



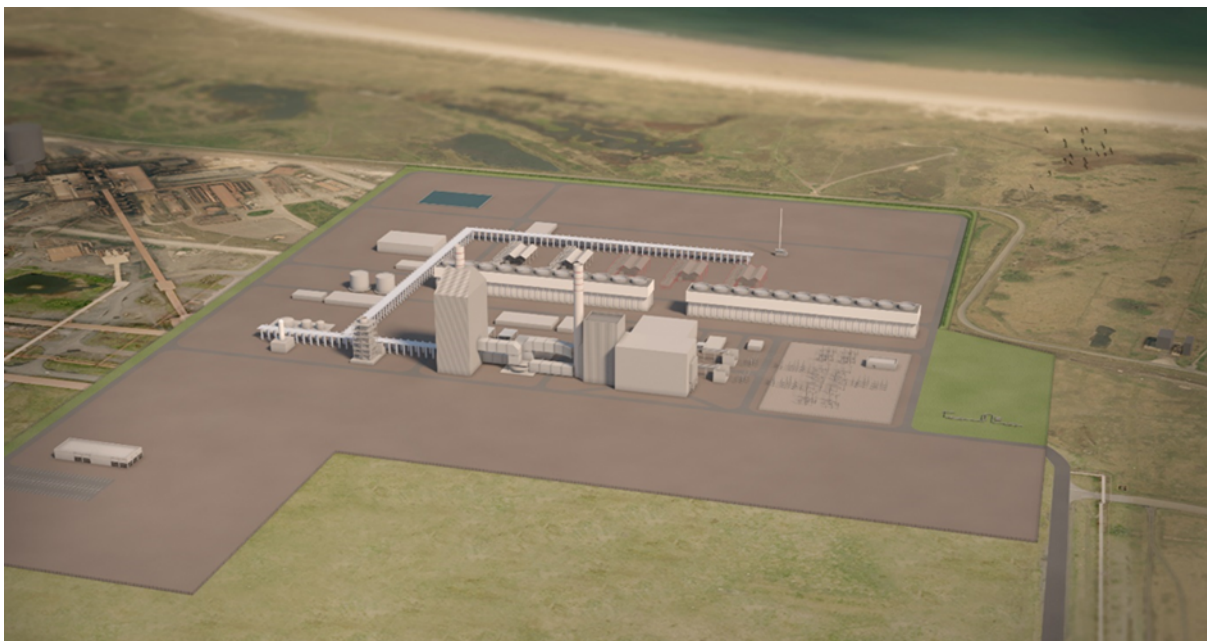
Net Zero Teesside – Environmental Statement

Planning Inspectorate Reference: EN010103

Volume III – Appendices

Appendix 9C: Water Framework Directive Assessment

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended)



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9C. Water Framework Directive Assessment

9.1 Introduction

Background

- 9.1.1 This Water Framework Directive (WFD) Assessment Report has been provided as part of the Environmental Statement (ES) and specifically, as an Appendix to Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2).
- 9.1.2 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. The Planning Inspectorate's Advice Note Eighteen (PINS, 2017) and the Environment Agency guidance for competing WFD assessments for coastal and transitional waters (Environment Agency, 2017), suggest that a three-stage approach should be adopted as follows:
- Stage 1: WFD Screening;
 - Stage 2: WFD Scoping; and
 - Stage 3: WFD Impact Assessment.
- 9.1.3 This report presents the findings of Stages 1-3, which have been undertaken in relation to the Proposed Development.

The Proposed Development

- 9.1.4 The Proposed Development comprises the construction and operation (including maintenance) of a Carbon Capture Utilisation and Storage (CCUS) facility comprising a gas-fired power station together with equipment required for the capture and compression of carbon dioxide (CO₂) emissions from the generating station. In addition, there is a need for the provision of supporting infrastructure and connections to support the generating station and to facilitate the development of a wider industrial carbon capture network in Teesside, the construction of which also forms part of this project. The project also includes high-pressure compression of CO₂ and a pipeline to export it for off-shore storage.
- 9.1.5 Whilst the Proposed Development is designed for the future collection and storage of CO₂ from third-party industrial emitters, the capture and compression of third-party CO₂ emissions does not form part of the DCO Application and is not considered in this WFD Assessment but will be the subject of separate consent applications.
- 9.1.6 The Site is divided into the following areas (described in more detail in Chapter 4: Proposed Development (ES Volume I, Document. Ref. 6.2) and shown on the Figures below which are presented in ES Volume II, Document. Ref. 6.3:
- The Power, Capture and Compressor site (PCC Site) (Figure 3-1);

- Onshore CO₂ Export Corridor (Figure 3-2A);
 - Electrical Connection Corridor (Figure 3-2C);
 - Water Supply and Discharge Corridors (Figure 3-2D);
 - Natural Gas Connection Corridor (Figure 3-2B); and
 - CO₂ Gathering Network Corridor (Figure 3-2E).
- 9.1.7 The PCC Site is located on the south bank of the River Tees, approximately 1.6 km east from the town of Redcar and 1.4 km north-east of Dormanstown. The PCC Site is located within the former Redcar steelworks site, comprising part of the former landholding to the east of the Redcar Bulk Terminal, on the south bank of the River Tees.
- 9.1.8 The PCC Site, together with the connection corridors for the electrical grid connection, water supply and discharge corridors and the onshore element of the CO₂ Export Pipeline, will be located within the administrative boundary of Redcar and Cleveland Borough Council (RCBC), in the ward of South Bank. Connections to the NGG and the CO₂ Gathering Network are intended to cross the River Tees to land within the administrative boundary of the Stockton on Tees Borough Council (STBC) in Billingham Ward.
- 9.1.9 The Site boundary extends south of the PCC Site in order to accommodate the Natural Gas Connection Corridor and Electrical Connection Corridor.
- 9.1.10 The section of the Site comprising the Natural Gas Connection Corridor and CO₂ Gathering Network Corridor extends to the east of the Electrical Connection Corridor. Here the Site boundary extends across the Tees either side of Tees Dock. The Site boundary extends across the chemical works on the western bank of the Tees on reclaimed land to the south of the Seal Sands inter-tidal mudflats. The Natural Gas Connection Corridor extends west as far as the brine field to the east of Cowpen Marsh. The CO₂ Gathering Network then follows existing pipeline routes around the perimeter of Salthome Nature Reserve, and into the industrial area at the eastern extent of Billingham, which includes recycling and recovery centres.
- 9.1.11 The indicative boundary for the PCC Site currently encompasses an area of approximately 42.5 hectares (ha) within the overall development boundary of 462.0 ha.
- 9.1.12 The design of the Proposed Development, at this consenting stage of the project, incorporates a degree of flexibility in the dimensions and configurations of buildings and structures to allow for the future selection of the preferred technology and contractor and recognising that the Proposed Development is First Of A Kind for this type of infrastructure project.
- 9.1.13 In order to ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the WFD assessment is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate. This involves assessing the maximum (or where relevant, minimum) parameters for the elements where flexibility needs to be retained (such as the building dimensions or operational modes for example). Where this approach is being applied, this is confirmed within this assessment.

- 9.1.14 Justification for the need to retain flexibility in certain parameters is also outlined in Chapter 4: Proposed Development and in Chapter 6: Alternatives and Design Evolution (ES Volume I, Document Ref. 6.2). As such, this assessment represents a reasonable worst-case assessment of the potential impacts of the Proposed Development at its current stage of design.
- 9.1.15 Construction of the Proposed Development is detailed in Chapter 5: Construction Programme and Management ES Volume I (Document Ref. 6.2). At this stage in the project development a detailed construction programme is not available as this is normally determined by the Engineering Procurement and Construction (EPC) contractor who has not yet been appointed; however, an indicative construction programme is presented within Chapter 5: Construction Programme and Management (ES Volume I, Document Ref. 6.2).
- 9.1.16 Should a DCO be granted for the Proposed Development then construction is anticipated to be in late 2022 at the earliest, with operation commencing in 2026 at the earliest.
- 9.1.17 It is envisaged that the power station and carbon capture plant will have a design life of around 25 years. At the end of the design life, these elements would be assessed for ongoing viability and, if appropriate, be decommissioned as outlined in Chapter 4: Proposed Development (ES Volume I, Document Ref. 6.2). It is anticipated that decommissioning of the power station and carbon capture plant will most likely commence at some point after 2051.
- 9.1.18 The CO₂ Gathering Network and CO₂ Export Pipeline have been designed to operate independently of the power generation and carbon capture plant and will have a design life of circa 40 years.
- 9.1.19 A number of mitigation features are incorporated into the design of the Proposed Development in order to avoid, minimise and reduce potential adverse impacts on water features and water resources during the operational phase of the Proposed Development, and these are described further below.

Structure of the Report

- 9.1.20 The structure of this report is set out as follows:
- Section 9.2 provides a summary of the WFD requirements and screening process;
 - Section 9.3 describes the assessment methodology;
 - Section 9.4 describes baseline conditions;
 - Section 9.5 provides the screening assessment for the Tees Estuary transitional waterbody and Tees Coastal waterbody;
 - Section 9.6 provides the scoping assessment for the Tees Estuary transitional waterbody and Tees Coastal waterbody;
 - Section 9.7 describes the results of the assessment and provides details of possible mitigation and monitoring options to alleviate adverse effects; and
 - Section 9.8 presents the conclusions and recommendations.

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

- Annex A WFD Water Body Assessments Cycle 2;
- Annex B Further WFD Waterbody Description;
- Annex C Surface Water Quality Data;
- Annex D Sediment Quality;
- Annex E Pond 14 Water Quality Monitoring Technical Note; and
- Annex F Water Resources Tables.

9.2 Overview of the Water Framework Directive

Legislative Context

- 9.2.1 The WFD aims to protect and enhance the quality of the water environment. The WFD is transposed into legislation in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017¹. 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.
- 9.2.2 Under the WFD, ‘waterbodies’ are the basic management units, defined as all or part of a river system or aquifer. Waterbodies form part of a larger ‘river basin district’ (RBD), for which ‘River Basin Management Plans’ (RBMPs) are used to summarise baseline conditions and set broad improvement objectives.
- 9.2.3 In England, the Environment Agency is the competent authority for implementing the WFD, although many objectives will be delivered in partnership with other relevant public bodies and private organisations (for example. local planning authorities, water companies, Rivers Trusts, large private landowners and developers). As part of its regulatory role and statutory consultee on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2010 (as amended)), the Environment Agency must consider whether proposals for new developments have the potential to:
- Cause a deterioration of a waterbody from its current status or potential; and / or
 - Prevent future attainment of good status or potential where not already achieved.
- 9.2.4 In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the Environment Agency must also consider the conservation objectives of any Protected Areas (i.e. Natura 2000 sites or water dependent Sites of Special Scientific Interest (SSSI)) and adjacent WFD water bodies, where relevant.

¹ Following the United Kingdom’s departure from the European Union and completion of the transition period, the requirements of the WFD as implemented in England by national legislation remain applicable until such time as new legislation is passed either revoking or amending the current 2017 WFD Regulations.

Surface Water Body Status

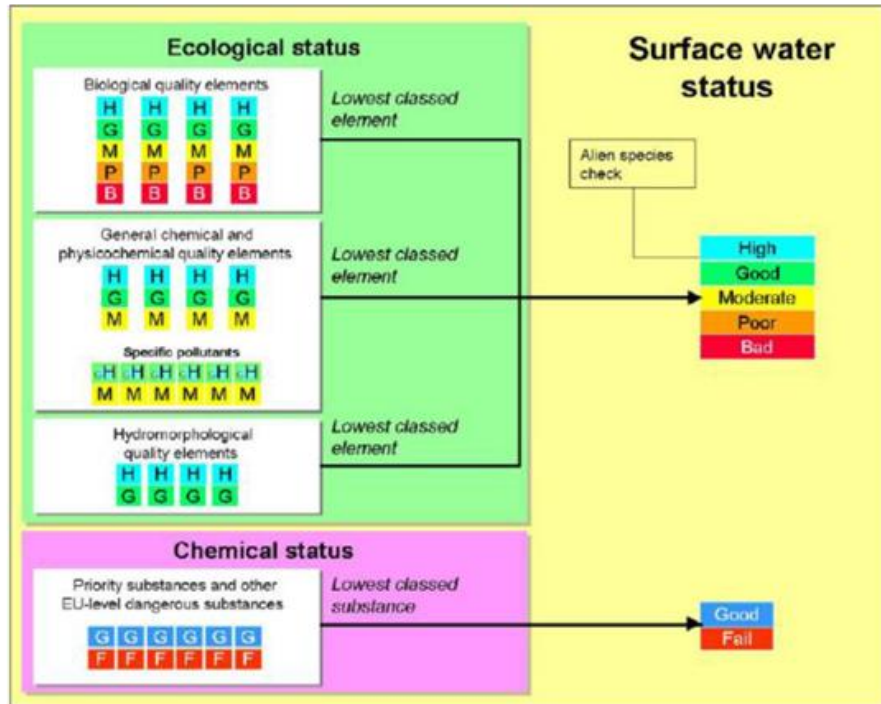
- 9.2.5 Under the WFD, surface water body status is classified on the basis of chemical and ecological status or potential. Ecological status is assigned to surface water bodies that are natural and considered by the Environment Agency not to have been significantly modified for anthropogenic purposes. 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 9C-1.

Table 9C- 1 Definition of status in the Water Framework Directive (Environment Agency, 2015)

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.

- 9.2.6 Ecological potential is assigned to artificial and man-made waterbodies (such as canals), or natural waterbodies that have undergone significant modification; these are termed Heavily Modified Waterbodies (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.
- 9.2.7 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 system '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 Figure 2.1.

Figure 9C- 1: WFD classification elements for surface waterbody status (Environment Agency, 2015)



Chemical Status

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

Ecological Status or Potential

9.2.9 Ecological status or potential is defined by the overall health or condition of the watercourse. This is assigned on a scale of High, Good, Moderate, Poor or Bad, and on the basis of four classification elements or 'tests' (Environment Agency, 2013), as follows:

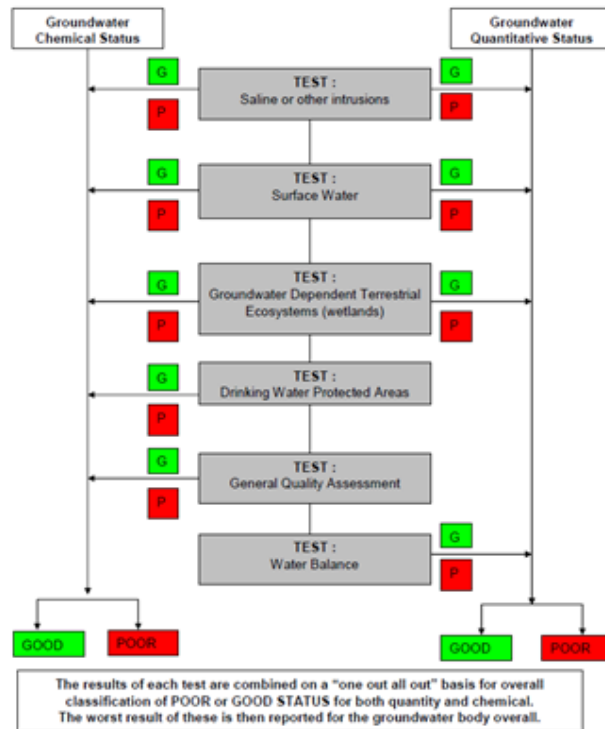
- Biological: this test is designed to assess the status indicated by a biological quality element such as the abundance of fish, invertebrates or algae and by the presence of invasive species. The biological quality elements can influence an overall water body status from Bad through to High.
- Physico-chemical: this test is designed to assess compliance with environmental standards for supporting physicochemical conditions, such as dissolved oxygen, phosphorus and ammonia. The physicochemical elements can only influence an overall water body status from Moderate through to High.

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

Groundwater Body Status

- 9.2.10 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 Figure 2-2.

Figure 9C- 2: WFD Classification Elements for Groundwater Body Status (Environment Agency, 2015)



Quantitative Status

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

- Saline or other intrusions: This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction, is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.
- Surface water: This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the ecological status of associated surface waterbodies.
- Groundwater Dependent Terrestrial Ecosystems (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 waterbodies and GWDTEs.

Chemical Status

9.2.12 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 waterbodies.
- 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 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.

9.3 Assessment Methodology

Introduction

9.3.1 Proposed developments having the potential to impact on current or predicted WFD status are required to assess their compliance against the objectives defined for potentially affected water bodies. As part of its role, the Environment Agency must consider whether proposals for new developments have the potential to:

- Cause a deterioration of a water body from its current status or potential; and/ or
- Prevent future attainment of Good status (or potential where not already achieved).

Assessment Stages

9.3.2 The Planning Inspectorate’s Advice Note Eighteen (PINS, 2017) and the Environment Agency guidance for competing WFD assessments for coastal

and transitional waters (Environment Agency, 2016) suggest that a three-stage approach is 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.

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

Defining No Deterioration

9.3.4 No deterioration was defined by the Environment Agency in its Position Paper (Environment Agency, 2013). 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.

9.3.5 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)), this has been redefined². The CJEU ruling clarified that:

- ‘Deterioration of the status’ of the relevant waterbody 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 waterbody as a whole;
- ‘Any deterioration’ in quality elements in the lowest class constitutes deterioration; and

² As this ruling has been adopted for use in the United Kingdom and precedent has been set, it continues to apply to decision makers regarding the compliance of new projects with the objectives of the WFD.

- 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.
- 9.3.6 Whilst deterioration within a status class does not contravene the requirements of the WFD, (except for Water Supply (Water Quality) (Amendment) Regulations 2017 parameters in drinking water protected areas), the WFD requires that action should be taken to limit within-class deterioration as far as practicable. For groundwater quality, measures must also be taken to reverse any environmentally significant deteriorating trend, whether or not it affects status or potential.
- 9.3.7 The no deterioration requirements are applied independently to each of the elements coming together to form the water body classification as required by Appendix V of the Water Framework Directive and Article 4 of the Groundwater Daughter Directive. This is transposed into UK legislation by the Groundwater (England and Wales) Regulations 2009.
- **Surface water:** 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.
 - **Groundwater:** The no deterioration requirements are applied to each of the four component tests for quantitative status and the five component tests for chemical status. The no deterioration requirement may not apply to elements at High status and elements at High status may be permitted to deteriorate to Good status, provided that:
 - The 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
- 9.3.8 The no deterioration baseline for each water body is the status that is reported in Annex A.

Surface Water Assessment

- 9.3.9 Table 9C-2 presents the matrix used to assess the effect of a project on surface water status or potential class. It ranges from a major beneficial effect, a positive change in overall WFD status, through no effect, and down to deterioration in overall status class. The colour coding used in Table 9C-2 is applied to the spreadsheet assessment in Annex B.

Table 9C- 2: Surface Water Assessment Matrix

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

9.3.10 The assessment has considered all water bodies that may be directly or indirectly affected (adjacent water bodies). It has also considered any Protected Areas as defined by other European Directives such as Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and water dependent SSSIs. Where more stringent (than WFD) standards apply (such as conservation objectives) these have also been considered.

Groundwater Assessment

9.3.11 Table 9C-3 presents the matrix used to assess the effect of a project on groundwater status class. It ranges from a beneficial effect, through no effect, and down to deterioration in overall status class.

Table 9C- 3: Groundwater assessment matrix

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

Future Status Objectives

9.3.12 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 are based on mitigation measures defined in the 2015 RBMP. Information on WFD measures available from the Environment Agency Catchment Data Explorer website (accessed January 2021) has also been reviewed. The assessment considers whether a project has the potential to prevent the implementation or impact the effectiveness of the defined measures.

Article 4.7 Derogations

9.3.13 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): 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).

9.3.14 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).

Environment Agency Clearing the Waters for All Guidance

9.3.15 Within the PINS Advice Note 18 (PINS, 2017), PINS advise following the approach given in the Environment Agency's Clearing the Waters for All guidance (Environment Agency, 2016) which was developed for estuarine and coastal waters. PINS consider the staged approach equally suitable for rivers, lakes and groundwater projects in England and Wales.

9.3.16 The Environment Agency's guidance on WFD assessment (Environment Agency, 2016) lists the following activities which can be screened out of assessment due to being of low risk:

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

Flood Risk Activity Permit Exemptions

9.3.17 Certain activities on or near waterbodies are exempt from the requirement for Environmental Permits for Flood Risk Activities, and hence would be also be

considered low risk activities that would unlikely require a WFD assessments, as summarised in Table 9C-4.

Table 9C- 4: Flood Risk Activity Exemptions

Activity	Type of Modification
Low impact maintenance activities (encourage removal of obstructions to fish/eel passage)	Re-pointing (block work structures)
	Void filling ('solid' structures)
	Re-positioning (rock or rubble or block work structures)
	Replacing elements (not whole structure)
	Re-facing
	Skimming/ covering/ grit blasting
	Cleaning and/or painting of a structure
Temporary works	Temporary scaffolding to enable bridge re-pointing
	Temporary clear span bridge with abutments set-back from bank top
	Temporary cofferdam(s) (if eel/ fish passage not impeded)
	Temporary flow diversion (if fish/ eel passage not impeded) such as flumes and porta-dams
	Repair works to bridge or culvert which do not extend the structure, reduce the cross-section of the river or affect the banks or bed of the river, or reduce conveyance
	Excavation of trial pits of boreholes in byelaw margin
	Structural investigation works of a bridge/ culvert/ flood defence such as intrusive tests, non-intrusive surveys
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

- 9.3.18 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.

General Approach and Scheme Assumptions

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

Desk Study

- 9.3.20 The assessment is based on a desk study and a site walkover survey. These are summarised below but are described in more detail in the ES Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2).

- 9.3.21 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.

- 9.3.22 The desk study and site survey has been used as the basis for a qualitative review of the Proposed Development and to determine the components that require assessment of WFD compliance, or where mitigation or further investigation and assessment will be required.

- 9.3.23 Site walkovers have been undertaken to allow water receptors in the area to be assessed in terms of their character and morphology, and their connectivity to the Proposed Development to be considered in terms of the surrounding topography and adjacent receptors (e.g. nearby sites of ecological importance). More details are given below.

Source-Pathway-Receptor Approach

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

- An impact source (such as the release of polluting chemicals, particulate matter, or biological materials that cause harm or discomfort to humans or other living organisms, or the loss or damage to all or part of a water body);
- A receptor that is sensitive to that impact (i.e. waterbodies and the services they support); and
- A pathway by which the two are linked.

- 9.3.25 The first stage in applying the Source-Pathway-Receptor model is to identify the causes or ‘sources’ of potential impact from a development. The sources have been identified through a review of the details of the Proposed Development, including the size and nature of the development, potential construction methodologies and timescales. The next step in the model is to undertake a review of the potential receptors, that is, the water environment receptors themselves that have the potential to be affected. Water bodies including their attributes have been identified through desk study and site surveys. The last stage of the model is, therefore, to determine if there is a viable exposure pathway or a ‘mechanism’ linking the source to the receptor. This has been undertaken in the context of local conditions relative to water receptors within the Study Area, such as topography, geology, climatic conditions and the nature of the impact (e.g. the mobility of a liquid pollutant or the proximity to works that may physically impact a water body).
- 9.3.26 The assessment of the likely significant effects is qualitative, and considers both construction and operation phases, as well as cumulative effects with other developments. This assessment has considered the risk of pollution to surface water bodies directly and indirectly from construction activities. The risk of pollution from road runoff has also been considered such that appropriate measures (SuDS, proprietary treatment devices) could be incorporated into the design of the Proposed Development.

Rochdale Envelope

- 9.3.27 The assessment contained herein makes use of the ‘Rochdale Envelope’ approach under the Planning Act (2008). The approach is employed where the nature of the Proposed Development means that some details of the whole project have not been confirmed when the application is submitted, and flexibility is sought to address the uncertainty.
- 9.3.28 Key principles in the context of the DCO Application process are given in the PINS Advice Note Nine: Using the Rochdale Envelope (The Planning Inspectorate, 2018). This includes the need to outline timescales associated with the flexibility sought, and that the assessment should establish those parameters likely to result in the maximum adverse effect (the reasonable worst-case scenario) and be undertaken accordingly to determine significant effects from the Proposed Development and to allow for the identification of necessary mitigation.
- 9.3.29 The following are the reasonable worst-case scenario assumptions (maximum parameters) for the purposes of the WFD assessment:
- 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 later in this report.
 - Water supply will be via the existing Northumbrian Water raw water feed.
 - This assessment assumes that either the existing Tees Bay outfall from the former steelworks is used unchanged and without refurbishment, or that a

new pipeline will be installed to the south of the existing pipeline (see Figures 3-2D and 5-2, ES Volume II, Document Ref. 6.3). This would be installed adjacent to the CO₂ Export Pipeline and both using trenchless techniques (see Chapter 5 Construction Programme and Management, ES Volume I, Document Ref. 6.2). The route has been selected to avoid the sensitive receptors, surface water bodies, and is along the line of an existing pipeline. At the outfall, the emplacement of a suitable diffuser head would also be required to be placed via a jack-up barge or similar. The footprint of the outfall head and associated scour protection is assumed to be no more than 100 m², and would be located at the furthest point along the discharge corridor. Both the re-use of the existing outfall and pipeline, and potential replacement pipeline and outfall head are included within the Site Boundary.

- There are up to nine effluent streams from the Proposed Development:
 1. Clean Surface water
 2. Potentially Contaminated Surface Water – no amine contamination
 3. Potentially Contaminated Surface Water – amine contaminated
 4. Process water from Capture plant DCC (contains ammonia or urea)
 5. Process water from CO₂ compression and dehydration (weak carbonic acid & numerous streams)
 6. Blowdown from cooling towers
 7. Blowdown from steam boilers
 8. Hazardous liquid wastes
 9. Foul Water (sewage)

These will be either discharged to the Tees Bay with minimal treatment (clean surface water only) or treated on-site (by dosing for example) before discharge to Tees Bay. The exceptions to this are:

- amine contaminated water, hazardous liquid wastes, which will be taken off-site by tanker to a specialist treatment plant;
- process water from the Capture Plant;
- foul water which will be treated at Northumbrian Water's Marske-by-the-Sea treatment plant.

Process water from the Carbon Capture Plant will be treated by a dedicated on-site water treatment plant which will then be discharged to Tees Bay via the outfall. Alternatively, subject to a techno-commercial agreement with Northumbrian Water, process water will be pumped to Bran Sands WwTW with the treated water returned to the site for discharge via the outfall using dedicated pipelines (Work no. 5C, Document Ref. 4.9). The potential inclusion of a wastewater treatment plant has been made in site layouts and considered in this ES as a worst-case assumption. In all cases, new discharge limits for the outfall will be sought via an application for an Environmental Permit

- It is assumed that the Tees crossings for the Natural Gas Connection and CO₂ Gathering Network will be constructed using trenchless technologies, and at a sufficient depth below the estuary bed to ensure that there is no risk of exposure. The launch location will be at Navigator Terminals.
- For the purposes of this assessment it has been assumed that all foul water from welfare facilities will either be directed to Northumbrian Water's Marske-by-the-Sea WwTW, or, given the relatively small volumes involved, to an on-site package plant for treatment of both construction and operational foul discharges. Should the water be treated by Northumbrian Water it is assumed that they would treat foul water from the development within their consent limits and in accordance with requirements to not cause deterioration or prevent improvement under the WFD or will upgrade their facilities if necessary.

General Limitations and Assumptions

- 9.3.30 The assessment has been undertaken using available data and the Proposed Development design details at the time of writing. However, there is often a degree of uncertainty as to the exact scale and nature of the environmental impacts, and in such cases the worst-case scenario has been considered.
- 9.3.31 A Site walkover was undertaken on 22 January 2020 by a surface water quality specialist and hydromorphologist in cold, dry and fair conditions. The walkover focused on surface water bodies in the Study Area, observing their current character and condition, the presence of existing risks and any potential pathways for construction and operational impacts from the Proposed Development. Additional site visits including water quality monitoring of Pond 14 have been undertaken between October 2020 and January 2021 to assess potential impacts to the Teesmouth and Cleveland Coast SSSI relating to potential construction of a new pipeline for the discharge outfall into Tees Bay.
- 9.3.32 The proposed works are located within the catchment of the Northumbria RBMP (Defra, 2016). 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 Northumbria RBMP published as part of the 2015 RBMP cycle has been considered in the summary baseline classification information which is presented in Section 9.4.
- 9.3.33 Aside, from Pond 14 within Teesmouth and Cleveland Coast SSSI (see Annex E), no water quality monitoring has been undertaken. Background water quality has been determined from the nearest Environment Agency monitoring stations. This has been considered robust enough for the characterisation of water body importance and the determination of impacts on the surface water environment. Water quality data was collected from Pond 14 to assess the risk of atmospheric deposition of nitrogen to this open water pond.
- 9.3.34 Assumptions relating to the thermal discharge modelling from the Tees Bay outfall are all outlined in the thermal modelling report (see Appendix 14E: Coastal Modelling Report (ES Volume III, Document Ref. 6.4).

- 9.3.35 The understanding of drainage arrangements assessed is based on BP supplied data. The drainage strategy will be subject to further development, in consultation with the Environment Agency and Lead Local Flood Authority (LLFA)
- 9.3.36 The expected treatment performance of different SuDS options is based on advice reported in CIRIA C753 The SuDS Manual (CIRIA, 2016) for use with the Simple Index Approach. This approach gives a number of example land uses which are not all directly applicable to the Proposed Development. Professional judgement has been used when deciding the most appropriate example land use, and what treatment a particular option may provide, taking into account the design of the SuDS feature and whether it is considered to be 'optimum' or 'sub-optimum' for whatever reason.

9.4 Baseline Information

- 9.4.1 The relevant baseline physical characteristics of the Study Area and the WFD water features present are described in this section. Please refer to Figure 9-1: WFD Waterbodies and their attributes throughout.

Consultation

- 9.4.2 The EIA Scoping Addendum Report was submitted in February 2019 and the Scoping Opinion was received in April 2019. The EIA PEI Report was submitted in July 2020 and consultation comments received in September 2020. Responses to all comments relevant to the WFD assessment are outlined in Chapter 9 Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref.6.2).

Study Area

- 9.4.3 The main site (the PCC Site) of the Proposed Development (centred on NGR NZ 56738 25104) will be on the south bank of the River Tees, south of Coatham Sands. There are also peripheral elements to the Proposed Development, including connection corridors for the electrical grid connection and the onshore element of the CO₂ transport pipeline.
- 9.4.4 For the purposes of the WFD assessment, a Study Area of approximately 1 km around the Site has been considered in order to identify surface water bodies that could reasonably be affected by the Proposed Development. However, since watercourse flow and water quality impacts may propagate downstream, where relevant the assessment also considers a wider Study Area of up to 2km, based on professional judgement This is considered sufficient given that 2km would be within the North Sea and so incorporates all upstream receptors. Additional, indirect effects may also occur to other water environment receptors distant from the Study Area through increased demand on potable water supplies and foul water treatment (if the adjacent Brans Sands WwTW does not have capacity).

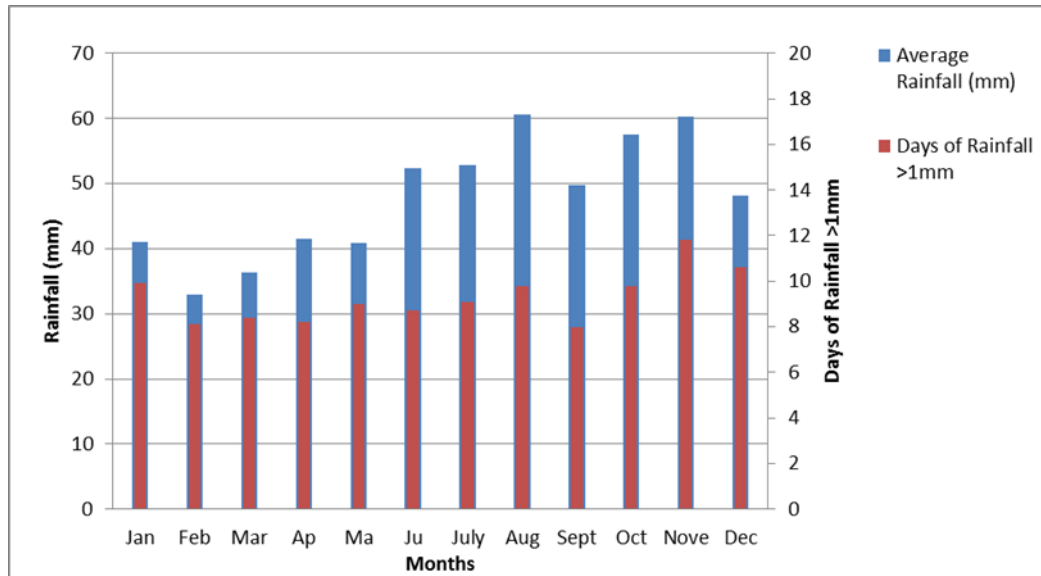
Catchment Characteristics

- 9.4.5 The PCC Site, part of the former Redcar steelworks, is coastal, being located immediately southwest of Teesmouth, at approximately 4 – 8 m above ordnance datum (AOD). Coatham Sands is immediately to the north and Bran

Sands is to the west (see Figure 9.1, ES Volume II, Document Ref. 6.3). The PCC Site is currently industrial, comprising former steelworks structures. The Dormanstown area of Redcar is located southeast of the PCC Site.

- 9.4.6 The Site boundary extends north of the PCC Site across Coatham Sands into Tees Bay in two locations (for the Water Discharge Pipeline and CO₂ Export Pipeline), and west across the Tees Estuary at the southern extent of Bran Sands (see Figure 9-1, ES Volume II, Document Ref. 6.3). These areas of the Site are included in order to incorporate existing water supply and discharge infrastructure that are to be retained for use by the Proposed Development and also for the Natural Gas Connection Corridor (see Figure 9-1, ES Volume II, Document Ref. 6.3).
- 9.4.7 The Site boundary extends south and southwest of the PCC Site in order to accommodate the Natural Gas Connection Corridor, Electrical Connection Corridor and CO₂ Gathering Network Corridor and highways connections for construction traffic.
- 9.4.8 The section of the Site comprising the Natural Gas Connection Corridor and CO₂ Gathering Network Corridor extends across the Tees adjacent to Dabholm Gut (see Figure 9-1, ES Volume II, Document Ref. 6.3). The Site boundary follows existing pipeline routes around the chemical works on the western bank of the Tees on reclaimed land to the south of the Seal Sands inter-tidal mudflats. The Natural Gas Connection Corridor extends west as far as the existing brine field to the east of Cowpen Marsh. The CO₂ gathering network then follows pipelines across Saltholme Nature Reserve, and into the industrial area at the western edge of Haverton Hill, where existing recycling and recovery centres are located. This whole section of the Site is very flat, being between 0 and 10 mAOD. The immediate surroundings include heavy industry on the banks of the Tees, mudflats to the north, marshland at Saltholme and Cowpen Marsh (including Cowpen Bewley Woodland Country Park), and the Tees Estuary itself. There are numerous large standing bodies of water in the marshland areas as well as small watercourses draining towards Seal Sands (which is included within local SSSI and SAC designations).
- 9.4.9 The nearest weather station on the Met Office website with historical data is located at Stockton-on-Tees, approximately 5.0 km southwest of the eastern extent of the Site, at NGR NZ 43846 19831. Based on the average climate data (for the period 1981 to 2010) for this weather station, it is estimated that the Study Area experiences an average of 574 mm of rainfall per year, with it raining more than 1 mm on around 112 days per year. This is a relatively low level of rainfall for England.
- 9.4.10 Figure 9C-3 illustrates this data to show how the average rainfall varies throughout the year, with the wettest period being in the late summer to autumn, and driest in late winter to early spring. Average monthly rainfall is generally less than 60 mm throughout the year, except in August and November when it is between 60 and 65 mm. February is the driest month with an average of approximately 33 mm between 1981 and 2010.

