlife Sites within 1km of the Proposed Development Site

D.2.11 Stainforth and Keadby Canal Corridor falls within the boundary of the Stainforth and Keadby Canal Corridor LWS, which is designated for its a rich aquatic flora and associated bankside habitats.

D.2.12 Warping Drain LWS is approximately 320m north of the Proposed Development Site and bisected by existing line of discharge from Keadby 1 Power Station. It is designated for supporting a population of whorled water-milfoil (*Myriophyllum verticillatum*). The site is also designated for its wet reed beds with a large population of common reed (Phragmites australis).

D.2.13 Keadby Boundary Drain LWS is adjacent to the Proposed Development Site to the west of Keadby Common and is designated as it supports abundant aquatic vegetation throughout.

D.2.14 Soak Drain LWS is approximately 25 m south of the Proposed Development Site and supports rich aquatic, emergent and marginal flora. The site is also designated for its swamp habitat which is dominated by common reed.

D.2.15 The Keadby Wetland LWS is approximately 25 m south-east of the Proposed Development Site and is designated for its mosaic habitat of willow scrub, wetland vegetation including large bindweed (*Calystegia sepum*).

D.2.16 The Keadby Wet Grassland LWS is approximately 50 m south of the Proposed Development Site and is designated for its marsh, swamp and drains supporting large number of wetland plants.

D.2.17 Three Rivers LWS is approximately 100 m south of the Proposed Development Site and is designated for its three parallel canalised watercourses which support a rich aquatic, emergent and marginal flora.

D.2.18 The Hatfield Waste Drain is adjacent to the Site at its south-western extent and is designated for supporting a rich aquatic, emergent and marginal flora with a surrounding mosaic of neutral grassland and common reed swamp.

ANNEX E WATER RESOURCES BASELINE

E.1.1 The following provides information on water availability, water activity permits (i.e. discharges), water abstractions and past pollution incidents based on information requested from the Environment Agency, and the Landmark Information Group Envirocheck report (Landmark, 2020).

E.2 Water Activity Permits

E.2.1 There are 13 active water permits (i.e. formerly discharge consents) within 1km of the Proposed Development. These are listed in Table E1 and shown in **Figure 12-1** (ES Volume III - **Application Document Ref. 6.4**).

Table E1: Water activity permits within the study area

Label on Fig 12.1	Licence	NGR	Issued Date	Discharge Type	Receiving Water
Environment Agency Data:					
D1	T/83/21614/O (Woodcarr Avenue Storm Overflow)	SE 83370 11090	22/06/1992	Storm Tank/ combined sewer overflow (CSO) on Sewerage Network (water company)	Three Rivers
D2	WQ/72/137 (Canal Side, Keadby)	SE 83200 11300	21/08/1975	Undefined or Other	Three Rivers
D3	EPRLB3392RP (Keadby Power Station)	SE 82607 11512 and SE 82334 11595	17/05/2019	Sub-station/ Electricity/ Gas/ Air Conditioning Supply	North Soak Drain
D4	3/28/83/0806 (Keadby 400kv substation)	SE 82300 11800	22/01/1968	Undefined or Other	North Soak Drain
D5	WQ/72/1350 (Keadby Sanitary Station)	SE 83100 12100	23/08/1977	Undefined or Other	Warping Drain
D6	T/84/45997/T (Keadby substation)	SE 82340 12160	12/09/2004	Sub-station/ Electricity/ Gas/ Air Conditioning Supply	Keadby Boundary Drain

Label on Fig 12.1	Licence	NGR	Issued Date	Discharge Type	Receiving Water
D7 / D8	T749 (Vazon Swing Bridge House)	SE 82500 11400	12/10/1960	WwTW (not water co) (not STP at a private premises)	South Soak Drain
Landmark Envirocheck Data:					
D9	Am6773 (Keadby Power Station)	SE 83661 12227, SE 82764 11755, SE 83001 11477, SE 82978 11592, SE 83017 11721 and SE 82596 11766	09/10/1995	Sub-station/ Electricity/ Gas/ Air Conditioning Supply, Trade Effluent Discharge – Site Drainage	River Trent, Unnamed Drainage Ditch, Stainforth and Keadby Canal
D10	T/84/45990/R (Gunness STW)	SE 83924 12359	11/08/2004	WwTW/ Sewage Treatment Works (Water Company)	River Trent
D11	WQ/72/1296/1 (Chemical Vessel Services Ltd)	SE 83397 11286	14/07/1977	Sewage Effluent	Groundwater
D12	T83/45559/R (Althorpe Sewage Treatment Works)	SE 83564 11268	24/09/2009	Sewage Discharges – Final/ Treated Effluent	River Trent
D13	T/83/21614/O	SE 83564 11268	22/06/1992	Public Sewage: Storm Sewage Overflow	Three Rivers

E.2.2 The consented discharges are for a range of uses including combined sewer overflows (CSO) on the sewerage network, final/ treated sewage effluent discharges, and discharges from Keadby Power Station including process water and runoff.

