The Keadby 3 Low Carbon Gas Power Station Project

PINS Ref: EN010114

The Keadby 3 Low-Carbon Gas Power Station Order

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

Preliminary Environmental Information (PEI) Report Volume II - Appendix 12B: Water Framework Directive Screening Report

The Planning Act 2008

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Applicant: SSE Generation Limited

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GLOSSARY

Abbreviation	Description
AEP	Annual Exceedance Probability
AGI	Above Ground Installation
AIL	Abnormal Indivisible Loads
CEMS	Continuous Emissions Monitoring System
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
DCC	Direct Contact Cooler
DEMP	Decommissioning Environmental Management Plan
DrWPA	Drinking Water Protected Areas
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HRSG	Heat Recovery Steam Generator
HSE	Health and Safety Executive
HMWB	Heavily Modified Water Body
HP	Hight Pressure
IDB	Internal Drainage Board
PCC	Power and Carbon Capture
RBMP	River Basin Management Plan
SCR	Selective Catalytic Reduction
WFD	Water Framework Directive
WwTW	Waste Water Treatment Works

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ANNEXES

TABLES

1.0 INTRODUCTION

1.1 Background

1.1.1 AECOM was commissioned by SSE Thermal Ltd ('The Applicant') to produce a Water Framework Directive (WFD) Screening Report for the proposed Keadby 3 Low Carbon Power Station project (hereafter referred to as the 'Proposed Development'). The WFD Screening Report has been provided as part of the Preliminary Environmental Information (PEI) Report and specifically, as an Appendix to **Chapter 12:** Water Resources and Flood Risk (PEI Volume I).

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 water bodies. In accordance with the Planning Inspectorate's Advice Note Eighteen (Ref. 6) and the Environment Agency guidance for competing WFD assessments for coastal and transitional waters (Ref. 7), a three-stage approach may be adopted:

- **Stage 1:** WFD Screening - Identification of the proposed work activities that are to be assessed and determination of which WFD water bodies could potentially be affected through identification of a Zone of Influence. This step also provides a rationale for any water bodies 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 water bodies and activities carried forward from the WFD screening and scoping stages.

1.1.3 This report therefore presents the findings of an initial WFD screening exercise (the first stage in the WFD assessment process) which has been undertaken in relation to the Proposed Development.

1.2 The Scheme

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 with an unabated capacity of up to 910MW (gross) electrical output to be located on land in the vicinity of the existing Keadby Power Stations (Keadby 1 and Keadby 2) near Scunthorpe in North Lincolnshire (the Proposed Development Site).

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

- **Figure 3.1**: DCO Site Red Line Boundary (PEI Report Volume III)
- **Figure 3.2**: Indicative Site Layout (PEI Report Volume III)

1.2.3 **Figure 4.1**: Indicative Layout for the Proposed Power and Carbon Capture (PCC) Site (PEI Report Volume III). Further details of the Proposed Development are set out in **Chapter 4:** The Proposed Development (PEI Report Volume I).

1.2.4 At this stage in the development of the Project, the final technology selection cannot yet be made, as it will be determined by various technical and economic considerations and will be influenced by future UK Government policy. The design of the Proposed Development, therefore, incorporates a necessary degree of flexibility, to allow for the future selection of the preferred technology in the light of prevailing policy and market conditions once a DCO is granted.

1.2.5 The Proposed Development will be designed to operate as a CCGT generating station with post-combustion carbon capture and compression plant (CCP) installed such that the plant can be operated as a dispatchable low carbon generating station. The Proposed Development therefore incorporates equipment required for the capture and compression of carbon dioxide (CO_2) emissions from the generating station for onward transport by a pipeline connecting off-site to the Humber Low Carbon (HLC) cluster for subsequent compression and transport to offshore geological storage site.

1.2.6 The Applicant will be responsible for the construction, operation including maintenance and decommissioning of the Proposed Development including the equipment required on-site for the capture of CO_2 emissions from the generating station.

1.2.7 Various routing options are available to connect the Proposed PCC Site into the necessary CO_2 export infrastructure. Discussions with HLC Cluster partners are ongoing in respect of the required pipeline connections and parties are working closely to identify options for pipeline routes, taking into consideration technical and environmental opportunities and constraints. **Chapter 19:** Cumulative and Combined Effects (PEI Report Volume I) provides further information on the likely effects of the CO_2 export pipeline.

1.2.8 The development of the CO_2 export pipeline will be progressed under separate consent and is not included in the indicative DCO order limits for the Proposed Development Site. Rather, the Proposed Development includes necessary equipment to enable connection into this infrastructure.

1.2.9 In summary, the Proposed Development would include:

- A CCGT unit with integrated CCP including compression equipment and associated utilities including cooling infrastructure, various pipework, water treatment plant, emergency diesel generator and control room, workshops, stores and gatehouse;
- Chemical storage facilities, other minor infrastructure and auxiliaries/ services (Proposed Power and Carbon Capture (PCC) Site);
- Natural gas pipeline from the existing National Grid Gas high pressure (HP) gas pipeline within the Proposed Development Site to supply the Proposed PCC Site, including an above ground installation (AGI) for both National Grid Gas's apparatus and the Applicant's (Gas Connection Corridor);
- Electrical connection works to and from the existing National Grid 400kV Substation (Electrical Connection Area to National Grid 400kV Substation) for export of power;

- Electrical connection from the existing Northern Powergrid 132kV Substation (Potential Electrical Connection to Northern Powergrid 132kV Substation) for supply of power to the Proposed PCC Site during start-up plant and equipment);
- Water Connection Corridors including:
  - A water intake within the Stainforth and Keadby Canal, which could be utilised for cooling water and make-up water subject to ongoing engagement with the Canal and Rivers Trust and Environment Agency (Canal Water Abstraction Option);
  - In the event that water from the Stainforth and Keadby Canal is not available or there is insufficient capacity for provision of water for the Proposed Development, an intake to provide cooling and make-up water from the River Trent (River Water Abstraction Option);
  - Disposal of treated cooling water to the River Trent (Water Discharge Corridor);
  - towns water connection pipeline from existing water supply within the Keadby Power Station for potable water;
- AGI for connection to third party CO_2 export infrastructure including compression facilities;
- New permanent access to the Proposed Development Site from A18 and means of permanent emergency access via Chapel Lane;
- A new surface water drainage system comprising pond(s) and/ or a tank or similar, including a new surface discharge connection to a drainage channel, subject to discussions with the local internal drainage board (IDB);
- Associated development including:
  - Temporary construction and laydown area including contractor facilities and parking;
  - Use of an existing Waterborne Transport Offloading Area and temporary Additional Abnormal Indivisible Load (AIL) Route;
  - Landscaping and biodiversity enhancement areas, internal access roads, roadways and footpaths;
  - A permanent laydown and turnaround area for maintenance; and
  - Security, fencing and Lighting.