Figure 9C- 3: Stockton-on-Tees weather station – average rainfall per month (1981-2010) and average days per month with >1mm of rainfall (1981-2010)



Geology and Soils

- 9.4.11 Full details of geology is provided in Chapter 10: Geology, Hydrogeology and Contaminated Land (ES Volume I, Document Ref. 6.2). In summary, the British Geological Society Geindex viewer (British Geological Society, n.d.) indicates that the solid geology beneath the study site consists of strata of Jurassic and Triassic age.
- 9.4.12 Immediately around the River Tees and to the south of Teesmouth the bedrock is Triassic Mercia Mudstone including the northern section of the PCC Site which is also underlain by the Penarth Group (Mudstone). The southern half of the PCC Site is underlain by Jurassic Redcar Mudstone, which also stretches south to beyond the Wilton International Site and underlies the majority of the town of Redcar.
- 9.4.13 To the north of the Tees Estuary, Mercia Mudstone underlies the Seal Sands Industrial Estate, which overlies the Triassic Sherwood Sandstone Group, which is present beneath Seal Sands, Cowpen Marsh and Saltholme..
- 9.4.14 Bedrock is overlain by superficial deposits consisting of Tidal Flat Deposits (sand, silt and clay). These are found beneath the Tees Estuary, Teesmouth, Seal Sands, Cowpen Marsh and Saltholme. To the northeast of the Site in the coastal area adjacent to Coatham Sands there are deposits of Beach and Tidal Flat Deposits and Blown Sand. The Lackenby Steelworks, Grangetown and Lazenby are underlain by glaciolacustrine deposits, Redcar is underlain by Devensian Till (diamicton). The northwest of the Study Area towards Cowpen Bewley is underlain by glaciolacustrine deposits. Finally, there are marine beach deposits on the coastline north of Teesmouth.
- 9.4.15 Defra's Multi-agency geographical information for the countryside (MAGIC) website (Defra, n.d.) indicates that the Sherwood Sandstone to the north of the Tees is classified a Principal Aquifer. These have high intergranular and/or fracture permeability - meaning they usually provide a high level of water

storage. They may support water supply and/or river base flow on a strategic scale.

- 9.4.16 The Mercia Mudstone bedrock deposits surrounding the Tees are classified as a Secondary B aquifer. These are lower permeability strata which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. The Redcar Mudstone to the south of this is Secondary (undifferentiated) aquifer. This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
- 9.4.17 The superficial deposits beneath the Site are predominantly classified as a Secondary (undifferentiated) aquifer, and in some cases unproductive (i.e. drift deposits with low permeability that have negligible significance for water supply or river base flow). However, there is an area of Secondary A superficial aquifer beneath the PCC Site and immediately south towards the A1085 and Dormanstown. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
- 9.4.18 Cranfield University's Soilscape website (Cranfield University, n.d.) indicates that the majority of the Study Area either side of the Tees Estuary is underlain by loamy and clayey soils of coastal flats with naturally high groundwater. Beyond this, the southern section of the Lackenby Steelworks is underlain by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soil. The latter is also found in the northern extent of the Study Area north of Haverton Hill and toward Billingham. However, due to past development soil type and structure is likely to have been altered and large areas of Made Ground exist. Finally, sand dune soils are found along the coastal areas to the north of the Study Area.

Water Features

- 9.4.19 A Site Walkover was undertaken on 22 January 2020 in cold, dry but overcast conditions. Using observations taken on this visit, data from OS mapping and the Environment Agency Catchment Data Explorer website, a summary list of the surface water bodies and where relevant to the assessment, groundwater water bodies, has been compiled. This is shown in Table 9C-5, and watercourses are also presented in Figure 9-1: Surface Water Features and Their Attributes and 9-2: Groundwater Features and Their Attributes (ES Volume II, Document Ref. 6.3). Table 9C-5 also provides an indication of whether the waterbody could be impacted or not by the Proposed Development, and which WFD designated waterbody catchment it is included within. Upstream waterbodies have all been scoped out of the assessment as there is no pathway to impact.

Table 9C- 5: Surface and Groundwater Water bodies Identified Within the Study Area

Water body	Type of waterbody	WFD designation or associated WFD water body (where applicable)	Scoped In / Scoped Out
Tees Bay	Coastal	Tees Coastal Water (GB650301500005)	Scoped In – Receives discharge directly from the Proposed Development and crossed by CO ₂ export corridor
Tees Estuary	Watercourse (Main River)	Tees Transitional Waterbody (GB510302509900)	Scoped In – Crossed by the Proposed Development and water may be abstracted from the waterbody for operation under an Environmental Permit
The Fleet	Watercourse (Ordinary)	Tees Estuary (S Bank) (GB1030250723320)	Scoped In - Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development
Main's Dike	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped Out – Located upstream of the Site boundary and so would not be impacted
Mill Race	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped In - Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD waterbody)
Dabholm Gut	Watercourse (Ordinary)	Designated under the TEES Transitional Waterbody (GB510302509900)	Scoped In - Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD waterbody)
Dabholm Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped In - Located within the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD waterbody)
Kettle Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped Out - This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Kinkerdale Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped Out - This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Knitting Wife Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped Out - This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Holme Fleet	Watercourse (Main River)	Tributary of the Tees Transitional WFD Waterbody	Scoped In – The Proposed Development requires pipeline construction adjacent to upstream tributaries of this waterbody, and so there is potential for pollutants from

Water body	Type of waterbody	WFD designation or associated WFD water body (where applicable)	Scoped In / Scoped Out
			construction or operation to be conveyed downstream (considered within the TEES Transitional WFD waterbody)
Belasis Beck	Watercourse (Ordinary)	Tributary of Holme Fleet and therefore associated with the Tees Transitional WFD Waterbody	Scoped In - Crosses the Site boundary and so has potential to be impacted by construction or operation of the Proposed Development (considered within the TEES Transitional WFD waterbody)
Cross Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped Out - This watercourse is upstream of any works relating to the Proposed Development and so is scoped out of further assessment.
Greatham Creek	Watercourse (Main River)	Designated under the Tees Transitional WFD Waterbody	Scoped In - This watercourse is outside the 1 km Study Area but is hydrologically connected by Mucky Fleet and Swallow Fleet and so has potential to be impacted during construction and operation of the Proposed Development (considered within the Tees Transitional WFD waterbody)
Mucky Fleet	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped In - This watercourse is outside the 1 km Study Area but has potential to receive pollutants and sediments during construction and operation of the Proposed Development via upstream watercourses (considered within the Tees Transitional WFD waterbody)
Swallow Fleet	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody	Scoped In - This watercourse is not within the Site boundary but has potential to receive pollutants and sediments during construction and operation of the Proposed Development via upstream watercourses (considered within the Tees Transitional WFD waterbody)
Saltholme Nature Reservoir Ponds, Brine Reservoirs, Brine Field and refinery ponds	Stillwater	Catchment of Tees Transitional WFD Waterbody	Scoped In – These waterbodies have hydrological connectivity to the Site boundary through upstream tributaries in Saltholme Marsh and so have the potential to be impacted during construction or operation of the Proposed Development (considered within the Tees Transitional WFD waterbody).
Lake at Charlton's Pond Nature Reserve	Stillwater	Catchment of Tees Transitional WFD Waterbody	Scoped Out – This pond is upslope of the Proposed Development and so will not be impacted.
Ponds at Billingham Technology Park	Stillwater	Catchment of Tees Transitional WFD Waterbody	Scoped In – In close proximity to the Site boundary and so have potential to be impacted (considered within the Tees Transitional WFD waterbody).
Ponds within Coatham Dunes and Bran Sands	Stillwater	Catchment of Tees Coastal WFD waterbody	Scoped In – The Site boundary extends over the dunes and includes an open water pond (Pond 14), which is scoped in. The remaining water bodies within the dunes complex are

Water body	Type of waterbody	WFD designation or associated WFD water body (where applicable)	Scoped In / Scoped Out
			fully vegetated wetlands and so are not included in the assessment .
Ponds at Coatham Marsh	Stillwater	Catchment of Tees Estuary (S Bank)	Scoped In – In close proximity to the Site boundary and so have potential to be impacted (considered within the Tees Transitional WFD waterbody).
Numerous industrial ponds and artificial waterbodies across the area including Lazenby Reservoirs and Salthouse Brine Reservoirs	Stillwater	Catchment of Tees Transitional WFD Waterbody	Scoped In – Numerous ponds are within the Site boundary and could be impacted by construction and operation of the Proposed Development.
Tees Sherwood Sandstone	Groundwater	WFD designation (GB40301G702000)	Scoped In – the Proposed Development is partly underlain by this groundwater body and so it is scoped in.
Tees Mercia Mudstone & Redcar Mudstone	Groundwater	WFD designation (GB40302G701300)	Scoped In – the Proposed Development is partly underlain by this groundwater body and so it is scoped in.

Surface Water Bodies

- 9.4.20 The Environment Agency’s Catchment Data Explorer website (Environment Agency, n.d.a) confirms that the estuarine and coastal water bodies in the Study Area are contained within the Northumbria River Basin District, the Northumbria Transitional and Coastal (TraC) Management Catchment, and the Tees Lower and Estuary TraC Operational Catchment.
- 9.4.21 The fluvial waterbodies are contained within the Northumbria River Basin District, Tees Management Catchment and Tees Lower and Estuary Operational Catchment.
- 9.4.22 There are four WFD designated surface waterbodies within the Study Area, and these are described in the following sections. Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses. The WFD waterbodies include one coastal water body (Tees Coastal Water), one estuarine water body (Tees transitional water body) and one river (The Fleet - designated as Tees Estuary (S Bank)). The WFD classification for these waterbodies are listed in Table 9C-6 as taken from the Environment Agency’s Catchment Data Explorer website (Environment Agency, n.d.a.) alongside observations recorded during the site walkover.
- 9.4.23 The full no deterioration baseline for each water body is the status that is reported in Annex A.

Table 9C- 6: WFD Surface Waterbodies in the Study Area

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
Tees Coastal Water (GB650301500005)	Moderate Ecological Potential	Fail	Good (2027)	Heavily Modified	The Tees Coastal waterbody stretches from approximately 20 km southeast of Redcar at Boulby, to approximately 13 km northwest of Redcar at Crimdon. It includes a total area of 88.31 km ² .
<p>Site observations: The Tees Coastal waterbody was observed from Coatham Sands between Redcar and Teesmouth. The waterbody is backed by a wide sandy beach and sand dunes and is popular for recreation. Coatham Sands has, in places along its length, been strongly influenced by historical deposition of slag from local ironworks. This means that large parts of the dunes are a mix of slag deposits and natural marine-deposited and subsequently wind-blown sand. Within the sand dune complex are a number of ponds and wetland areas. Discharge infrastructure was not apparent and is presumably buried or only observable at very low tide. One pipe was noted across the beach emanating from the direction of Cleveland Links golf course and the area of Warrenby Industrial Estate and is likely to be for discharges to the Tees. The Teesside Offshore Wind Farm was observed approximately 1.5 km off the coast from Redcar.</p>					
<p>Mitigation Measures: Details of mitigation measures for this waterbody were requested from the Environment Agency but none were provided.</p>					
Tees Transitional Waterbody (GB510302509900)	Moderate Ecological Potential	Fail	Moderate (2015)	Heavily Modified	The Tees Transitional Waterbody extends from the Tees Barrage to the east of Stockton-on-Tees, to Teesmouth. This is a distance of approximately 16 km. It includes a total area of 11.44 km ² . The designation includes the mud and sand flats at Seal Sands, Tees Dock, Greatham Creek and Dabholm Gut, Greatham Creek is the estuarine section of Greatham Beck, which flows from the north of Elwick (NZ 45077 33468) to Seal Sands (NZ 51667 25568) and into the Seaton on Tees Channel. Dabholm Gut is a kilometre-long tidal channel on the east bank of the Tees, left when the land on both sides was reclaimed from the Tees estuary.

Site observations: The Tees waterbody was observed from near the Dabholm Gut on the south bank. At this point the estuary is approximately 455 m wide. The estuary is also a busy route for navigation with docks and jetties on both banks. Land either side of the waterbody is flat, having been largely reclaimed in this area and is currently occupied by various heavy industries. Further details regarding hydrodynamics, tides and sediments are provided later in the baseline.

The Dabholm Gut is an artificial channel of around 1km length left following historical land reclamation. Upstream is Dabholm Beck which is formed from the coalescence of numerous small watercourses and drains through an area of freshwater marshland to the northwest of the Wilton International Site (upstream of the tidal limit). Dabholm Beck has a single stem channel is around 3-4 m wide, incised and straight, and lacking bedform features of interest, being indicative of extensive past modification. Reeds surround the channel on both banks and there are several large outfalls that discharge into the channel. At the tidal limit where it becomes Dabholm Gut, the channel widens to approximately 30 m and numerous other active outfalls were observed with relatively high rates of discharge, with some visible foaming suggesting potential presence of agitated chemicals. There are numerous consented discharges here from the adjacent industry, and consents are shown in Figure 9-1: Surface Water Features and Their Attributes (ES Volume II, Document Ref. 6.3). The channel width remains constant up to the confluence with the Tees. At low tide, fine sediments are exposed in the channel and are dark in colour suggesting potential presence of pollutants. During especially high tides anecdotal evidence suggests the channel has been known to overtop onto the adjacent access road. The site is popular with birdlife and is included in the Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI).

Waterbody	Ecological Status / Chemical Status Potential	Overall Target Objective	Hydromorphological Designation	Designated Reach
Mitigation Measures: Details of mitigation measures for this waterbody were requested from the Environment Agency but none were provided.				
Tees Estuary (South Bank) (GB1030250723320)	Moderate Ecological Potential	Fail	Good (2027)	Heavily Modified
<p>This watercourse is known on local mapping as The Fleet and is designated from adjacent to Longbeck Lane in Saltburn (NGR NZ 60988 20908). It continues north to the west of Redcar, and then flows west through the industrial works to discharge into Dabholm Gut at NGR NZ 56131 24038.</p>				
<p>Site observations: The watercourse was observed in Coatham Marsh Nature Reserve, where the channel has been artificially widened to flow through a pond/wetland area that reduces the rate of flow and likely alters the character of water quality. The channel is culverted beneath a bridge within the nature reserve through an overly constrained arch of around 2 m width, which leads to backing up of flow upstream. The channel is also choked by submerged and emergent macrophytes, the extent of which suggests some enrichment by nutrients. Upstream of the bridge the channel is approximately 8-9 m wide but increases to approximately 25-30 m wide immediately downstream where the channel looks like it may have been artificially constructed for access. There is good connectivity with the floodplain upstream of the culvert but less so downstream. Flows upstream of the culvert may on occasion spill onto the surrounding marsh. Various service crossings were noted over the watercourse near this location. Flow is sluggish as a result of the widespread macrophytes, culverted crossing and overwide nature of the channel. The watercourse flows into Dabholm Gut approximately 2 km downstream of this observation point in the Nature Reserve, although there are expected to be controlling structures before the confluence with Dabholm Gut.</p> <p>A tributary of The Fleet was also observed as it crosses Limerick Road in Dormanstown. This was an artificial, perfectly straight channel of around 5 m width. The bed was smothered in fine sediment and pollution pressures were notable with an oil sheen on the water. There were very few macrophytes and the channel has incised banks, rising steeply 1-2 m abruptly from the channel bed.</p> <p>Mitigation Measures: The Environment Agency have outlined mitigation measures to improve this waterbody. These are listed In Annex A Table A4 and include re-opening of culverts, restoring in channel morphological diversity, water level management, implementing appropriate vegetation control, removing obsolete structures, installing fish passes and enhancing structures to improve ecology. None of the mitigation measures are currently in place, except for water level management.</p>				

9.4.24 Within the catchments of the WFD waterbodies outlined in Table 9C-6, there are also a number of named watercourses shown on OS mapping (Bing, n.d.), and these are described in Table 9C-7 (please refer to Figure 9-1: WFD Surface Water Features and Their Attributes (ES Volume II, Document Ref. 6.3) throughout).

Table 9C- 7: Other named watercourses in the Study Area that are not defined WFD water bodies

Name	Tributary of	Watercourse Description	Site Observations
Belasis Beck	Holme Fleet (within Tees Transitional Waterbody Catchment)	Belasis Beck appears to rise from ponds in Belasis Hall Technology Park (NZ 47373 23267) and flows east for 2 km before its confluence with Holme Fleet within Salthome Nature Reserve at NZ 49071 23577.	Belasis Beck was observed in the pastoral fields adjacent to Cowpen Bewley Road, where the main channel appeared to be shallow and wide (~6-7 m). Water levels were high during the site visit and overtopping slightly onto the floodplain. Here the channel flows roughly parallel with an adjacent pipeline, which cuts through the fields either side of the road. Flow was sluggish as a result of the shallow gradient and probable tidal locking. This creates a depositional environment, encouraging the growth of submerged and emergent macrophytes. Although these will take up nutrients during their growth, if they are not removed these are released back into the water column resulting in permanent recycling of nutrients and enriched conditions that support further growth of invasive macrophytes. Sediments are fine with little evidence of any transportation. They are also likely to be contaminated due to the past and current industry in this location. The road crossing appeared largely buried at this location, and flows appeared to be backing up upstream of the road leading to the spillage onto the floodplain. A brown surface scum was observed and was thought to be indicative of organics.
Dabholm Beck	Tees Transitional Waterbody Catchment	Dabholm Beck is a drainage channel marked on mapping as flowing northeast above ground for 700 m between NZ 56161 23102 and NZ 56710 23730. It then flows northwest into the tidal Dabholm Cut.	Refer to the Dabholm Gut description under the Tees Transitional Waterbody description above.
Kettle Beck	Tees Transitional Waterbody Catchment	Kettle Beck rises at Lazenby Bank and flows approximately 4 km generally north along the edge of the Wilton International Site, beneath the A1085, beneath the Teesside Works	Kettle Beck was observed at the western edge of the Wilton International Site. Here the channel was between 2 and 3 m wide, with an artificial, straightened character. The bed was dominated by fine sediment

Name	Tributary of	Watercourse Description	Site Observations
		(Lackenby), and beyond the A1053 before discharging to the Tees. The exact course of the watercourse is not clear from online mapping north of the A1085 as the watercourse is culverted.	with some isolated very fine gravel accumulations. Submerged macrophytes were abundant and some sections of the channel were shaded by overhanging vegetation and thick riparian vegetation. Flow was impeded by a road culvert at the observation site, which consisted of six small diameter (~0.5 m) pipes. The banks rose steeply from the channel bed and were incised meaning the channel is likely to be disconnected from the floodplain.
Holme Fleet	Tees Transitional Waterbody Catchment	Holme Fleet is a marshland channel that meanders between Cowpen Marsh (NZ 50596 24732) and Port Clarence (NZ 50703 21620). It is around 5.6 km in length, and a large number of marshland channels join the Fleet, which also flows through several marshland open waterbodies and reedbeds.	Not visited during the site visit as it is outside of the Site Boundary but still considered where relevant within the Study Area of the assessment.
Kinkerdale Beck	Tees Transitional Waterbody Catchment	This watercourse is mapped as a surface waterbody for 320 m at the north-western extent of the Wilton International Site (NZ 56071 20996) and is then in culvert. As such, the source and exact course of the watercourse is not known, although it is known to outfall to the Lackenby Channel.	Kinkerdale Beck is a 2-3 m wide ditch which appears to be fed from an overflow connection from Kettle Beck. It was observed just downstream of Kettle Beck where it has an artificial, straightened character with steep banks. The bed was dominated by fine sediment. Submerged macrophytes were abundant and some sections of the channel were shaded by overhanging vegetation. Water in this section of the channel was largely ponded. Further downstream the watercourse is largely culverted beneath the Wilton International Site.
Knitting Wife Beck	Tees Transitional Waterbody Catchment	This watercourse rises just north of the A66 in Grangetown (NZ 55172 20910), before flowing north for approximately 300 m towards the Lackenby Steelworks. The watercourse is then culverted and so the course alignment is unclear but is known to outfall at the Lackenby Channel.	The watercourse was visited as it emerges from an approximately 1 m wide box culvert to the north of the A66. The channel was approximately 1-1.5 m wide, and artificial in nature being straight with steep incised banks rising 2-3 m from the channel bed. Fine sediment accumulations were abundant; the channel was largely overgrown; and this section of the channel largely shaded by overhanging deciduous vegetation. Pollution was evident with red staining on all of the vegetation immediately downstream of the culvert.
Lackenby Channel	Tees Transitional	The Lackenby Channel is a drainage cut between the Lackenby steelworks (NZ 55305	Lackenby Channel was not visited during the site visit, but aerial photography available online indicates

Name	Tributary of	Watercourse Description	Site Observations
	Waterbody Catchment	22207) and the eastern bank of the Tees estuary (NZ 54145 23341). It is approximately 1.6 km in length and conveys flows from Knitting Wife Beck, Kinkerdale Beck and Kettle Beck to the Tees.	that it is an artificial, straight channel varying between 10 and 15 m in width. It is likely to be very similar to Dabholm Gut with limited hydromorphological interest.
Main's Dike	Tees Estuary (S Bank) WFD Waterbody	Main's Dike watercourse rises from a spring in Wilton Wood to the southeast of the Site at NZ 59328 19741. The watercourse then flows north along the eastern boundary of the Wilton International Site, and into the Mill Race at NZ 57893 22824.	Main's Dike was observed along the eastern edge of the Wilton International Site where it was very straight, around 1 m in width and with steep incised banks rising around 4 m from the channel. The watercourse was heavily shaded, and no macrophytes were observed in the channel at this location although marginal vegetation was dense. The bed was dominated by fine sediment, with some isolated fine gravel patches (e.g. 2-3 cm diameter). Significant sediment accumulations were observed downstream of the Mains Dike Bridge culvert. There was also evidence of some lateral erosion of the banks and the formation of small, alternating fine gravel lateral bars, although the gradient was still shallow and the channel stable.
Mill Race	Tees Estuary (S Bank) WFD Waterbody	The course of the Mill Race is unclear as it is largely culverted but appears to emanate from coalescence of ditches and watercourses at NZ 57893 22824, then flows north of the Wilton International Site beneath the A1085. It reemerges at NZ 57102 24152 and flows west into The Fleet.	The Mill Race was observed within the Wilton International Site to the south of the A1085. Here the watercourse was overly wide (around 3.5-4 m wide) leading up to a circular culvert of around 2 m diameter, with artificial concrete banks in places. Banks were step and incised. The bed was dominated by fine sediment. There are numerous service crossings of the watercourse at this location. The Mill Race was also observed downstream of the A1085 adjacent to the Trunk Road roundabout where it was 2-3 m wide, very straight, with a bed dominated by fine sediment. Road runoff appears to discharge into the channel.
Mucky Fleet / Swallow Fleet	Tees Transitional Waterbody Catchment	Mucky Fleet and Swallow Fleet are meandering channels draining Cowpen Marsh. A large number of marshland channels intersect these channels, which ultimately drain to the Tees Transitional Waterbody.	Not visited during the site visit because they are outside of the Site Boundary but still considered where relevant within the Study Area of the assessment

9.4.25 In addition to the watercourses described in Tables 9C-6 and 9C-7, there are numerous drains and ditches in the Study Area. These are predominantly

related to drainage infrastructure in the industrial areas, and many are culverted beneath ground and so their exact course is unclear. These ditches do not have nature conservation designations and due to largely being in culvert are expected to have minimal biodiversity value. In places, the drainage channels are visible above ground and are typically of the order of 0.5-1 m in width, ephemeral (i.e. flowing for only part of the year or only after storms), have artificial engineered and sometimes concrete channels, and thus generally do not support functional flows (i.e. flows with the ability to erode, transport and deposit sediment resulting in the formation of geomorphic bedforms).

- 9.4.26 There is also a network of small watercourse channels throughout the saltmarsh and wetland area to the south and southwest of Seal Sands. Some of these channels were observed on site from the Saltholme RSPB Nature Reserve, and they are small (1-2 m wide) low gradient, single thread, meandering water bodies that are closely connected to their floodplains.
- 9.4.27 Other water bodies shown in Figure 9-1: Surface Water Features and Their Attributes (ES Volume II, Document Ref. 6.3) outside of the 1 km Study Area are not included in this assessment where they are upstream of any proposed works and so would not have any pathways through which to be impacted. This includes Skelton Beck, Cross Beck, Spencer Beck, Middle Beck, Marton West Beck, Lustrum Beck, Billingham Beck, Cowbridge Beck, North Burn, Claxton Beck and Greatham Beck.
- 9.4.28 In total, there are 138 still water bodies within 250 m of the Site boundary (see Chapter 13: Aquatic Ecology of the ES, Volume I), the majority of which are small ponds or artificial standing water bodies. The majority of these on the southeast bank of the Tees are small artificial water bodies and ponds related to the surrounding industrial land use. To the northeast of the Tees there are further artificial and industrial water bodies, such as the large brine reservoirs immediately north of the Site boundary at Saltholme. The surrounding wetlands here also includes several large, interconnecting water bodies which attract a great deal of biodiversity interest, especially birdlife. The ponds within the Site boundary itself are predominantly very small and generally artificial, with the exception being several waterbodies within the South Gare and Coatham Dunes.
- 9.4.29 The Coatham Dunes ponds have been surveyed (see Annex E) and appear to have formed in depressions in the relatively impermeable historic slag deposits that lie between the PCC Site and the more natural sand dunes that have evolved adjacent to the Tees Bay shoreline. Based on site visits between October 2020 and January 2021, they appear to be predominantly rainwater fed with little influence from tidal variation and groundwater. With the exception of Pond 14 (as numbered in Chapter 13: Aquatic Ecology, ES Volume I, Document Ref. 6.2) all ponds across the dunes have succeeded to become fully vegetated wetlands covered by *Phragmites australis*. Therefore, only Pond 14 will be considered by this assessment.
- 9.4.30 Further descriptions of the Tees Coastal and Tees Transitional waterbodies are provided in Annex B.

Surface Water Quality

- 9.4.31 The Tees Coastal WFD waterbody is at Fail Chemical Status under the WFD Cycle 2 classifications (2019) due to failures for Polybrominated diphenyl ethers (PBDEs) and mercury and its compounds. All other priority substances, priority hazardous substances, specific pollutants and other pollutants are at Good Status or higher or have not been assessed.
- 9.4.32 The Tees Transitional WFD waterbody is at Fail Chemical Status under the WFD Cycle 2 classifications (2019), due to failures for PBDEs, Benzo(g-h-i)perylene, tributyltin compounds, and Cypermethrin (priority hazardous) which all have a status of Fail. The failure for PBDEs is under investigation, while the tributyltin compounds are attributed to diffuse pollution from contaminated waterbody bed sediments.
- 9.4.33 The Tees Estuary (South Bank) waterbody is at Fail Chemical Status under the WFD Cycle 2 classifications (2019), due to failures for Polybrominated diphenyl ethers (PBDEs) and mercury and its compounds (Environment Agency, n.d.a). Priority substances were all at Good Status and Other Pollutants did not require assessment.
- 9.4.34 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, n.d.c) for the Tees Transitional WFD water body (Tees Estuary). Annual average values for the period 2009-2019 are summarised in Annex C Table C1 for a sampling point close to the mouth of the Tees, and at Smiths Dock, Redcar Jetty, Teesport and the confluence with Dabholm Gut moving upstream (these monitoring locations are also shown on Figure 9-1, ES Volume II, Document Ref.6.3). The parameter values presented Annex C Table C1 are compared against WFD standards where they apply to transitional waters.
- 9.4.35 These data indicate only one failure against WFD Environmental Quality Standards (EQS) for transitional waters, which was for tributyltin in Dabholm Gut, although there is some evidence of slightly elevated metal concentrations across the monitoring sites, which is expected given the industrial and urban nature of the area surrounding the estuary mouth and the immediate upstream reaches of the River Tees. Raised tributyltin concentrations are consistent with the WFD 'Fail' classification for this water body.
- 9.4.36 The Water Quality Archive website (Environment Agency, n.d.c) also provides water quality for other water bodies and sites in close proximity to the Proposed Development, spanning the period 2009-2019 inclusive. A summary table of this data is provided in Annex C Table C2 indicating parameters that were measured and a brief overview of water quality implications. Summary data for these sampling points is shown in Annex C Tables C3-C8.
- 9.4.37 The data presented in Annex C Table C2 indicates that there remains substantial pollution pressure on the Tees Estuary from existing effluent and pollution discharges (e.g. several failures against EQS in the Wilton Complex effluent), although as noted above the Tees has a large capacity to absorb these pollutants with concentrations of most pollutants being below EQS in the monitored data from the Teesmouth area.

- 9.4.38 The freshwater streams in the Study Area draining to the River Tees are generally not routinely monitored by the Environment Agency. There is data for Billingham Beck, which is outside of the 1 km Study Area and is upstream of the Site, and so has been scoped out of the assessment as it will not be impacted. However, the watercourse is likely to exhibit similar water quality traits to those in the Study Area given the similar surrounding urban land with heavy industry, low gradients and tide locking effect of the Tees Estuary. The data for this watercourse indicates that certain dissolved metals, including copper and zinc, exceed WFD standards, although the standard for copper is 'bioavailable', which would typically be lower than any measured dissolved copper result. Nitrates and phosphates are also slightly elevated.
- 9.4.39 Further water quality data for the Study Area is available for Bathing Water areas as designated under the Bathing Waters Directive. In the northeast of the Study Area, Coatham Sands is a designated bathing water (as 'Redcar Coatham'). Water quality at designated bathing water sites in England is assessed by the Environment Agency. From May to September each year, weekly assessments measure current water quality, and at a number of sites daily pollution risk forecasts are issued. Annual ratings classify each site as excellent, good, sufficient or poor based on measurements of *Intestinal enterococci* and *Escherichia coli* taken over a period of up to four years. Redcar Coatham had a 2019 classification of Excellent (Environment Agency n.d.d).
- 9.4.40 The Environment Agency's Bathing Water Quality website (Environment Agency n.d.a) notes that the Redcar Coatham bathing water is subject to short term pollution caused when heavy rainfall or high tides wash faecal material to the sea from livestock, sewage and urban drainage via rivers and streams, with water quality typically returning to normal after a few days.
- 9.4.41 The southern extent of the Seaton Carew North Gare Bathing Water is also within 2 km of the Site and also has a classification of Excellent for 2019 (Environment Agency n.d.a).
- 9.4.42 Numerous investigations of sediment quality have recently been undertaken to support various recent dredging proposals and developments around the Tees Estuary, with samples compared to the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Action Levels for the disposal of dredged material. These give an indication of sediment quality in the Tees Estuary and Teesmouth areas. A summary is provided in Annex D, and indicates significant historical contamination in the Tees Estuary, which is more concentrated at the margins of the channel and at depth than in surface sediments. In some locations, concentrations of contaminants exceeded CEFAS Action Level 2 and so disposal at sea is not considered suitable in these cases. Refer to Annex D for further details.
- 9.4.43 The only open water pond within the Coatham Dunes (Pond 14 within the Teesmouth and Cleveland Coast SSSI) has been monitored as part of the assessment in order to determine the potential for impacts from atmospheric deposition of pollutants from the Proposed Development. Pond 14 was monitored on eight occasions between October 2020 and January 2021. In summary, the monitoring indicated that the water is circum-neutral (mean pH 7.67), mean DO values were 106% saturated and 12.72 mg/l suggesting

supersaturation (i.e. over 100%) which is often associated with photosynthesis activity during daylight hours, and/or significant aeration.

- 9.4.44 Mean electrical conductivity was 2250 $\mu\text{S}/\text{cm}$ suggesting brackish water. Average ammoniacal nitrogen was recorded at marginally above the laboratory limit of detection (LoD) at 0.05 mg/l. Furthermore, average nitrate values were low (0.2 mg/l) and nitrites were all below the LoD. Total nitrogen had a mean average of 1.10 mg/l.
- 9.4.45 Certain metals including boron and molybdenum were elevated with recorded mean dissolved values of 503.25 $\mu\text{g}/\text{l}$ and 217.75 $\mu\text{g}/\text{l}$ respectively, and total values of 494.38 $\mu\text{g}/\text{l}$ and 213.88 $\mu\text{g}/\text{l}$ respectively. Total iron was also found to be elevated with an average value of 795 $\mu\text{g}/\text{l}$; however dissolved iron was far lower at 30.17 $\mu\text{g}/\text{l}$ only slightly above the LoD of 20 $\mu\text{g}/\text{l}$.
- 9.4.46 Only two samples of polyaromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPHs) were taken, all of which fell below LoDs. One sample of polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs) and phenols was taken, all of which fell below LoDs. Please refer to Annex E for more details.

Marine Ecology Overview

- 9.4.47 Full details regarding marine ecology within the Study Area is provided in Chapter 14: Marine Ecology and Nature Conservation (ES, Volume I). A brief summary is provided below.
- 9.4.48 In terms of fisheries, the Tees Transitional WFD waterbody is an important water body for diadromous fish species which make seasonal migrations between the sea and riverine environment. Salmon (*Salmo salar*), sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are all known to be present and have been identified as Local Priority Species within the Tees Valley BAP. Salmon, river lamprey and sea lamprey are also protected species under Annex II of the Habitats Directive. The River Tees is designated as one of the 64 main salmon rivers in England and Wales.
- 9.4.49 Estuarine and marine fish communities within the vicinity of the Proposed Development represent a mixed demersal and pelagic fish assemblage typical of the central North Sea. Data on the Environment Agency website indicates that the total number of the monthly combined upstream counts for salmon and sea trout at the Environment Agency fish counter at the Tees Barrage on the Lower Tees have steadily declined in recent years, with total fish counted being 498 (2016), 297 (2017), 217 (2018), 204 (2019) and 328 (2020) (Environment Agency, 2019).
- 9.4.50 Common shellfish species within inshore waters include edible crab (*Cancer pagurus*), European lobster (*Homarus gammarus*) and velvet swimming crab (*Necora puber*). There are no designated shellfish waters within the vicinity of the Site.
- 9.4.51 The North Sea and coastal waters around the Site are known to be important for harbour porpoise (*Phocoena phocoena*), which is an Annex II species under the Habitats Directive.

- 9.4.52 No protected phytoplankton species or invasive non-native species (INNS) were identified during the Environment Agency surveys in the Tees Estuary. However, there is evidence of some forms of taxa being present that cause harmful algal blooms in UK coastal waters. These included: *Alexandrium* spp., *Karenia mikimotoi*, *Dinophysis acuminata*, *Dinophysis acuta*, and *Pseudo-nitzschia* spp. which are all known to cause shellfish poisoning (Defra, 2008). In addition, several taxa known to cause mortality in fish due to physical damage were also recorded; these included *Gymnodinium* spp., *Dictyocha speculum*, *Chaetoceros* spp. and *K. mikimotoi* (Defra, 2008).
- 9.4.53 No formal monitoring of harmful algal blooms is carried out within the lower Tees estuary or coastal water bodies although the Tees WFD water body which covers the lower reaches of the estuary is classified as having 'Good' phytoplankton status, despite Seal Sands being recognised as a sensitive eutrophic area.
- 9.4.54 With regard to zooplankton, several INNS are known to have been introduced to the North Sea due to human activities and have responded to favourable conditions, but no protected species have been identified.
- 9.4.55 Results of the Intertidal benthic Phase I and Phase II surveys and subtidal benthic sampling is reported in Chapter 14: Marine Ecology and Nature Conservation (ES, Volume I). Overall, benthic communities were characterised by relatively low abundance, biomass, species richness and diversity. No protected species were identified during the intertidal survey. However two biotopes (EUNIS A5.233 and A5.242 (EEA, 2012)) were identified in the subtidal sampling which qualify as habitats of principal importance being listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and belong to the UK BAP priority habitat type, 'subtidal sands and gravels'. The only INNS recorded during the benthic surveys was the seaweed wakame (*Undaria pinnatifida*), found in the intertidal zone.