E.3 Abstractions

E.3.1 Data provided by the Environment Agency and derived from the Envirocheck report indicates that there are 16 licensed water abstractions within 1km of the Proposed Development Site, which are presented in Table E2 and **Figure 12.1** (ES Volume III - **Application Document Ref. 6.4**).

Table E2: Abstraction licenses within the study rea

Fig 12.1 Ref	Licence Holder	Abstraction Licence	Use	Source Description	National Grid Reference
Environment Agency:					
A1	Canal and River Trust	03/28/83/0171 (Surface Water -Canal)	Boiler Feed	Production Of Energy - Electricity	SE 8279 1149
A2	R Smith & Son	03/28/83/0245 (Surface Water - River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 8190 1040
A3	R Smith & Son	03/28/83/0245 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 8256 1004
A4	M & J AGRICULTURE	03/28/83/0246 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 8190 1040
A5	KEADBY GENERATION LTD	03/28/85/0007 (Tidal Waters)	Non-Evaporative Cooling	Production of Energy - Electricity	SE 8354 1164
A6	KEADBY GENERATION LTD	03/28/85/0007 (Tidal Waters)	Boiler Feed	Production of Energy -Electricity	SE 8354 1164
A7	Canal and River Trust	MD/028/0083/014 (Surface Water – Canal)	Evaporative Cooling	Production of Energy - Mechanical Non Electrical	SE 82790 11478

Fig 12.1 Ref	Licence Holder	Abstraction Licence	Use	Source Description	National Grid Reference
A8	Siemens Public Limited Company	MD/028/0083/040 (Groundwater)	Dewatering	Industrial, Commercial and Public Services - Other Industrial/Commercial/Public Services	SE 82653 11642
A9	Siemens Public Limited Company	MD/028/0083/040 (Groundwater)	Dewatering	Industrial, Commercial and Public Services - Other Industrial/Commercial/Public Services	SE 82619 11656
A10	Siemens Public Limited Company	MD/028/0083/040 (Groundwater)	Dewatering	Industrial, Commercial and Public Services - Other Industrial/Commercial/Public Services	SE 82420 11710
A11	ER Woodhouse	MD/028/0084/002/R01 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 82260 12480
A12	RJ & AE GODFREY	MD/028/0084/005 (Surface Water – River)	Spray Irrigation - Direct	Agriculture - General Agriculture	SE 83171 12204.
Landmark Envirocheck Data					
A13	Mr W Foster-Thornton	03/28/85/0007 (Surface Water - River)	General agriculture: spray irrigation - direct	Agriculture - General Agriculture	SE 81780 12230
A14	J A Chapman Farms	03/28/83/0094 (Surface Water - River)	General agriculture: spray irrigation - direct	Agriculture - General Agriculture	SE 81800 11400

Fig 12.1 Ref	Licence Holder	Abstraction Licence	Use	Source Description	National Grid Reference
A15	Holly Hall Farms Ltd	03/28/85/0006/1 (Tidal Waters)	Spray irrigation	Agriculture - General Agriculture	SE 83700 11795
A16	T F Belton Limited	03/28/85/0010 (Tidal Water)	General agriculture: spray irrigation - direct	Agriculture - General Agriculture	SE 83700 11795

E.3.2 Three of the abstractions are from groundwater, and these are all for dewatering relating to the Keadby 2 Power Station (under construction). There are four abstractions from tidal waters, both for use in the operational Keadby 1 Power Station to the west of the River Trent, and for agricultural spray irrigation to the east of the River Trent. There are two abstractions from the Stainforth and Keadby Canal for process water relating to the operational Keadby 1 Power Station and (under construction) Keadby 2 Power Station. The remaining seven licenses are from rivers and are for agricultural use (direct spray irrigation).

E.3.3 NLC have confirmed that there are no records of any private water supplies in the study area.

E.4 Water Pollution Incidents

E.4.1 In response to the submitted data request, the Environment Agency has stated that there have been no Category 3 or above pollution incidents in the area of interest within the last 5 years.