1.2.10 A more detailed description of the Proposed Development is set out in **Chapter 4:** The Proposed Development (PEI Report Volume I).

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 screening methodology.
- Section 4 describes the screening assessment.
- Section 5 provides the conclusions and next steps.

2.0 OVERVIEW OF THE WATER FRAMEWORK DIRECTIVE

2.1 Legislative Context

2.1.1 The Water Framework Directive (WFD) (Ref. 1) aims to protect and enhance the quality of the water environment across all European Union (EU) member states. 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. The main aims of the directive are:

- To prevent further deterioration and protect and enhance the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- Promote sustainable water use based on a long-term protection of available water resources;
- Aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- Ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and
- Contribute to mitigating the effects of floods and droughts.

2.1.2 The WFD 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.

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

2.1.4 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

[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.

(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.

2.1.5 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. Natura 2000 sites or water dependent Sites of Special Scientific Interest (SSSI)) and adjacent WFD water bodies, where relevant.

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 water bodies that are natural and considered by the Environment Agency not to have been significantly modified for anthropogenic purposes. The overall objective for natural surface water bodies 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 (Ref. 2)

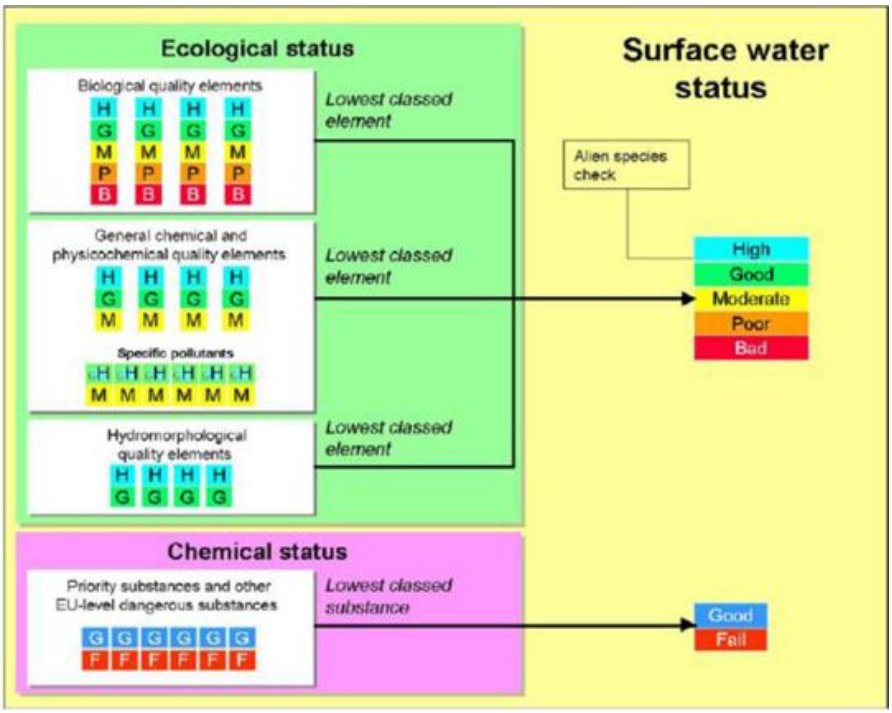
Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity 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 water bodies (such as canals), or natural water bodies that have undergone significant modification; these are termed Heavily Modified Water Bodies (HMWBs). 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 water bodies 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 (Ref. 2)



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 Environmental Quality Standards Directive (2008/105/EC) (Ref. 3). This is assigned on a scale of good or fail. Surface water bodies are only monitored for priority substances where there are known discharges of these pollutants; otherwise surface water bodies 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' (Ref. 2), 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

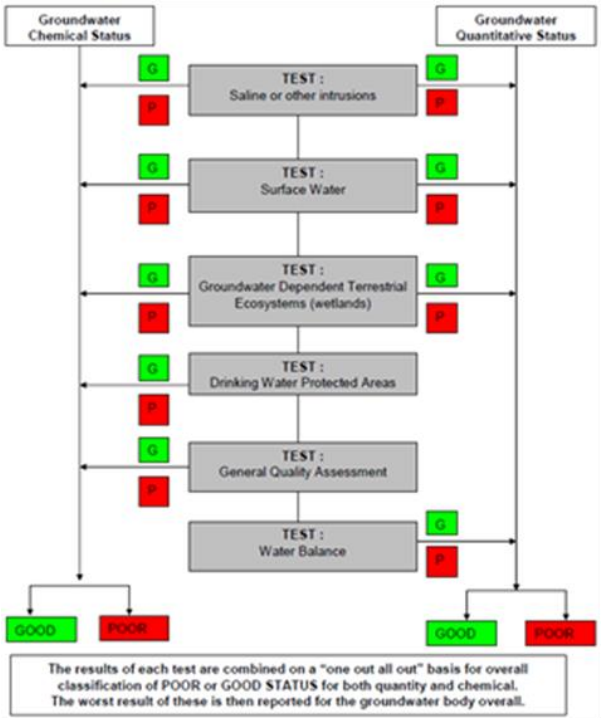
presence of invasive species. The biological quality elements can influence an overall water body status from Bad through to High.

- **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 water bodies.

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 (Error! Reference source not found.**, Ref. 5)**



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 water bodies.
- **Groundwater Dependent Terrestrial Ecosystems (GWDTEs)**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTEs (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 water bodies and GWDTEs.

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.
- **Groundwater Dependent Terrestrial Ecosystems (GWDTEs)**: This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE's (with respect to water quality).
- **Drinking Water Protected Areas (DrWPAs)**: This test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WFD (Ref. 1) 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 SCREENING METHODOLOGY

3.1 Overview

3.1.1 In England, the Environment Agency is the competent authority for implementing the WFD. As the competent authority they must make sure that development:

- Does not result in a deterioration of status of the water body;
- Does not prevent the achievement of 'good' status by 2027;
- Does not infringe other legislation; and
- Where possible, enhances the environment.