Freshwater Ecology Overview

- 9.4.56 Full details regarding freshwater ecology within the Study Area are provided in Chapter 13: Aquatic Ecology (ES, Volume I, Document Ref. 6.2). A brief summary is provided below.
- 9.4.57 There is only one riverine WFD water body within the Site Boundary of the Proposed Development and this is the Tees Estuary South Bank (GB103025072320). Routine WFD monitoring is therefore limited in the area and there is limited availability of aquatic datasets. Those that are available were requested from the Environmental Records and Information Centre (ERIC). Given the limited data available, further aquatic baseline surveys have been undertaken to gather more robust data to inform the assessment.
- 9.4.58 No notable fish species were recorded within 2 km of the Site boundary within the past three years based on the ERIC data. Site surveys have shown European eel in Dabholm Gut and Pond 3 (see Chapter 13: Aquatic Ecology, ES Volume I, Document Ref. 6.2).
- 9.4.59 In the past five years there are records of designated aquatic invertebrates being present in ponds associates with Coatham Dunes near Coatham Sands, in Saltholme Nature Reserve, and Cowpen Marsh (see Chapter 13:

Aquatic Ecology, ES Volume I, Document Ref. 6.2 for details of species), although none are within the Site boundary. Data requests returned no records for designated aquatic macroinvertebrates species within a 2 km radius from the Site within the past three years. Further surveys have been undertaken to inform the Proposed Development, but no notable species were recorded.

- 9.4.60 The WFD macroinvertebrate monitoring data provided by the Environment Agency from 2016 for Dabholm Gut (part of the 'Tees Estuary South Bank' WFD waterbody) at NZ 56570 23772 indicates that the water body has very poor quality (Whalley Hawkes Paisley Trigg score of 17.6 to 19.5, Average Score Per Taxa of 3.3 to 3.5, very low diversity) and no species of conservation interest were recorded.
- 9.4.61 On the basis of available data, there are no notable or protected macrophyte species recorded within the Study Area.
- 9.4.62 A range of INNS species listed on Schedule 9 of the Wildlife & Countryside Act are recorded in the Study Area, based on data provided by the ERIC. Only one was in the Proposed Development area, which was Nuttall's Waterweed (*Elodea nuttallii*). A range of historical aquatic INNS records were returned for the Study Area by ERIC including water fern (*Azolla filiculoides*), New Zealand pigmyweed (*Crassula helmsii*), parrot's feather (*Myriophyllum aquaticum*), floating pennywort (*Hydrocotyle ranunculoides*) and Canadian waterweed (*Elodea canadensis*). Waterbody surveys for the Proposed Development indicate that the only INNS of concern was floating pennywort, which was identified in the Fleet.

Sites of Ecological Importance – Surface Water

- 9.4.63 Designations within and in close proximity to the Study Area are shown on Figure 9-3: Ecological Designations (ES Volume II, Document Ref. 6.3). The Water Connection Corridors, the CO₂ Gathering Network and Natural Gas Connection Corridor (where it crosses the Tees Estuary) of the Proposed Development cross the Teesmouth and Cleveland Coast SSSI. The Teesmouth and Cleveland Coast SSSI is notified under Section 28C of the Wildlife and Countryside Act 1981 and is of special interest for many nationally important features that occur within and are supported by the wider mosaic of coastal and freshwater habitats. Habitats in the SSSI include sand dunes, saltmarshes, mudflats, rocky and sandy shores, saline lagoons, grazing marshes, reedbeds and freshwater wetlands. The site stretches from Crimdon Dene Mouth in the north, to Marske-by-the-Sea in the south, and inland to Billingham including the entire Tees Estuary upstream to the Tees Barrage.
- 9.4.64 The coast either side of Teesmouth is also designated as being of international importance as the Teesmouth and Cleveland Coast Special Protection Area (SPA) which is designated under the EU Birds Directive, and the Teesmouth and Cleveland Coast Ramsar site, which is a wetland designated as being of international importance under the Ramsar Convention. The designation is for its important bird populations, and the SPA is a complex of discrete coastal and wetland habitats. These include sandflats, mudflats, rocky foreshore, saltmarsh, sand dunes, wet grassland

and freshwater lagoons. The SPA is classified for its breeding Little Tern, passage Sandwich Tern and Redshank, wintering Red Knot and an assemblage of over 20,000 wintering birds. The SPA and Ramsar site both cross the Proposed Development boundary at its northern extent for the water connection corridor.

- 9.4.65 Seaton Dunes and Common Local Nature Reserve (LNR) (part of the Teesmouth and Cleveland Coast SSSI) is located just over 2 km from the Proposed Development boundary. The area is of considerable importance for its invertebrate fauna, flora and bird life. The range of habitats include sandy, muddy, and rocky foreshore, dunes, dune slacks and dune grassland, as well as relict saltmarsh, grazed freshwater marsh with dykes, pools and swells (Natural England, n.d.).
- 9.4.66 Charlton's Pond LNR is located approximately 1 km west of the eastern extent of the Site boundary. This is an 8 ha site, consisting of wetlands, amenity grassland and woodland. The site is upslope and upstream of the Site and so is scoped out of further assessment.
- 9.4.67 There are no other statutory, local non-statutory or other non-statutory designated sites whose reason for designation is due to aquatic habitats, species or their assemblage up to 1 km from the Site.

Groundwater WFD Waterbodies

- 9.4.68 The ground waterbodies are contained within the Northumbria River Basin District and the Northumbria Groundwater Management Catchment. The Tees Sherwood Sandstone groundwater body is within the Tees Sherwood Sandstone Operational Catchment, and the Tees Mercia Mudstone and Redcar Mudstone waterbody is within the Tees Mercia Mudstone and Redcar Mudstone Operational Catchment.
- 9.4.69 The Study Area to the east and south of the Tees estuary is wholly within the Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body (GB40302G701300) (Environment Agency, n.d.a). The waterbody is at Poor Overall Status, with Good Quantitative Status, but Poor Chemical Status. The latter is a consequence of Poor Chemical Dependent Surface Water Body Status, due to point source pollution from mining and quarrying sources. The waterbody has an area of 494.57 km². The water body objective is Poor Status by 2015. It is not higher due to an unfavourable balance of costs and benefits. One protected area falls within the WFD designation, which is the Tees Mercia Mudstone & Redcar Mudstone (UKGB40302G701300) Drinking Water Protected Area (DWPA).
- 9.4.70 The Study Area to the west and north of the Tees Estuary is within the Tees Sherwood Sandstone WFD groundwater body (GB40301G702000). The Tees Sherwood Sandstone groundwater body is at Good Overall Status, with Good Quantitative and Chemical Elements. The water body has an area of 293.01 km². It has an objective of maintaining Good Status. Protected areas within the designated WFD waterbody are the Tees Sherwood Sandstone (UKGB40301G702000) DWPA and the Low Dindale (G100) Nitrate Vulnerable Zone (NVZ).
- 9.4.71 The full no deterioration baseline for each groundwater body is outlined in Annex A Tables A5 and A6.

- 9.4.72 There are no Groundwater Dependent Terrestrial Ecosystems (GWDTE) or Source Protection Zones (SPZ 1 to 3) which are likely to be affected by activities related to the Proposed Development.

Water Resources

- 9.4.73 The Study Area itself is not within a Drinking Water Protected Area, Drinking Water Safeguard Zone or near any Source Protection Zones.
- 9.4.74 The following provides information on water activity permits (i.e. discharges), water abstractions and past pollution incidents.

Water Activity Permits

- 9.4.75 The Envirocheck report (Landmark Information Group, 2019 (and updated digitally in 2021) for the Proposed Development indicates that there are 45 active water permits (i.e. formerly discharge consents) within 250 m of the Proposed Development. Details are provided in Annex F Table F1 and locations are shown in Figure 9-1: Surface Water Features and Their Attributes (ES Volume II, Document Ref. 6.3).
- 9.4.76 The majority of consented discharges are of treated/untreated sewage effluent from storm tanks, pumping stations, and combined sewer overflows (both private and water company). There are also a significant number of trade effluent, process/chemical and cooling water discharges in the Study Area, reflecting the industrial land uses. Finally, there are two active discharges for raised mine/groundwater where past activity is still having present day water quality impacts.

Abstractions

- 9.4.77 Data provided by the Environment Agency indicates that there are 18 licensed water abstractions within 2 km of the Site, which are presented in Annex F Table F2 and the water attributes plan (presented in Figure 9-1: Surface Water Features and Their Attributes, ES Volume II, Document Ref. 6.3).
- 9.4.78 Twelve abstractions are for groundwater from the underlying Triassic Sherwood Sandstone to the north and west of the Tees Estuary. They are predominantly for industrial, commercial and public service use. There are also groundwater abstractions for water supply.
- 9.4.79 There are six surface water abstractions, from both the Tees and Holme Fleet. Again, the predominant use is the industrial, commercial and public service sector, with one abstraction also for power generation.
- 9.4.80 Details on private water supplies have been requested from the local authorities. Redcar and Cleveland Borough Council and Stockton-on-Tees Borough Council have confirmed that there are no private water supplies in the Study Area in their respective administrative areas.

Water Pollution Incidents

- 9.4.81 The Envirocheck report (Landmark Information Group, 2019) for the Proposed Development indicates that there have been four water pollution incidents of Category 3 (minor) or worse within 250 m of the Site within the last 10 years. Details are given in Annex F Table F3 and locations are shown

in Figure 9-1: Surface Water Features and Their Attributes (ES Volume II, Document Ref. 6.3).

- 9.4.82 The recorded pollution incidents have impacted the Tees Estuary, Dabholm Gut and a tributary of the Fleet. They have been related to pollution from oils, crude sewage and contaminated water associated with firefighting runoff.

Future Baseline

Construction (2022)

- 9.4.83 The future baseline has been determined qualitatively by considering the possibility of changes in the attributes that are considered when deciding the importance of water bodies in the Study Area.
- 9.4.84 Generally, there is an improving trend in water quality and the environmental health of waterways in the UK since the commencement of significant investment in sewage treatment in the 1990s, the adoption of the WFD from 2003, and the application of ever more stringent planning policies. In terms of water quality impacts, the future baseline assumes that all WFD water bodies achieve their planned target status by 2027.
- 9.4.85 It is likely that through the action of new legislative requirements and ever more stringent planning policy and regulation, that the health of the water environment will continue to improve post-2027, although there are significant challenges such as adapting to a changing climate and pressures of population growth that could have a retarding impact. It is also difficult to forecast these changes with any certainty.
- 9.4.86 Under the WFD, The Tees Coastal water body has an objective of achieving Good Ecological Potential by 2027, the Tees transitional waterbody has an objective of achieving Moderate Ecological Potential by 2015, and the Tees S Bank (Estuary) WFD waterbody has an objective of achieving Good Ecological Potential by 2027. It is assumed that these objectives would still be achieved following the completion of the Proposed Development notwithstanding the potential effects of construction of the development.
- 9.4.87 There are additional significant challenges such as adapting to a changing climate (i.e. in general drier summers, wetter winters and an increased frequency of significant storms are forecast for the UK) and the pressures of population / economic growth that could have a retarding effect on the water environment if it is not managed carefully through the design of projects, mitigation, and the maintenance of those mitigating solutions. However, again it is difficult to forecast these changes with any certainty.
- 9.4.88 The assessment of the importance of water bodies takes into account a large range of attributes and does not focus solely on water quality. This assessment takes into account other attributes such as scale, nature conservation designations, fish habitat type, the presence of protected species, social and economic uses. For some of these attributes, it is unlikely that they will change in the future (e.g. water body size, whether a river is likely to support cyprinid or salmonid fish populations, the presence of a designated nature conservation site or bathing water).

Operation (2026)

- 9.4.89 The same future baseline conditions expected during construction will apply to the operation phase (i.e. all WFD targets are met, improving water quality, no change in the presence and status of designated sites).
- 9.4.90 The wider area around the PCC Site is allocated in the local plan for industrial development, and if the Proposed Development was not progressed, then another form of development would likely take its place or it is assumed that the Site would be left in its current state.

9.5 Screening Assessment

- 9.5.1 In Table 9C-5 waterbodies within the Study Area but upstream of the Proposed Development were scoped out of further assessment. In this section a screening assessment is undertaken to determine whether there is a potential pathway by which those remaining waterbodies in the Study Area could be impacted, and whether there are any exempt activities related to the construction or operation of the Proposed Development that do not require assessment.
- 9.5.2 The 'Proposed Development' section of this report within Section 9.1: Introduction provides a description of the Proposed Development from which all potential pathways to an impact and Zones of Influence (ZOIs) have been identified. In accordance with Article 4.9 of the WFD, potential for impacts on protected areas have also been considered with those WFD protected areas within 2 km of the proposed works screened in for further consideration. Further details of the Proposed Development are set out in Chapter 4: Proposed Development (ES Volume I, Document Ref.6.2) and Figures 3-2A to E (ES Volume II, Document Ref.6.3).
- 9.5.3 The following WFD waterbodies were identified in the baseline as relevant to the screening and further assessment:
- Tees Coastal water body (GB650301500005);
 - Tees Transitional water body (GB510302509900);
 - Tees Estuary (S Bank) water body (GB1030250723320);
 - Tees Mercia Mudstone & Redcar Mudstone groundwater body (GB40302G701300); and
 - Tees Sherwood Sandstone WFD groundwater body (GB40301G702000).

Zone of Influence

- 9.5.4 WFD waterbodies have been screened into this assessment using a Zone of Influence (Zol) approach and on the basis of whether they are a designated WFD waterbody within the Zol and so could be directly or indirectly impacted.
- 9.5.5 Table 9C-8 sets out the pathways to an effect, the extent of the Zol and the water bodies that are directly within the Zol.

Table 9C- 8: Zols and relevant WFD water bodies

Potential pathway	Zol and basis for determination	Relevant water bodies	Adjacent water bodies
Construction works adjacent to, on the banks of, and within watercourses can be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the past industrial activities at the Proposed Development Site. This would include works within watercourses for outfall points, pipeline installation beneath or adjacent to watercourses, or any excavations or construction with potential to runoff to watercourses.	All watercourses within and immediately adjacent to the Proposed Development Site or boundary could be impacted by runoff containing fine sediment during construction. These include the Tees Estuary (S Bank), Tees Transitional and Tees Coastal WFD waterbodies and their tributaries. Given dilution and dispersal potential in the tidal Tees Transitional and Tees Coastal waterbodies, a zone of influence up to 1km downstream of the Proposed Development in Tees Coastal WFD waterbody is appropriate.	Tees Estuary (S Bank) WFD water body (including the Mill Race) Tees Coastal WFD water body Tees Transitional WFD waterbody (including Dabholm Gut and Belasis Beck) A number of unnamed drainage ditches.	All watercourses in the Study Area drain to Tees Coastal WFD waterbody, and so there are no additional downstream receptors.
The potential requirement for a new water discharge pipeline and outfall head in Tees Coastal waterbody (including use of a jack up barge or similar during construction) would cause some mobilisation of fine sediments during its installation, which may propagate fine sediment into the water column.	The Zone of Influence for mobilised sediments in the Tees Coastal waterbody 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.	Tees Coastal WFD waterbody	No adjacent receptors given scale of Tees Coastal water body
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	All watercourses or groundwater within or immediately adjacent to the Proposed Development Site or boundary could be impacted by accidental spillages during construction. These include the Tees Estuary (S Bank), Tees Transitional and Tees Coastal WFD surface waterbodies and their	Tees Estuary (S Bank) WFD waterbody (including the Mill Race) Tees Coastal WFD waterbody Tees Transitional WFD waterbody (including Dabholm Gut and Belasis Beck) Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body	All watercourses in the Study Area drain to Tees Coastal WFD waterbody, and so there are no additional downstream surface water receptors. Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body

Potential pathway	ZoI and basis for determination	Relevant water bodies	Adjacent water bodies
carefully controlled and spillages enter existing flow pathways or water bodies directly.	tributaries, and the Tees Mercia Mudstone & Redcar Mudstone and Tees Sherwood Sandstone groundwater bodies. Given dilution and dispersal potential in the tidal Tees Transitional and Tees Coastal waterbodies, a zone of influence up to 1km downstream of the Proposed Development in Tees Coastal WFD waterbody is appropriate.	Tees Sherwood Sandstone WFD groundwater body A number of unnamed drainage ditches	Tees Sherwood Sandstone WFD groundwater body
Excavations, cuttings or piling required during construction of the Proposed Development have the potential to intercept groundwater and may create a pathway for pollutants to be transferred to groundwater if not mitigated.	Groundwater bodies directly beneath the Proposed Development Site.	Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body Tees Sherwood Sandstone WFD groundwater body	Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body Tees Sherwood Sandstone WFD groundwater body
Physical modification of waterbodies which may have adverse morphological impacts (including scour, deposition and habitat loss)	The immediate footprint and environs of waterbodies that will be directly physically altered (within which any scour affects would be expected to occur). Morphological impacts would be to the Tees Coastal waterbody for potential installation of a new outfall head for the water discharge pipeline.	Tees Coastal WFD waterbody	Not applicable, this pathway relates to morphology of the bed of the waterbody that is directly impacted
Surface water runoff from the Site during operation could contain various diffuse urban 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	All surface water runoff is to be discharged to the Tees Bay (Tees Coastal WFD water body), via attenuation for flows and water quality. The ZoI for Tees Coastal water body is not expected to be greater than 1 km downstream or upstream of the outfall	Tees Coastal WFD waterbody	No adjacent receptors given scale of Tees Coastal water body

Potential pathway	Zol and basis for determination	Relevant water bodies	Adjacent water bodies
SuDS) prior to discharge to Tees Bay.	location as a reasonable worst case, given the dynamic nature of this water.		
Process water from the Proposed Development may be discharged to Tees Bay after treatment There is potential for the thermal discharge to impact fish migration, as well as for chemical pollution should any contaminants not be suitably treated.	All treated process water runoff is to be discharged to Tees Bay. The Zol for the estuary is not expected to be greater than 1 km downstream of the (current or alternative) outfall location as a worst case, given the dynamic nature of this coastal water.	Tees Coastal WFD water body	No adjacent receptors given scale of Tees Coastal water body
Foul water will be treated at Northumbrian Water treatment plant at Marske-by-the-Sea, which discharges to Tees Bay	Given that any treated effluent from a wastewater treatment works would be subject to an Environmental Permit, the Zol should be small. A reasonable worst-case scenario would be 1 km downstream from the outfall in the receiving waterbody.	Tees Coastal WFD waterbody	No adjacent receptors given scale of Tees Coastal water body

Screening against Clearing the Waters exemptions

9.5.6 In accordance with Environment Agency Clearing the Water guidance (Environment Agency, 2016), a scoping assessment is not required if the proposed activity meets any one of several criteria that indicate the activity is low risk. The screening criteria are listed in Table 9C- 9, alongside assessment of whether the Proposed Development meets the criteria.

Table 9C- 9: Screening criteria from the Environment Agency Clearing the Waters Guidance

Screening Criteria	Screening Assessment
A self-service marine licence activity or an accelerated marine licence activity that meets specific conditions	The Proposed Development is not applicable for a self-service or accelerated marine licence activity
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	Not applicable
Removing blockages or obstacles like litter or debris within 10 m of an existing structure to maintain flow	Not applicable

Screening Criteria

Screening Assessment

Replacing or removing existing pipes, cables or services crossing over a waterbody – but not including any new structure or supports, or new bed or bank reinforcement	The Proposed Development will require new crossings over (or under) waterbodies rather than replacement or removal, and so is not exempt from further assessment.
'Over water' replacement or repairs to, for example bridge, pier and jetty surfaces – if you minimise bank or bed disturbance	The Proposed Development will require new crossings over (or under) waterbodies rather than replacement or removal, and so is not exempt from further assessment.
The activity was carried out during 2009 to 2014 and a WFD assessment was undertaken. The WFD assessment does not need repeating unless:	You've since changed how you carry out that activity, including method, size or scale, volume, depth, location or timings There's been a pollution incident since your activity was last carried out

9.5.7 The Proposed Development does not meet any of the criteria assessed in Table 9C- 9, therefore a scoping assessment is required.

Flood Risk Activity Exemptions

9.5.8 The Proposed Development can also be screened against the list of Flood Risk Activity exemptions detailed in Table 9C-4.

9.5.9 The following exemptions are relevant:

- 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 – this is relevant to the crossing of the Tees Estuary for the CO2 gathering network. This will either be via an auger bored tunnel (shared with the Natural Gas Connection) or installed using a horizontal directional drilled bore. As an exempt activity this is not assessed further; and
- Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road – the Proposed Development includes numerous pipeline crossings, for example for the CO2 gathering network and electrical connection corridors. These are comparable to a 'service crossing over a river' and do not involve any direct works to the river channel, and so it is considered appropriate that this exemption is applied where relevant.

9.6 Scoping Assessment

Overview

9.6.1 A scoping assessment is required to determine which coastal and estuarine receptors may be impacted by the Proposed Development, and therefore need to be assessed in the WFD impact assessment. These receptors are defined in accordance with the Environment Agency Clearing the Waters Guidance (Environment Agency, 2016) and are based on the water body's quality elements; the receptors include:

- Hydromorphology;
- Water quality;
- Biology – habitats;
- Biology – fish; and
- Protected areas.

9.6.2 The scoping assessment also considers Invasive Non-Native Species (INNS).

9.6.3 As the scoping assessment outlined in the Clearing the Waters Guidance is designed for coastal and estuarine waterbodies it is applied here to the Tees Coastal and Tees Transitional waterbodies only. The fluvial (Tees Estuary (S Bank)) and groundwater bodies (Tees Mercia Mudstone & Redcar Mudstone and Tees Sherwood Sandstone) are taken forward for further assessment on the basis of the screening assessment presented in Section 9.5.

Tees Coastal Waterbody

9.6.4 The footprint of the Proposed Development falls partially within the catchment of the Tees Coastal WFD waterbody, with some works directly within the estuary (i.e. at the existing water discharge outfall location or installation of a new outfall) and other works adjacent to the waterbody (i.e. potential water discharge pipeline installation).

9.6.5 The Tees Coastal waterbody is a HMWB that is currently at Moderate Ecological Potential. There are currently no mitigation measures identified in the Northumbria RBMP for this water body. It has an objective of Good Ecological Potential by 2027 (see Annex A).

Hydromorphology

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

9.6.7 The proposed works have the potential to affect hydromorphological quality elements in the Tees Coastal waterbody through the construction of a potential new outfall and water discharge pipeline should the existing outfall be unsuitable. The pipeline would be installed by trenchless technologies techniques beneath the dunes at Coatham Sands adjacent to the CO₂ Export Pipeline and beneath the seabed to the outfall. At the outfall, the emplacement of a suitable discharge head would be required to be placed via a jack-up barge or similar.

9.6.8 These activities may impact the waterbody by altering the morphology of the sea bed as a result of the lowering of the jack-up-barge legs and emplacement of the outfall head causing disturbance that may lead to

localised scour, as well as the loss of a section of the sea bed to the new structure. This could alter local flow properties to result in local bed or erosion and scour.

- 9.6.9 The scoping assessment of the potential effects to hydromorphology is provided in Table 9C-10. The risk criteria in the table is taken from the Environment Agency guidance on WFD assessment for estuarine and coastal waters (Environment Agency, 2017).

Table 9C- 10: Scoping assessment of risks to hydromorphology

Risk	Requires Impact Assessment	Impact Assessment Not Required	Hydromorphology risk issue(s)
Could impact on the hydromorphology (e.g. morphology or tidal patterns) of a water body at high status		✓ (waterbody not at high status)	N/A
Could significantly impact the hydromorphology (i.e. bed morphology and substrate) of any water body	✓		Proposed activities could adversely impact the morphology of the seabed and local sediment dynamics during installation of the alternative to existing water discharge pipeline and outfall head (if required).
Activity is in a water body that is heavily modified for the same use as your activity	✓		Proposed activities could adversely impact the morphology of Tees Coastal waterbody, a designated heavily modified waterbody

Water Quality – Physico-chemical Quality Elements

- 9.6.10 Impacts to ecological water quality relates to effects on any of the following: Water clarity, temperature, salinity, oxygen levels, nutrients, microbial patterns for longer than a spring neap tidal cycle (approximately 14 days). In addition to the above, if the water body has a history of harmful algae or a phytoplankton status of Moderate, Poor or Bad, this will need to be considered.
- 9.6.11 The potential installation of the outfall head within Tees Bay for the water discharge pipeline could impact water quality temporarily through mobilisation of fine sediments into the water column. There is also potential for chemical spillages and runoff containing contaminants should plant be operated off a jack-up barge (or similar) during construction at the outfall point.
- 9.6.12 During operation, if not mitigated there could be impacts on Tees Coastal chemical status from diffuse urban pollutants in surface water runoff, or as a result of accidental chemical spillages, which are discharged via the outfall to Tees Bay. Similarly, changes in water quality within Tees Bay could occur from operational discharges of treated process wastewater and water from the cooling system (although these would only be allowed under an Environmental Permit).

- 9.6.13 Phytoplankton status has been not been classified for the Tees Coastal water body. There is no monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this waterbody. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment, summarised in Table 9C-11.

Table 9C- 11: Scoping assessment of risks to physico-chemical quality elements

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality Risk Issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	✓		Impacts on Tees Coastal waterbody from mobilisation of sediments, diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which are discharged via the outfall to Tees Bay.
Is in a water body with a phytoplankton status of moderate, poor or bad		✓	There is no monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment
Is in a water body with a history of harmful algae		✓	N/A as per above comment.

Water Quality – Chemical Status

- 9.6.14 As for physico-chemical status, the potential installation of the outfall head within Tees Bay for the water discharge pipeline could impact water quality temporarily during construction through mobilisation of sediments into the water column, which may contain contaminants deposited from the existing outfall from the former Redcar steelworks on the Proposed Development site, as well as the wider surrounding industrial area. There is also potential for chemical spillages and runoff containing contaminants should a jack-up barge (or similar) be used during construction at the outfall point.
- 9.6.15 During operation, if not mitigated there could be impacts on Tees Coastal chemical status from diffuse urban pollutants in surface water runoff, or as a result of accidental chemical spillages, which are discharged via the outfall to Tees Bay. Similarly, changes in water quality within Tees Bay could occur from operational discharges of treated process wastewater and water from the cooling system (although these would only be allowed under an Environmental Permit).
- 9.6.16 The scoping assessment for chemical status is summarised in Table 9C-12.

Table 9C- 12: Scoping assessment of risks to chemical status

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		Potential for a range of chemicals to be discharged to Tees Coastal water body from diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which could be discharged via the outfall to Tees Bay, if not mitigated.
It disturbs sediment with contaminants above CEFAS Action Level 1	✓		Potential for sediment at the outfall location to contain contaminants above CEFAS Action Level 1.

Biology - Habitats

9.6.17 A number of habitats have been highlighted in the Environment Agency Clearing the Waters guidance (Environment Agency, 2016) as being of higher and lower sensitivity based on their resistance to, and recovery rate, from human pressures. Table 9C-13 outlines the higher and lower sensitivity habitats associated with the Tees Coastal water body (based on the Environment Agency WFD water body summary table), which have the potential to be impacted during construction by direct habitat loss, physical disturbance and changes in water quality (e.g. a sediment plume relating to outfall construction), or during operation by discharges from the outfall causing thermal plumes or chemical changes in water quality and deposition of air pollutants.

Table 9C- 13: Higher and Lower Sensitivity Habitats found in the Tees Coastal water body

Higher Sensitivity Habitats	Area (ha)	Lower Sensitivity Habitats	Area (ha)
Mussel beds (including blue and horse mussel)	121.98	Cobbles, gravel and shingle	3.36
Subtidal kelp beds	175.17	Intertidal soft sediment	845.53
		Rocky shore	184.33
		Subtidal rocky reef	7170.03
		Subtidal soft sediments	1219.64

9.6.18 Habitats should be included as part of the WFD impact assessment if the footprint of the activity is any of the following (Environment Agency, 2016), noting that this also includes the footprint of thermal or sediment plumes:

- 0.5 km² or larger in area within the estuarine or coastal water body;
- 1% or more of the water body's area; and

- Within 500 m of any higher sensitivity habitat or covering 1% or more of any lower sensitivity habitat area.

9.6.19 Magic Map (DEFRA, n.d.a) has been used to confirm the proximity of the noted sensitive habitats to the proposed works. The Site boundary directly cross Lower Sensitivity Habitat (Intertidal Soft Sediment, Subtidal Soft Sediment and Subtidal Rock Reef). The nearest Higher Sensitivity Habitat (Mussel beds at South Gare) are over 1 km away.

9.6.20 In accordance with this guidance and as shown in Table 9C-14, the habitats outlined in Table 9C-13 have been scoped into the WFD impact assessment on account of the potential sediment or thermal plume to be produced by the Proposed Development.

Table 9C- 14: Scoping assessment of risks to biological habitat

Footprint is:	Requires Impact Assessment	Impact Assessment Not Required	Biological habitat risk issue(s)
0.5 km ² or larger	✓		On a precautionary basis as no modelling of sediment plume risks has been undertaken, there is the potential for a temporary sediment plume during construction could exceed 0.5 km ² . Modelling of thermal plumes has been undertaken for the operational phase and indicates potential for a plume to exceed 0.5 km ² .
1% or more of the waterbody's area		✓	Footprint of activity is not expected to be this large, with the only physical footprint on the seabed being the outfall point (c.100m ² maximum area).
Within 500 m of any higher sensitivity habitat		✓	Over 1 km to nearest higher sensitivity habitat
1% or more of any lower sensitivity habitat		✓	Footprint of activity is not expected to be this large, with the only physical footprint on the seabed being the outfall point.

Fish

9.6.21 The Tees Coastal water body is known to support several nationally and internationally protected migratory fish species, including salmon, sea trout, European eel, river lamprey and sea lamprey. This water body also supports a range of estuarine and marine demersal and pelagic fish taxa which are of national and international importance, such as cod (*Gadus morhua*), herring (*Clupea herengus*), and whiting (*Merlangius merlangus*).

9.6.22 The potential physical disturbance of the bed associated with works to install a new water discharge outfall (if required), could affect fish within the waterbody with potential impacts including habitat loss, water quality deterioration, underwater sound and visual stimuli. Similarly, there could be operational impacts such as the release of a thermal plume from process water which could affect fish movement or contaminants in surface water

runoff may affect fish population health in the short term (construction works and risk of chemical spillages or failures in long term treatment systems) or longer term (spillages and routine discharges from the development). The scoping assessment of risk to fish is provided in Table 9C-15.

Table 9C- 15: Scoping assessment of risks to biological fish

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

WFD Protected Areas

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

- Special areas of conservation (SAC);
- Special protection areas (SPA);
- Shellfish waters;
- Bathing waters; and
- Nutrient sensitive areas.

9.6.24 The outcome of the scoping assessment for WFD protected areas is shown in Table 9C-16.

Table 9C- 16: Scoping assessment of WFD Protected Areas

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Activity is within 2 km of any WFD protected area	✓		Activity is within 2 km of WFD protected areas – i.e. it overlaps Teesmouth and Cleveland Coast Special Protection Area SPA and Redcar and Coatham Bathing Waters.

Invasive non-native species

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

9.6.26 The scoping assessment of risks from INNS is summarised in Table 9C-17.

Table 9C- 17: Scoping assessment of risks from INNS

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Activity may introduce or spread INNS to a water body	✓		Marine plant and vessels (e.g. jack-up barge) may be required for installation of new outfall head and have the potential to introduce INNS to the Site and wider water body as biofouling or from the discharge of ballast and bilge water. INNS may also be introduced via the addition of construction materials, such as the rock armouring / scour protection to be placed around the outfall head.

Summary

9.6.27 A summary of the receptors and relevant WFD quality elements that have been scoped into the WFD impact assessment for the Tees Coastal is shown in Table 9C-18.

Table 9C- 18: Scoping outcome for the Tees Coastal water body

Receptor	Relevant WFD quality element(s)	Potential risk to receptor
Hydromorphology	Hydromorphological elements	Proposed activities could impact the morphology of the seabed and local sediment dynamics
Water Quality	Physico-chemical and chemical water quality elements	Impacts from mobilisation of sediments, diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages, which are discharged via the outfall to Tees Bay.
Biology: Habitats	Habitats and benthic invertebrates	Potential temporary sediment plume during construction or thermal plume during operation.
Biology: Fish	Fish	Fish behaviour could be affected by chemical or thermal change in the water body, as well as changes in visual stimuli (such as artificial light), underwater noise and physical disturbance.
Protected areas	N/A	Activity is within 2 km of WFD protected areas (i.e. it overlaps Teesmouth and Cleveland Coast SPA and Redcar and Coatham Bathing Waters).

9.6.28 INNS will also be considered within the assessment.

Tees Transitional Water body

- 9.6.29 The footprint of the Proposed Development falls partially within the catchment of the Tees Transitional WFD water body (i.e. the Tees Estuary).
- 9.6.30 There will be a new crossing beneath the Tees Transitional water body for the CO₂ Gathering Network and potentially for the Natural Gas Connection. These crossings will be installed by trenchless technologies and were screened out in Section 9.5 on the basis of being installed at a suitable distance beneath the estuary bed, with no impact on the water body itself.
- 9.6.31 The Tees Transitional waterbody is a HMWB that is currently at Moderate Ecological Potential. There are currently no mitigation measures identified in the Northumbria RBMP for this water body. It has an objective of Good Ecological Potential by 2015.

Hydromorphology

- 9.6.32 The Proposed Development will not have any hydromorphology impacts given that crossings of the Tees Estuary have been screened out above, and there are no other direct impacts to the waterbody or its upstream tributaries.
- 9.6.33 The scoping assessment of the potential effects to hydromorphology is provided in Table 9C-19.

Table 9C- 19: Scoping assessment of risks to hydromorphology

Risk	Requires Impact Assessment	Impact Assessment Required	Not	Hydromorphology risk issue(s)
Could impact on the hydromorphology (e.g. morphology or tidal patterns) of a water body at high status		✓		N/A
Could significantly impact the hydromorphology (i.e. bed morphology and substrate) of any water body		✓		N/A
Activity is in a water body that is heavily modified for the same use as your activity		✓		N/A

Water Quality – Physico-chemical Quality Elements

- 9.6.40 Across the wider Site there will be works in close proximity to Dabholm Gut, The Fleet (Tees Estuary (S Bank)), The Mill Race, Lackenby Channel, Knitting Wife Beck, Kinkerdale Beck, Belasis Beck and minor tributaries of these watercourses for the Natural Gas Connection Corridor, Electrical Connection Corridor, CO₂ Gathering Network and potential highway improvements to allow abnormal indivisible loads from Teesport to travel to the PCC Site during construction. There would be the potential for conveyance of fine sediment and chemical spillages to any of these water bodies through uncontrolled site runoff or through any existing drains that discharge to these watercourses, if not mitigated. All of these water bodies

discharge to Tees Estuary, where there is potential for a cumulative impact in terms of fine sediment impacts or chemical spillages on water quality.

- 9.6.41 Phytoplankton Status is Good for the Tees Transitional water body. There is no monitoring of harmful algae, which it is assumed to indicate that this is not a particular risk for this water body. As such, further consideration of phytoplankton and harmful algae has been scoped out from further consideration in the WFD impact assessment, summarised in Table 9C-20.

Table 9C- 20: Scoping assessment of risks to physico-chemical quality elements

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

Water Quality – Chemical Status

- 9.6.48 As for physico-chemical status, there is potential for chemical spillages and runoff containing contaminants from upstream tributaries, which discharge to the waterbody and also intersect the Site.
- 9.6.49 The scoping assessment for chemical status is summarised in Table 9C-21.

Table 9C- 21: Scoping assessment of risks to Chemical Status

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	✓		Potential for a range of chemicals to be discharged to Tees Transitional waterbody from diffuse urban pollutants in surface water runoff or process water effluent, or as a result of accidental spillages

Risk	Requires Impact Assessment	Impact Assessment Not Required	Water Quality risk issue(s)
It disturbs sediment with contaminants above CEFAS Action Level 1		✓	No direct works to the Tees Estuary or upstream tributaries, and so no disturbance of sediment anticipated.

Biology - Habitats

Table 9C-22 outlines the higher and lower sensitivity habitats associated with the Tees Transitional water body (based on the Environment Agency WFD waterbody summary table).

Table 9C- 22: Higher and Lower Sensitivity Habitats found in the Tees Transitional waterbody

Higher Sensitivity Habitats	Area (ha)	Lower Sensitivity Habitats	Area (ha)
Saltmarsh	46.24	Cobbles, gravel and shingle	0.77
Subtidal kelp beds	4.13	Intertidal soft sediment	400.13
		Rocky shore	26.93
		Subtidal rocky reef	4.13
		Subtidal soft sediments	610.31

- 9.6.54 Magic Map (DEFRA) has been used to confirm the proximity of the noted sensitive habitats to the proposed works. The existing abstraction point is immediately adjacent to Lower Sensitivity Habitat (Intertidal Soft Sediment and Subtidal Soft Sediment). The nearest Higher Sensitivity Habitat (Saltmarsh at Seal Sands) is over 800 m away from the existing abstraction point.
- 9.6.55 Habitats should be included as part of the WFD impact assessment if the footprint of the activity is any of the following (Environment Agency, 2016), noting that this also includes the footprint of thermal or sediment plumes:
- 0.5 km² or larger;
 - 1% or more of the water body's area;
 - Within 500 m of any higher sensitivity habitat or 1% or more of any lower sensitivity habitat.
- 9.6.56 In accordance with this guidance the habitats outlined in Table 9C-23 have been scoped into the WFD impact assessment on account of a potential sediment plume being produced by the installation and removal of the coffer dam.

Table 9C- 23: Scoping assessment of risks to biological habitat

Footprint is:	Requires Impact Assessment	Impact Assessment Not Required	Biological habitat risk issue(s)
0.5 km ² or larger		✓	Any plume relating to runoff laden with fine sediment would not cover this size area, given no direct works to any upstream watercourse is planned.
1% or more of the water body's area		✓	Any plume relating to runoff laden with fine sediment would not cover this size area, given no direct works to any upstream watercourse is planned.
Within 500 m of any higher sensitivity habitat		✓	Over 800 m to nearest higher sensitivity habitat.
1% or more of any lower sensitivity habitat		✓	Any plume relating to runoff laden with fine sediment would not cover this size area, given no direct works to any upstream watercourse is planned.

Fish

- 9.6.57 The Tees Transitional water body is known to support several nationally and internationally protected migratory fish species (e.g. salmon, sea trout, European eel, river lamprey and sea lamprey), whilst also supporting a range of national and international important estuarine and marine demersal and pelagic fish taxa.
- 9.6.58 Release of a pollutants from runoff or spillages during construction could affect fish population health. The scoping assessment of risk to fish is provided in Table 9C-24.

Table 9C- 24: Scoping assessment of risks to biological fish

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	✓		Proposed construction works could cause a chemical change in the water body through disturbance of fine sediment or chemical spillages, which could adversely impact fish health if not mitigated
Could impact on normal fish behaviour like movement, migration, or spawning (e.g. creating a physical barrier, noise, chemical change or change in depth or flow)		✓	Any impact is not considered sufficient is scale to have such an effect given that no direct works are planned to watercourses that would mobilise large amounts of fine sediment.

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Could cause entrainment or impingement of fish		✓	No activities proposed that would have this impact.

9.6.59 WFD Protected Areas

9.6.60 The location of the proposed works in relation to the following WFD protected areas has been considered:

- Special areas of conservation (SAC);
- Special protection areas (SPA);
- Shellfish waters;
- Bathing waters; and
- Nutrient sensitive areas.

9.6.61 The outcome of the scoping assessment for WFD protected areas is shown in Table 9C-25.

Table 9C- 25: Scoping assessment of risks WFD Protected Areas

Risk	Requires Impact Assessment	Impact Assessment Not Required	Biological fish risk issue(s)
Activity is within 2 km of any WFD protected area	✓		Activity is within 2 km of WFD protected areas –Teemouth and Cleveland Coast Special Protection Area SPA and a Eutrophic Coastal Sensitive Area (designated under the Urban Wastewater Treatment Directive).

Invasive non-native species

9.6.62 The scoping assessment of risks from INNS is summarised in Table 9C-26.

Table 9C- 26: Scoping assessment of risks from INNS

Risk	Requires Impact Assessment	Impact Assessment Not Required	INNS Summary
Activity may introduce or spread INNS to a water body		✓	No direct works within the channel of Tees Estuary nor its upstream tributaries, and so no INNS impact anticipated to this waterbody

Summary

9.6.63 A summary of the receptors and relevant WFD quality elements that have been scoped into the WFD impact assessment for the Tees Coastal is shown in Table 9C-27.

Table 9C- 27: Scoping outcome for the Tees Coastal waterbody

Receptor	Relevant WFD quality element(s)	Potential risk to receptor
Hydromorphology	Hydromorphological elements	No Risk
Water Quality	Physico-chemical and chemical water quality elements	Potential for conveyance of fine sediment and chemical spillages to Tees Estuary or its upstream tributaries or through any existing drains that discharge to these watercourses, if not mitigated
Biology: Habitats	Habitats and benthic invertebrates	No Risk
Biology: Fish	Fish	Fine sediment and chemical spillages could impact fish species if not mitigated.
Protected areas	N/A	Fine sediment and chemical spillages could impact fish species if not mitigated.

9.6.64 INNS will also be considered within the assessment.

9.7 WFD Assessment

No Deterioration Assessment

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

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

Potential Construction Phase Impacts

9.7.3 During the construction phase the following surface and ground water environmental impacts may occur, if appropriate mitigation is not applied:

- Temporary impacts on surface water quality due to deposition or spillage of soils, sediments, oils, fuels or other construction chemicals, or through mobilisation of contamination following disturbance of contaminants in sediments, ground or groundwater, or through uncontrolled site run off;
- Temporary impacts on sediment dynamics and morphology in the Tees Estuary as a result of the potential installation of a cofferdams and other construction works associated with the refurbishment of the water abstraction intake structure;
- Temporary impacts on sediment dynamics and morphology in Tees Bay as a result of the potential installation of new water discharge pipeline

and associated outfall head and associated use of marine plant (e.g. jack-up barge);

- Remedial works, including disturbance and / or removal of the ground and groundwater which could potentially remove, relocate or mobilise potential existing contaminants (e.g. during foundation construction, earthworks and excavations);
- Creation of new linkages (e.g. pile foundation construction through existing Made Ground into underlying natural soils or bedrock, pile foundation construction or excavation through an existing aquiclude (impermeable fine / cohesive soils) into a groundwater aquifer; and
- Changes to the hydrogeological regime (e.g. dewatering activities) may impact groundwater.

9.7.4 Prior to construction works commencing, a Ground Investigation and testing followed by a Quantitative Risk Assessment and development of a Remediation Strategy will be completed, as described in ES Chapter 10: Geology and Hydrogeology (ES, Volume I). This will be in accordance with CLR11 Model Procedures for the Management of Contaminated Land (Environment Agency, 2004), BS10175:2011+ A2:2017 Investigation of Potentially Contaminated Sites: Code of Practice (British Standards Institute, 2013b) and the Environment Agency's GPLC1 Guiding Principles for Land Contamination in Assessing Risks to Controlled Waters (Environment Agency, 2010).

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

9.7.6 Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the past heavy industrial activities on this Site. Background sediment quality data (see Annex D) shows that it is quite likely that marginal sediments within the Tees Estuary could contain contaminants at levels that make them unsuitable for disposal at sea. Other watercourses across the Study Area may also contain contaminated sediments due to the past industry in this area and the limited erosion and conveyance ability of these watercourses. Potential need for installation of a new offshore outfall (if the existing pipeline is not in a sufficient state of repair) could also lead to the disturbance and mobilisation of historical contamination that may be found at depth in sediments within Tees Bay.

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

9.7.8 Generally, excessive fine sediment in runoff is chemically inert and affects the water environment through smothering riverbeds and plants, temporarily

changing water quality (e.g. increased turbidity and reduced photosynthesis) and causing physical and physiological adverse impacts on aquatic organisms (such as abrasion, irritation). However, given the past industrial activity on the PCC Site and potentially elsewhere across the Study Area, there may also be the potential for acute and chronic toxic effects to aquatic organisms and possibly a risk to other water uses (e.g. bathing waters).

- 9.7.9 There is a requirement for works within Tees Bay for the discharge outfall and CO₂ Export pipeline. There may also be works in close proximity to The Fleet (Tees Estuary (S Bank)), The Mill Race, Lackenby Channel and Belasis Beck for the Natural Gas Connection Corridor, Electrical Connection Corridor, CO₂ Gathering Network and potential highway improvements to allow loads from Teesport to travel to the PCC Site during construction. There would be the potential for conveyance of fine sediment, debris and any contamination during these construction works to any of these water bodies or downstream water bodies and receptors.
- 9.7.10 During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and / or used on site. There may also be substantial volumes of stagnant water or other liquid/chemical substances within existing drainage and other redundant process infrastructure on the Site. Leaks and spillages of these substances could pollute the nearby surface watercourses if their use or removal is not carefully controlled and spillages enter existing flow pathways or waterbodies directly. Like excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within waterbodies.
- 9.7.11 To allow such substances to enter a watercourse could be in breach of the Environmental Permitting (England and Wales) Regulations 2016 and the Water Resources Act 1991 (as amended). Therefore measures to control the storage, handling and disposal of such substances will need to be in place prior to and during construction.

Construction Phase Mitigation

Surface Water

- 9.7.12 During construction water pollution may occur directly from spillages of polluting substances into waterbodies, or indirectly by being conveyed in runoff from hardstanding, other sealed surfaces or from construction machinery. Construction works will require the dismantling and removal of existing drainage infrastructure that may also contain liquid chemicals and wastewater. Fine sediment may also be disturbed in waterbodies directly or also wash off working areas and hardstanding (including approach roads) into waterbodies indirectly via existing drainage systems or overland. Due to past industrial activity, this sediment may not 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.
- 9.7.13 Prior to construction starting on Site, a Final Construction Environmental Management Plan (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. A Framework CEMP is provided in the Environmental Statement (see Appendix 5A in ES Volume III, Document Ref. 6.4).

- 9.7.14 The Final 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. The principles of the mitigation measures set out below are the minimum standards that the Contractor will implement. However, it is acknowledged that for some issues, there are multiple ways in which they may be addressed. 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.
- 9.7.15 The Final 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 will 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.
- 9.7.16 The potential for adverse impacts would be avoided, minimised and reduced by the adoption of the general mitigation measures which are outlined in the following sections and described in the WMP and CEMP.

Good Practice Guidance

- 9.7.17 The following relevant GPPs have been released to date on the NetRegs website (NetRegs, n.d.) and are listed below. While these are not regulatory guidance in England where the UK government website outlines regulatory requirements, it remains a useful resource for best practice:
- GPP1: Understanding your environmental responsibilities – good environmental practices;
 - GPP 2: Above ground oil storage;
 - GPP3: Use and design of oil separators in surface water drainage systems;
 - GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;
 - GPP 5: Works and maintenance in or near water;
 - GPP 8: Safe storage and disposal of used oils;
 - GPP 13: Vehicle washing and cleaning;
 - GPP 19: Vehicles: Service and Repair;
 - GPP 20: Dewatering underground ducts and chambers;
 - GPP 21: Pollution Incident Response Plans;
 - GPP22: Dealing with spills; and
 - GPP26: Safe storage – drums and intermediate bulk containers.

9.7.18 Where new GPPs are yet to be published, previous Pollution Prevention Guidance (PPG) 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 following PPG:

- PPG6: Working at construction and demolition sites (Environment Agency, 2012);
- PPG7: Safe storage – the safe operation of refuelling facilities (Environment Agency, 2011); and
- PPG18: Managing fire water and major spillages (Environment Agency, 2000).

9.7.19 Additional good practice guidance for mitigation to protect the water environment can be found in the following key CIRIA documents and British Standards Institute documents:

- British Standards Institute (2009) BS6031:2009 Code of Practice for Earth Works (British Standards Institute, 2009);
- British Standards Institute (2013) BS8582 Code of Practice for Surface Water Management of Development Sites (British Standards Institute, 2013a);
- C753 (2015) The SuDS Manual (second edition) (CIRIA, 2015a);
- C744 (2015) Coastal and marine environmental site guide (second edition) (CIRIA, 2015b);
- C741 (2015) Environmental good practice on site guide (fourth edition) (CIRIA, 2015c);
- C648 (2006) Control of water pollution from linear construction projects, technical guidance (CIRIA, 2006);
- C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice (CIRIA, 2004); and
- C532 (2001) Control of water pollution from construction sites – Guidance for consultants and contractors (CIRIA, 2001).

Management of Construction Site Runoff

9.7.20 The measures outlined below, which will be included in the Framework CEMP and the WMP (to accompany the Final CEMP), may be required for the management of fine sediment in surface water runoff as a result of the construction activities:

- Reasonably practicable measures will be taken to prevent the deposition of fine sediment or other material in, and the pollution by sediment of, any existing waterbody, arising from construction activities. The measures will accord with the principles set out in industry guidelines including the CIRIA report 'C532: Control of water pollution from construction sites' (CIRIA, 2001). Measures may include use and maintenance of temporary

lagoons, tanks, seeding / covering of earth stockpiles, earth bunds, straw bales and sandbag walls, proprietary measures (e.g. lamella clarifiers or contained chemical treatment) and fabric silt fences or silt screens as well as consideration of the type of plant used.

- A temporary drainage system will be developed to prevent runoff contaminated with fine particulates from entering surface water drains without treatment. This will include identifying all land drains and water bodies on the Site and ensuring that they are adequately protected using drain covers, sandbags, earth bunds, geotextile silt fences, straw bales, or proprietary treatment (e.g. lamella clarifiers). Discharge to such water bodies (directly or indirectly) will only be made with the permission of the Environment Agency (or Northumbrian Water if to the public foul sewer) and with the necessary treatment measures implemented.
- Where possible, earthworks will be undertaken during the drier months of the year and will avoid periods of wet weather, if possible, to minimise the risk of generating runoff contaminated with fine particulates. However, it is likely that some working during wet weather periods will be unavoidable, in which case mitigation measures will be implemented to control fine sediment laden runoff.
- To protect waterbodies from fine sediment runoff, topsoil/subsoil will be stored a minimum of 20 m from any waterbody on flat lying land (and further if the ground is sloping, subject to a site risk assessment and observational monitoring) and not within the fluvial floodplain. Where this is not possible, and it is to be stockpiled for longer than a two-week period, the material will either be covered with geotextile mats or seeded to promote vegetation growth. In all situations, runoff from the stockpile will be prevented from draining to a watercourse without prior treatment. If located where there is a risk of tidal flooding or within fluvial Flood Zone 2, additional measures will be provided to reduce the risk of erosion (e.g. by protecting the base using spaced out concrete blocks, pegged in geotextile sheets, etc.).
- Appropriately sized runoff storage areas for the settlement of excessive fine particulates in runoff will be provided. It is likely that treated water will then be pumped under a temporary Water Activity Permit from the Environment Agency or agreed with Northumbrian Water to an existing Treatment Works (assumed to be treated at the Brans Sands WwTW).
- Mud deposits will be controlled at entry and exit points to the Site using wheel washing facilities and / or road sweepers operating during earthworks activities or other times as considered necessary.
- Equipment and plant are to be washed out and cleaned in designated areas within the Site compound where runoff can be isolated for treatment before discharge to surface water drainage under appropriate consent and / or agreement with Environment Agency and / or Northumbrian Water, or otherwise removed from site for appropriate disposal at a licensed waste facility.
- Debris and other material will be prevented from entering surface water drainage, through maintenance of a clean and tidy site, provision of

clearly labelled waste receptacles, grid covers and the presence of site security fencing.

- The WMP will include details of pre, during and post-construction water quality monitoring. This will be based on a combination of visual observations, frequent in situ testing using water quality probes, and periodic sampling for laboratory analysis.

Management of Spillage Risk

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

- Fuel will be stored and used in accordance with the Control of Substances Hazardous to Health Regulations 2002, and the Control of Pollution (Oil Storage) (England) Regulations 2001. Particular care will be taken with the delivery and use of concrete and cement as it is highly corrosive and alkaline.
- Fuel and other potentially polluting chemicals will either be in self bunded leak proof containers or stored in a secure impermeable and bunded area (minimum capacity of 110% of the capacity of the containers).
- Any plant, machinery or vehicles will be regularly inspected and maintained to ensure they are in good working order and clean for use in a sensitive environment. This maintenance is to take place off site if possible or only at designated areas within the Site compound. Only construction equipment and vehicles free of all oil/fuel leaks will be permitted on site. Drip trays will be placed below static mechanical plant.
- All washing down of vehicles and equipment will take place in designated areas and wash water will be prevented from passing untreated into watercourses.
- All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and watercourses, and away from drains as far as reasonably practicable. Vehicles will not be left unattended during refuelling.
- As far as reasonably practicable, only biodegradable hydraulic oils will be used in equipment working in or over watercourses. All fixed plant used on the Site will be self-bunded. Mobile plant is to be in good working order, kept clean and fitted with plant 'nappies' at all times.
- A Pollution Prevention Plan will be prepared and included alongside the CEMP. Spill kits and oil absorbent material will be carried by mobile plant and located at high risk locations across the Site and regularly topped up. All construction workers will receive spill response training and toolbox talks.
- The Site will be secure to prevent any vandalism that could lead to a pollution incident.

- Construction waste / debris are to be prevented from entering any surface water drainage or water body.
- Surface water drains on roads or within the construction compound will be identified and, where there is a risk that fine particulates or spillages could enter them, the drains will be protected (e.g. using covers or sandbags).
- Suitable facilities for concrete wash water (e.g. geotextile wrapped sealed skip, container or earth bunded area) will be adequately contained, prevented from entering any drain, and removed from the Site for appropriate disposal at a suitably permitted waste facility.
- Water quality monitoring of potentially impacted watercourses will be undertaken to ensure that pollution events can be detected against baseline conditions and can be dealt with effectively.

9.7.22 In addition, any site welfare facilities will be appropriately managed, and all foul waste disposed of by a licensed contractor to a suitably permitted facility.

Management of Risks to Groundwater

9.7.23 Construction phase mitigation measures in relation to the hydrogeological environment are summarised here, where different to the measures described above:

- Prior to the design and construction of the project, a GI will be undertaken to assess the degree to which the Site is contaminated and identify the potential impacts this may have to site users and the environment. The findings will feed into the detailed design process and the CEMP will be updated and implemented in order to mitigate the effect of potential impacts of the Proposed Development during construction so that appropriate measures are taken.
- Should the GI prove the need for piling or soil mixing to take place, the construction methodology will be assessed to reduce as far as reasonably practicable the risk of development of preferential pathways (e.g. groundwater flow) between the Made Ground present and the underlying Secondary 'A' or 'B' bedrock Aquifers. If piling is required, low noise piling techniques will be adopted where possible.
- If during the course of the development any contamination is found which has not been previously identified, an appropriate risk assessment will be prepared. Any actions resulting from the risk assessment will be agreed with the Local Planning Authorities / Environment Agency / Natural England along with any remedial measures. Contamination assessment will be in accordance with the CIRIA C552 - Contamination Land Risk Assessment, A Guide to Good Practice and the Model Procedures for the Management of Contaminated Land, CLR11 (Environment Agency, 2004). These remedial measures will be adopted as part of the Proposed Development.

Treated Water Outfall

9.7.24 Although still operational for small discharges, the condition of the existing outfall from the former steelworks for long term use for this Proposed

Development is unconfirmed. If it is possible to re-use the existing tunnel, any maintenance activities are likely to be very minor and limited to inspection and hand-based maintenance.

- 9.7.25 If it is not possible to re-use the existing discharge tunnel, a new pipeline (estimated 0.8 m diameter) would be installed adjacent to the CO₂ Export Pipeline as shown on ES Figure 3-2A (ES Volume II (Document Ref. 6.3)). This would be installed using trenchless techniques (micro-bored tunnel) from the PCC Site beneath Coatham Dunes and Sands and out to Tees Bay. Construction would be carried out at the same time as the CO₂ Export Pipeline (see below).
- 9.7.26 The emplacement of a new outfall head for the new water discharge pipeline would involve the following potential activities:
- Preliminary dredge;
 - Final assembly, float and positioning of the outfall head;
 - A flood and sink exercise or similar works to position the outfall head;
 - Either piling or pin drilling to secure the outfall head;
 - The positioning of rock armouring/scour protection around the outfall head (assumed worst-case volume of rock armour 250 m³ equating to an area on 100 m²);
 - Final assembly, pipeline jointing, connections, fabrication and ancillary commissioning works to install a safe and fit for purpose discharge pipeline; and
 - The presence of vessels such as work boat(s) and/or barge(s) to support the installation process.
- 9.7.27 The use of trenchless technologies beneath the foreshore would minimise direct impact to the sea bed and associated sediment mobilisation and scour but would require presence of a jacking rig seaward of the South Gare dune complex, a punch-hole / break-out through the seabed at the intended discharge point and connection into an outfall head (if design required it), and the presence of vessels such as work boat(s) and/or barge(s) to support the refurbishment process.
- 9.7.28 Appropriate licences and permits will be obtained from the Environment Agency and Marine Management Organisation with regards to discharges and construction of the outfall tunnel within Tees Bay, and all conditions would be adhered to. Best practice construction approaches would be adopted, as at the abstraction point described above.

Construction of CO₂ Export Pipeline

- 9.7.29 Construction of the CO₂ Export Pipeline) from the Compressor Station) across Coatham Dunes and Coatham Sands to Mean Low Water Springs (MLWS) (including into the Teesmouth and Cleveland Coast SPA/Ramsar and the Teesmouth and Cleveland Coast SSSI) will be undertaken using trenchless technologies (HDD) beneath through the dunes and sands and out into Tees Bay.

- 9.7.30 The corridor within which the CO₂ Export Pipeline will run as shown on Figure 3-2A (ES Volume II, Document Ref. 6.3). The CO₂ Export Pipeline will extend beyond MLWS. The export pipeline would be extended beyond this point to connect to the off-shore storage facility, however, consent for this section below MLWS of the pipeline is not being sought as a part of the DCO Application.

Construction of CO₂ Gathering Network and Natural Gas Connection

- 9.7.31 The CO₂ Gathering Network will be an above ground pipeline installed utilising existing support infrastructure (i.e. existing pipe racks, sleeper tracks, culverts and pipe bridges), where feasible. In the event that a pipe rack is at capacity, the pipe rack will be extended to accommodate the additional line. Alterations will not be any lower than the lowest pipe or soffit of the existing structure, so as to avoid any increase in flood risk. The potential section of CO₂ Gathering Network on the north bank of the Dabholm Gut and running north from Bran Sands to the PCC Site may be installed underground using open-cut techniques. The proposed routing for the CO₂ Gathering Network pipelines are shown on Figure 3-2E: Development Areas (ES Volume II, Document Ref. 6.3). No new crossings of watercourses are required with the exception of Tees Estuary.
- 9.7.32 The CO₂ Gathering Network will need to cross the Tees Transitional waterbody. This will use trenchless techniques beneath the waterbody (either micro-bored tunnel shared with the Gas Connection or an HDD). A temporary works compound will be required at the drilling launch site in Navigator Terminals and at the drilling exit site within the Teesworks site (for the tunnel) or on Dabholm Gut (for the HDD).

Construction of Electrical Connection Corridor

- 9.7.33 The Electrical Connection between the Electricity Generating Station and National Grid's Tod Point sub-station would comprise up 275 kV electrical cables and control system cables which would be installed below ground. The corridor within which the Electrical Connection Corridor will run is shown on Figure 3-2C: Development Areas (ES Volume II, Document Ref. 6.3).
- 9.7.34 As with the CO₂ Gathering Network, no open-cut crossings of watercourses are required.

Water Quality Monitoring

- 9.7.35 During construction it is proposed to undertake a water quality monitoring programme to ensure that mitigation measures are operating as planned and preventing pollution. This is standard practice for construction works of this type, and full details will be outlined in the WMP (accompanying the Final CEMP). The purpose of the monitoring programme will also be to ensure that should pollution occur it is identified as quickly as possible and appropriate action is taken in line with a Pollution Prevention Plan.
- 9.7.36 The water quality monitoring programme will be developed by the Principal Contractor in consultation with the Environment Agency and Marine Management Organisation during the process of obtaining environmental permits/licences for works affecting, or for temporary discharges to, watercourses within the Site.

Construction Phase Assessment

Tees Coastal Waterbody (Tees Bay)

Surface Water Quality – Suspended Fine Sediment

- 9.7.37 Should it not be possible to re-use the existing water discharge tunnel and outfall to Tees Bay unchanged, then a new pipeline would be installed adjacent to the CO₂ Export Pipeline as shown on Figure 3-2A: Development Areas (ES Volume II, Document Ref. 6.3). The water discharge and CO₂ Export pipelines would be installed beneath the seabed using trenchless technologies and thereby avoiding sediment disturbance. The discharge pipeline would then be connected to a new outfall head, positioning of which would involve a flood and sink exercise, potential piling or pin drilling and installation of rock armour / scour protection. A jack-up-barge or similar would be used during construction.
- 9.7.38 Emplacement of the outfall head and lowering of the jack-up-barge legs (or similar) has the potential to temporarily disturb sediment on the seabed of the Tees Coastal water body. Increased suspended sediment concentrations would result in a temporary increase in the turbidity of the water column and could potentially (subject to sediment properties and chemical composition) cause an oxygen demand within the sediment plume.
- 9.7.39 However, it is considered that any sediment plume arising from this construction activity poses a limited risk to water quality as open seas have a large capacity to accommodate an increase in oxygen demand, and fish and mammals are able to avoid the plume. Furthermore, the relatively shallow inshore of the North Sea is a naturally turbid environment. There is, however, potential to have a short-term impact on the 'Redcar Coatham' Bathing Water for works around the discharge point, and so works to the outfall head may require short-term restrictions on bathing.
- 9.7.40 Construction works on the PCC Site itself, including installation of new drainage infrastructure has the potential to mobilise sediments e.g. soils exposed during excavations or levelling, which could be directed to Tees Bay through existing drainage infrastructure. However, implementation of best practice construction approaches, as outlined above, including measures outlined in the Final CEMP would mitigate for this.
- 9.7.41 Overall, given that the construction phase mitigation measures described above would be in place, it is considered that there would be a very localised and temporary minor impact to the Tees Coastal water body due to works to the potential new outfall head. This would not be significant at the water body scale and any sediment plume would be very quickly dispersed by the prevailing hydrodynamic conditions. As such, no reduction in any WFD element would occur due to suspended fine sediments, nor any non-compliance with WFD objectives for the water body.

Surface Water Quality – Chemical Spillages

- 9.7.42 If appropriate mitigation measures are implemented as described in 'Construction Phase Mitigation' above, including water quality monitoring, then the risk of chemical spillages to the Tees Coastal water body would be minor. The main risk would result from working directly over and within the

waterbody itself for installation of the water discharge pipeline outfall head, and the requirement for use of associated marine plant and jack-up-barge (or similar), from which spillages of fuels, oils and other chemicals could occur. As previously described, the impact to Tees Bay would not occur if the existing pipeline and outfall can be used.

- 9.7.43 There is also an indirect risk of spillages entering the water body from works undertaken at the PCC Site, whereby any spillages that enter the existing drainage infrastructure would discharge to Tees Bay through the existing outfall tunnel. Overall, this impact is considered minor given the mitigation outlined above, including best practice measures in the Final CEMP, and the fact that Tees Coastal water body has a large capacity to dilute and disperse pollutants. No reduction in any WFD element would therefore be anticipated from chemical spillages, or any prevention of future improvement.

Marine Ecology

- 9.7.44 The following construction activities have the potential to result in permanent and temporary direct loss and physical disturbance of subtidal sandflat habitat in the Tees Coastal water body. These include:
- Dredging of a pocket for emplacement of the outfall head;
 - The installation of rock armouring / scour protection around the outfall head;
 - Creation of breakout points within the foreshore using trenchless technologies for the water discharge tunnel and the CO₂ Export pipeline; and
 - Anchoring, grounding or positioning of work boat(s) and /or barge(s) on the seabed to support the construction works.
- 9.7.45 Soft sediment habitats characterise much of the footprint of the marine construction works including subtidal sandflats, which are representative of Annex I habitat and are also afforded national conservation protection. Soft sediment habitats are, according to the Marine Life Information Network's (MarLIN) Marine Evidence Based Sensitivity Assessment (MARESA), known to be highly resilient to direct physical disturbance arising from substrate loss and penetration (e.g. from anchoring or grounding of vessels).
- 9.7.46 Following temporary loss and physical disturbance of subtidal habitats, including Annex I subtidal sandflat habitat, recovery would be expected to occur over reasonable timescales (i.e. <5 years) within this area following completion of construction. The habitats known to be present are well adapted to regular natural disturbance from for example, storm events. Furthermore, the spatial extent of impact would be small and highly localised to the marine construction works.
- 9.7.47 However, any habitat can be regarded as intolerant of permanent loss. Emplacement of the outfall head and installation of the associated rock armouring / scour protection would result in a direct localised but permanent subtidal habitat loss, along with loss of the associated infaunal and epifaunal communities under the footprint of the structure.

- 9.7.48 The exact volume of rock armouring required for protection of the outfall is as a worst-case, expected to be around 250 m³. This presents a significant surface area for colonisation by flora (e.g. algae) and fauna (e.g. barnacles, tube worms, sea squirts and soft corals such as *Alcyonium digitatum*). Following placement and during the remaining construction phase and into the operational phase, a succession in the benthic communities associated with this structure is likely to be observed, transitioning from early colonisers (e.g. diatoms, filamentous algae and barnacles) to a climax community. In terms of biomass, this newly available food resource can be expected to offset to some extent the loss of infauna habitats.
- 9.7.49 Whilst construction of the Proposed Development can be expected to alter the extent, distribution and structure of habitats and communities under the footprint of the marine works, these adverse impacts are only predicted to occur at the local level. In the context of the availability of similar habitat across the wider WFD water body, the impact of direct loss and physical disturbance to subtidal habitats and communities under the footprint of the marine construction works is predicted to be not significant.
- 9.7.50 The area under the footprint of the marine construction works and outfall head is not considered to provide particularly important functional habitat for most fish and shellfish. The only exception is sandeel (*Ammodytes* spp.) as there is evidence to suggest that this species utilises inshore areas as a nursery ground (see Appendix 14B: Fisheries and Fish Ecology (ES Report, Volume III, Document Ref. 6.4)). This species exhibits a degree of site fidelity and is therefore likely to be more vulnerable to habitat disturbance than other fish species.
- 9.7.51 Nonetheless, the majority of species and life stages known to be present in the area are mobile and would be able to move away from the area of disturbance. Owing to the prevalence of the same or similar habitats within the area, fish and shellfish are expected to be relatively tolerant of displacement. Recovery of species populations and habitat function under the footprint of the temporary marine construction works would also be expected. This includes the recolonisation of suitable sediments by sandeels following completion of the works. Overall, the sensitivity of fish and shellfish to direct loss and physical disturbance is considered to be low.
- 9.7.52 Increased suspended sediment concentrations from the construction works associated with the Proposed Development has the potential to result in smothering and physical disturbance of benthic habitats. However, the subtidal habitats and communities known to be present around the intake are considered to have a medium sensitivity to smothering and scouring effects (see Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2)). However, any contaminated sediments which are disturbed during the construction phase would be expected to disperse, settle out and be potentially further redistributed over a wide area and thus, the potential for impact to marine ecological receptors would be limited. Given the mitigation (including use of a cofferdam to minimise dispersion of sediment and sediment-bound contaminants), no adverse impact is anticipated at the water body scale.

- 9.7.53 Mobile fish species or life stages would be expected to move away from unfavourable conditions and would be capable of returning to an area once adverse conditions had abated. Although demersal life stages are less able to adapt to adverse levels of turbidity and deposition, many are known to be reasonably tolerant of smothering. Sandeel are adapted to live in highly dynamic environments characterised by mobile sediments and variable turbidity and so there is considered limited potential for physiological damage (e.g. disruption to feeding or respiratory) or mortality of adult, juvenile or larval sandeel. Taking into consideration the design mitigation, the resultant nature of potential impacts to fish and shellfish from increased turbidity and deposition (i.e. small in extent, temporary and short-term) and the low sensitivity of fish and shellfish to increased turbidity and smothering means that there is no significant impact at the water body scale.
- 9.7.54 An assessment of the potential impact of underwater sounds during construction on fish is presented in ES Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref.6.2). This could include sounds relating to drilling of pin piles for installation of the outfall head, rock placement on the seabed, marine vessel movements. None of the construction activities are expected to occur for longer than 12 hours and in many cases are unlikely to occur continuously for more than a few hours. Also, the fish with high hearing sensitivity are pelagic species, highly mobile and free-ranging and so unlikely to remain within the impact zone. Thus, no injurious impacts in fish are anticipated. Overall, behavioural disturbance to fish from continuous sound sources would be localised, short-term and intermittent.
- 9.7.55 In terms of visual stimuli, changes may occur from land and marine-based construction activities (such as artificial lighting) which could lead to behavioural responses in fish and shellfish taxa who are photoreceptive. However, any changes would be highly localised to the construction works or Site and therefore the spatial extent of any disturbance would be small. The majority of lighting, plant and personnel would also be mobile and so any effect would be temporary, short-term and intermittent.
- 9.7.56 Given the above discussion, there is not anticipated to be any deterioration in any WFD ecological element as a result of the construction works within the Tees Coastal water body, or prevention of future objectives being met.

Introduction and Spread of Invasive Non-Native Species

- 9.7.57 INNS have the potential to out-compete native species with possible detrimental impacts to native habitats via species loss, modifications to ecosystems and the introduction of disease and pathogens leading to mortality.
- 9.7.58 Marine plant and vessels required for construction of the Proposed Development represents the most likely pathway for the introduction of INNS, either from biofouling or from the discharge of ballast water and bilge water. However, INNS may also be introduced via construction materials (e.g. placement of rock armouring required around the outfall head). The introduction of hard artificial structures also has the potential to facilitate the colonisation of INNS as these are known to disproportionately favour non-native species compared to naturally occurring hard-bottom species due to

the absence of competition and predation. New substrates or structures can also serve as 'stepping stones' in otherwise inhospitable areas, which can assist with the expansion of species distributions.

- 9.7.59 All project vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of marine INNS.
- 9.7.60 All project vessels shall adhere to the International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines).
- 9.7.61 Given adherence to these guidelines, the risk of introduction and spread of INNS through ballast water exchange and biofouling would be reduced and therefore the probability of transmission is low. Given the relatively small volume of rock armouring which would be required to protect the treated water outfall head, the risk of INNS transmission on this material is also low.
- 9.7.62 The prevalence of existing INNS within the vicinity of the Site is limited and none appear to be detrimental to native species habitats, diversity or ecosystem functioning. Given the limited extent of loss and physical disturbance to habitats and species, and volume of artificial substrate added during construction, the risk of existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is considered to be very low and will not cause detriment or prevent future improvement of the WFD water body.

Morphological Impacts

- 9.7.63 Should the existing Tees Coastal water discharge outfall be used, then only minor refurbishment with hand tools is assumed and there would be no morphological impacts to the waterbody. However, if a new water discharge tunnel be required, then a new outfall consisting of a diffuser head weighed down with rock armour will be installed as previously described. The water discharge and CO₂ Export pipeline will be installed beneath the seabed using trenchless technologies until close to the position of the diffuser head, thereby mitigating any morphological impact. Such impacts would be limited to the loss of an area the subtidal seabed for the outfall structure itself and potential sediment disturbance beneath the jack-up-barge legs. Given the dynamic nature of the water body with significant sediment transport, any disturbance beneath the jack-up-barge legs would be restored naturally in under five years as described above. However, there will be permanent loss of seabed beneath the outfall head itself and adjacent scour protection and rock armouring. This is anticipated to be an area of 100 m² as a worst case scenario. The morphological loss of a small area of the seabed is insignificant at the scale of the WFD water body (88 km²), and so is not considered to cause a deterioration or prevention of future improvement.