3.1.2 New developments that therefore 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 water bodies.

3.1.3 In accordance with the Planning Inspectorate's Advice Note Eighteen (Ref. 6) and the Environment Agency guidance for competing WFD assessments for coastal and transitional waters (Ref. 7), 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 water bodies could potentially be affected through identification of a zone of influence. This step also provides a rationale for any water bodies 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 water bodies and activities carried forward from the WFD screening and scoping stages. It involves:
  - The baseline conditions of the concerned water bodies;
  - 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.

3.1.4 The initial screening stage (Stage 1) identifies the water bodies which may potentially be affected by the proposed scheme. Scoping (Stage 2) identifies the WFD parameters which need to be considered to inform WFD impact assessment (Stage 3). This report covers Stage 1: Screening only.

3.2 Defining no Deterioration

3.2.1 No deterioration was defined by the Environment Agency in its Position Paper (Ref. 8). 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), Ref. 9), 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 Drinking Water Directive 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 (Ref. 1) and Article 4 of the Groundwater Daughter Directive (Ref. 10).

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.

3.2.7 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 water body'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

3.3 Future Status Objectives

3.3.1 RBMPs 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. The screening assessment should consider whether the project has the potential to prevent the implementation or impact the effectiveness of the defined measures.

3.4 Article 4.7 Derogations

3.4.1 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).

3.4.2 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).

3.5 Environment Agency Clearing the Waters for All Guidance

3.5.1 Within the PINS Advice Note 18 (Ref. 6), PINS advise following the approach given in the Environment Agency's Clearing the Waters for All guidance (Ref. 7). While developed for estuarine and coastal waters, PINS consider the staged approach equally suitable for rivers, lakes and groundwater projects in England and Wales.

3.5.2 The Environment Agency's guidance on Water Framework Directive assessment (Ref. 7) 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 water body – 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.

3.6 Flood Risk Activity Permit Exemptions

3.6.1 Certain activities on or near waterbodies are exempt from the requirement for Environmental Permits for Flood Risk Activities, and hence do not require WFD assessments, as summarised in Table 2.

Table 2: 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
	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

Activity	Type of Modification
	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
Bridges	Permanent clear span bridge, with abutments set-back from bank top
	Bridge deck/ parapet replacement/ repair works
	Replacing road surface on a bridge
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

3.6.2 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.

3.7 General Approach and Scheme Assumptions

3.7.1 The screening assessment is qualitative and has been based on readily available data and information (including data provided in response to a Freedom of Information Request to the Environment Agency) as well as a site survey.

3.7.2 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 (PEI Report Volume I). For baseline water quality data (2019), please refer to **Annex B** of this Appendix.

Desk Study

3.7.3 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;
- Review WFD classifications, Environment Agency investigation reports, and any mitigation measures proposed to meet Good Ecological Potential; and
- Review 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.

3.7.4 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 (PEI Report Volume I). 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.

Limitations and Assumptions

3.7.5 The screening contained herein makes use of the 'Rochdale Envelope' approach under the Planning Act (2008) (Ref. 11). 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.

3.7.6 Key principles in the context of the DCO application process are given in the Planning Inspectorate's Advice Note Nine: Using the Rochdale Envelope (Ref. 12). 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.

3.7.7 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 (PEI Report Volume I):

- 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 water bodies. Details of this mitigation and best practice standards are described in **Chapter 12:** Water Environment and Flood Risk (PEI Report Volume I).
- Cooling water will be required for heat rejection from the combined cycle gas turbine (CCGT) and carbon capture and compression plant (CCP). There are a number of options under consideration to support this process, both in terms of the cooling technology and abstraction/discharge. The preferred solution is hybrid cooling of

both the CCGT and CCP using water abstracted from the Stainforth and Keadby Canal (Canal Water Abstraction Option). In the event that it is not possible to abstract sufficient volumes of water from the canal, 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. It is anticipated that cooling would be achieved through the use of hybrid wet/ dry cooling towers using make up water that is either abstracted from the River Trent or from the Stainforth and Keadby Canal, supplemented with extra pre-cooling by dry fin-fan coolers when necessary (e.g. in summer months when the hybrid cooling towers will not provide enough standalone cooling). As a worst-case scenario the assessment considers both abstraction from the River Trent and from Stainforth and Keadby Canal.

- 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 will be used for the Proposed Development. As the existing Aqseptence Group screen installation is designed for 442L/s, and the maximum hybrid cooling water demand for The Proposed Development is predicted to be ~308L/s, it is expected that the overall dimensions of the new inlet will be no larger than the Keadby 2 installation. Consultation is ongoing with the Environment Agency and Canal and River Trust to define the parameters of any abstraction / discharge, such as the amount of water that could be abstracted or discharged per annum, and at what frequency and rate.
- 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.
- It is assumed that installation works will require use of a cofferdam(s) in close proximity to the intake structure in the River Trent and/or proposed intake structure location in the Stainforth and Keadby Canal. A cofferdam will extend no further into the River Trent channel than 25m from the banks, and 15m in the case of the structure on the Stainforth and Keadby Canal. This is a relatively small distance in the context of a river channel that is 150m wide, and in the case of the canal impinges less than 50% of the 35m total channel wide. 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.
- 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 Anglian Water.
- For the purposes of this assessment it has been assumed that all foul water from welfare facilities will be directed to the nearest Waste Water 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 Anglian Water.
- In terms of site drainage, 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, Demin Plant and Condensate Polishing Plant Regeneration Wastewater, Heat Recovery Steam Generator (HRSG) boiler blowdown and reject water (brine) from the desalination process.

- At this preliminary stage, it is assumed that bypass oil water separators and storage tanks will be provided for surface water runoff to any chosen SuDS (e.g. retention pond) situated upstream of the main outfall from the Proposed Development Site. It is also assumed that penstocks would be provided to isolate any accidental spillages. A fire water drainage philosophy 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. Further details on the proposed SuDS will be provided in an outline drainage strategy to accompany the Application. An initial Conceptual Drainage Strategy is provided within **Appendix 12A (Section 5 – 6):** Flood Risk Assessment (PEI Report Volume II).
- It is assumed that water discharged from the Proposed Development Site will be limited to the greenfield runoff rate, and that water storage (i.e. the retention pond) is appropriately sized to accommodate the 1% Annual Exceedance Probability (AEP) event with 40% allowance for climate change.
- As a worst case, it has been assumed that open-cut methods will be required for installation of any pipework across minor watercourses and drains associated with the water connection corridors and the low voltage electrical connection. In such cases, it is assumed that flow would be temporarily over-pumped, diverted around or flumed through the working area and the watercourse fully reinstated as before. Although none are anticipated at this preliminary stage, 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 mimimise the length of bank affected and impacts to these watercourses.