Tees Transitional Waterbody (Tees Estuary)

Surface Water Quality – Suspended Fine Sediment

- 9.7.64 Across the wider Site there will be works in close proximity to Dabholm Gut, The Fleet (Tees Estuary (S Bank)), The Mill Race, Lackenby Channel, Belasis Beck and minor tributaries of these watercourses for the Natural Gas

Connection Corridor, Electrical Connection Corridor, CO₂ Gathering Network and potential highway improvements to allow loads from Teesport to travel to the PCC Site during construction. There would be the potential for conveyance of fine sediment to any of these water bodies through uncontrolled site runoff or through any existing drains that discharge to these watercourses, if not mitigated. All of these water bodies discharge to Tees Estuary, where there is potential for a cumulative impact in terms of fine sediment impacts on water quality.

- 9.7.65 Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge will be implemented as described in the Final CEMP and WMP. This would include implementation of a temporary site drainage system. Given this mitigation, any residual impact would be temporary and minor within the waterbodies directly affected and are not significant to the Tees Estuary at the WFD waterbody scale, particularly given the dispersal and diluting potential of the estuary.
- 9.7.66 Overall, no reduction in any WFD element in the Tees Estuary is anticipated due to suspended fine sediments, nor any non-compliance with WFD objectives. As such, there would be no subsequent impact on other WFD elements including status of fish and protected areas.

Surface Water Quality – Chemical Spillages

- 9.7.67 There is also an indirect risk of spillages entering the waterbody from works undertaken across the wider Site, whereby uncontrolled site runoff enters watercourses (or on-line ponds) and pollutants propagate downstream to the Tees Estuary. However, this risk is considered minor given the mitigation outlined above, including best practice measures in the CEMP, and the fact that Tees Transitional water body has a large capacity to dilute and disperse pollutants. No reduction in any WFD element would therefore be anticipated from chemical spillages, or any prevention of future improvement. If appropriate mitigation measures are implemented as described in 'Construction Phase Mitigation' above, including water quality monitoring, then the risk of chemical spillages to the Tees Transitional waterbody and its upstream tributaries would be low. As such, there would be no subsequent impact on other WFD elements including status of fish and protected areas.

Morphological Impacts

- 9.7.68 No morphological impacts are anticipated to any of the tributaries of the Tees Estuary catchment. No open-trench crossings are required for any of the required connection corridors (Natural Gas Connection Corridor, Electrical Connection Corridor, CO₂ Gathering Network) and so there would be no disturbance of river beds. Where crossings are needed these are to use existing pipe racks, sleeper tracks, culverts and existing pipe bridges, service crossings of this nature are an exempt activity. As such there is no morphological impact to watercourses, and no deterioration or prevention of improvement in morphology for the wider WFD waterbody.

Tees Estuary (S Bank) Water body (The Fleet)

Surface Water Quality – Suspended Fine Sediment

- 9.7.69 There will be works undertaken in close proximity to the Tees Estuary (S Bank) water body and its tributary The Mill Race and several unnamed ditches for the Natural Gas Connection Corridor, Electrical Connection Corridor and CO₂ Gathering Network. However, there are no direct works to these watercourses for crossings or outfalls.
- 9.7.70 During works in close proximity to the above watercourses, there would be the potential for conveyance of fine sediment to any of these water bodies through uncontrolled site runoff or through any existing drains that discharge to these watercourses, if not mitigated.
- 9.7.71 Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge will be implemented as described in a Final CEMP and WMP. This would include implementation of a temporary site drainage system. Given this mitigation, any residual impact would be negligible within the water bodies directly affected and are not significant to the Tees Estuary (S Bank) at the WFD waterbody scale, particularly given the dispersal and diluting potential of this river.
- 9.7.72 Overall, no reduction in any WFD element in the Tees Estuary (S Bank) is anticipated due to suspended fine sediments, nor any non-compliance with WFD objectives.

Surface Water Quality – Chemical Spillages

- 9.7.73 If appropriate mitigation measures are implemented as described in 'Construction Phase Mitigation' above, including water quality monitoring, then the risk of chemical spillages to the Tees Estuary (S Bank) waterbody would be minor. The main risk would result from working immediately adjacent to the river (and its tributaries such as The Mill Race), and for work over the river to install the new pipe bridge. During this work there is potential for spillages of fuels, oils and other chemicals.
- 9.7.74 There is also an indirect risk of spillages entering the water body from works undertaken across the wider Site, whereby uncontrolled site runoff enters watercourses (or on-line ponds) and pollutants propagate downstream to the Tees Estuary (S Bank) waterbody. However, this risk is considered negligible given the mitigation outlined above, including best practice measures in the Final CEMP. No reduction in any WFD element would therefore be anticipated from chemical spillages, or any prevention of future improvement.

Aquatic Ecology

- 9.7.75 Works associated with construction of the connection corridors could result in runoff laden with fine sediment or containing pollutants into the water body as described above. This could potentially lead to temporary adverse effects on aquatic ecology in the Tees Estuary (S Bank) and its tributaries, if not mitigated. However, given the implementation of the best practise mitigation described in 'Construction Phase Mitigation' above, including the Final CEMP, temporary site drainage systems and spillage controls and response protocols, then the risk is temporary and minor to aquatic ecology. No

adverse effect to any of the ecological WFD parameter would be anticipated or prevention of future improvement.

Morphology Impacts

- 9.7.76 There are no morphological impacts predicted to the Tees Estuary (S Bank) water body as there are no direct works proposed to the river or its tributaries.
- Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body & Tees Sherwood Sandstone WFD groundwater body*
- 9.7.77 During construction works there is the potential for impact to ground water through the creation of new pathways, or exacerbation of existing pathways that may open or modify potential pollutant linkages (e.g. from piling foundations). Excavation of cuttings may liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits (sands, clays, gravels) that are intercepted. This liberated groundwater may not be suitable for discharge without treatment of contaminants. There is also potential for underlying groundwater to be contaminated from spillages associated with vehicles, construction materials and storage of fuels, oils and other chemicals.
- 9.7.78 Appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Final CEMP and WMP. This would also outline pollution control measures, such as the need for all fuel and chemical storage areas to be bunded. Foundations and services will be designed and constructed to prevent the creation of pathways for the migration of contaminants and will be constructed of materials that are suitable for the ground conditions and designed use. For example, below ground connection corridor pipelines would be designed in accordance with current good practice and applicable guidance to ensure pipes are protected from potential impacts associated with contamination. All waters removed from excavations by dewatering will be discharged appropriately, subject to the relevant licences being obtained.
- 9.7.79 If during the course of the development any contamination is found which has not been previously identified, an appropriate risk assessment will be prepared. Any actions resulting from the risk assessment will be agreed with the Local Planning Authorities / Environment Agency / Natural England along with any remedial measures. These remedial measures will be adopted as part of the Proposed Development.
- 9.7.80 The need for piling works will be assessed Study. Any piling works required would be planned in accordance with best practice guidance '*Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention, EA National Groundwater & Contaminated Land Centre Report NC/99/73* (Environment Agency, 2001). Any piling operations required would be subject to a works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements.
- 9.7.81 With the implementation of the mitigation measures to be described in the Final CEMP, WMP and Chapter 10: Geology and Hydrogeology of the ES (Volume I), any residual impacts to the groundwater body would be temporary and minor, and would not be significant at the water body scale. The

Proposed Development is therefore compliant with the WFD objectives for these two water bodies during construction.

Potential Operation Phase Impacts

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

- Impacts on receiving water bodies from diffuse urban pollutants in surface water runoff, or as a result of accidental spillages;
- Changes in water quality within Tees Bay from operational discharges from the PCC Site including the discharge of treated process wastewater and water from the cooling system;
- Potential nutrient enrichment of ponds located adjacent to the PCC Site from atmospheric deposition of nitrogen emitted from the Power and Capture Plant (see Chapter 8: Air Quality and Chapter 12: Terrestrial Ecology, ES, Volume I); and
- Impacts on morphology of waterbodies.

Operation Phase Mitigation

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

9.7.84 The Power-Capture & Compression site at STDC will need to have access to an effluent treatment and disposal route and this will need to be permitted for the final development approval with the Environment Agency and local authorities prior to construction of the development. The types of effluent that will be seen as part of the project development during its operating life will be:

- Clean Surface water
- Potentially Contaminated Surface Water – no amine contamination
- Potentially Contaminated Surface Water – amine contaminated
- Process water from Capture plant DCC (contains ammonia or urea)
- Process water from CO₂ compression and dehydration (weak carbonic acid & numerous streams)
- Blowdown from cooling towers
- Blowdown from steam boilers
- Hazardous liquid wastes
- Foul Water (sewage)

9.7.85 These will be managed as follows:

- Clean surface water which can be discharged with minimal treatment;

- Potentially contaminated surface water (no amine contamination), process water (except from the Carbon Capture Plant) and blowdown which can be discharged following onsite treatment (e.g. dosing);
- Process water from the Carbon Capture plant DCC ammonia or urea) which can be discharged following treatment at either an on-site treatment plant or off-site at Brans Sands (and returned to the site for discharge);
- Wastes requiring off-site treatment or disposal (hazardous liquid wastes including amine contaminated water); and
- foul water treated at Northumbrian Water's Marske-by-the-Sea treatment plant.

Surface Water Drainage

- 9.7.86 A new surface water drainage network and management system will be provided for the PCC Site that will provide adequate interception, conveyance and treatment of surface water runoff from buildings and hardstanding. The connection corridors will not require drainage. As surface water discharge will be to Tees Bay via the Water Discharge Corridor, no attenuation capacity is required.
- 9.7.87 Due to the nature of the Proposed Development it is likely that a range of different diffuse pollutant types may be present, with concentrations of these pollutants varying depending on many factors. However, this risk will be offset by the fact that the Site is an existing brownfield site that is currently not operating (i.e. surface water from the Site may already contain diffuse pollutants). Prior to development the site will need to be cleared and any remedial works required undertaken.
- 9.7.88 The drainage strategy for the PCC will be defined in consultation with the Environment Agency, the LLFA (RCBC and STBC) and Northumberland Water as the project progresses, taking into account the findings of the Flood Risk Assessment (FRA) and water quality assessment. The proposed drainage system is to include the use of sustainable drainage systems (SuDS) to provide treatment of runoff to ensure potential adverse effects on water quality are avoided.
- 9.7.89 The key objectives of the site drainage system are to provide a drainage system which is inherently safe and protects the local environment and the outfall in Tees Bay from accidental discharges of oil, chemicals or run-off from firefighting effluent. Clean water, storm water and firewater drainage are segregated from contaminated water through the minimisation of paved areas and use of rain shelters. Gravity drainage is also used wherever practicable.

Handling and Disposal of Chemicals

- 9.7.90 There are a number of chemicals utilised within the facility that cannot be discharged to the site outfall (see Table 9C-28). There is no site wide chemical drainage and all chemical drainage and spills are to be contained locally for off-site disposal. Drainage of small volumes from equipment for maintenance shall be to containers/drums and be disposed of appropriately off-site.

9.7.91 Areas for chemical injection packages and storage tanks shall be paved and kerbed/bunded to ensure that spillages and leaks from chemical dosing packages and associated intermediate storage tanks can always be contained. To minimise rainwater collection where practicable and safe to do so these chemical injection packages and intermediate storage tanks shall be located indoors or be provided with a rain shelter if outdoors.

Table 9C- 28: Chemical injection packages and intermediate storage tanks (day tanks) anticipated to be used by the Proposed Development

Power Plant Area	Capture Plant Area	Water Treatment Plant Area	Cooling Tower Area
Ammonia Phosphate Oxygen scavenger	Sodium hydroxide	Biocide Anti-scalant Sodium meta-bisulphate Sulphuric acid Sodium hydroxide Phosphoric acid Polyelectrolyte Molasses	Biocide Bio-dispersant Corrosion inhibitor

9.7.92 Any chemical spillages that might occur on hard standing in the kerbed/bunded areas will be manually cleaned up and disposed of off-site in accordance with the operational sites Environmental Management System (EMS).

9.7.93 Road vehicle unloading shall be within kerbed/bunded areas with controlled discharge which shall be arranged to provide the capacity to contain accidental release of a full tanker. Each area shall be provided with a small air-driven pump to allow clean stormwater that may build up within the bunded areas to be pumped away to a Potentially Contaminated Surface Water (PCSW) drainage system, described later on in this section.

9.7.94 Pumps handling fluids with the potential to contaminate which are not located within a bunded area shall be provided with a drip tray that is routed via a tundish to a local sump.

Open Drainage System

9.7.95 The open drain collection systems within the facility have two routes for disposal, either 1) via the existing or new site outfall to Tees Bay; or 2) via vacuum truck for off-site disposal at a suitably licensed waste facility. Only uncontaminated surface run-off free from any elevated levels of chemical or particulate pollutants when compared to what might be expected in normal surface water runoff (i.e. 'clean'), will be discharged directly to Tees Bay (via a SuDS treatment train). Chemicals, such as amine and diesel shall be contained within bunded areas and disposed of off-site to a suitably licensed waste facility via vacuum truck. The open drainage system will be designed to manage:

- Clean surface water runoff;
- Potentially contaminated surface water runoff;
- Power plant surface water drainage;

- Carbon plant area surface water drainage;
 - Common utilities area surface water drainage;
 - Diesel generator, tankage area and central chemical storage area;
 - Surface water drainage; and
 - Firewater run-off collection.
- 9.7.96 A Surface Water Maintenance and Management Plan will be provided with the Final CEMP detailing the requirements of access and frequency for maintaining the different SuDS and surface water features proposed on the Site.. The maintenance regime must be properly implemented to ensure all treatment measures and processes operate as intended for the lifetime of the Proposed Development, and to avoid issues such as blockages which could lead to flooding.
- 9.7.97 The maintenance required for SuDS and drainage networks will be based on standard guidance and practice. Requirements for maintenance and management of vegetated drainage systems (e.g. ponds) are described in The SuDS Manual (CIRIA, 2015a) and DMRB CD532 (Highways Agency, 2020). Furthermore, it is expected that silt / oil alarms will be fitted on all interceptors and water storage facilities to alert operators when they require emptying. The drainage strategy should also outline the consequences for the drainage system should the Proposed Development close or be decommissioned.

Amine Drainage Systems

- 9.7.98 Amine utilised in the Capture Plant shall not be discharged to any open drain systems or to the outfall to Tees Bay. Disposal of degraded amine will be via vacuum tanker and off-site disposal at a suitably permitted waste facility.
- 9.7.99 Surface water run-off from uncovered external paved areas containing amine equipment , which during normal operation is expected to result in chemical drips, leaks and minor spill and which could be contaminated, shall be located within minimised local kerbed areas and be routed to the amine drain vessel.

Foul Water Drainage

- 9.7.100 Sanitary waste from welfare facilities in the administration and control building, workshop and warehouse building and gatehouse will be drained via conventional foul sewer sumps and be pumped off-site to the Northumbrian Water foul sewer connection for treatment at Marske-by-the-Sea.

Process Water Drainage

- 9.7.101 Process waste waters may be generated on Site from various activities, notably those described below:
- Turbines;
 - Heat recovery steam generator;
 - Heat recovery steam generator blowdown;
 - Direct contact cooler (dcc) blowdown;

- Compression and dehydration water; and
- Cooling tower blowdown.

9.7.102 Wastewater treatment will be provided for process effluent prior to discharge to the environment. Two options are under consideration for the approach to wastewater treatment. The first option is that the wastewater will be treated on-site to an appropriate standard and then discharged to Tees Bay via an outfall. The alternative under consideration is that the wastewater will be directed to the adjacent Bran Sands WwTW via a pipeline for treatment. The treated effluent will be returned by a parallel pipeline to the PCC Site for discharge to Tees Bay via the outfall. For option one, the treatment plant may include a biological treatment process for the treatment of ammonia contaminated wastewater.

9.7.103 It is anticipated that the wastewater environmental regulatory emission limit values (ELVs) that apply within the Environmental Permit shall be in-line with the target Best Available Technology (BAT) Associated Emission Levels (AELs) from wastewater treatment plants treating effluent from chemicals sites, or processes as identified within the BAT Reference Document for Common Waste Water and Waste Gas Treatment / Management Systems in the Chemical Sector (2016) (otherwise known as the CWW BREF) and its associated BAT Conclusions document. If the project Environmental Risk Assessment shows that significant impact could occur with the plant discharging at the BAT-AEL concentrations, tighter emission limits could subsequently be applied.

9.7.104 Following treatment, process water that is to be directed to the outfall would flow via the outfall retention pond upstream of the outfall to Tees Bay. The retention pond would provide sufficient residence time to allow equalisation and for operators to take action should water quality deteriorate.

Management of Hazardous Substances on Site

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

9.7.106 A site Emergency Response Plan (prepared for Regulation 9 of the COMAH Regulations) will be in place for dealing with emergency situations involving loss of containment of hazardous substances. This will detail how to contain and control incidents to minimise the effects and limit danger to persons, the environment and property. As described above, all aspects of the drainage system that have the potential to receive contaminants include containment provision to contain chemical spillage on Site and upstream the site outfall to Tees Bay.

9.7.107 Further guidance to be consulted in development of the site Emergency Response Plan will include:

- HS(G)191 Emergency planning for major accidents. Control of Major Accident Hazards Regulations 1999 (Health and Safety Executive, 1999);
- HS(G)71 Chemical warehousing: the storage of packaged dangerous substances (Health and Safety Executive, 1992); and

- BS 5908: Fire and explosion precautions at premises handling flammable gases, liquids and dusts. Code of practice for precautions against fire and explosion in chemical plants, chemical storage and similar premises (British Standards Institute, 1990).

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

Water Demand

9.7.109 There is a significant clean water requirement for the Proposed Development comprising:

- cooling water make-up;
- fire water;
- utility stations;
- boiler feed water make-up; and
- amine solution make-up.

9.7.110 Water will be supplied by Northumbrian Water for the Proposed Development. The Proposed Development will include a WTP for treated water and demineralised water.

Tees Coastal Waterbody

Surface Water Routine Runoff and Accidental Spillages

9.7.111 The Proposed Development is an industrial site with constant use of a range of fuels, oils and other chemicals. There is potential for these to be mobilised by surface water runoff and to discharge into the Tees Coastal waterbody via the new drainage pipeline and outfall. Surface water runoff may therefore contain a range of pollutants that could lead to chronic adverse impacts on the receiving watercourses in terms of their physicochemical and ecological status, although it should be noted that there is a large capacity for dilution and dispersal in this water body. There is also a risk that a significant chemical spillage or pollution incident occurs on the Site, thereby impacting the Tees Coastal water body.

9.7.112 These potential impacts are proposed to be managed and treated by appropriate measures as summarised in 'Operation Phase Mitigation' above. All potentially contaminated surface water runoff is to be discharged to a balancing pond prior to oily water treatment using an oil interceptor, and then discharged to the Tees Bay outfall via a further retention pond. A SuDS CIRIA C753 SuDS Manual Simple Index Assessment of the treatment train is provided in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2). This indicates that the assessment does not currently pass due to proprietary treatment systems such as oil interceptors not being considered within the Simple Index Assessment as the performance varies between available products. However, provided that a product with sufficient treatment potential is selected in consultation with the

Environment Agency and LLFA, then the treatment train will be suitable to avoid adverse water quality impacts to Tees Coastal waterbody, and hence subsequent effects on ecological receptors.

- 9.7.113 A Surface Water Maintenance and Management Plan will be prepared during the detailed design phase to describes the requirements for access and frequency for maintaining drainage infrastructure proposed on the Site. The maintenance regime must be fully implemented throughout the lifetime of the Proposed Development to avoid issues such as blockages which could lead to flooding, or failure of the spillage containment and pollution prevention systems.
- 9.7.114 Provisions for dealing with chemical spillages and firewater include kerbed / bunded areas, valves, sluices and interception sumps for isolating spillages or contaminated water. Water quality monitoring will be regularly undertaken by the site's Operator confirm the quality of any water in bunded areas, sumps or tanks to ensure that it is suitable for discharge from the site to the Tees Bay, or otherwise is taken by tanker for off-site disposal at a suitably licenced waste water facility. An Emergency Response Plan would also be prepared and implemented as part of the sites EMS. Should any spillage occur that results in the pollution of Controlled Waters, then the Environment Agency would immediately be informed, or Northumbrian Water should it impact the foul water system. Further details regarding the surface water drainage system are outlined above under 'Operation Phase Mitigation'.
- 9.7.115 Given that the Drainage Strategy will have to meet standards required by the Environmental Permit (with an associated Environment Agency H1 Risk Assessment) and the expected local policy requirements, and that measures are in place for dealing with spillages and firewater and for treating regular surface water runoff, then a negligible impact is predicted to the Tees Coastal water body during operation. As such, no deterioration in any WFD element or prevention of future improvement is predicted from surface water runoff or chemical spillages.

Impacts of Process Discharges

Cooling Water System – Impacts of Thermal Discharges

- 9.7.116 Cooling water from the Power and Capture Plant will discharge to the Tees Coastal water body under an Environmental Permit. If water is not sufficiently cooled it could create a thermal barrier to fish passage, especially salmon and lamprey, and have other environmental consequences on the designated coastal sites in terms of ecosystem dynamics and assemblages.
- 9.7.117 To better understand the consequences of this discharge of cooling water, near-field and far-field thermal discharge modelling and assessment has been undertaken (see ES Appendix 9B: Coastal Modelling Report, ES Volume III, Document Ref. 6.4).
- 9.7.118 The set-up for both the near-field and far-field modelling, including the ambient conditions at each outfall location, the key characteristics of the effluent water body, the geometrics of the discharge point, and the results of the sensitivity analysis is discussed in full detail within Appendix 14E: Coastal Modelling Report (ES Volume III, Document Ref. 6.4). The approach to modelling has been discussed via a series of technical engagement meetings

with the Environment Agency in March 2019, January 2021 and February 2021. It has been assumed at both Outfall 1 and Outfall 2, that the effluent will consist of a temperature excess of 15°C, a flow rate of 1.37 m³/s and a density of 1,018 and 1,020 kg/m³ to represent summer and winter conditions, respectively. The outfall pipe at both locations was assumed to measure 0.8 m in diameter and located 1 m above the seabed with the outlet orientated in the vertical plane (i.e. pointing upwards).

- 9.7.119 The modelling was based on three CCGT trains whereas there will now only be a single CCGT train, and as such is highly precautionary.
- 9.7.120 Results of near-field thermal plume modelling undertaken using the CORMIX modelling software show that, for Outfall 1 under spring conditions, the likely extent of a thermal plume (with a 15°C excess temperature at source) would be very localised: a 3°C temperature excess only extends approximately 45m from the discharge point on the flood and 98m on the ebb; for a 2°C temperature excess, the ebb extent of the plume increases to 140m. Considering a further reduced excess temperature shows that a 0.1°C temperature excess is estimated to extend around 750 m from the origin on a spring flood tide, and 720 m on an ebb. In all cases tested, the mixing and plume dispersion appear to occur very rapidly from the origin with very little detectable change (>0.1°C) beyond ~800 m of the outfall location.
- 9.7.121 At Outfall 2, as a result of lower energy conditions leading to lower/slower rates of dissipation of the outfall plume, the neap tidal phases offer a larger plume, with the 2°C contour extending 600 m and 400 m from the outfall on the flood and ebb respectively, compared to the spring tide which extends 170 m and 270 m on the flood and ebb tide respectively, under normal discharge conditions.
- 9.7.122 Sea temperature changes are assessed in full detail within Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2); this includes potential changes to the marine environment surrounding the outfall and associated effects on receptors.
- 9.7.123 In terms of plankton, given the highly limited predicted extent of the thermal plume and the apparent degree of mixing, it is unlikely that the planktonic community would be exposed to a temperature increase that would affect their metabolic rate or productivity, even within the immediate vicinity of the treated water outfall. Any effect is therefore unlikely to impact the wider abundance and diversity of plankton communities and is considered to have a negligible impact.
- 9.7.124 With regard to intertidal habitats and communities, the intertidal area within the vicinity of the discharge outfall is known to support a low abundance and diversity of macrofauna with few species of macroalgae present. All intertidal habitats and associated communities within the footprint of the thermal plume are considered to be highly resistant and resilient to local temperature increases (see Chapter 14: Marine Ecology and Nature Conservation, ES Volume I, Document Ref.6.2). There is predicted to be limited interaction between the thermal plume and intertidal habitats and so the magnitude of impact is predicted to be minor and highly localised.

- 9.7.125 Subtidal organisms are naturally less adapted to wide fluctuations or increases in temperature than those in intertidal communities, and as a result are possibly more susceptible to the effects of thermal stress. The extent of the thermal plume within the water column will be highly localised, with a small temperature uplift of 1°C predicted to extend approximately 179 m and 235 m from the outfall for a mean spring tide under peak flood and ebb conditions, respectively. Thermal effluent generated by the Proposed Development will be naturally buoyant (due to lower salinity and the lower density of warmer water) and therefore the footprint of the thermal plume on the seabed will likely be further reduced. Given sensitivity of habitats and species known to be present (dominated by *Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand'), discharge of thermal effluents during operations of the Proposed Development is not predicted to have any discernible impact on the subtidal habitats and the abundance, distribution and diversity of associated species beyond the immediate vicinity of the outfall. The magnitude of impact is therefore predicted to be minor and highly localised.
- 9.7.126 The exposure of fish and shellfish (namely demersal life stages and species such as sandeels) to the thermal plume is unlikely to result in changes to communities in terms of abundance and diversity. The thermal plume is also not predicted to affect the reproductive success of fish species of conservation and / or commercial importance nor would it represent a barrier to migratory species, and so a negligible impact on fish is expected.
- 9.7.127 Direct effects to marine mammals from the discharge of thermal effluent, including harbour seal which is a feature of the Teesmouth and Cleveland Coast SSSI, is predicted to be insignificant. Refer to Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref.6.2) for further details. As such, no impact on designated sites is predicted.
- 9.7.128 Finally, in terms of INNS, during baseline surveys, wakame (*Undaria pinnatifida*) was reported as the only INNS currently known to be present and growing within the Study Area. This intertidal macroalgae is a species of kelp which originates from Japan. Due to its rapid growth rate, it is known to outcompete native species within rocky reef habitats (GB NNSS, nd.).
- 9.7.129 The growth of wakame is stimulated by reduced rather than increased temperatures with persistent colder conditions below 15°C promoting recruitment and growth. Thus, cooling water system operations are not predicted to exacerbate growth of this species within the vicinity of the Proposed Development.
- 9.7.130 It is possible that some INNS which are present in the surrounding waters, that are adapted to warmer water, could become established in the vicinity of the treated water outfall during operation. The baseline for non-native species will continue to evolve during the construction phase and therefore it is not possible to accurately predict the species that could become established.
- 9.7.131 Overall, the risk that thermal discharge from the Proposed Development could facilitate introduction and spread of INNS during operation is considered to be low. The effect on native habitats and species from the establishment of non-natives linked to the thermal plume is therefore predicted to not be significant.

9.7.132 Given the above assessment, no deterioration or prevention of future improvement of the Tees Coastal WFD water body is predicted in relation to discharge of water from the cooling water system.

Chemical Impacts from Process Wastewater Discharge

9.7.133 There is potential for physico-chemical water quality impacts at the Tees Bay outfall, as discharged water is likely to include that from:

- Heat Recovery Steam Generator Blowdown – effluent from which includes low concentrations of ammonia, phosphate and di-ethyl hydroxyl amine (DEHA);
- Direct Contact Cooler Blowdown – effluent from which may include high concentrations of ammonia and nitrogen;
- Compression and Dehydration Water – effluent from which could have a low pH; and
- Cooling Tower Blowdown – effluent from which may have high COD and free chlorine, although treatment is proposed in the form of sodium bisulphate dosing.

9.7.134 It will need to be demonstrated that the discharged effluent from the Proposed Development meets the required standards for a range of water quality indicators in order to obtain a Water Activity Permit (i.e. a consent from the Environment Agency to discharge).

9.7.135 As outlined above in ‘Operation Phase Mitigation’ process water from the above sources will be treated on site to an appropriate standard and then discharged to Tees Bay via the outfall, or otherwise wastewater will be directed to the adjacent Bran Sands WwTW via a pipeline for treatment. The treated effluent will be returned by a parallel pipeline to the PCC Site for discharge to Tees Bay via the outfall. The process water treatment plant would include a biological treatment process for the treatment of ammonia contaminated wastewater.

9.7.136 Following treatment, process water that is to be discharged would flow via the outfall retention pond upstream of the outfall to Tees Bay. The retention pond would provide a minimum of eight hours residence time to allow equalisation and for operators to take action should water quality deteriorate. Water sampling facilities are to be provided for manual sampling of water prior to discharge. The frequency of testing and parameters to be tested will be agreed with the permitting authority. In situ continuous monitoring of flow, temperature, total organic carbon (TOC), conductivity and pH measurement shall also be undertaken. The Proposed Development will have an Environmental Management System (EMS) defining how to deal with any chemical spillages that may occur.

9.7.137 Given the information presented above, the low predicted rate of treated effluent which will be discharged to the Tees Bay and the open nature of the coastline where hydrodynamic conditions are expected to facilitate rapid dispersion, the potential for adverse effects to marine water quality is considered to be minor, and not significant at the water body scale. Furthermore, no detectable effects to marine species or habitats are

predicted, nor to biodiversity or the conservation objectives for any marine species or designated site.

Foul Water Discharge

- 9.7.138 Sewage and sanitary waste from the Proposed Development will be sent off-site via pipeline connecting to the local Northumbrian Water treatment plant at Marske-on-Sea, which discharges to Tees Bay in line with the conditions of an Environmental Permit. Given the small volumes required to be treated (i.e. foul water would only be from the administration and control building, workshop and warehouse building and gatehouse) it has been assumed that Northumbrian Water will treat foul water prior to discharge to Tees Bay in accordance with requirements to not cause deterioration or prevent improvement under the WFD. Further consultation with Northumbrian Water will be undertaken as the Proposed Development is progressed. Given that the discharge from wastewater treatment works is tightly regulated, no deterioration or prevention of future improvement in any WFD element for the Tees Bay water body is predicted.

Morphological Impacts

- 9.7.139 If the existing outfall to Tees Coastal waterbody cannot be used unchanged, then a new water discharge pipeline and outfall head will need to be installed, as described above. The new outfall would consist of a pipeline and diffuser head weighed down with rock armour.
- 9.7.140 An obstruction on the seabed, such as a new diffuser head, has the potential to induce localised scouring of the seabed. This is likely to occur quite rapidly leading to the development of a 'scour pit,' which will then be subject to ongoing, smaller-scale erosion/accretion in response to the natural tidal and wave processes. However, the risk will depend on the nature of the shallow bed substrate and whether this consists of sand (which will settle quickly), consolidated clay (which is resistant to erosion), or unconsolidated fine sediments that are easy to erode. Appropriate scour protection would be installed to minimise this impact around the diffuser head, which would be very localised and is not anticipated to have any adverse impact on WFD objectives for the water body. Indeed, the maximum size of the outfall head and associated scour protection would be 100 m², which is small at the scale of the WFD waterbody which is 88 km² in area.

Atmospheric Deposition Impacts

- 9.7.141 Deposition of air pollutants released from point source emissions can be deposited into the marine environment either by wet or dry deposition processes. Deposition of air pollutants, particularly nitrogen and sulphur compounds can cause direct disturbance to marine habitats and species through acidification.
- 9.7.142 The air quality assessment (see Chapter 8: Air Quality, ES Volume I, Document Ref.6.2) has identified a potential air quality impact on coastal habitats including sand dune and saltmarsh habitat for which the Teesmouth and Cleveland Coast Ramsar and SSSI and the Teesmouth NNR are designated and which support the interest features of the SPA. A formal assessment of effects to these habitats and designated sites has been made in Chapter 12: Terrestrial Ecology and Nature Conservation (ES, Volume I).

This assessment concluded a significant (major adverse) effect to sand dune and saltmarsh habitats. Consequently, there is considered potential for the deposition of air pollutants to effect other intertidal habitats (e.g. mudflats) and species, as well as fish species which may depend on these for specific functions (e.g. nursery grounds).

- 9.7.143 Further assessment into the impact of atmospheric deposition on the marine environment, shows that nitrogen deposition from the Proposed Development will be at its peak in the area of Coatham Sands. This encompasses the intertidal mudflats and sandflats in the marine environment within this area. Despite this, the hydrodynamic conditions and the open nature of the coastline mean that this area is subject to frequent tidal washing. This will facilitate the rapid dispersion of nitrogen deposits and therefore the potential for effects to intertidal habitats is considered to be negligible.
- 9.7.144 An assessment of atmospheric deposition on the single remaining open water pond within Coatham Dunes (see Annex E) has also been undertaken, which falls within the Tees Coastal WFD catchment. Pond 14 is within the Teesmouth and Cleveland Coast SSSI and the Teesmouth and Cleveland Coast SPA designations. The Coatham Sands waterbodies and dune slacks provide habitat for bird populations, particularly redshank (*Tringa totanus*), who move inland to open water at high tide. Site survey has indicated that Pond 14 is the only water body remaining in the Coatham Sands dunes complex that has not succeeded to a fully vegetated wetland state, and therefore has particular importance as the sole area of open water habitat within the dunes.
- 9.7.145 The assessment indicates that the contribution of the Proposed Development to atmospheric oxides of nitrogen (NO_x) concentrations and ammonia (NH₃) concentrations will exceed 1% of the critical level at Teesmouth and Cleveland Coast SPA. However, at no point will total NO_x or ammonia concentrations exceed the critical level at the SPA, even with the Proposed Development. The highest Predicted Environmental Concentration (i.e. the baseline, plus the Proposed Development and any other relevant projects expected over the same timetable) reported in Appendix 8B: Operations (ES, Volume III) for NO_x is <70% of the critical level at the Teesmouth and Cleveland Coast SPA, while that for ammonia is equivalent to 23% of the critical level.
- 9.7.146 Since the critical levels will not be exceeded, the only effect that may arise is through the role of NO_x and NH₃ in nitrogen deposition rather than through direct effects of the pollutants in the atmosphere.
- 9.7.147 The nitrogen deposition isopleths for the stack emissions from the Power and Capture plant reported in Appendix 8B: Operational Phase (ES Volume III, Document Ref.6.4) show that there will be an additional nitrogen deposition of approximately 0.36 kg N/ha/yr at the Teesmouth and Cleveland Coast SPA due to the Proposed Development alone, which occurs at the edge of Coatham Dunes. This would represent an additional deposition equivalent to 3.6% of the critical nitrogen load for the broad habitat contained therein (as identified on UK Air Pollution Information System (APIS) – calcareous fixed dunes with a minimum critical load of 10 kgN/ha/yr; a similar critical load

applies to the reeds that are present within the open pool, although the open water itself has no critical load on APIS). A 3.6% change in nitrogen deposition is a 'small' dose (typically defined as a dose of between 1% and 5% of the critical load). The predicted nitrogen dose to the SSSI from the Proposed Development is very modest when compared against historic doses from the former steelworks and there can be reasonable certainty that it would not undermine conservation objectives for the SPA (see further discussion in Chapter 12: Terrestrial Ecology and Nature Conservation (ES, Volume I, Document Ref. 6.2)). Moreover, the birds that use these dunes and pools within the SPA/ Ramsar (redshank) are noted on APIS as not being sensitive to atmospheric nitrogen deposition.

- 9.7.148 Furthermore, water quality monitoring of Pond 14 between October 2020 and January 2021 indicates a maximum total nitrogen concentration value of 1.6 mg/l (6 January 2021). This is variable over relatively short time scales with total nitrogen having been below the laboratory limits of detection on three of eight sampling visits (i.e. <0.5 mg/l on 22 October 2020). Based on the maximum recorded total nitrogen baseline value of 1.6 mg/l in Pond 14, deposition of 0.36 kg/N/ha/yr as a worst-case scenario would cause an increase in total nitrogen concentration to 1.78 mg/l after one year, for a hypothetical scenario with no other gains or losses of nitrogen. This is considered to be within the likely range of concentrations that would be observed in the pond over a year and would not be of detriment to the pond ecosystem.
- 9.7.149 Given the low level of enrichment of Pond 14, and the fact that the bird populations which utilise the pond are not sensitive to atmospheric deposition, then a negligible impact is considered appropriate for this waterbody, with no impact predicted at the larger WFD catchment scale, nor on the status of the designated sites in which it is located.

Tees Transitional Waterbody (Tees Estuary)

- 9.7.150 The water discharge corridor for the Proposed Development includes a pipeline between the PCC Site and Brans Sands WwTW. This includes space for another parallel pipeline to convey final treated effluent from Bran Sands WwTW back towards the site for onward discharge to Tees Bay. This last option has been included at the request of the Environment Agency as a potential replacement for the existing discharge from Bran Sands WwTW to Dabholm Gut, and which may incorporate waste from other sites in the area in the future. This option to redirect treated effluent from Brans Sands does not form part of the Proposed Development and so is not assessed herein.
- 9.7.151 No operational impacts are predicted to this water body given that it does not have any direct hydrological connection to the Proposed Development once operational. There will be pipe bridges tributaries of the waterbody, but all operational surface water runoff and process water discharges are directed to the Tees Coastal water body. As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Tees Estuary (S Bank) Water body (The Fleet)

- 9.7.152 No operational impacts are predicted to this water body given that it does not have any direct hydrological connection to the Proposed Development. There

will be pipe bridges over the watercourse, but all operational surface water runoff and process water discharges are directed to the Tees Coastal water body. As such, the Proposed Development would be compliant with all WFD objectives for this water body.

Tees Mercia Mudstone & Redcar Mudstone groundwater body & Tees Sherwood Sandstone WFD groundwater body

- 9.7.153 All surface water runoff and treated process water from areas of hardstanding on the Proposed Development site will be discharged to Tees Bay including the use of attenuation ponds. There are no planned discharges to groundwater during operation. There is some potential for leaks, spillages and contamination from storage of chemicals and use of fuels that could affect groundwater. However, any fuel and chemical storage areas would be bunded as outlined in 'Operation Phase Mitigation' above to prevent spread of spillages and to allow rapid clean up and removal for off-site disposal. Given that the majority of spillages would be directed to the surface water drainage system (including treatment and isolation potential), and that storage areas would be adequately bunded, negligible impacts on these WFD groundwater bodies are predicted during operation of the Proposed Development. The Proposed Development would therefore be compliant with all WFD objectives for these water bodies.

Decommissioning

- 9.7.154 At the end of its design life decommissioning of the Proposed Development will see the removal of all above ground equipment down to ground level.
- 9.7.155 It is assumed that all underground infrastructure will remain in-situ; however, all connection and access points will be sealed or grouted to ensure disconnection. At this stage it is assumed that decommissioning impacts are expected to be limited and will be the same/similar to the construction impacts, as discussed above.

Mitigation Measures / Reasons for not Achieving Good Status Assessment

- 9.7.156 No mitigation measures have been provided by the Environment Agency for the Tees Transitional, Tees Coastal and Tees Mercia Mudstone and Redcar Mudstone groundwater body. As such, consideration has been given to the potential impact of the Proposed Development on the pressures and reasons for not achieving Good Status/Potential that can be viewed on the Environment Agency's Catchment Data Explorer Website (see Table 9C-29 to Table 9C-31). As the Tees Sherwood Sandstone WFD groundwater body is already at Good Ecological Potential, no pressures are listed for these water bodies.
- 9.7.157 With the available information about the pressures and reasons for not being at Good Ecological Status or Good Ecological Potential no potential non-compliance with the WFD objective 'failure to prevent improvement' is predicted.
- 9.7.158 The Environment Agency has provided mitigation measures for the Tees Estuary (S Bank). An assessment has been made in Table 9C-29 regarding whether the Proposed Development has the potential to prevent

implementation of these mitigation measures. It is concluded that the Proposed Development will not prevent implementation of any of these mitigation measures.

Table 9C- 29: Tees Coastal water body – assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Mitigation Measures Assessment	Physical Modification	Local and Central Government / Sector under Investigation	It is proposed to use the existing water discharge pipeline from the Proposed Development which would result in no new physical modifications to the waterbody being required. However, if this is in poor condition and requires replacement then a new pipeline and outfall head would be installed. The pipeline would be installed beneath the water body using trenchless techniques, and so the only physical modification to the bed would be the outfall head, which would have a very small footprint when considered in the context of the WFD water body. As a worst case scenario the footprint with rock armouring may be 0.025 ha. The overall water body is 8838 ha in size. As such, it is not considered that the Proposed Development would prevent implementation of improvements in terms of physical modifications.

Table 9C- 30: Tees Estuary water body – assessment against reasons for not achieving Good Status and reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Tributyltin Compounds	Diffuse source	Contaminated water body bed sediments	There is no potential for mobilisation of bed sediments which may contain tributyltin compounds.
Angiosperms	Physical modification	Coastal Squeeze	No new structures are proposed and so there should be no impact on the angiosperm WFD classification from physical modification associated with the Proposed Development.
Polybrominated diphenyl ethers (PBDE)	Unknown	Unknown	PBDEs are flame retardants found in a wide array of products and can commonly pollute watercourses. Measures to protect watercourses from pollution during construction are outlined in the CEMP and

Classification element affected	Pressure Type	Activity	Appraisal
			WMP. No operational runoff is discharged to Tees Estuary. As such, there is not anticipated to be any impact on PBDEs as a result of the Proposed Development in this water body.
Dissolved Inorganic Nitrogen	Diffuse Source	Agriculture – Poor nutrient management	Not applicable – relates to other parts of the catchment
	Point Source	Water Industry – Sewage discharge (continuous)	Foul water from the Proposed Development will be treated at Marske-by-the-Sea WwTW and discharged to Tees Bay under the conditions of Northumbrian Water’s environmental permit. Northumbrian Water is responsible for ensuring no deterioration or prevention of improvement in the receiving waterbody from their treatment works. Consultation will continue with Northumbrian Water as the scheme develops to ensure there is sufficient capacity to take foul water from the Proposed Development.
	Point Source	Industry – Trade / Industry discharge	There are no surface water or operational discharges to Tees Estuary from the Proposed Development, and so there will be no further increase in industrial discharges which might affect dissolved inorganic nitrogen.
Macroalgae	Diffuse Source	Agriculture – Poor nutrient management	Not applicable – relates to other parts of the catchment
	Point Source	Navigation – Ports and harbours (structures) and recreation	There will be no construction impacts relating to navigation and not have any impact on the macroalgae classification.
	Physical modification	Coastal squeeze	No new permanent structures are proposed, and so there should be no impact on the macroalgae WFD classification from physical modification associated with the Proposed Development.
	Point Source	Industry – trade / industry discharge	There are no surface water or operational discharges to Tees Estuary from the Proposed Development, and so there will be no further direct increase in industrial discharges which might affect macroalgae.

Classification element affected	Pressure Type	Activity	Appraisal
	Point Source	Sewage discharge (continuous)	Foul water from the Proposed Development will be treated at Marske-by-the-Sea WwTW and discharged to Tees Bay under the conditions of Northumbrian Water's environmental permit. Northumbrian Water is responsible for ensuring no deterioration or prevention of improvement in the receiving water body from their treatment works. Consultation will continue with Northumbrian Water as the scheme develops to ensure there is sufficient capacity to take foul water from the Proposed Development.
Invertebrates	Point Source	Sewage discharge (continuous)	Foul water from the Proposed Development will be treated at Marske-by-the-Sea WwTW and discharged to Tees Bay under the conditions of Northumbrian Water's environmental permit. Northumbrian Water is responsible for ensuring no deterioration or prevention of improvement in the receiving waterbody from their treatment works. Consultation will continue with Northumbrian Water as the scheme develops to ensure there is sufficient capacity to take foul water from the Proposed Development.
	Point Source	Industry – trade / industry discharge	There are no operational discharges to Tees Estuary from the Proposed Development, and so there will be no further direct increase in industrial discharges which might affect macroalgae.

Table 9C- 31: Tees Mercia Mudstone and Redcar Mudstone Groundwater Body – Assessment against Reasons for not achieving Good Status and Reasons for Deterioration

Classification element affected	Pressure Type	Activity	Appraisal
Chemical Dependent Surface Water Body Status	Point Source	Mining and Quarrying – Abandoned Mine	<p>Pollution impacts to groundwater during construction would be controlled through measures outlined in the Final CEMP, WMP and Remediation Strategy. Any piling operations required would be subject to foundation works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements.</p> <p>There are no planned discharges to groundwater during operation. There is potential for leaks,</p>

Classification **Pressure** **Activity** **Appraisal**
element affected **Type**

spillages and contamination from storage of chemicals and use of fuels that may affect groundwater. However, any fuel and chemical storage areas would be bunded to prevent spread of spillages and to allow rapid clean up and removal for off-site disposal.

Given the above, there is not considered to be any prevention of future improvement of the Chemical Dependent Surface Water Body Status for this groundwater body.

Table 9C- 32: Tees Estuary (S Bank) – Mitigation Measures Assessment

Mitigation Measure Option	Mitigation Measure screening and status	Appraisal
Restore or increase floodplain (lateral) connectivity	Required but not yet implemented	No new structures (e.g. culverts) are proposed over the watercourse. There would be no adverse impacts on future implementation of this mitigation measure
Install fish passes	Required but not yet implemented	Not applicable
Enhance existing structures to improve ecology	Required but not yet implemented	No works to existing structures are planned with the exception of certain pipe bridges that will need strengthening to accommodate new pipes. There would be no adverse impacts on future implementation of this mitigation measure.
Remove obsolete structure(s)	Required but not yet implemented	No works to existing structures are planned with the exception of certain pipe bridges that will need strengthening to accommodate new pipes. There would be no adverse impacts on future implementation of this mitigation measure.
Implement changes to locks etc.	Required but not yet implemented	Not applicable
Implement appropriate vegetation control technique	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed.
Implement appropriate timing (vegetation control)	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed.
Implement invasive species techniques	Required but not yet implemented	The Final CEMP will include measures to ensure that invasive species are not spread during construction. The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed.

Mitigation Measure Option	Mitigation Measure screening and status	Appraisal
Retain habitats	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to vegetation proposed. Any potential construction impacts that may affect habitats (e.g. runoff of sediment or chemical spillages) will be dealt with by best practice measures outlined in the Final CEMP.
Ensure maintenance minimises habitat impact	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works to the watercourse proposed following strengthening of pipe bridge structures.
Remove or soften hard bank engineering	Required but not yet implemented	There are no works proposed to the banks of this watercourse. This will not prevent future softening of watercourse banks.
Ensure maintenance prevents sediment transfer	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, and mitigation measures described in the Final CEMP will be implemented to prevent further sediment entering the watercourse during construction.
Water level management	In place and functioning effectively	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works that might impact water levels proposed. All surface water runoff and process water will be discharged to Tees Coastal water body rather than this watercourse.
Preserve or restore habitats	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no works that might impact habitats proposed to this watercourse. Any potential construction impacts that may affect habitats (e.g. runoff of sediment or chemical spillages) will be dealt with by best practice measures outlined in the Final CEMP.
Educate landowners	Required but not yet implemented	Not applicable – applies elsewhere in the catchment.
Restore or Increase In-channel morphological diversity	Required but not yet implemented	The Proposed Development does not prevent this mitigation measure from being implemented in future, with no direct works to the channel bed or banks proposed that might influence morphology.
Re-opening of culverts	Required but not yet implemented	No works to existing structures are planned with the exception of certain pipe bridges that will need

Mitigation Measure Option	Mitigation Measure screening and status	Appraisal
Alter culvert channel bed	Required but not yet implemented	<p>strengthening to accommodate new pipes. There would be no adverse impacts on future implementation of this mitigation measure.</p> <p>No culverts are required as a result of the Proposed Development or works to any existing culverted crossings, and so no adverse impact on this mitigation measure.</p>

9.8 Conclusions

- 9.8.1 The WFD assessment indicates that, based on the current understanding of the Proposed Development, that no significant adverse impacts to WFD relevant waterbodies will occur and therefore the Proposed Development is compliant with the WFD objectives for the Tees Coastal waterbody, the Tees Transitional waterbody, the Tees Estuary (S Bank) waterbody, Tees Mercia Mudstone & Redcar Mudstone groundwater body & Tees Sherwood Sandstone WFD groundwater body, provided that the outlined mitigation measures are implemented.
- 9.8.2 These mitigation measures include best practise to be adopted during construction to manage all pollution risks, and which will be implemented by the Contractor using a WMP prepared as part of a Final CEMP. They also include measures to treat surface water runoff, process water, and to manage the risk of future spillages or pollution incidents occurring on the Site.
- 9.8.3 A number of permissions will be required from the Environment Agency (unless these are disapplied by the DCO and replaced with alternative agreements in consultation with the relevant regulator) and these will provide an additional check on the proposed works. Prior to construction this will include consents related to discharges of any 'unclean' runoff during construction, for any activity within 8 m of the bank of a main river or culvert on a main river, works affecting the flow within ordinary watercourses (from the LLFA) and a marine licence for regulated activities below the Mean High Water Spring Tide level.
- 9.8.4 Appropriate licences and permits will be obtained from the Environment Agency and Marine Management Organisation with regards to the operational discharges to Tees Coastal waterbody and potential construction of the outfall tunnel and outfall head, as well as the CO₂ export corridor.
- 9.8.5 Consultation with Northumbrian Water will continue to confirm capacity to supply the Proposed Development with water, and to accept foul water from the Proposed Development at Marske-by-the-Sea WwTW.

9.9 References

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Annex A - WFD Water Body Assessments - Cycle 2 (2019)

Table A1 Surface Water Body Classification Details – Tees Coastal

RMBP Parameter	Northumbria Middle Cycle 2 2019 Classification
RBMP	Northumbria RMBP
Waterbody Name and ID	Tees Coastal - GB650301500005
Water Body Type	Coastal Water
Hydromorphological Designation	Heavily Modified
Length	-
Catchment area	8838.147 ha
Overall Ecological Potential	Moderate
Chemical Status	Fail
Downstream Waterbody	-
Supporting elements (Surface Water)	Moderate
Mitigation Measures Assessment	Moderate or less
Biological Quality Elements	High
Angiosperms	-
Fish	-
Invertebrates	High
Macroalgae	-
Phytoplankton	-
Physico-Chemical Parameters	High
Dissolved Inorganic Nitrogen	-
Dissolved oxygen	High
Hydromorphological Supporting Elements	-
Specific Pollutants	Moderate
Arsenic	High
Copper	High
Iron	High
Zinc	High
Priority Substances	Good
Fluoranthene	Good
Lead and Its Compounds	Good
Nickel and Its Compounds	Good
Other Pollutants	Does not require assessment
Priority Hazardous Substances	Fail
Polybrominated diphenyl ethers (PBDEs)	Fail
Perfluorooctane sulphonate (PFOS)	Good
Benzo(a)pyrene	Good
Cadmium and Its Compounds	Good
Dioxins and dioxin-like compounds	Good
Heptachlor and cis-Heptachlor epoxide	Good
Hexabromocyclododecane (HBCDD)	Good
Hexachlorobenzene	Good

RMBP Parameter

**Northumbria Middle Cycle 2 2019
Classification**

Hexachlorobutadiene	Good
Mercury and Its Compounds	Fail

Table A2 Surface Water Body Classification Details – Tees

RMBP Parameter

Cycle 2 2019 Classification

RBMP	Northumbria RBMP
Waterbody Name and ID	TEES - GB510302509900
Water Body Type	Transitional Water
Hydromorphological Designation	Heavily Modified
Length	-
Catchment area	1144.046 ha
Overall Ecological Potential	Moderate
Chemical Status	Fail
Downstream Waterbody	-
Supporting elements (Surface Water)	Moderate
Mitigation Measures Assessment	Moderate or Less
Biological Quality Elements	Moderate
Angiosperms	Moderate
Fish	Good
Invertebrates	Good
Macroalgae	Moderate
Phytoplankton	Good
Physico-Chemical Parameters	Moderate
Dissolved Inorganic Nitrogen	Moderate
Dissolved Oxygen	High
Hydromorphological Supporting Elements	Supports Good
Hydrological regime	Supports Good
Specific Pollutants	High
Chlorothalonil	High
Pendimethalin	High
Chromium (IV)	High
Triclosan	High
2,4-dichlorophenol	High
2,4-dichlorophenoxyacetic acid	High
Arensic	High
Copper	High
Diazinon	High
Dimethoate	High
Iron	High
Linuron	High
Mecoprop	High
Phenol	High
Toluene	High
Un-ionised ammonia	High
Zinc	High

RMBP Parameter	Cycle 2 2019 Classification
Priority Substances	Good
1,2-dichloroethane	Good
Atrazine	Good
Benzene	Good
Alachlor	Good
Chlorpyrifos	Good
Cypermethrin (Priority hazardous)	Fail
Octylphenol	Good
Dichlorvos (Priority)	Good
Aclonifen	Good
Bifenox	Good
Chlorfenvinphos	Good
Cybutryne (Irgarol®)	Good
Terbutryn	Good
Dichloromethane	Good
Diuron	Good
Fluoranthene	Good
Isoproturon	Good
Lead and Its Compounds	Good
Napthalene	Good
Nickel and Its Compounds	Good
Pentachlorophenol	Good
Simazine	Good
Trichlorobenzenes	Good
Trichloromethane	Good
Other Pollutants	Good
Aldrin, Dieldrin, Endrin & Isodrin	Good
Carbon Tetrachloride	Good
DDT Total	Good
para - para DDT	Good
Tetrachloroethylene	Good
Trichloroethylene	Good
Priority Hazardous Substances	Fail
Anthracene	Good
Polybrominated diphenyl ethers (PBDE)	Fail
Perfluorooctane sulphonate (PFOS)	Good
Cadmium and Its Compounds	Good
Dioxins and dioxin-like compounds	Good
Benzo(b)fluoranthene	Good
Benzo(g-h-i)perylene	Fail
Benzo(k)fluoranthene	Good
Heptachlor and cis-Heptachlor epoxide	Good
Hexabromocyclododecane (HBCDD)	Good
Quinoxifen	Good
Di(2-ethylhexyl) phthalate (Priority hazardous)	Good
Endosulfan	Good
Hexachlorobenzene	Good

RMBP Parameter	Cycle 2 2019 Classification
Hexachlorobutadiene	Good
Mercury and Its Compounds	Fail
Nonylphenol	Good
Pentachlorobenzene	Good
Tributyltin Compounds	Fail
Trifluralin (Priority hazardous)	Good

Table A3 Surface Water Body Classification Details – Tees Estuary (S Bank)

RMBP Parameter	WFD Cycle 2 2019 Classification
RBMP	Northumbria RBMP
Waterbody Name and ID	Tees Estuary (S Bank) - GB103025072320
Water Body Type	River
Hydromorphological Designation	Heavily Modified
Length	8.721 km
Catchment area	3245.943 ha
Overall Ecological Potential	Moderate
Chemical Status	Fail
Downstream Waterbody	Tees (GB510302509900)
Supporting elements (Surface Water)	Moderate
Mitigation Measures Assessment	Moderate or Less
Biological Quality Elements	Bad
<i>Invertebrates</i>	<i>Bad</i>
Physico-Chemical Parameters	-
Hydromorphological Supporting Elements	Supports Good
Hydrological regime	Supports Good
Specific Pollutants	-
Priority Substances	Good
Cypermethrin (Priority hazardous)	Good
Fluoranthene	Good
Other Pollutants	Does not require assessment
Priority Hazardous Substances	Fail
Polybrominated diphenyl ethers (PBDE)	Fail
Perfluorooctane sulphonate (PFOS)	Good
Dioxins and dioxin-like compounds	Good
Heptachlor and cis-Heptachlor epoxide	Good
Hexabromocyclododecane (HBCDD)	Good
Hexachlorobenzene	Good
Hexachlorobutadiene	Good
Mercury and Its Compounds	Fail

Table A4 Tees Estuary (S Bank) – Mitigation Measures

Mitigation Measure Option	Mitigation Measure screening & status
Restore or increase floodplain (lateral) connectivity	Required but not yet implemented
Install fish passes	Required but not yet implemented
Enhance existing structures to improve ecology	Required but not yet implemented
Enhance existing structures to improve ecology	Required but not yet implemented
Remove obsolete structure(s)	Required but not yet implemented
Implement changes to locks etc.	Required but not yet implemented
Implement appropriate vegetation control technique	Required but not yet implemented
Implement appropriate timing (vegetation control)	Required but not yet implemented
Implement invasive species techniques	Required but not yet implemented
Retain habitats	Required but not yet implemented
Ensure maintenance minimises habitat impact	Required but not yet implemented
Remove or soften hard bank engineering	Required but not yet implemented
Ensure maintenance prevents sediment transfer	Required but not yet implemented
Water level management	In place and functioning effectively
Preserve or restore habitats	Required but not yet implemented
Educate landowners	Required but not yet implemented
Restore or Increase In-channel morphological diversity	Required but not yet implemented
Re-opening of culverts	Required but not yet implemented
Alter culvert channel bed	Required but not yet implemented

Table A5 Ground Water Body Classification Details – Tees Sherwood Sandstone

RMBP Parameter	WFD Cycle 2 2019 Classification
RMBP	Northumbria RMBP
Waterbody Name and ID	Tees Sherwood Sandstone - GB40301G702000
Water Body Type	Groundwater Body
Groundwater Area	29301.122 ha
Surface Area	293.011 km ²
Overall Water Body Status	Good
Quantitative Status	Good
Quantitative Saline Intrusion	Good
Quantitative Water Balance	Good
Quantitative GWDTEs Test	Good
Quantitative Dependent Surface Water Body Status	Good
Chemical Status	Good
Chemical Drinking Water Protected Area	Good
General Chemical Test	Good
Chemical GWDTEs Test	Good
Chemical Dependent Surface Water Body Status	Good
Chemical Saline Intrusion	Good

Table A6 Ground Water Body Classification Details – Tees Mercia Mudstone & Redcar Mudstone

RMBP Parameter	Cycle 2 2019 Classification
RBMP	Northumbria RBMP
Waterbody Name and ID	Tees Mercia Mudstone & Redcar - GB40302G701300
Water Body Type	Groundwater Body
Groundwater Area	49457.045 ha
Overall Water Body Status	Poor
Quantitative Status	Good
Quantitative Saline Intrusion	Good
Quantitative Water Balance	Good
Quantitative GWDTEs Test	Good
Quantitative Dependent Surface Water Body Status	Good
Chemical Status	Poor
Chemical Drinking Water Protected Area	Good
General Chemical Test	Good
Chemical GWDTEs Test	Good
Chemical Dependent Surface Water Body Status	Poor
Chemical Saline Intrusion	Good

Annex B Further WFD Water body Description

Tees Estuary

- B.1.1 The present-day Tees Estuary has a largely anthropogenic character due to land reclamation, canalisation and channel deepening that began in the mid-1800s. Originally the estuary was surrounded by expansive wetlands and the tidal ingress extended for approximately 44 km upstream from the mouth. Historical maps indicate a channel width of up to 300 m between Stockton and Middlesbrough prior to 1900, which has reduced to a modern-day width varying between 100 and 200 m. This relatively narrow estuarine channel has marginal intertidal areas, especially where the mouth widens, spanning around 300 ha. This includes an approximately 140 ha area known as Seal Sands, on the north bank, which is separated from other intertidal areas by Seaton Channel (Royal Haskoning, 2016a). In the mid-1990s the Tees Barrage was built. This comprises a river barrage together with a road bridge and a footbridge. Navigation for boats is maintained by a barge lock, whilst there is also a fish pass. Water is held upstream of the barrage at the level of a typical high tide and the water used to supply a white-water course. The barrage has reduced the tidal stretch of the Tees to approximately 14 km from the mouth and reduced tidal volume upstream of South Gare by around 7% (ABPmer, 2002).
- B.1.2 The Tees Estuary is not designated as a Bathing Water or Shellfishery. Northumbrian Water's Brans Sands WwTW discharges to the estuary close to Teesmouth.
- B.1.3 The mouth of the Tees Estuary has a breakwater to either side, the North Gare and South Gare breakwaters. The South Gare breakwater is the larger and longer structure (approximately 2 km in length compared to around 850 m for the North Gare breakwater). The South Gare breakwater runs parallel to the main approach channel of the Tees and is built over areas of deposited slag. Within the mouth of the Tees, to the south, is Bran Sands Bay, while Coatham Sands is to the east of the breakwater. North Gare Sands is to the south of the North Gare breakwater, with Seaton Sands to the north.
- B.1.4 PD Teesport report that the Tees Approach Channel has a charted depth of 15.4 m, which progressively reduces to 4.5 m east of Billingham Beck, which is 8 nautical miles upstream from the entrance to the estuary (Royal Haskoning, 2016c).
- B.1.5 The tide curve at Teesmouth is near sinusoidal in shape with a mean spring range of 4.6 m and a mean neap tide range of 2.3 m (UKHO, 2006). Other tidal statistics are given in Table B1.

Table B1: Tidal Statistics for the Tees Estuary (ABPmer, 2002)

Tide Statistic	Level (m Chart Datum)
Lowest recorded water level	-0.38
Lowest astronomical tide	0.00
Mean low water spring tide	+0.90
Mean low water neap tide	+2.00
Mean sea level	+3.20
Mean high water neap tide	+4.30
Mean high water spring tide	+5.50
Highest astronomical tide	+6.10
Highest recorded water level	+6.86

- B.1.6 The data in Table B1 indicates that there is variability between the astronomical tide range and the maximum and minimum recorded water levels, thereby suggesting that meteorological factors (e.g. wind, surge and waves) have an important influence on water levels in the estuary.
- B.1.7 The source of the Tees is at Cross Fell in the Pennines, some 160 km from the mouth of the Tees. Freshwater input to the estuary is measured at a gauging station at Low Moor (NGR NZ 364 105). According to the National River Flow Archive (CEH, n.d.) for the period 1969-2018, the Tees at this point has a mean flow of 20.528 m³/s, with a 10% exceedance (Q10) of 46.5 m³/s, and a 95 exceedance (Q95) of 3.07 m³/s.
- B.1.8 The Tees Barrage controls freshwater flow into the Tees Estuary and allows partial mixing with saline water. However, the combination of reduced tidal volume, partial mixing and longitudinal salinity gradient drive a density driven gravitational circulation. Ebb flows are strongest at the surface, while flood tide flows are more evenly spread through depth. As such, the tidally average currents tend to be seawards in the surface waters and landwards closer to the estuary bed (Royal Haskoning, 2016a). This effect leads to a net sediment supply into the estuary from offshore areas.
- B.1.9 Waves in the Tees Estuary result from a combination of locally generated wind waves, and offshore swell. The majority of offshore swell is from a northerly direction. The most common wind direction observed at South Gare is from the southwest (210-217°N), although the largest wind events (i.e. of over 40 m/s) tend to be from the north (HR Wallingford, 2006).
- B.1.10 Extreme wave heights for defined return periods, as previously reported for the waverider buoy north of the Tees North Buoy, are presented in Table B2. The North and South Gare breakwaters limit swell wave energy into the Tees Estuary, where any remaining energy is combined with local wind-driven waves (Royal Haskoning, 2016a).

Table B2: Extreme Wave Heights North of Tees North Buoy as Reported by HR Wallingford (2006)

Return Period in Years	Significant Wave Height (Hs (m))
0.1	3.87
1	6.03
10	8.63
50	10.69

B.1.11 Suspended sediment concentrations are generally low in Tees Bay and in the Tees Estuary when compared to some UK estuaries, with values typically below 50 mg/l based on historical (pre-Tees Barrage) measurements held by the Environment Agency. Highest concentrations tend to coincide with spring tides, and inputs tend to be derived from marine influences downstream, freshwater inputs from further up the catchment and industrial inputs. The marine input is washed in with the flood tide, and often causes resuspension of fine bed sediments.

B.1.12 The DCO Application relating to York Potash Harbour Facilities in 2016 (Royal Haskoning, 2016a) demonstrates that historical bed sampling in the vicinity of the Proposed Development has bed sediments comprising 65-70% silt, with some clay (around 20%) and the remainder sand and gravel. Coarser sands tend to settle in the lower estuary, with finer material transported further up the estuary by the tides. It is estimated that the total fine material input to the estuary is 280,000 m³ to 330,000 m³ per year (Royal Haskoning, 2016d).

Tees Bay

B.1.13 Tees Bay includes Bathing Waters designated under the Bathing Waters Directive, with 'Redcar Coatham' being located immediately north of the PCC Site, and 'Seaton Carew North Gare' being situated immediately north of the Study Area. There are no designated shellfisheries within Tees Bay.

B.1.14 Tees Bay has a tidal regime driven by the North Sea tidal wave, which originates in the north and travels south. The tide is semi-diurnal, repeating every 12.5-13 hours, with a macro-tidal range of 4.6 m for a mean spring tide and meso-tidal range of 2.3 m for a mean neap tide. Tidal velocities are generally low, reaching up to 0.25 m/s to 0.3 m/s. The flood tide direction in the Bay is southeast and the ebb direction northwest (EDF Energy, n.d.).

B.1.15 The sediment regime in the area includes surface seabed sediments, suspended sediments and a variety of sources and sinks. Silts and muds are readily transported as suspended sediment load and can remain in suspension for extended periods through the tidal cycle, while coarser sands and gravels may only be mobilised at times of peak hydrodynamic forcing carried as bedload. Suspended sediment concentrations between 1500 and 4000 mg/l have been measured at exposed locations during peak wave events (EDF Energy, n.d.).

- B.1.16 Coatham Sands are protected at the western end by nearshore slag banks exposed at low water and known as the German Charlies. The Redcar seafront then extends as a defended headland for around 1.5 km. The headland results from the outcropping rocks of Coatham Rocks and Redcar Rocks (Royal Haskoning, 2014).
- B.1.17 Within this area is the cable landfall of the Teesside Offshore Wind Farm, which is a 27 turbine 62 MW capacity offshore wind farm situated 1.5 km north of Coatham Sands, and which has been operational since 2013. There is also the discharge point from the former Steelworks site within Tees Bay off Coatham Sands.

Navigation

- B.1.18 The Tees Estuary and adjacent Tees Bay is subject to significant commercial vessel traffic. The Navigational Risk Assessment for the York Potash Harbour development (Royal Haskoning, 2016c) provided a summary of vessel movements within the Tees Estuary for 2013-2014, which are shown in Table B3. Updated figures will be requested from PD Teesport and will be included in the full impact assessment once received. The general pattern from 2013 is of an average of 878 vessel movements per month, peaking in May (1009) and with fewest in December (714).

Table B3: Vessel Movements for the Tees Estuary 2013 (Royal Haskoning, 2016c)

Month	No of movements
January	824
February	808
March	981
April	922
May	1009
June	871
July	899
August	867
September	869
October	890
November	886
December	714

- B.1.19 Further to the above, commercial fishing vessels are launched from Redcar and Marske-by-the-Sea and give rise to further traffic in the Tees Bay area. In particular, fishing effort in the area is focused on potting for crab and lobster, supplemented by trawling for cod, haddock, sole, whiting, plaice and turbot (EDF Energy, n.d.).
- B.1.20 The nearest HM Coastguard moorings (Maritime and Coastguard Agency, n.d.) are to the north of the Study Area at Hartlepool Marina. There is an RNLI Lifeboat station at Redcar Seafront.

Annex C - Surface Water Quality Data

Table C1 Summary of Tees Estuary Water Quality Data Based on Monitoring at Multiple Sites Between 2009 - 2019 (Environment Agency, n.d.c)

Parameter	WFD Threshold for Transitional Waters (for Good)	Tees at the Gares, NGR NZ 55200 28400	Dabholm Gut Confluence, NGR NZ 54822 24858	Teesport, NGR NZ 54400 23700	Redcar Jetty, NGR NZ 54500 25700	Smiths Dock, NGR NZ 52800 22100
Temperature of Water (°C)	-	10.28	12.01	11.9	10.2	10.6
Ammoniacal Nitrogen as N (mg/l)	21	0.270	-	-	0.545	-
Nitrate as N (mg/l)	-	0.43	-	-	0.88	1.19
Nitrite as N (mg/l)	-	0.011	-	-	0.0205	0.0155
Orthophosphate, reactive as P	-	0.045	-	-	0.0961	0.1185
Oxygen, Dissolved, % Saturation	-	101.95	98.07	94.25	97.41	93.39
Arsenic, Dissolved	25	1.15	-	1.100	-	1
Chromium, Dissolved		-	5.22	0.5	-	0.5
Copper, Dissolved	3.76*	0.630	1.39	-	0.91	0.89
Lead, Dissolved	1.3	0.128	0.574	0.294	0.244	0.59
Nickel, Dissolved	8.6	0.891	3.483	-	1.598	0.168
Zinc, Dissolved	6.8**	2.167	8.90	4.30	3.24	3.79
Tributyltin	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002
Lindane		-	-	-	0.0004	-
para para DDT	0.01	-	-	-	0.0012	-
Chloroform		-	1.060	0.116	-	-
Hexachlorobenzene	0.05	-	-	-	0.0004	-
Hexachlorobutadiene	0.6	-	-	-	0.0004	-

*where DOC is less than or equal to 1 mg **dissolved plus Ambient Background Concentration (µg/l)

Table C2: Summary of Water Quality Data Waterbodies within the Study Area based On Monitoring between 2009-2019 (Environment Agency, n.d.c)

Monitoring Station	Duration of Sampling	Type of Water Sampled	Parameters	General Quality Comments
COASTAL / ESTUARINE:				
Wilton Complex Main Effluent Composite NGR: NZ 56100 24100	1 year (2019)	Effluent	Sanitary pollutants (e.g. Biochemical Oxygen Demand (BOD)), metals and organics (e.g. chloroform).	This effluent shows high levels of numerous pollutants. BOD is very high and indicative of sanitary wastewater containing high concentration of organic material; Chloroform exceeds the EQS stated in the Dangerous Substance Directive; and copper and zinc exceed WFD EQS.
Brans Sands NGR: NZ557002660 0	2000-2019	Estuarine water	Physico-chemical parameters (e.g. pH, temp, dissolved oxygen); Nutrients and sanitary products (e.g. nitrate, ammoniacal nitrogen, orthophosphate).	Slightly alkaline and well oxygenated. Concentration of nitrates was relatively low, although orthophosphate elevated. Copper and zinc were not measured at this site. Escherichia coli and Intestinal enterococci have been measured once (2014) and were below limits of detection.
Dabholm Gut 100 m upstream from the Tees confluence NGR: NZ555002450 0	2000-2019	Estuarine water	Physico-chemical parameters (e.g. pH); Trace metals (copper and zinc).	Circum-neutral pH with average concentrations zinc exceeding the WFD Standards for estuarine water. It should be noted that only six samples were taken at this site.
Greatham Creek 100 m from outfall (adjacent to Able UK) NGR: NZ524902649 0	2009-2012	Estuarine Water	Physico-chemical parameters (e.g. pH, temp, dissolved oxygen); Nutrients and sanitary products (e.g. nitrate, ammoniacal nitrogen, orthophosphate)*; Trace metals.	Slightly alkaline and well oxygenated. Concentration of nitrates and phosphate were low. Numerous metals were measured at this site, all falling below EQS (as outlined in Table 9-11).
FRESHWATER:				
Billingham Beck 50 m upstream of River Tees confluence NGR: NZ474702050 7	2000-2019	River	Physico-chemical parameters (e.g. pH, temp, dissolved oxygen); Nutrients and sanitary products (e.g. nitrate, ammoniacal nitrogen, orthophosphate); Intermittent metals	Circum-neutral and well oxygenated. Concentration of nitrates and phosphate are slightly elevated. Dissolved copper concentrations are above the WFD Standard of 1 µg/l even in the 10 th percentile value. However, the standard applies to bioavailable copper, and there is insufficient data to determine bioavailability.

Monitoring Station	Duration of Sampling	Type of Water Sampled	Parameters	General Quality Comments
			monitoring until 2014 following which monitoring was regular.	The mean concentration of zinc is just below the WFD Standard of 10.9 µg/l (plus ambient)
Billingham Beck at Billingham Bottoms NGR: NZ454952239 3	2000-2019	River	Physico-chemical parameters (e.g. pH, temp, dissolved oxygen); Nutrients and sanitary products (e.g. nitrate, ammoniacal nitrogen, orthophosphate); Trace metals (copper and zinc).	Circum-neutral and well oxygenated. Concentration of nitrates and phosphate are considerably lower than the downstream sampling site close to the Tees confluence. Dissolved copper concentrations are high and may rise above the WFD Standard of 1 µg/l bioavailable (insufficient data to determine bioavailability).