3.7.8 Whilst no Construction Method Statements are available at the time of writing, the Applicant would require the contractor to produce and maintain a CEMP to control construction activities to minimise, as far as reasonably practicable, impacts on the environment. This would include industry best practice measures and specific measures set out in this PEI Report. A Framework CEMP will be produced in support of the Application and will set out the key measures to be employed during construction of the Proposed Development to control and minimise impacts on the environment. Further information on the management of potential environmental effects is available within **Chapter 5:** Construction Programme and Management (PEI Report Volume I).

3.7.9 The understanding of drainage arrangements assessed herein is based the options under technical evaluation by the Applicant regarding Water Supply and Wastewater Discharge (Ref. 13). The drainage strategy is subject to further development, in consultation with the Environment Agency and LLFA, and will be presented and assessed at the full impact assessment stage.

4.0 Screening Assessment

4.1 Overview

4.1.1 The water bodies 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 works.
- The relevant water bodies have been determined using a Zone of Influence (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 Section 4.2 below provides a description of the Proposed Development including construction and decommissioning activities from which all potential pathways to an effect and ZoIs have been identified (see Section 4.3). A description of the baseline WFD status for those water bodies which are screened into the assessment via the ZoI approach is presented in Section 4.4. 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 (Ref. 14). The first RBMPs were published in 2009, and the first cycle of planning then took place between 2009 and 2015 when the second RBMPs 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 Section 3.4.

4.2 Description of the Proposed Development Components

4.2.1 This section describes the key components of the Proposed Development which are of relevance to the Water Environment and require consideration in terms of the WFD Assessment. Further details of the Proposed Development are provided within **Chapter 4:** The Proposed Development (PEI Report Volume I) and represented in **Figure 3.2** (PEI Report Volume III). Potential construction and decommissioning impacts and avoidance measures are also described and detailed within **Chapter 5:** Construction Programme and Management (PEI Report Volume I).

The Proposed PCC Site

4.2.2 The Proposed PCC Site will be a gas fired powered power station with carbon capture. It will comprise a single CCGT unit with a nominal power export capacity of 910MWe. The operation of the carbon capture and compression systems will reduce the amount of electricity that can be exported from the Proposed Development to the UK transmission system.

4.2.3 The Proposed PCC Site comprises an integrated power generation and carbon capture train encompassing:

- Natural gas reception facility including National Grid and Applicant AGI, gas conditioning, let down and metering equipment;
- A gas turbine, generator and auxiliaries enclosed within a building, with associated air inlet;
- A heat recovery steam generator (HRSG), continuous emissions monitoring system (CEMS) and auxiliaries and instrumentation enclosed within a building, with associated stack;
- A steam turbine, generator and condenser and auxiliaries/ transformers enclosed within a building;
- An emergency diesel generator;
- Selective catalytic reduction (SCR) equipment for the removal of nitrogen oxides (NO_x) from the flue gas;
- A direct contact cooler (DCC) and associated pumps for carbon capture;
- An absorber column, with wash plant, CEMS and associated stack(s);
- CO_2 treatment plant and associated electrical and instrumentation building;
- CO_2 compression and metering equipment and a National Grid CO_2 AGI to facilitate the export of pressurised CO_2 to the HLC network off-site;
- Transformers (for the import and export of electricity);
- Hybrid cooling cells and associated pipework;
- Instrumentation and electrical building;
- Water treatment plant;
- Wastewater treatment plant; and
- Ancillary equipment (including air compressors, pumps, chemical storage, above ground demineralised and fire water storage tanks and associated infrastructure).

4.2.4 The electrical, steam and water circuits within the capture plant will be integrated as far as is reasonably practicable in order to reduce energy use. For example, steam will be extracted from the HRSG for use in the capture plant and, once used, condensed and returned to the HRSG for re-use.

4.2.5 The Proposed PCC Site will also include:

- A gatehouse, security building and staff parking;
- Administration, control and stores buildings; and
- A new surface water drainage system comprising pond(s) and/ or a tank or similar.

4.2.6 The administration/ control building(s) would contain the main reception, offices, control room, electrical equipment and staff welfare facilities.

4.2.7 Stores building(s) would be required for operation and maintenance activities and storage of materials.

4.2.8 There would be provision for several car parking spaces and cycle storage on-site for operational use. Additional car parking spaces would be provided to support outages, if required.

4.2.9 Each of the main components of the Proposed PCC Site is described further in **Chapter 4:** The Proposed Development (PEI Report Volume I). An illustrative layout for the Proposed PCC Site can be found in **Figure 4.1:** Indicative Proposed PCC Site (PEI Report Volume III).

CO_2 Compression Station and Export Pipeline

4.2.10 The Proposed PCC Site has been sited to connect into a CO_2 gathering network including a CO_2 export pipeline that is being designed by HLC to operate independently of the Proposed Development. Various routing options are available to connect the Proposed PCC Site into the necessary CO_2 export infrastructure. Discussions with HLC Cluster partners are ongoing in respect of the required pipeline connections and parties are working closely to identify options for pipeline routes, taking into consideration technical and environmental opportunities and constraints

4.2.11 The development of the CO_2 export pipeline will be progressed under separate consent and is not included in the indicative DCO order limits for the Proposed Development Site. Rather, the Proposed Development includes necessary equipment to enable connection into this infrastructure.

Other Connections

Natural Gas (Fuel) Connection and Treatment Infrastructure

4.2.12 Natural gas will be used as the fuel for the operation of the CCGT. Subject to agreement with National Gas Grid (NGG), natural gas will be supplied via a tie-in to the HP gas transmission network within and directly adjacent to the Proposed Development Site. It is currently anticipated that a minimum off-take connection will be constructed, and natural gas will be transferred via a below ground pipeline corridor within the Proposed PCC Site from a new National Grid AGI and gas receiving area, where the gas would be metered and conditioned to that required for the Proposed Development.

Electricity Connections

4.2.13 The existing electrical infrastructure in the area comprises 132 kilovolt (kV) and 400 kV overhead lines as well as underground cables that serve existing substations.