Table C3: Summary of Water Quality Data for Wilton Complex Main Effluent Composite based on Monitoring Data from 2019

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
BOD	mg/l	35.8	14.96	68.2	37
Chromium	ug/l	14.8	5.7	25.6	38
Chloroform	ug/l	25.2	13	39.4	38
Copper	ug/l	12.37	7.3	16.02	38
Zinc	ug/l	65.8	43.3	106.2	38

Table C4: Summary of Water Quality Data for Brans Sands (Surface) Based on Monitoring Between 2009-2019

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
pH	pH Units	8.10	8.01	8.23	6
Temperature of Water	°C	10.77	6.81	16.04	6
Ammoniacal Nitrogen as N	mg/l	0.48	0.15	0.75	5
Nitrogen, Total Oxidised as N	mg/l	0.75	0.20	1.27	5
Nitrate as N	mg/l	0.70	0.18	1.20	5
Nitrite as N	mg/l	0.05	0.01	0.09	5
Orthophosphate, reactive as P	mg/l	0.07	0.03	0.10	5
Oxygen, Dissolved, % Saturation	%	114.20	114.20	114.20	1

Table C5: Summary of Water Quality Data for Dabholm Gut 100m U/S Tees (Surface) Based on Monitoring Between 2009-2019

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
pH	pH Units	7.96	7.80	8.17	6
Copper, Dissolved	µg/l	1.83	0.37	3.38	6
Zinc, Dissolved	ug/l	21.75	4.51	34.40	6

Table C6: Summary of Water Quality Data for Greatham Creek-100m from out – Surface Based on Monitoring Between 2009-2019

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
pH	pH Units	8.00	7.98	8.13	17
Temperature of Water	°C	11.32	6.05	14.95	17
Ammoniacal Nitrogen as N	mg/l	0.21	0.16	0.29	5
Arsenic, Dissolved	ug/l	1.19	1.0	1.41	11
Copper, Dissolved	µg/l	0.69	0.36	0.94	9
Zinc, Dissolved	ug/l	3.14	2.21	5.09	12
Cadmium, Dissolved	ug/l	<0.04	<0.04	<0.04	<0.04
Nickel, Dissolved	ug/l	0.83	0.47	1.26	12
Nitrogen, Total Oxidised as N	mg/l	0.39	0.20	0.69	5
Nitrate as N	mg/l	0.37	0.18	0.67	5
Nitrite as N	mg/l	0.02	0.01	0.02	5
Orthophosphate, reactive as P	mg/l	0.05	0.04	0.07	5
Oxygen, Dissolved as O ₂	mg/l	8.40	7.55	9.47	12
Oxygen, Dissolved, % Saturation	%	92.47	86.74	97.17	12

Table C7: Summary of Water Quality Data for Billingham beck 50m U/S of River Tees Confluence Based on Monitoring Between 2009-2019

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
pH	pH Units	7.46	7.01	7.94	164
Temperature of Water	°C	13.07	6.20	20.82	117
Ammoniacal Nitrogen as N	mg/l	19.78	4.98	35.54	117
Carbon, Organic, Dissolved as C- {DOC}	mg/l	12.07	8.25	16.31	60

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
Copper, Dissolved	µg/l	3.51	2.46	4.56	73
Zinc, Dissolved	ug/l	9.31	3.78	15.54	73
Nitrogen, Total Oxidised as N	mg/l	28.49	6.69	49.62	117
Nitrate as N	mg/l	28.39	6.60	49.48	117
Nitrite as N	mg/l	0.11	0.06	0.18	117
Orthophosphate, reactive as P	mg/l	1.60	0.21	2.93	117
Oxygen, Dissolved, % Saturation	%	79.69	61.25	96.45	116
Oxygen, Dissolved as O2	mg/l	8.58	5.77	11.25	116

Table C8: Summary of Water Quality data for Billingham Beck at Billingham Bottoms based on monitoring between 2009-2019

Determinand	Unit	Mean	10th percentile	90th percentile	No. of samples
pH	pH Units	7.93	7.62	8.20	77
Temperature of Water	°C	9.55	3.96	14.64	77
Ammoniacal Nitrogen as N	mg/l	0.11	0.03	0.23	76
Copper, Dissolved	µg/l	2.84	1.68	4.12	58
Nitrogen, Total Oxidised as N	mg/l	4.92	2.69	8.55	102
Nitrate as N	mg/l	4.88	2.63	8.51	102
Nitrite as N	mg/l	0.04	0.01	0.06	105
Orthophosphate, reactive as P	mg/l	0.21	0.13	0.34	38
Oxygen, Dissolved, % Saturation	%	84.37	71.00	95.60	77
Oxygen, Dissolved as O2	mg/l	9.75	7.14	12.10	77

Annex D - Sediment Quality

- D.1.1 Numerous investigations of sediment quality have recently been undertaken to support various recent dredging proposals and developments around the Tees Estuary, with samples compared to CEFAS3 Action Levels for the disposal of dredged material. These give an indication of sediment quality in the Tees Estuary and Teesmouth areas. In general, contaminant levels in dredged material below Action Level 1 are of no concern and are unlikely to influence marine licensing decisions and is suitable for sea disposal. However, dredged material with contaminant levels above Action Level 2 is generally considered unsuitable for sea disposal.
- D.1.2 Samples were collected in 2017 and 2018 to support dredging at Seaton Port (Able UK, 2018), adjacent to the Seaton Port Dry Dock facility on the north bank of the River Tees, centred approximately on NGR NZ 52416 26658. This is approximately 2.4 km west of the abstraction point for the Proposed Development. Sampling consisted of four surface samples in the vicinity of the dry dock in 2017 and a further five in 2018. A summary of results is shown against CEFAS Action Levels in Table D1. It is clear that several metals are present in concentrations over Action Level 1, which triggered additional sampling, but none were found to exceed Action Level 2.

Table D1: Assessment of Sediment Samples Against CEFAS Action Levels for Samples Collected in 2017/18 from Seaton Port (Adapted From Able UK (2018))

Parameter	Action Level 1	Action Level 2	Maximum 2017 Result	Maximum 2018 Results	Comment
Arsenic	20	100	36.28	26.2	Above Level 1; Significantly below Level 2.
Mercury	0.3	3	0.72	0.35	Above Level 1; Significantly below Level 2.
Cadmium	0.4	5	0.47	Below AL1	2017 result above Level 1; Significantly below Level 2.
Chromium	40	400	105.84	92.8	Above Level 1; Significantly below Level 2.
Copper	40	400	66.4	40	Above/equal to Level 1; Significantly below Level 2.
Nickel	20	200	42.88	40.2	Above Level 1; Significantly below Level 2.
Lead	50	500	151.32	108	Above Level 1; Significantly below Level 2.
Zinc	130	800	244.5	199	Above Level 1; Significantly below Level 2.

Note: all value as mg/kg Dry weight (ppm)

- D.1.3 The DCO Application relating to York Potash Harbour Facilities in 2016 (Royal Haskoning, 2016a) also included sediment sampling in the main Tees

³ Centre for Environment, Fisheries and Aquaculture Science

Estuary downstream of Dabholm Gut. The sampling was undertaken in 2014 and full results are available in Royal Haskoning (2016b).

- D.1.4 Surface sediment samples were collected as well as sediment from a range of depths down to 4.87 m below the surface. In summary, the sediments contained relatively high levels of contamination, including elevated metals and polycyclic aromatic hydrocarbon (PAH) concentrations. Metals and PAHs exceeded CEFAS Action Level 1 at the majority of sampling stations and depths. In some cases, CEFAS Action Level 2 was also exceeded, notably for chromium, copper and mercury. As such these sediments were not considered suitable for disposal at sea. The concentration of metals in dredged samples from the Tees Approach Channel were generally less than those sampled closer to the east bank, with no exceedances of CEFAS Action Level 1 in the samples from the approach channel. On the whole, there were fewer exceedances of Polychlorinated biphenyls (PCBs) against the CEFAS Action Levels than metals and PAHs, although there were instances of exceedances against both Action Level 1 and 2. Concentrations of contaminants are greater at depth than in surface samples, reflecting the historical impact of heavy industry in this area around the waterbody, which in the past received a large amount of waste discharge.
- D.1.5 Two earlier impact assessments of sediment quality were undertaken to support the EIA of the Northern Gateway Container Terminal (NGCT) and QE II berth redevelopment project.
- D.1.6 The QE II berth sediment assessment consisted of two samples immediately west of Tees Dock, taken in 2008. Two vibrocores were used for sampling sediment to a depth of 4 m below ordnance datum. Results indicated that all metals exceeded CEFAS Action Level 1 levels of contamination. Concentrations of dibutyl tin and organotins were present below Action Level 1. Concentrations of cadmium, chromium, copper, lead, mercury and zinc also exceeded CEFAS Action Level 2 (Royal Haskoning, 2016a) and were not considered suitable for disposal at sea.
- D.1.7 The NGCT sediment samples were collected in 2006 from several locations throughout the Tees Estuary, including the main channel between Tees Dock and Dabholm Gut, Seal Sands, Bran Sands and the Tees Approach Channel. In summary, there was some level of contamination recorded in the samples, particularly with regard to heavy metals. However, levels were not deemed high enough to prevent material being disposed of at sea (Royal Haskoning, 2016a).
- D.1.8 These past sampling campaigns indicate significant historical contamination in the Tees Estuary, which is more concentrated at the margins of the channel and at depth than in surface sediments. In some locations, concentrations of contaminants exceeded CEFAS Action Level 2 and so disposal at sea is not considered suitable in these cases.

Annex E - Pond 14 Water Quality Monitoring Technical Note

9A. Annex E: Coatham Sands Water Quality and Hydrological Monitoring

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9.1 Introduction

Background

- 9.1.1 The Coatham Sand Dunes are a natural feature and part of the South Gare and Coatham Sands Site of Special Scientific Interest (SSSI) and were formed following the construction of the South Gare Breakwater. However, to the south of these dunes there is an extensive tract of made ground between the dunes and the former Redcar Steelworks, formed of historic slag deposits. Within the dunes and area of made ground there is a complex of ponds and wetlands.
- 9.1.2 According to the Natural England citation (REF 1) for the site, “*The site known as South Gare and Coatham Sands is of considerable interest for its flora, invertebrate fauna and birdlife. The range of habitats present includes extensive tracts of intertidal mud and sand, sand dunes, saltmarsh and freshwater marsh which have all developed since the construction of the South Gare breakwater with tipped slag during the 1860’s. Also exposed at low tide are areas of rocky foreshore along the breakwater, three slag banks known as the German Charlies, and Coatham Rocks.*”
- 9.1.3 In the UK, there is a general trend for dune slack ponds to be drying out and becoming more nutrient enriched. Using historical satellite imagery, it is evident that these ponds (albeit not natural ‘dune slacks’) have been succeeding as the spatial area of the standing water bodies has significantly decreased over the last 20 years.
- 9.1.4 A combination of a site walkover and water quality and water level monitoring was undertaken by AECOM Water Scientists between September 2020 and January 2021 at Coatham Sand Dunes in order to better understand the current baseline conditions and help characterise the water chemistry of these ponds.
- 9.1.5 This baseline data will provide an indication of trophic status and the pond and wetland sensitivity to atmospheric nitrogen/ammonia deposition. Furthermore, these visits provided an opportunity to better understand the hydrology of these ponds and any temporal fluctuations or trends (including the possibility of any tidal influence).
- 9.1.6 This data also informs the water environment impact assessment of the ponds as outlined in Chapter 9, Surface Water, Flood Risk and Water Resources (ES Volume I) and also the assessments presented in Chapter 13: Aquatic Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2) and Chapter 14: Marine Ecology and Nature Conservation of the Environmental Statement (ES Volume I, Document Ref. 6.2).

9.2 Water Quality and Hydrology of Dune Slack Ponds

- 9.2.1 Dune slack ponds are thought to be more sensitive to nutrient enrichment than other small still water bodies as they do not tend to have catchments from where nutrients may be sourced. If a water body is already nutrient rich, then it will be less sensitive to increases in atmospheric nutrient deposits than other still waters.
- 9.2.2 Large water bodies and those that have short residence times will also tend to be less sensitive as they offer greater dilution or flushing of excess nutrients. However, a small waterbody that is naturally oligotrophic (i.e. relatively poor in nutrients) and with a long residence time (i.e. low overturn or flushing of the water column) will tend to be more sensitive to excess deposition of nutrients, potentially including the loads from atmospheric deposition.
- 9.2.3 Where flushing rates are limited, small waterbodies will tend to accumulate nitrogen/ammonia, and this will result in changes in water chemistry and poorer conditions for aquatic organisms.
- 9.2.4 Furthermore, any reduction in water levels and the overall size of a water body may reduce dilution and limit dissolved oxygen levels, which may already be reduced due to the effects of eutrophication. However, biological activity may remove nutrients from the water column during the growing season, although seasonal die back of vegetation can re-release nutrients back into the water column.
- 9.2.5 Small waterbodies with long residence times may also be susceptible to changes in pH, although the presence of bases may allow the water body to buffer the risk from acidification.
- 9.2.6 Overall, water chemistry, conversion and removal processes, hydrology and biological activity are all important considerations.
- 9.2.7 The sensitivity of a pond and the risk of acidification, nutrient enrichment or other chemical changes due to the deposition of nitrogen and ammonia will depend on:
- Changes in atmospheric deposition/amount of atmospheric deposition;
 - Pond hydrology; and
 - Water chemistry, conversion and removal processes.

9.3 Groundwater

Groundwater levels

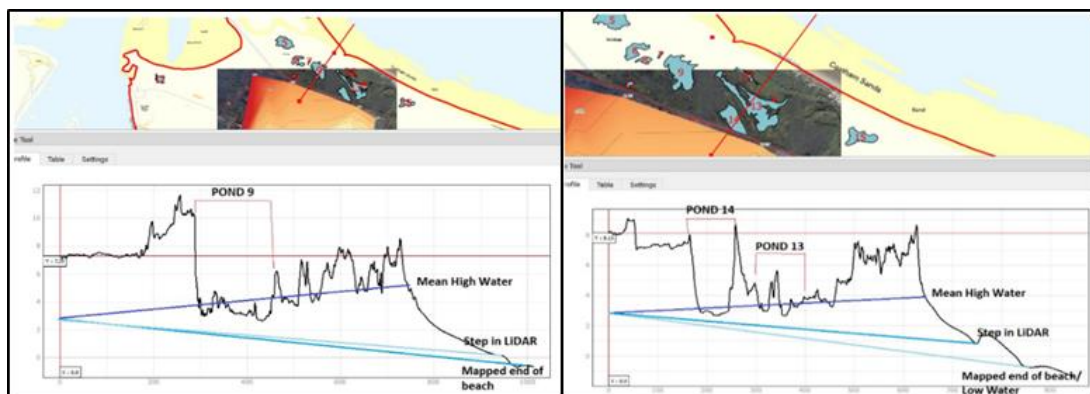
- 9.3.1 Groundwater level, as measured in an observation borehole, reflects the amount of water in storage in the monitored aquifer. In general, when recharge exceeds natural discharge plus abstraction, groundwater levels rise. When recharge is less than natural discharge plus abstraction,

groundwater levels fall. In addition to this, groundwater levels at the shoreline may also be influenced by the rise and fall of the tide.

Current groundwater levels

- 9.3.2 Geological maps show substantial covering of beach and tidal flat deposits (sand), blown sand and Tidal Flat Deposits (sand, silt and clay) across the sand dune complex. These superficial deposits are classed as a Secondary A Aquifer. Beneath this the local bedrock is Mercia Mudstone, which is classified only as a Secondary B Aquifer.
- 9.3.3 Historic British Geological Survey (BGS) logs (Ref. 2) located within the former Redcar steelworks site and less than 200 m from the Coatham Dunes indicate that superficial deposits are over 15 m thick above the Mercia Mudstone (e.g. BGS Borehole ID 718374, NGR NZ 56627 25778), which would indicate a sizeable superficial aquifer extending inland. This would also imply that there is the possibility of groundwater supporting the hydrology of these dune slack ponds. However, there is clear evidence especially on the more landward side of the sand dunes, that the natural superficial deposits have been interfered with by past industrial activity with extensive Made Ground, including surrounding Pond 14. As a result, the hydrology of these ponds may differ considerably from the natural processes controlling the formation and character of dune slacks.
- 9.3.4 Dune slacks are normally formed by blow outs and erosion of the sand down to the Groundwater Level (GWL) and thus their hydrology is usually controlled by groundwater rather than surface water contributions (there is no surface drainage network to provide an inflow). We have considered the relative position of previously monitored groundwater depth beneath the SSI Site and the location and likely depth of these ponds, drawing a theoretical (and linear) GWL between this point and either MHW and MLW (as inferred from the further position of the sea on Ordnance Survey maps). This is shown in Figure 9A-1, below.

Figure 9A-1 Graphs showing theoretical GWL between SSI site and MHW/MLW



- 9.3.5 If we assume that the lidar is sensitive to water level (some penetration would be expected, and this may be why the lidar data is not level for each pond) then we need to also consider a pond depth below the level shown. Site evidence indicates that water depths are generally <1 m. Although a

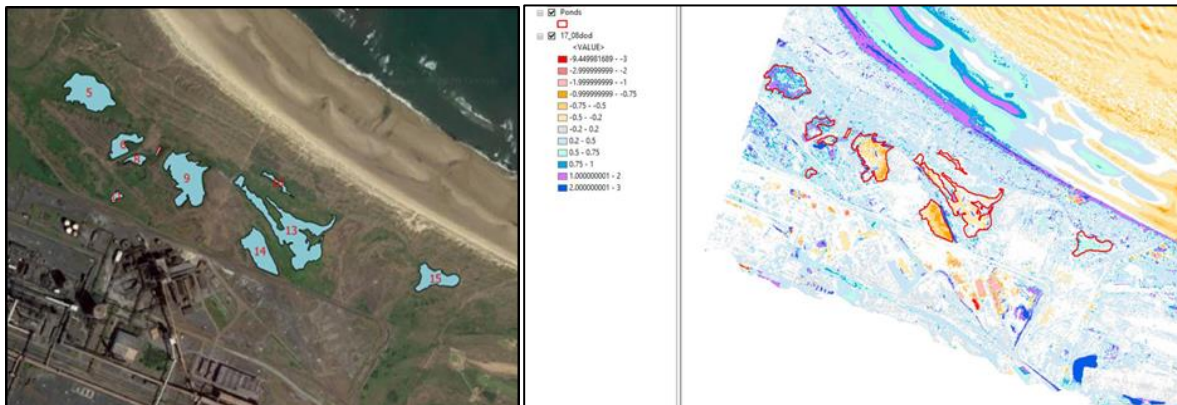
linear and static GWL would not be expected, this illustrates that GWL may well intersect with the base of some of these ponds and thus cannot be ruled out easily.

- 9.3.6 Theoretically, there could also be ingress from the sea to the ponds, but the influence from the sea will be dependent on the duration of time the head is higher than GWL and how easily the signal is transmitted to groundwater through the ground and ultimately to the ponds (which depends on the permeability of the ground). A few salinity readings taken during ecology surveys suggested only marginal salinity, and this would indicate a more limited connectivity with the sea (for example, only slightly brackish conditions may potentially be caused by salt spray).
- 9.3.7 Overall, the potential role of groundwater in the superficial deposits in driving water levels in the dune slacks cannot be determined without more detailed investigations (including seasonal trends in GWL over time (GWL may fluctuate seasonally to intercept the base of slacks)).
- 9.3.8 Groundwater Dependent Terrestrial Ecosystems (GWDTEs) do not need to hold open water but groundwater close to the surface - surface/groundwater interactions exist even if groundwater is not above the surface. However, the limited groundwater data that is available suggests flow towards the shore, and with any future CO₂ pipeline or replacement cooling water outfall being perpendicular to the shore, there is a reduced risk of interrupting groundwater flow, although this depends on depth and size of the pipe.
- 9.3.9 Furthermore, if the proposed new CO₂ Export Pipeline and potentially Water Discharge Pipeline is constructed to the south of the ponds, the risk of interrupting any groundwater supply to the ponds is further reduced. Refer to ES Volume I, Chapter 10: Geology and Hydrogeology (ES Volume I, Document Ref. 6.2) for more details of the ground investigation and ground conditions.

Digital Elevation Model Data

- 9.3.10 As shown in Figure 9A-2, below, using relative levels of Digital Elevation Models (DEM) from 2008 and 2017 lidar data, the overall trend suggests a decrease in pond size, most likely due to a fall in water level or pond succession. As there are different evolutions occurring it would suggest the hydrology of the various ponds differ and leads to further uncertainty in response to potential scheme impacts. It was therefore recommended that further survey and monitoring be undertaken to better understand the hydrology of these ponds in order that a more robust assessment of the potential hydrological and water quality effects can be made.

Figure 9A-2 Aerial view and DEM view of ponds at Coatham Sands; 2008 (left) and 2017 (right)



9.4 Site Walkover

- 9.4.1 A Site walkover was undertaken on 17th September 2020 in dry, fair weather conditions. All waterbodies marked on Figure 9A-2 were viewed on Site.
- 9.4.2 The walkover involved making visual observations of all ponds identified on Ordnance Survey maps and aerial imagery. Where open water ponds were located dissolved oxygen and temperature data was collected using a self-calibrating handheld YSI Pro20 probe.
- 9.4.3 The visit confirmed that all ponds are unnatural features developed in the historic slag deposits which are likely to be relatively impermeable, and their hydrological functioning is unlikely to be consistent to typical sand dune slacks (that are found more to seaward).
- 9.4.4 Notably, only one of these ponds (Pond 14), contained open water and could be considered a 'pond' and surface waterbody. The remaining waterbodies are fully overgrown with emergent macrophytes to the extent that no open water could be observed, and so they should be considered as wetlands. This remained the case throughout the water quality monitoring period, which included periods of heavy rainfall in December 2020 and January 2021.
- 9.4.5 Typical photos of the waterbodies are shown in Photo 1, and the open water of Pond 14 in Photo 2.

Photo 1: Panoramic Photos of ‘waterbodies’ 5 (top) and 13 (bottom)



Photo 2: Panoramic Photos of Pond 14; taken on 17 September 2020 (top), 8th October 2020 (middle) and 21st January 2021 (bottom)





9.5 Designated Conservation Sites

- 9.5.1 The ponds between the Coatham Sands and former Redcar steelworks fall under the Teesmouth and Cleveland Coast SSSI designation. This is a large SSSI consisting of 33 units.
- 9.5.2 Unit 28 is 'South Gare and Coatham Sands'. This unit itself is 143 ha in area, while the whole SSSI is 2,964 ha in size. The citation details for this SSSI state the following with regard to freshwater waterbodies¹:
- 9.5.3 *The Teesmouth and Cleveland Coast SSSI is an extensive mosaic of coastal and freshwater habitats centred on the Tees Estuary. These include sand dunes, saltmarshes, mudflats, rocky and sandy shores, saline lagoons, grazing marshes, reedbeds and freshwater wetlands.*
- 9.5.4 *The site supports an extensive complex of dunes flanking both side of the Tees estuary. It is the largest dune complex between Druridge Bay and Spurn Point. The dunes support a large area of semi-natural vegetation, including the typical succession from strandline through foredunes and mobile dunes to fixed dune grassland, as well as transitions to wetter habitats.*
- 9.5.5 *There are two main dune systems: Seaton Dunes to the north of the Tees, and Coatham Dunes to the south. The structure and geomorphology of both systems has been heavily influenced by a long history of human intervention, including sand extraction. Most significant has been the construction of two large breakwaters (North Gare and South Gare), which guard the entrance to the estuary. They have a strong influence on sediment dynamics and result in both dune systems showing a combination of the features of bay and spit dune systems.*
- 9.5.6 *There are a number of damp depressions ('slacks') in both dune systems, which support a range of wetter vegetation types, usually with a sward dominated by mixtures of red fescue, Yorkshire fog (*Holcus lanatus*) and*

¹ Natural England, Teesmouth and Cleveland Coast SSSI Citation. Available at: https://consult.defra.gov.uk/natural-england-marine/teesmouth-and-cleveland-coast-potential-sp/supporting_documents/1.%20Teesmouth%20and%20Cleveland%20Coast%20SSSI%20%20Citation%2018%20April%202019.pdf.

creeping bent (Agrostis stolonifera). Creeping willow (Salix repens) is extremely scarce in the Tees Estuary and so does not form a regular component of the dune slacks in contrast to many dunes systems. A particularly prominent feature of some of the slacks are large and colourful stands of marsh orchids (Dactylorhiza) species and their hybrids. Some of the slacks show affinities with saltmarsh vegetation, with a selection of salt tolerant species such as saltmarsh rush (Juncus gerardii), sea plantain (Plantago maritima) and sea-milkwort (Glaux maritima), and are likely to have been derived from the isolation of saltmarsh vegetation by developing dunes. More consistently wet slacks support swamp communities. Fertile feather moss (Drepanocladus polygamous) and flat-sedge (Blysmus compressus) occur in some of the slacks.

- 9.5.7 Pond 14 is not a true sand dune slack and does not appear to support the above interest features. The pond is an artificial feature and appears to have limited biodiversity with were few ecological features of note aside from a stand of common reed at its northern margin, which is not thought to contribute to the designation of the SSSI Unit. However, the pond provides open water habitat which is limited in the sand dune complex and habitat at times for certain bird populations, particularly redshank (*Tringa totanus*), who move inland to open water at high tide.
- 9.5.8 It should be noted that the ponds at Coatham Sands are also within the Teesmouth and Cleveland Coast Special Protection Area (SPA). The SPA was first classified in 1995 for its numbers of European importance of breeding little tern, passage sandwich tern, wintering Red knot (*Calidris canutus islandica*) and passage Common redshank (*Tringa totanus tetanus*) as well as an assemblage of over 20,000 waterbirds. At this time only Pond 5 (as shown in Figure 9A-2) was in the designation The SPA was updated in 2000 to include additional areas of coastal and wetland habitats important for waterbirds. Coatham Sands is an important feeding and roosting areas for waders, notably red knot and sanderling.
- 9.5.9 The ponds are also within the Teesmouth and Cleveland Coast Ramsar site. The Ramsar site was first classified in 1995 for encompassing a range of habitats which support internationally important numbers of waterbirds, such as Common redshank (*Tringa totanus tetanus*) and wintering Red knot (*Calidris canutus islandica*).
- 9.5.10 Following formal consultation in 2018 led by Natural England, the Teesmouth and Cleveland Coast SPA and Ramsar sites were extended on the 16th January 2020, and now encompass the ponds shown in Figure 9A-2 having only included Pond 5 prior to this date.

9.6 Monitoring Approach

Water Quality Monitoring

- 9.6.1 Water quality monitoring at Pond 14 at Coatham Sands SSSI was undertaken between October 2020 and January 2021 by AECOM Water Scientists. During this period eight water samples were collected for

laboratory analysis, as well as in situ measurements of temperature and dissolved oxygen (DO).

- 9.6.2 Monitoring was undertaken across a variety of climatic conditions and tidal conditions, where feasible, to understand the effects of these external factors on Pond 14 water quality and hydrology.
- 9.6.3 Water quality samples were analysed for a comprehensive suite, as summarised below in Table 9A-1.

Table 9A-1: Water Quality Analysis Suite

Determinands	Units	Determinands	Units
Biochemical Oxygen Demand (BOD)	mg/l	Heavy Metals (total and dissolved)	µg/l
Ammoniacal Nitrogen	mg/l	Colour	pcu
Unionised Ammonia	mg/l	Salinity	%
Nitrate	mg/l	Chlorophyll A	µg/l
Nitrite	mg/l	Total Organic Carbon	mg/l
Total Oxidised Nitrogen	mg/l	Dissolved Organic Carbon	mg/l
Total Inorganic Nitrogen	mg/l	Total Phosphorous	µg/l
Chloride	mg/l	Soluble Reactive Phosphorus (Orthophosphate as PO ₄)	mg/l
Total Suspended Solids (TSS)	mg/l	Polycyclic Aromatic Hydrocarbons (PAHs)	µg/l
Turbidity	NTU	Total Petroleum Hydrocarbons (TPHs)	µg/l
pH	pH units	Temperature (in situ)	°C
Alkalinity	mg/l	Dissolved Oxygen (in situ)	mg/l
Electrical Conductivity	µS/cm	Semi-Volatile Compounds (SVOCs)	µg/l
PCBs	µg/l	Phenols	µg/l
Earth Metals (dissolved)	mg/l	Iron II and III (dissolved)	mg/l

- 9.6.4 DO and water temperature were measured in situ using a fully calibrated handheld probe (e.g. YSI Pro20).
- 9.6.5 It is important to note that the results of Polyaromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPHs), Polychlorinated biphenyls (PCBs), Semi-Volatile Organic Compounds (SVOCs) and Phenols all fell below the laboratory limit of detection (LoD). The LoDs are generally higher than the WFD annual average EQS but lower than some of the maximum allowable concentration EQS. However, not all of the organic compounds have standards. Overall, samples were not analysed for PCBs, SVOCs and Phenols after the initial visit, and PAHs and TPHs after the second sampling visit.
- 9.6.6 The raw results can be found in Annex A.

Water Level Monitoring

- 9.6.7 Water level monitoring of Pond 14 was undertaken at the same time as water quality monitoring, again for eight visits.
- 9.6.8 During the first monitoring visit, a wooden stake with 5 cm banded intervals was installed in a corner of Pond 14. The bands were used to record the approximate water level on each visit compared to the reference value from the initial site visit.

Photo 3: Wooden stake used to record water levels in Pond 14 with 5 cm bands



9.7 Results

Water Quality Monitoring

- 9.7.1 Table 9A-2 summarises the water quality results for physico-chemical, major ions, nutrients and sanitary pollutants in Pond 14. See Annex A for raw laboratory results.
- 9.7.2 Due to the water in Pond 14 being slightly 'brackish' with a mean specific electrical conductivity of 2,250 $\mu\text{S}/\text{cm}$ ('clean' freshwater would typically not have an electrical conductivity above 2,000 $\mu\text{S}/\text{cm}$), it is considered appropriate to compare the results against WFD saltwater standards for specific pollutants (where relevant). Furthermore, DO results are compared against the standards for transitional and coastal waters with salinities <35 , and ammonia against the standards for lakes (REF 3).
- 9.7.3 Some compounds are compared against the WFD Annual Average (AA-EQS) and Maximum Allowable Concentration (MAC-EQS) Environmental Quality Standards for Priority Substances and Other Pollutants for inland surface waters (REF 3).

Table 9A-2: Summary of water quality results for Physico-chemical, major ions, nutrients and sanitary pollutants

Parameter	Units	Limit of Detection	Average	Max.	Min.	90%ile	10%ile
Temperature	°C	n/a	7.37	12.5	1.6	12.4	1.9
Dissolved Oxygen (DO)	% Sat.	n/a	106	119.8	92.5	117.3	92.9
DO	mg/l	n/a	12.72	16.5	9.9	16.09	9.9
Apparent Colour	mg/l PtCo	<15	34.8	39	30	39	30.4
pH	pH units	<0.01	7.67	8.14	7.18	8.01	7.20
Total Alkalinity as CaCO ₃	mg/l	<1	61.25	68	44	68	52.4
Electrical Conductivity @25°C	µS/cm	<2	2250	2637	1386	2581.7	1834.7
Salinity	%	<0.1	0.11	0.2	0.1	0.14	0.1
Chloride	mg/l	<0.3	243.46	325.1	112.2	316.56	149.51
BOD (Settled)	mg/l	<1	1.5	2	1	2	1
Total Suspended Solids	mg/l	<10	18.4	26	12	24.8	13.2
Turbidity	NTU	<0.1	6.43	9.9	1.7	9.34	2.4
Dissolved Organic Carbon	mg/l	<2	3.86	4	3	4	3.6
Total Organic Carbon	mg/l	<2	5.25	16	2	8.3	2.7
Free Ammonia as N	mg/l	<0.006	Below Limit of Detection				
Ammoniacal Nitrogen as N	mg/l	<0.03	0.05	0.12	0.03	0.09	0.03
Total Oxidised Nitrogen as N	mg/l	<0.2	Below Limit of Detection				
Inorganic Nitrogen	mg/l	<0.05	0.05	0.05	0.05	0.05	0.05
Total Nitrogen	mg/l	<0.5	1.10	1.6	0.8	1.56	0.8
Nitrate as NO ₃	mg/l	<0.2	0.2	0.2	0.2	0.2	0.2
Nitrite as NO ₂	mg/l	<0.02	Below Limit of Detection				
Ortho Phosphate as PO ₄	mg/l	<0.06	Below Limit of Detection				
Chlorophyll A	µg/l	<1	21.25	70	7	39.9	8.4

- 9.7.4 Average DO values were 106% and 12.72 mg/l indicating supersaturation (i.e. over 100%) which is often associated with photosynthesis activity during daylight hours, and/ or significant aeration. The large water-air interface and exposed nature of Pond 14 is considered to have the greatest influence on aeration compared to photosynthesis, especially due to lack of macrophytes and the timing of the monitoring over the late autumn and winter period.
- 9.7.5 An average DO value of 12.72 mg/l is classified as 'High' under the WFD DO standards for transitional and coastal water with salinities <35, suggesting that the pond is well oxygenated.
- 9.7.6 The highest DO values were recorded during the 6th and 7th visits at 114.8% and 119.8% respectively, which coincided with the lowest recorded pond temperatures of 2.2°C and 1.6°C respectively, consistent with the solubility of oxygen increasing with decreasing temperature. Furthermore, the 6th and 7th visits also coincided with rainfall which may have added to increased DO

levels at the time of monitoring. It is possible that dissolved oxygen levels will fall in the summer as water level decreases and the water warms. However, there appears to be a lack of faunal organisms to consume oxygen, and a lack of plants that might decompose later in the year and further deplete DO levels.

- 9.7.7 The average pH value is circum-neutral at 7.67. Minimum and maximum values of 7.18 and 8.01 indicate Pond 14 is within generally acceptable pH levels for aquatic organisms.
- 9.7.8 Average electrical conductivity was 2,250 $\mu\text{S}/\text{cm}$. However, during the 6th visit the electrical conductivity was recorded at 1,386 $\mu\text{S}/\text{m}$ which lies within the upper end of what is generally considered freshwater. This value coincided with rain during the site visit and snowmelt the previous day, suggesting precipitation has a strong influence on conductivity in Pond 14. The water temperature was also a lot lower which would reduce electrical conductivity readings.
- 9.7.9 Average Ammoniacal Nitrogen is 0.05 mg/l, marginally above the laboratory limit of detection (LoD), indicating a negligible presence of sanitary pollutants in the pond. This falls within the WFD 'Good' category for a Type 3 lake, defined as having an alkalinity between 50 and 100 mg/l. This is reinforced by low Biological Oxygen Demand values. Furthermore, average Nitrate is 0.2 mg/l, whilst average Nitrite is below LoD.
- 9.7.10 Average Total Nitrogen concentration is 1.1 mg/l and a maximum of 1.6 mg/l was recorded. Average Total Phosphorus concentration is 0.047 mg/l. Based on these average concentrations, the total nitrogen (TN) to total phosphorus (TP) ratio is 23.4, indicating the phosphorus is by far the limiting nutrient, with total nitrogen inputs expected to predominantly related to atmospheric deposition. Further details on the potential impact of nitrogen deposition from the Proposed Development can be found in Chapter 9 Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2). Chlorophyll a has a mean concentration of 21.25 $\mu\text{g}/\text{l}$, with a maximum concentration of 70 $\mu\text{g}/\text{l}$, indicating that the pond would typically be considered eutrophic (i.e. nutrient enriched) but can become hyper-eutrophic. However, more data would be needed to fully determine the trophic status of the pond, and water clarity, colour and lack of macrophytes across the body of the water do not support this. It is likely that there are other controls that are preventing colonisation of the pond by macrophytes. The variable water levels or perhaps a hard, impenetrable bed from Made Ground just beneath a soft veneer of organic sediment that prevents rooting by plants are possible reasons.