4.2.14 It is anticipated that the Proposed Development will require a direct connection to the 400kV system and is therefore likely to connect to the existing National Grid 400kV substation directly to the east of the Proposed PCC Site. The connection between the Proposed Development and existing 400kV substation would comprise 400kV electrical cables which would be installed either above ground or below ground, with watercourse crossings potentially being required.

Cooling Water and Wastewater Connection Works

4.2.15 The Proposed PCC Site will require a source of cooling water for heat rejection purposes. Process water will also be required in order to provide make-up to the steam/ water cycle of the Proposed PCC Site. There will also be a requirement for water for domestic and sanitary use.

4.2.16 Technical assessments are ongoing in order to identify preferred cooling options for the Proposed Development and at this stage, two water sources are under consideration; the Stainforth and Keadby Canal or the River Trent.

4.2.17 The preferred cooling method 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 which may comprise screens, baffles and fish return system (similar to that approved by the Environment Agency and currently being constructed for Keadby 2 Power Station). A pipeline would be constructed from this inlet into the Proposed PCC Site broadly following the route consented for Keadby 2 Power Station.

4.2.18 Treatment of the raw abstracted water would be undertaken in a water treatment plant located on the Proposed PCC Site to provide the necessary quality for use as make-up water in the hybrid cooling towers. Water would be treated to remove dissolved solids present and provide demineralised make-up water to the steam/ water cycle.

4.2.19 In the event that it is not possible to abstract sufficient volumes of water from the canal, 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 significant modification (either involving a new gravity or pumped intake system) to address silt issues and to comply with the Eels (England and Wales) Regulations 2009. In either case, the screen wash water and associated screenings/ fish would be returned to the River Trent and any captured grit either disposed of to landfill or returned to the River (for example during ebb tides), subject to further assessment. The existing pipeline would be extended by approximately 1km into the Proposed PCC Site.

4.2.20 The Applicant is proposing to re-use existing assets and pipework for Keadby 1 Power Station for the discharge of 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 corridor north-east from Keadby 1 Power Station connecting with the River Trent. Interconnecting pipework would extend from Proposed PCC Site to connect to this infrastructure.

4.2.21 Given the options that remain under consideration for the preferred cooling method, a number of potential sources of wastewater remain under consideration at this stage including (but not limited to):

- Neutralised effluent streams from the demineralisation plant;
- Blowdown from the Proposed PCC Site (CCP and CCGT);

- River water treatment wastewater, including brine where relevant (if hybrid cooling options selected); or
- Canal water wastewater.

4.2.22 Discharges would be treated and regulated by the Environment Agency through the Environmental Permit required for the operation of the Proposed Development. Specific details regarding control of discharges are set out in **Chapter 12:** Flood Risk and Water Resources (PEI Report Volume I).

4.2.23 As part of refurbishment and/ or replacement works within the Water Discharge Corridor, various ancillary works may be required.

4.2.24 Discharge of domestic/ sanitary effluent would be to the local sewerage system, subject to agreement with the local sewerage undertaker.

Chemical Storage

4.2.25 A number of chemicals will be required to be transported to, stored and used on the Proposed PCC Site. The Proposed PCC Site will therefore contain chemical storage facilities including road tanker unloading area.

4.2.26 Some of these materials will be classed as hazardous. Where any substance could pose a risk to the environment through its uncontrolled release (e.g. surface water drains), the substance will be stored within appropriate containment facilities including impermeable concrete surfaces and appropriately designed and sized bunds.

4.2.27 The inventory of materials to be stored on the Proposed PCC Site will be developed through the design process. However, where storage of hazardous materials, individually or in-combination exceeds the relevant thresholds, separate permissions will need to be sought from the Health and Safety Executive (HSE) and local planning authority as appropriate for their storage, under the Planning (Hazardous Substances) Regulations 2015 and Control of Major Accident Hazards Regulations 2015 (COMAH) regimes. All chemical storage will be regulated by the Environment Agency through an environmental permit that will be required for the operation of the PCC Site.

Operational Process Inputs

4.2.28 The Proposed Development will use various raw materials during operation. Except for natural gas and water, these will be delivered to the Proposed Development by road tanker. Storage capacity at the Proposed Development Site has been designed to reflect the process requirements and delivery capability.

4.2.29 Materials including chemicals to be used will be subject to control via the Environmental Permit, COMAH Licence (if applicable) and other necessary consents required, and are anticipated to include:

- Solvent that will remove the CO_2 from the gas stream in the CCP. The solvent to be used is the subject of ongoing technical studies but is assumed to be an aqueous solution of amines. The CCP includes equipment for reclaiming used solvent within the process, but make-up will be required;

- Sodium hydroxide and sulphuric acid for pH control and treatment within the CPP;
- Power plant treatment chemicals (oxygen scavenger, SCR reagent (ammonia or urea) and phosphate);
- Capture plant treatment chemicals (sodium hydroxide, sulphuric acid and triethylene glycol;
- Water treatment plant chemicals (biocides, antiscalants, sulphuric acid, sodium hydroxide, phosphoric acid, polyelectrolyte, molasses);
- Cooling tower chemicals (biocides, bio dispersants, corrosion inhibitors);
- Distillate fuel;
- Nitrogen (natural gas system and other equipment purge);
- Cleaning chemicals;
- Acetylene (metal cutting);
- Inert fire-fighting gases;
- Lubricating oils;
- Hydrogen for generator cooling and deoxygenation of product CO_2 stream; and
- Carbon dioxide for purging of electrical generators for maintenance purposes.

Routine and Emergency Access/ Egress

4.2.30 Access to the Proposed Development Site during operation would be via the existing road access road from the A18 which passes via the existing Pilfrey Bridge over the Stainforth and Keadby Canal and the Scunthorpe to Doncaster passenger rail line. Vehicles would access the Proposed Development Site from the A18, via this existing access road/ Bonnyhale Road/ existing private access roads and a new main access road to be constructed into the Proposed PCC Site.

4.2.31 A gatehouse and parking may be provided at the entrance to the Proposed Development Site, off the A18. Alternatively, this would be provided within the Proposed PCC Site. The Proposed PCC site includes a main car park, including muster point (upwind of CCP) in the event of emergency, manned gate house and control building which shall be designed as a place of safety in the event of emergency.

4.2.32 A total of four potential emergency access points have been identified for the Proposed Development Site at this stage:

- A northern emergency exit (both pedestrian and single track vehicular). A new crossing will be installed across the existing unnamed drain to allow for emergency vehicle access (single track, circa 3.5m wide) and will connect with the existing service road for Keadby Wind Farm. The emergency access will be gated, and under normal operation this gate will be closed and unmanned;
- A western emergency exit (pedestrian only). This is located south-west of the CCP and therefore in an emergency scenario, upwind of a potential release;

- An eastern emergency exit (pedestrian only). This is located adjacent to the northern perimeter fence and existing 400kV National Grid Substation; and
- The southerly route main access (pedestrian and two lane vehicular). This main access to the Proposed Development Site that would also be available for emergency purposes.

Construction Impact and Avoidance Measures

Surface Water

4.2.33 During construction there is potential for water pollution to occur. This could be directly from spillages of polluting substances into water bodies, or indirectly by being conveyed in runoff from hard standing, other sealed surfaces or from construction machinery. Fine sediment may also be disturbed in water bodies directly or also wash off working areas and hard standing (including approach roads) into water bodies indirectly via existing drainage systems or overland. Due to past industrial activity in the study area, this sediment may not necessarily be inert and may potentially contain contamination that could be harmful to the aquatic environment. However, potential impacts to the water environment during the construction phase would tend to be temporary and short term.

4.2.34 Prior to commencement of construction, a CEMP will be prepared by the Contractor. The CEMP would outline the measures necessary to avoid, prevent and reduce adverse effects where possible upon the local surface water (and groundwater) environment. An Outline CEMP will be provided in the Environmental Statement.

4.2.35 The CEMP will need to be reviewed, revised and updated as the project progresses towards construction to ensure all potential impacts and residual effects are considered and addressed as far as practicable, in keeping with available good practice at that point in time. In addition, the methods of dealing with pollutant risk will need to be continually reviewed on Site and adapted as construction works progress in response to different types of work, weather conditions, and locations of work.

4.2.36 The CEMP will be standard procedure for the Proposed Development and will describe the principles for the protection of the water environment during construction. The CEMP will be supported by a Water Management Plan (WMP), that would be included as a technical appendix. The WMP will provide greater detail regarding the mitigation to be implemented to protect the water environment from adverse impacts during construction.

Good Practice Guidance

4.2.37 The construction of the Proposed Development would be in accordance with good practice guidance. A series of Guidance for Pollution Prevention (GPP) 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 GPPs have been released to date on the NetRegs website (Ref. 15) and should be identified as good practice:

- GPP 2: Above ground oil storage;

- 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 Plans;
- GPP22: Dealing with spills; and
- GPP26: Safe storage – drums and intermediate bulk containers.

4.2.38 Where new GPPs are yet to be published, previous PPGs still 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 Environment Agency PPG (Ref.16), including:

- PPG1: General guide to the prevention of pollution;
- PPG3: Use and design of oil separators in surface water drainage systems;
- PPG6: Working at construction and demolition sites;
- PPG7: Safe storage – the safe operation of refuelling facilities;
- PPG18: Managing fire water and major spillages; and
- PPG19: Control of Spillages and Fire Fighting Runoff.

4.2.39 Additional good practice guidance for mitigation to protect the water environment will be taken from the following key CIRIA documents and British Standards Institute documents:

- British Standards Institute (2009) BS6031:2009 Code of Practice for Earth Works (Ref. 17).
- British Standards Institute (2013) BS8582 Code of Practice for Surface Water Management of Development Sites (Ref. 18).
- C753 (2016) The SuDS Manual (Ref. 19);
- C744 (2015) Coastal and marine environmental site guide (second edition) (Ref. 22);
- C741 (2015) Environmental good practice on site guide (fourth edition) (Ref. 20);
- C688 (2010) Flood Resilience and Resistance for Critical Infrastructure (Ref 21)
- C648 (2006) Control of water pollution from linear construction projects, technical guidance (Ref. 23);

- C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice (Ref. 24); and
- C532 (2001) Control of water pollution from construction sites – Guidance for consultants and contractors (Ref. 25).

Use of CofferDam(s) at the Potential Abstraction Points

4.2.40 At this stage, it is assumed that installation works will require use of a cofferdam(s) in close proximity to the intake structure in the River Trent or proposed intake structure location in the Stainforth and Keadby Canal in order to create a dry, safe working environment.

4.2.41 Installation of the cofferdam would be undertaken in accordance with a Marine Licence from the MMO and any associated licence conditions. Such a licence may be 'Deemed' within the body of the DCO (the preferred option) or 'standalone'. Permission from the Environment Agency and CRT would be required in the case of the Stainforth and Keadby Canal. 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 and estuary/canal.

4.2.42 The works would be undertaken with due regard to the Eels (England and Wales) Regulations 2009 (Ref. 26), which may require installation of an eel screen. Furthermore, a fish rescue would be required from the cofferdam(s) before pumping out of water.

4.2.43 A cofferdam is estimated to extend a maximum of 25m into the Trent around the existing abstraction point on the western bank of the River Trent. This is a preliminary, estimated extent; the maximum required area for a cofferdam in order to ensure a safe and dry working area – if required - will be refined further as the EIA progresses.

4.2.44 A smaller cofferdam would be expected in the Stainforth and Keadby Canal if this location was used (likely extending approximately 15m 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). For all potential applications, the cofferdam would be designed to minimise changes to the estuary or canal bed and bank erosion and toe scour by extending the minimum distance into the channel.

4.2.45 Dewatering within the cofferdam(s) area will be done only once any fine sediment has settled out to the point where it is consistent with the turbidity of the flowing River Trent 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.

4.2.46 Whilst in-situ, the cofferdam(s) 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).

Construction of Water Connection Corridors

4.2.47 The Proposed Development Site includes pipework corridors which follow the same or similar routes as the cooling water network associated with the (Operational) Keadby 1 Power Station.

4.2.48 The route of the existing discharge and outfall to the River Trent is also proposed to be utilised for treated water from Keadby 2 Power Station, once operational. This infrastructure is also proposed to be used by the Proposed Development.

4.2.49 In addition, the cooling water intake from the River Trent used for Keadby 1 could also be used for the Proposed Development and is referred to as the River Water Abstraction Option. The existing pipework and associated infrastructure in the River Trent may need to be upgraded or replaced as part of the Proposed Development, due to the age and condition of it. As a 'worst case' in terms of potential environmental impacts, the EIA assumed that a temporary cofferdam(s) may need to be installed to enable construction works to take place in the river as described above.

4.2.50 It is assumed that pipelines beneath minor watercourses (e.g. small drains of 1-2m width) will be constructed using open cut methods. In such cases, it is assumed that flow would be temporarily over-pumped, diverted around or flumed through the working area and the watercourse fully reinstated as before. It is assumed that other methods would be used for any crossings of more significant watercourses (e.g. horizontal directional drilling) so as not to disturb the bed.

Waterborne Transport Off-Loading Area and Additional Abnormal Indivisible Load Route

4.2.51 During construction of the Proposed Development, there will be works to the temporary haulage route and waterborne transport offloading facilities on land east of the (Operational) Keadby 1 Power Station site and at the River Trent, comprising the maintenance, strengthening and improvement of the existing temporary paved haulage route and ditch crossings. This area would be available should waterborne transport of components, such as Abnormal Indivisible Loads (AIL) be required. There is an existing crane adjacent to the wharf which may be utilised should waterborne transport be preferred. This area is currently being used in the construction of Keadby 2 as a haul route and would be maintained for use in the Proposed Development.

Decommissioning

4.2.52 The Proposed Development is expected to operate for up to 25 years. At the end of operation, it is expected that the Proposed Development will have some residual life remaining and an investment decision would then be made based on the market conditions prevailing at that time. If the operating life were to be extended, the Proposed Development would be upgraded in line with the legislative requirements at that time. On this basis, decommissioning activities are currently anticipated to commence after 2057.

4.2.53 At the end of its operating life, it is anticipated that all above-ground equipment associated with the Proposed Development will be decommissioned and removed from the Proposed Development Site.

4.2.54 Prevention of contamination is a specific requirement of the Environmental Permit for the operation of the Proposed Development and therefore it is being designed such that it will not create any new areas of ground contamination or pathways to receptors as a result of construction or operation. Once the plant and equipment have been removed to ground level, it is expected that the hardstanding and sealed concrete areas will be left in place. Any areas of the Proposed Development that are below ground level will be backfilled to ground level to leave a levelled area.

4.2.55 A Decommissioning Plan (including Decommissioning Environmental Management Plan (DEMP)) will be produced and agreed with the Environment Agency as part of the Environmental Permitting and site surrender process. The DEMP will consider in detail all potential environmental risks and contain guidance on how risks can be removed, mitigated or managed. This will include details of how surface water drainage should be managed on the Proposed PCC Site during decommissioning and demolition.

4.3 Relevant WFD water bodies

4.3.1 Table 3 provides a summary of the baseline status/potential of the various WFD water bodies that have been identified within 1km of the scheme boundary. Full baseline status classifications under Cycle 2 (2019) of the WFD are shown in **Annex A** within this Appendix.

Table 3: WFD Surface Water bodies 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 margins surrounded by vegetation that appeared typical of a salt marsh. **Protected Areas**: 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 Trent) (GB104028064300)	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 Crowle and the River Trent, totalling

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					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**: The drain is a designated 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 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**: 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**: 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 northeast of Rossington and flows generally northwest to meet the River Trent at Keadby. In places the drains

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
					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**: 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) (GB70410281)	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 southwest, to the River Trent immediately southeast 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. 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**: 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 (1,924km2) and extends from Ashby-de-la-Zouch to the south to the Humber Estuary to the north.
Protected Areas: 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: Nitrates Directive area Nottinghamshire (G40); Idle Torn – Secondary Mudrocks Drinking Water Protected Area (UKGB40402G992200)					

4.4 Zone of Influence

4.4.1 WFD water bodies 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.

4.4.2 Table 4 sets out the pathways to an effect, the extent of the ZoI and the water bodies that are directly within the ZoI.

Table 4: ZOIs and relevant WFD water bodies

Potential pathway	ZoI and basis for determination	Relevant water bodies	Adjacent water bodies
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 zone of influence 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 and / or Stainforth and Keadby Canal for works to the abstraction and discharge point would cause some mobilisation of fine sediments during its installation and removal, and this may mobilise some fine sediment into the water column.	The Zone of Influence for mobilised sediments in the River Trent is not expected to be greater than 1 km downstream or upstream of the cofferdam location as a worst 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 zone of influence is	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 but is too far 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.

Potential pathway	ZoI and basis for determination	Relevant water bodies	Adjacent water bodies
	considered appropriate as a reasonable worst case.		
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 water bodies 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 zone of influence 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 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	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
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 coffer dam in the River Trent and / or Stainforth and Keadby Canal for works to the abstraction and discharge point (including scour, deposition and habitat loss)	The immediate footprint and environs (within which any scour affects would be expected to occur) of the coffer dam in the River Trent and / or Stainforth and Keadby Canal.	Humber Upper WFD waterbody – i.e. River Trent Sheffield and South Yorkshire Navigation (New Junction and Stainforth and Keadby) WFD waterbody	Not applicable, this pathway relates to morphology of the Humber Upper bed only.

Potential pathway	ZoI and basis for determination	Relevant water bodies	Adjacent water bodies
There could be morphological impacts to the drains which may require new crossings relating to connection corridors and access routes. Non-intrusive crossing methodologies will be used wherever possible (e.g. horizontal directional drilling), 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 20 m 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 impacted watercourse only.
Surface water runoff from the Proposed Development Site could contain various diffuse pollutants given the 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.	All surface water runoff is to be discharged to the River Trent, via attenuation for flows and water quality. The ZoI for in the River Trent 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.	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.
Process water from the Proposed Development is to be discharged to the River Trent and will include water from: i) cooling tower blowdown; ii) direct contact cooler blowdown, iii) demin plant and condensate polishing plant regeneration, iv) heat recovery steam generator boiler blowdown; and v) water treatment works residuals. An onsite effluent treatment plant would be provided following Best Available Techniques (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. There is	All treated process water runoff is to be discharged to the River Trent. The Zone of Influence for 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 water bodies	Adjacent water bodies
potential for the thermal discharge to impact fish migration, as well as for chemical pollution should any contaminants not be suitably treated.			
Sections of Drains on the Proposed Development Site are expected to be lost beneath the footprint of the power station.	The Zone of Influence will be the extent of the drains that are directly lost beneath the Proposed Development.	Unnamed drainage ditches (tributaries of the Humber Upper WFD waterbody / Paupers Drain Catchment (trib of Trent) 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 abstraction relates to water volume, the Zone of Influence 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.
Sewage and sanitary waste from the Proposed Development will be sent off-site via pipeline connecting to a local Anglian Water treatment plant. At this stage, it is not known which treatment plant would be used and so it is not known which watercourse would ultimately receive the treated water.	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 the outfall in the receiving waterbody.	Unknown at this stage, as it will depend on the Anglian Water treatment works that is utilised (subject to consultation).	Unknown at this stage, as it will depend on the Anglian Water treatment works that is utilised (subject to consultation).

5.0 CONCLUSION

5.1.1 A WFD screening exercise has been undertaken following guidance in the PINS Advice Note 18 (Ref 6). Proposed work activities that could influence water bodies (WFD designated or otherwise as non-designated reaches are still part of a WFD catchment) have been outlined and the WFD water bodies that could potentially be affected have been identified through consideration of the Zone of Influence.

5.1.2 The following water bodies have been identified within the study area and screened in for further consideration as the DCO application is advanced:

- 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).

5.1.3 The WFD baseline status of these water bodies has been presented along with related protected areas. The Proposed Development will have to demonstrate that there is no deterioration in any of the identified baseline classifications, and no prevention of future improvement for these classifications. If this cannot be achieved, an Article 4.7 derogation would be required.

5.1.4 As design details for the Proposed Development are finalised for assessment within the Environmental Statement, the following WFD assessment stages will be advanced, for inclusion within a full WFD Assessment to accompany the DCO application:

- **Stage 2: WFD Scoping** - For each water body identified in Stage 1, a qualitative assessment informed by readily available data and a site walkover survey will be carried out to identify the effects and potential risks to quality elements from all relevant 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); and
- **Stage 3: WFD Impact Assessment** - A detailed assessment of the water bodies and activities carried forward from the WFD screening and scoping stages. The scope of this stage would be agreed with the Environment Agency.

5.1.5 These stages of assessment will be undertaken in consultation with the Environment Agency, Canal and River Trust, Natural England and Internal Drainage Board, to ensure an appropriate level of assessment.

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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 km^2	55.641 km^2	120.158 km^2	85.295 km^2	-
Length (km)	12.332 km^2	13.287 km	26.44 km	36.482 km	50.603 km	43.815 km
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**
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	-	-	-	-	-

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)
Phytoplankton	High	-	-	-	-	-
Invertebrates	-	Good	Moderate	Moderate	Good	-
Macrophytes and Phytobenthos combined	-	Good	-	Moderate	-	-
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	-
pH	-	High	High	High	High	-
Phosphate	-	Poor	High	Poor	Moderate	-
Temperature	-	High	High	High	High	-
Specific Pollutants	High	-	Moderate	-	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)
Chlorothalonil	High	-	-	-	-	-
Pendimethalin	High	-	-	-	-	-
Triclosan	High	-	-	-	-	-
Manganese	-	-	High	-	-	-
Chromium (VI)	High	-	-	-	-	-
2,4-dichlorophenol	High	-	-	-	-	-
2,4-dichlorophenoxyacetic acid	High	-	-	-	-	-
Arsenic	High	-	-	-	-	-
Copper	High	-	-	-	High	-
Diazinon	High	-	-	-	-	--
Dimethoate	High	-	-	-	-	-
Iron	High	-	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)
Linuron	High	-	-	-	-	-
Mecoprop	High	-	-	-	-	-
Permethrin	High	-	-	-	-	-
Phenol	High	-	-	-	-	-
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	-	-	-	-	-

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)
Cypermethrin (Priority hazardous)	Fail	Good	-	Good	Good	-
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	-	-	-	-	-
Lead and Its Compounds	Good	-	-	-	-	-
Napthalene	Good	-	-	-	-	-
Nickel and Its Compounds	Good	-	-	-	Good	-
Pentachlorophenol	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)
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	-	-	-	-	-
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
Perfluorooctane sulphonate (PFOS)	Good	-	Good	Good	Fail	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)
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	-	-	-	-	-
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 km^2	1924.4 km^2
Overall Status	**Good**	**Good**
Quantitative	**Good**	**Good**
Quantitative Saline Intrusion	Good	Good
Quantitative Water Balance	Good	Good
Quantitative GWDTEs 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 GWDTEs test	Good	Good
Chemical Dependent Surface Water Body Status	Good	Good
Chemical Saline Intrusion	Good	Good

ANNEX B: BASELINE SURFACEWATER QUALITY INFORMATION AND DATA

Surface Water Quality

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.

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.

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.

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.

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.

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

The Water Supply and Wastewater Discharge Study (Ref 12B-1) 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 (Ref 12B-1);
- 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 (Ref. 12B-2);

- 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 (Ref 12B-3).

The results of the four sampling programmes were combined in the following Table 12-1.

Table B1 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
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

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
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
			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
			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

Parameter	Units	WFD EQS (for pass/good)	Sampling Programme	No. Samples	Min	5%ile	Mean	95%ile	Max
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
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

According to the WFD Standards and Classification (Ref. 12B-4), Table 12-1 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.

Based on the data in Table 12-1, 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 (Ref. 12B-4) for transitional waterbodies with a salinity of <35ppt.

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.

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

The Water Supply and Wastewater Discharge Study (Ref 12B-1) summarises water quality monitoring data for the Stainforth & Keadby Canal undertaken by SSE / Siemens. The following table (Table 12-2) 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 (Ref 12B-2). 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 B2 –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
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
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

Table B2 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 (currently under construction).

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

Water quality data has been obtained from the Environment Agency's Water Quality Archive (Ref 12B-6) for Keadby Warping Drain. Ten samples were taken between 2016 and 2018, see Table B3.

Table B3: 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
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

Table B2 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.

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.

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.

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

Water quality data has been obtained from the Environment Agency's Water Quality Archive (Ref 12B-6) for Keadby Pumping Station Drain. 14 samples were taken between 2018 and 2020, see Table B4.

Table B4: 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
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

Parameter	Units	WFD Standards	Mean	Max	Min	90th%ile	10th%ile
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

Table B4 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.

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.

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.

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.

Annex B - References

12B-1 SSE Thermal (2020) Keadby 3 Low Carbon Power Project: Water Supply & Wastewater Discharge Study.

12B-2 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.

12B-3 Environment Agency (2013) Implications on water quality and sedimentation from the provision of fish access at water-level management structures, Report – SC110017.

12B-4 Her Majesty's Stationery Office. 2017. Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

12B-5 Keadby 2-CCGT Water Specification, Sched Pt 4 Att 004,SSE Engineering Centre.

12B-6 Environment Agency Water Quality Archive website (Online) Available at: https://environment.data.gov.uk/water-quality/view/landing.