9.7.11 Table 9A-3 and Table 9A-4 below summarise the water quality results for a number of metals and metalloids including those often associated with the steel making process such as arsenic, chromium, cadmium, zinc, nickel and boron. These are compared against the WFD standards outlined in paragraphs 9.7.2 and 9.7.3. See Annex A for raw laboratory results.



Table 9A-3: Summary of water quality results for Dissolved Heavy Metals, Earth Metals, and Iron II and III

Parameter	Units	Limit of Detection	Average	Max.	Min.	90%ile	10%ile
<i>Dissolved Heavy Metals</i>							
Aluminium	µg/l	<20	22.33	25	20	24.4	20.4
Antimony	µg/l	<2	4	4	4	4	4
Arsenic	µg/l	<2.5	3.43	3.9	3.1	3.78	3.13
Barium	µg/l	<3	20.38	27	11	24.2	16.6
Beryllium	µg/l	<0.5				Below LoD	
Boron	µg/l	<12	503.25	596	298	577.8	440.8
Cadmium	µg/l	<0.5				Below LoD	
Chromium	µg/l	<1.5				Below LoD	
Cobalt	µg/l	<2				Below LoD	
Copper	µg/l	<7				Below LoD	
Iron	µg/l	<20	30.17	51	20	43	22
Lead	µg/l	<5				Below LoD	
Manganese	µg/l	<2	36.63	71	12	60.5	15.5
Mercury	µg/l	<1				Below LoD	
Molybdenum	µg/l	<2	217.75	340	96	301.5	126.1
Nickel	µg/l	<2	2	2	2	2	2
Phosphorus	µg/l	<5	8.2	10	5	9.6	6.2
Selenium	µg/l	<3	4	4	4	4	4
Thallium	µg/l	<3				Below LoD	
Vanadium	µg/l	<1.5	1.95	2	1.9	1.99	1.91
Zinc	µg/l	<3	4.25	5	4	4.7	4
<i>Dissolved Earth Metals</i>							
Calcium	mg/l	<0.2	274.53	345.80	177.60	333.98	204.81
Magnesium	mg/l	<0.1	28.68	32.80	21.90	31.99	24.30
Potassium	mg/l	<0.1	50.68	62.10	35.30	59.49	40.28
Sodium	mg/l	<0.1	112.00	143.50	77.40	136.36	86.40
<i>Dissolved Iron II and III</i>							
Iron II	mg/l	<0.02	0.04	0.05	0.03	0.048	0.032
Iron III	mg/l	<0.02	0.02	0.02	0.02	0.02	0.02



- 9.7.12 Both average dissolved arsenic (3.43 µg/l) and average dissolved zinc (4.25 µg/l) fall below the WFD long-term (mean) standard for specific pollutants of 25 µg/l and 10.9 µg/l (6.8 µg/l plus 4.1 µg/l Tees catchment ambient background concentration), respectively.
- 9.7.13 Average dissolved nickel and its compounds falls below the AA-EQS and MAC-EQS of 4 µg/l and 8.6 µg/l respectively.
- 9.7.14 Average dissolved mercury and its compounds were not detected above its LoD of 1 µg/l. However, its MAC-EQS of 0.07 µg/l indicates that there is a 0.93 µg/l margin where the WFD standard could be exceeded without detection.
- 9.7.15 Similarly, average dissolved cadmium and its compounds were not detected above its LoD of 0.5 µg/l. Its AA-EQS of 0.09 µg/l indicates that there is a 0.41 µg/l margin where the WFD standard could be exceeded without detection. However, its MAC-EQS of 0.6 µg/l was not exceeded.

Table 9A-4 Summary of water quality results for Total Heavy Metals

Parameter	Units	Limit of Detection	Average	Max.	Min.	90%ile	10%ile
Aluminium	µg/l	<20	160.33	290	93	235	98.5
Antimony	µg/l	<2	8	8	8	8	8
Arsenic	µg/l	<2.5	3.05	3.2	2.9	3.17	2.93
Barium	µg/l	<3	21.13	34	8	29.1	13.6
Beryllium	µg/l	<0.5			Below LoD		
Boron	µg/l	<12	494.38	579	307	567.1	431.6
Cadmium	µg/l	<0.5			Below LoD		
Chromium	µg/l	<1.5			Below LoD		
Cobalt	µg/l	<2			Below LoD		
Copper	µg/l	<7			Below LoD		
Iron	µg/l	<20	795	2373	57	1415.4	260
Lead	µg/l	<5			Below LoD		
Manganese	µg/l	<2	65.25	127	21	112.3	31.5
Mercury	µg/l	<1			Below LoD		
Molybdenum	µg/l	<2	213.88	336	96	289.8	128.2
Nickel	µg/l	<2	2	2	2	2	2
Phosphorus	µg/l	<5	47.00	68	9	67.3	30.7
Selenium	µg/l	<3	5.5	8	3	7.5	3.5
Thallium	µg/l	<3			Below LoD		
Vanadium	µg/l	<1.5	3	4.1	2.3	3.8	2.36
Zinc	µg/l	<3	7.63	15	4	12.2	4



- 9.7.16 The results show that beryllium, cadmium, chromium, cobalt, copper, lead, mercury and thallium are all below the LoD for both dissolved and total concentrations.
- 9.7.17 Elevated levels of boron and molybdenum were recorded with average dissolved values of 503.25 µg/l and 217.75 µg/l respectively, and total values of 494.38 µg/l and 213.88 µg/l, respectively.
- 9.7.18 Both average dissolved and total boron and molybdenum concentrations are significantly elevated suggesting that not only are their concentrations high, but these metals are primarily present in their soluble forms. Both average total aluminium and iron concentrations are significantly higher than their dissolved concentrations; 160.3 µg/l and 795 µg/l vs 22.33 µg/l and 30.77 µg/l respectively. As total metal concentration equals dissolved metal concentration plus the particulate (insoluble) metal concentration, this suggests there is a much higher proportion of insoluble aluminium and iron in Pond 14 compared to the soluble portion.
- 9.7.19 These metals, along with the majority of others analysed, may have been used as part of the steel manufacturing process at the former SSI works, with the pond being formed in slag deposits from the works. However, it is not possible to determine the reasons behind the variability in metal concentrations found in Pond 14 based on the water quality sampling results alone. It might be considered that the type of steel manufactured (and associated materials) influences the concentration of metals in the waste product (i.e. slag deposits, which can change over time). For example, boron and molybdenum can be used in the steel manufacturing process to improve high-temperature strength and corrosion resistance.

Water Level Monitoring

Table 9A-5 Summary of Pond 14 water levels, weather conditions and tide height

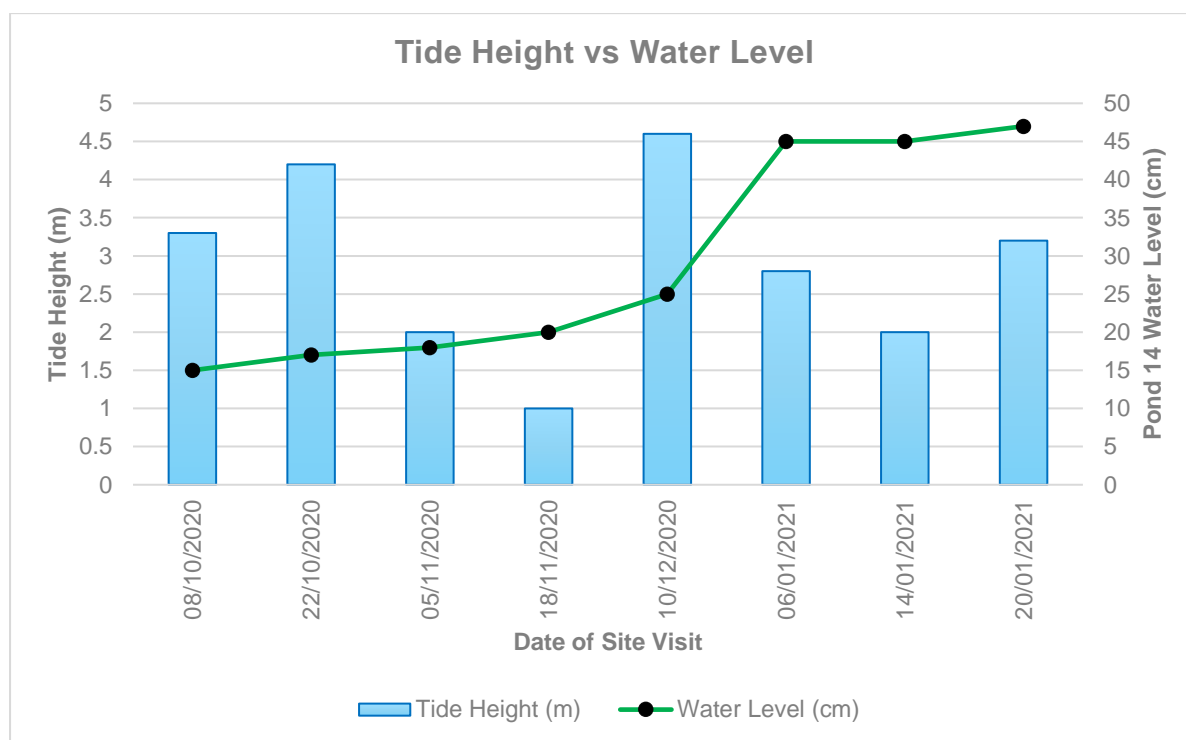
Visit No.	Date	Tide	Approx. Tide Height (m)	Observed Water Level (cm)	Weather Conditions on Day of Site Visit
1	08/10/20	Falling tide	3.3	15	Dry / Sunny
2	22/10/20	Falling tide	4.2	17	Dry / Overcast
3	05/11/20	Falling tide	2	18	Dry / Overcast
4	18/11/20	Peak low tide	1	20	Drizzle / Overcast
5	10/12/20	Peak high tide	4.6	25	Drizzle / Overcast
6	06/01/21	Falling tide	2.8	45	Heavy Rain
7	14/01/21	Rising tide	2	45	Rain
8	20/01/21	Falling tide	3.2	47	Light Rain

- 9.7.20 The results in Table 9A-5 indicate that during the monitoring period the water level in Pond 14 increases but does not appear to correlate to changes in the tide and tide height. This would suggest water levels are primarily being

recharged by precipitation from late autumn and likely until early spring, with minimal connection to groundwater.

9.7.21 As shown below in Graph 1, an increase in water levels towards mid-winter when monitoring ended does not correlate with changes in tidal state and is most likely related to the winter season being generally wetter with higher average rainfalls than summer and autumn months, and lower levels of evaporation.

Graph 1: Combination graph showing tide height vs recorded water levels at Pond 14



Runoff and Overland Flow

9.7.22 No evidence of any surface water runoff or other overland flow pathways into Pond 14 were observed during the monitoring site visits, which included monitoring coincident with heavy rainfall.

9.8 Conclusions

9.8.1 The water quality monitoring results suggest that water quality is generally stable with physico-chemical parameters primarily affected by changes in seasonal climate such as rainfall and temperate. The pond water is slightly brackish overall, well-oxygenated and appears to be eutrophic (nutrient enriched). Several metals are elevated and are likely related to the previous industrial use of the surroundings and the slag deposits within which they are formed. While other pollutants such as sanitary products, hydrocarbons and semi-volatile organic compounds were all low in concentration or below laboratory limits of detection, the pond is not believed to support a diverse aquatic fauna and flora.

- 9.8.2 Water levels in Pond 14 appears to be controlled by seasonal heavy rain over the late autumn and winter periods, when direct precipitation and overland flow and seepage from surrounding embankments exceed losses from infiltration and evaporation. No influence from groundwater or the tide was observed.
- 9.8.3 The lack of vegetation across the pond implies that there may be a hard, impenetrable bed that is preventing rooting by plants. This would also support the notion that Made Ground is not very permeable and does not support significant volumes of groundwater. Thus, the long periods of heavy rain that occurred late December 2020 and early January 2021, with limited infiltration and evaporation, resulted in an acceleration of the ponds recharge as seen in Graph 1.
- 9.8.4 With limited inflows and outflows, once water is contained within the pond losses will be controlled by infiltration (unknown rate but believed to be low) and evaporation. Therefore, it is expected that the retention time in the pond will be very long and thus any chemical pollutants or excess nutrients present (or from atmospheric deposition) would tend to concentrate during periods of low rainfall, where they are not deposited on the bed or taken up by plants around the ponds northern perimeter.
- 9.8.5 Overall, Pond 14 is most likely to be considered an isolated water body and in effect is 'cut off' from groundwater and the hydrology of the pond is unlikely to be impacted by any new pipeline trenches requiring dewatering.

9.9 References

- REF 1. Natural England Designated Sites Viewer tool. South Gare & Coatham Sands SSSI (Archived). Available at: <https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1000178.pdf> [accessed February 2021].
- REF 2. British Geological Society (n.d.) Geoindex Website. Available at: <https://mapapps2.bgs.ac.uk/geoindex/home.html> [accessed March 2021].
- REF 3. HSMO 2015. The Water Framework Directive (Standards and Classification) Directions (England and Wales).

Annex A

Site Information			Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Average	Max	Min	90th%ile	10th%ile	
Site	Coatham Sand Dunes	Job Ref	20/13898	20/14764	20/15439	20/16216	20/17623	21/121	21/499	21/778	For results above LoD only					
Water Body	Pond 14	Date	08/10/2020	22/10/2020	05/11/2020	18/11/2020	10/12/2020	06/01/2021	14/01/2021	20/01/2021						
Sample Location Grid Ref	NZ 56950 25950	Time	10:45	11:00	11:30	12:30	11:30	12:30	11:30	11:15						
Weather Conditions			Dry / Sunny / 15 C	Dry / Overcast / 12 C	Dry / Overcast / 10 C	Drizzle / Windy / 13 C	Drizzle / Overcast / 7 C	Heavy rain	Rain	Light rain						
Tide			Falling tide	Falling tide	Falling tide	Low tide	High tide	Falling tide	Rising tide	Falling tide						
Tide Height (m)			3.3	4.2	2	1	4.6	2.8	2	3.2						
Water Level (cm)			15	17	18	20	25	45	45	47						
			Water was clear.	Water was clear.	Water was slightly turbid.	Quite windy and slight drizzle of rain.	Water was clear and no signs of birds or wildfowl on pond.	Heavy rain in the morning and in the weeks ahead of the site visit. Very cold water temp. No flows observed though into the pond. Water level increased significantly.	Rained during samplings and snowed during the previous day and night. The shoreline of the pond extended by around 2 m since the previous visit.	Shoreline of the pond extended even further from the previous visit by around another 2 meters. Light rain but generally mild.						
Parameter	Unit	LoD	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Average	Max	Min	90th%ile	10th%ile	
Temperature	°C	N/A	12.3	12.3	12.5	8.4 no data	no data	2.2	1.6	7.2	7.37	12.5	1.6	12.4	1.9	
Dissolved Oxygen (%)	% Sat.	N/A	93.3	92.5	110	no data	no data	114.8	119.8	105.5	106.0	119.8	92.5	117.3	92.9	
Dissolved Oxygen (mg/l)	mg/l	N/A	9.88	9.91	11.72	no data	no data	15.63	16.54	12.65	12.72	16.5	9.9	16.085	9.895	
General Organics																
Apparent Colour	mg/l PtCo	<15	<15		30	39	35	31	39	<15	<15	34.8	39	30	39	30.4
pH	pH units	<0.01	7.65	7.95	8.14	7.88	7.59	7.18	7.76	7.21	7.67	8.14	7.18	8.01	7.20	
Total Alkalinity as CaCO3	mg/l	<1	56	64	68	68	66	62	44	62	61.25	68	44	68	52.4	
Electrical Conductivity @25C	uS/cm	<2	2558	2637	2507	2557	2245	2079	1386	2027	2250	2637	1386	2581.7	1834.7	
Salinity	%	<0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.11	0.2	0.1	0.14	0.1	
Chloride	mg/l	<0.3	312.9	325.1	289.3	300	240.5	202.2	112.2	165.5	243.46	325.1	112.2	316.56	149.51	
BOD (Settled)	mg/l	<1	<1	<1	2	1	2	<1	1	<1	1.5	2	1	2	1	
Total Suspended Solids	mg/l	<10	<10	16	26	12	15	23	<10	<10	18.4	26	12	24.8	13.2	
Turbidity	NTU	<0.1	2.7	6.4	6.1	8.4	7.1	9.9	9.1	1.7	6.43	9.9	1.7	9.34	2.4	
Dissolved Organic Carbon	mg/l	<2	4	4	4	4	4	4	<2	3	3.86	4	3	4	3.6	
Total Organic Carbon	mg/l	<2	4	4	4	4	5	16	3	4	5.25	16	2	8.3	2.7	
Free Ammonia as N	mg/l	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	Below LoD					
Ammoniacal Nitrogen as N	mg/l	<0.03	0.05	0.04	0.03	<0.03	0.12	<0.03	<0.03	0.03	0.05	0.12	0.03	0.09	0.03	
Total Oxidised Nitrogen as N	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	Below LoD					
Inorganic Nitrogen	mg/l	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.05	0.05	0.05	0.05	
Total Nitrogen	mg/l	<0.5	1.5	<0.5	0.8	0.8	0.8	1.6	<0.5	<0.5	1.10	1.6	0.8	1.56	0.8	
Nitrate as NO3	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	0.2	0.2	0.2	0.2	0.2	
Nitrite as NO2	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	Below LoD					
Ortho Phosphate as PO4	mg/l	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	Below LoD					
Chlorophyll A	µg/l	<1	9	14	12	27	22	70	9	7	21.25	70	7	39.9	8.4	
Heavy Metals/Metalloids																
Dissolved																
Aluminium	µg/l	<20	25	22	20	<20	<20	<20	<20	<20	22.33	25	20	24.4	20.4	
Antimony	µg/l	<2	4	<2	<2	<2	<2	<2	<2	<2	4	4	4	4	4	
Arsenic	µg/l	<2.5	<2.5	3.1	3.9	3.5	<2.5	3.2	<2.5	<2.5	3.43	3.9	3.1	3.78	3.13	
Barium	µg/l	<3	21	23	19	22	20	20	11	27	20.38	27	11	24.2	16.6	
Beryllium	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	Below LoD					
Boron	µg/l	<12	504	570	544	596	503	509	298	502	503.25	596	298	577.8	440.8	
Cadmium	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	Below LoD					
Chromium	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	Below LoD					
Cobalt	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2	Below LoD					
Copper	µg/l	<7	<7	<7	<7	<7	<7	<7	<7	<7	Below LoD					
Iron	µg/l	<20	24	35	26	25	<20	51	<20	20	30.17	51	20	43	22	
Lead	µg/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	Below LoD					
Manganese	µg/l	<2	56	21	12	17	41	35	40	71	36.63	71	12	60.5	15.5	
Mercury	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	Below LoD					
Molybdenum	µg/l	<2	340	285	253	252	210	167	96	139	217.75	340	96	301.5	126.1	
Nickel	µg/l	<2	2	2	<2	<2	<2	<2	<2	<2	2	2	2	2	2	
Phosphorus	µg/l	<5	8	<5	10	9	9	9	<5	5	8.2	10	5	9.6	6.2	
Selenium	µg/l	<3	<3	<3	4	<3	<3	<3	<3	<3	4	4	4	4	4	
Thallium	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	Below LoD					
Vanadium	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	1.9	2	<1.5	1.95	2	1.9	1.99	1.91	
Zinc	µg/l	<3	<3	<3	<3	<3	<3	4	5	4	4.25	5	4	4.7	4	
Dissolved Earth Metals																
Calcium	mg/l	<0.2	no sample	no sample	no sample	no sample	no sample	268.3	345.8	177.6	306.4	345.80	177.60	333.98	204.81	
Magnesium	mg/l	<0.1	no sample	no sample	no sample	no sample	no sample	30.1	29.9	21.9	32.8	32.80	21.90	31.99	24.30	
Potassium	mg/l	<0.1	no sample	no sample	no sample	no sample	no sample	62.1	53.4	35.3	51.9	50.68	62.10	35.30	59.49	
Sodium	mg/l	<0.1	no sample	no sample	no sample	no sample	no sample	143.5	119.7	77.4	107.4	112.00	143.50	77.40	136.36	
Dissolved Iron II and III																
Iron II	mg/l	<0.02	no sample	no sample	no sample	no sample	no sample	<0.02	0.03	<0.02	0.05	0.04	0.05	0.03	0.048	
Iron III	mg/l	<0.02	no sample	no sample	no sample	no sample	no sample	<0.02	0.02	<0.02	0.05	0.02	0.02	0.02	0.032	
Total																
Aluminium	µg/l	<20	104	93	180	140	155	290	<20	195	160.33	290	93	235	98.5	
Antimony	µg/l	<2	8	<2	<2	<2	<2	<2	<2	<2	8	8	8	8	8	
Arsenic	µg/l	<2.5	2.9	3.2	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	3.05	3.2	2.9	3.17	2.93	
Barium	µg/l	<3	20	22	16	22	20	27	8	34	21.13	34	8	29.1	13.6	
Beryllium	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	Below LoD					
Boron	µg/l	<12	505	562	522	579	495	485	307	500	494.38	579	307	567.1	431.6	
Cadmium	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	Below LoD					

Site Information			Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Average	Max	Min	90th%ile	10th%ile	
Site	Coatham Sand Dunes	Job Ref	20/13898	20/14764	20/15439	20/16216	20/17623	21/121	21/499	21/778	For results above LoD only					
Water Body	Pond 14	Date	08/10/2020	22/10/2020	05/11/2020	18/11/2020	10/12/2020	06/01/2021	14/01/2021	20/01/2021						
Sample Location Grid Ref	NZ 56950 25950	Time	10:45	11:00	11:30	12:30	11:30	12:30	11:30	11:15						
Weather Conditions			Dry / Sunny / 15 C	Dry / Overcast / 12 C	Dry / Overcast / 10 C	Drizzle / Windy / 13 C	Drizzle / Overcast / 7 C	Heavy rain	Rain	Light rain						
Tide			Falling tide	Falling tide	Falling tide	Low tide	High tide	Falling tide	Rising tide	Falling tide						
Tide Height (m)			3.3	4.2	2	1	4.6	2.8	2	3.2						
Water Level (cm)			15	17	18	20	25	45	45	47						
			Water was clear.	Water was clear.	Water was slightly turbid.	Quite windy and slight drizzle of rain.	Water was clear and no signs of birds or wildfowl on pond.	Heavy rain in the morning and in the weeks ahead of the site visit. Very cold water temp. No flows observed though into the pond. Water level increased significantly.	Rained during samplings and snowed during the previous day and night. The shoreline of the pond extended by around 2 m since the previous visit.	Shoreline of the pond extended even further from the previous visit by around another 2 meters. Light rain but generally mild.						
Parameter	Unit	LoD	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Average	Max	Min	90th%ile	10th%ile	
Chromium	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	Below LoD					
Cobalt	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2	Below LoD					
Copper	µg/l	<7	<7	<7	<7	<7	<7	<7	<7	<7	Below LoD					
Iron	µg/l	<20														
Lead	µg/l	<5	347	<5	386	<5	932	457	803	2373	1005	795	2373	57	1415.4	260
Manganese	µg/l	<2	73	21	37	36	76	106	46	127	65.25	127	21	112.3	31.5	
Mercury	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	Below LoD					
Molybdenum	µg/l	<2	336	<2	270	248	247	204	168	96	142	213.88	336	96	289.8	128.2
Nickel	µg/l	<2	<2	<2	<2	<2	<2	<2	2 <2	<2	2	2	2	2	2	
Phosphorus	µg/l	<5	51	40	43	46	67	52	9	68	47.00	68	9	67.3	30.7	
Selenium	µg/l	<3	3	3	8 <3	<3	<3	<3	<3	<3	5.5	8	3	7.5	3.5	
Thallium	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	Below LoD					
Vanadium	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	4.1	2.3	2.6	3	4.1	2.3	3.8	2.36	
Zinc	µg/l	<3	5	4	8	6	8	15	4	11	7.63	15	4	12.2	4	
PAH (MS)																
Naphthalene	µg/l	<0.1	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Acenaphthylene	µg/l	<0.013	<0.013	<0.013	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Acenaphthene	µg/l	<0.013	<0.013	<0.013	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Fluorene	µg/l	<0.014	<0.014	<0.014	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Phenanthrene	µg/l	<0.011	0.019	<0.011	no sample	no sample	no sample	no sample	no sample	no sample	0.02	0.019	0.019	0.019	0.019	
Anthracene	µg/l	<0.013	<0.013	<0.013	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Fluoranthene	µg/l	<0.012	0.027	<0.012	no sample	no sample	no sample	no sample	no sample	no sample	0.03	0.027	0.027	0.027	0.027	
Pyrene	µg/l	<0.013	0.019	<0.013	no sample	no sample	no sample	no sample	no sample	no sample	0.02	0.019	0.019	0.019	0.019	
Benzo(a)anthracene	µg/l	<0.015	<0.015	<0.015	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Chrysene	µg/l	<0.011	0.011	<0.011	no sample	no sample	no sample	no sample	no sample	no sample	0.01	0.011	0.011	0.011	0.011	
Benzo(b)fluoranthene	µg/l	<0.018	0.018	<0.018	no sample	no sample	no sample	no sample	no sample	no sample	0.02	0.018	0.018	0.018	0.018	
Benzo(a)pyrene	µg/l	<0.016	<0.016	<0.016	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Indeno(1,2,3-cd)pyrene	µg/l	<0.011	<0.011	<0.011	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Dibenzo(ah)anthracene	µg/l	<0.01	<0.01	<0.01	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Benzo(ghi)perylene	µg/l	<0.011	<0.011	<0.011	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
PAH 16 Total	µg/l	<0.195	<0.195	<0.195	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Benzo(b)fluoranthene	µg/l	<0.01	0.01	<0.01	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Benzo(k)fluoranthene	µg/l	<0.01	<0.01	<0.01	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
PAH Surrogate % Recovery	%	<0	52SV	83	no sample	no sample	no sample	no sample	no sample	no sample	83.00	83	83	83	83	
MTBE	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Benzene	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Toluene	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Ethylbenzene	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
m/p-Xylene	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
o-Xylene	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
TPH (CWG)																
Aliphatics																
>C5-C6	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>C6-C8	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>C8-C10	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>C10-C12	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>C12-C16	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>C16-C21	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>C21-C35	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Total aliphatics C5-35	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Aromatics																
>C5-EC7	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>EC7-EC8	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>EC8-EC10	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>EC10-EC12	µg/l	<5	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>EC12-EC16	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>EC16-EC21	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
>EC21-EC35	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Total aromatics C5-35	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
Total aliphatics and aromatics (C5-35)	µg/l	<10	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
PCBs																
PCB 28	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					
PCB 52	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD					

Site Information			Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Average	Max	Min	90th%ile	10th%ile
Site	Coatham Sand Dunes	Job Ref	20/13898	20/14764	20/15439	20/16216	20/17623	21/121	21/499	21/778	For results above LoD only				
Water Body	Pond 14	Date	08/10/2020	22/10/2020	05/11/2020	18/11/2020	10/12/2020	06/01/2021	14/01/2021	20/01/2021					
Sample Location Grid Ref	NZ 56950 25950	Time	10:45	11:00	11:30	12:30	11:30	12:30	11:30	11:15					
	Weather Conditions		Dry / Sunny / 15 C	Dry / Overcast / 12 C	Dry / Overcast / 10 C	Drizzle / Windy / 13 C	Drizzle / Overcast / 7 C	Heavy rain	Rain	Light rain					
	Tide		Falling tide	Falling tide	Falling tide	Low tide	High tide	Falling tide	Rising tide	Falling tide					
	Tide Height (m)		3.3	4.2	2	1	4.6	2.8	2	3.2					
	Water Level (cm)		15	17	18	20	25	45	45	47					
			Water was clear.	Water was clear.	Water was slightly turbid.	Quite windy and slight drizzle of rain.	Water was clear and no signs of birds or wildfowl on pond.	Heavy rain in the morning and in the weeks ahead of the site visit. Very cold water temp. No flows observed though into the pond. Water level increased significantly.	Rained during samplings and snowed during the previous day and night. The shoreline of the pond extended by around 2 m since the previous visit.	Shoreline of the pond extended even further from the previous visit by around another 2 meters. Light rain but generally mild.					
Parameter	Unit	LoD	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Average	Max	Min	90th%ile	10th%ile
PCB 101	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
PCB 118	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
PCB 138	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
PCB 153	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
PCB 180	µg/l	<0.1	<0.1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Total 7 PCBs	µg/l	<0.7	<0.7	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Total Phenols HPLC	µg/l	<0.15	<0.15	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
SVOC (MS)															
<i>Phenols</i>															
2-Chlorophenol	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2-Methylphenol	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2-Nitrophenol	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2,4-Dichlorophenol	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2,4-Dimethylphenol	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2,4,5-Trichlorophenol	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2,4,6-Trichlorophenol	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Chloro-3-methylphenol	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Methylphenol	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Nitrophenol	µg/l	<10	<10	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Pentachlorophenol	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Phenol	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
<i>PAHs</i>															
2-Chloronaphthalene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2-Methylnaphthalene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
<i>Phthalates</i>															
Bis(2-ethylhexyl) phthalate	µg/l	<5	<5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Butylbenzyl phthalate	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Di-n-butyl phthalate	µg/l	<1.5	<1.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Di-n-Octyl phthalate	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Diethyl phthalate	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Dimethyl phthalate	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
<i>Other SVOCs</i>															
1,2-Dichlorobenzene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
1,2,4-Trichlorobenzene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
1,3-Dichlorobenzene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
1,4-Dichlorobenzene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2-Nitroaniline	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2,4-Dinitrotoluene	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
2,6-Dinitrotoluene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
3-Nitroaniline	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Bromophenylphenylether	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Chloroaniline	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Chlorophenylphenylether	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
4-Nitroaniline	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Azobenzene	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Bis(2-chloroethoxy)methane	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Bis(2-chloroethyl)ether	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Carbazole	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Dibenzofuran	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Hexachlorobenzene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Hexachlorobutadiene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Hexachlorocyclopentadiene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Hexachloroethane	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Isophorone	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
N-nitrosodi-n-propylamine	µg/l	<0.5	<0.5	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Nitrobenzene	µg/l	<1	<1	no sample	no sample	no sample	no sample	no sample	no sample	no sample	Below LoD				
Surrogate Recovery 2-Fluorobiphenyl	%	<0		70	no sample	no sample	no sample	no sample	no sample	no sample	70	70	70	70	70
Surrogate Recovery p-Terphenyl-d14	%	<0		75	no sample	no sample	no sample	no sample	no sample	no sample	75	75	75	75	75

Annex F - Water Resources Tables

Table F1: Water Activity Permits within 250m from the Proposed Development Boundary

Label on Fig 9.1	Licence	NGR and approx. distance from nearest Site boundary / direction	Issued Date	Discharge Type	Receiving Water
D1	Qr.25/04/1588	NZ4753022100	2nd August 1999	Trade Discharge - Process Water	Tees
D2	254/1941	NZ5400023150	6th March 2007	Trade Discharges - Site Drainage	River Tees Estuary
D2	254/1923	NZ5033023272	11th November 2008	Sewage Discharges - Final/Treated Effluent - Not Water Company	Trib Of Holme Fleet
D4	254/A/0583	NZ5081023310	4th January 1980	Sewage Discharges - Final/Treated Effluent - Not Water Company	Tees, Tributary Of
D5	254/A/0583	NZ5081023310	4th January 1980	Sewage and Trade Combined - Unspecified	Tees, Tributary Of
D6	254/A/0582	NZ5080023300	21st November 1979	Sewage Discharges - Final/Treated Effluent - Not Water Company	Greatham Creek, Tributary Of
D7	254/A/0583/5262	NZ5080023295	21st November 1979	Septic tank	Greatham Creek; Tributary Of
D8	254/D/0250/5512	NZ5060023495	27th November 1970	Engineering	Greatham Creek; Tributary Of
D9	QC.25/04/1432	NZ5193024405	11th September 1995	Sewage Effluent Discharge-Treated Effluent	Land
D10	25/04/1739	NZ5267024785	26th July 2012	Sewage Discharges - Final/Treated Effluent - Not Water Company	Land
D11	254/1141	NZ5396024160	4th September 1992	Trade Discharges - Site Drainage	Tees Estuary
D12	254/1365	NZ5390024100	19th August 1987	Chemical	Tees
D13	AO0237	NZ5390023695	23rd December 1994	Trade Effluent Discharge-Treated Effluent	Tees Estuary

Label on Fig 9.1	Licence	NGR and approx. distance from nearest Site boundary / direction	Issued Date	Discharge Type	Receiving Water
D14	AL6956	NZ5425024350	16th June 1994	Trade Effluent Discharge-Treated Effluent	Tees
D15	254/0653	NZ5413024190	2nd September 1988	Sewage Discharges - Final/Treated Effluent - Not Water Company	Tees
D16	25/04/1654	NZ5474023470	30th October 2001	Trade Discharge - Process Water	Tees Dock - Saline Estuary
D17	254/1271	NZ5470023500	19th November 1993	Miscellaneous Discharges - Mine / Groundwater As Raised	Tees Estuary
D18	254/1271	NZ5470023500	19th November 1993	Miscellaneous Discharges - Mine / Groundwater As Raised	Tees Estuary
D19	254/B/0153	NZ5470023200	23rd March 1972	Unspecified	Tees
D20	254/1942	NZ5635019810	16th April 2007	Trade Discharges - Site Drainage	Tributary Of Kettle Beck
D21	254/1942	NZ5635019810	16th April 2007	Sewage Discharges - Final/Treated Effluent - Not Water Company	Tributary Of Kettle Beck
D22	25/04/1776	NZ5717720096	23rd March 2010	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Unnamed Trib Of Dabholme Beck
D23	25/04/1777	NZ5717020090	18th February 2004	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Unnamed Trib Of Dabholme Beck
D24	254/1813	NZ5714020140	21st February 2005	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Dabholme Beck, Trib Of
D25	256/E/0259	NZ5647019710	25th March 1960	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Kettle Beck
D26	254/E/0130	NZ5713019990	26th October 1956	Unspecified	Dabholme Beck,

Label on Fig 9.1	Licence	NGR and approx. distance from nearest Site boundary / direction	Issued Date	Discharge Type	Receiving Water
D27	254/1935	NZ5536122142	15th February 2019	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Kinkerdale Beck
D28	254/1814	NZ5533022170	3rd March 2005	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Kinkerdale Beck
D29	254/1423	NZ5600023000	26th July 2012	Trade Discharges - Cooling Water	Land
D30	QC 254/1423	NZ5600023000	19th October 1995	Cooling Water	Land
D31	QC.254/1423	NZ5600022995	19th October 1995	Trade Effluent Discharge-Cooling Water (Direct)	Soakaway
D32	AR0241	NZ5650022600	7th September 1995	Trade Effluent Discharge-Cooling Water (Direct)	Not Supplied
D33	254/1528	NZ5614024055	31st July 2014	Trade Discharge - Process Water	The Dabholm Gut
D34	254/1528	NZ5614024055	31st July 2014	Sewage (Private)/SSO	The Dabholm Gut
D35	254/1920	NZ5614024090	25th November 2010	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	Dabholm Gut
D36	254/1920	NZ5614024090	25th November 2010	Sewage Discharges - Pumping Station - Water Company	Dabholm Gut
D37	254/1920	NZ5614024090	25th November 2010	Sewage Discharges - Final/Treated Effluent - Water Company	Dabholm Gut
D38	254/1920	NZ5614024090	25th November 2010	Sewage Discharges - Unspecified - Water Company	Dabholm Gut
D39	25/04/1630	NZ5612024090	21st August 2002	Sewage Discharges - Unspecified - Water Company	The Dabholm Gut
D40	25/04/1630	NZ5612024090	21st August 2002	Sewage Discharges - Stw Storm Overflow/Storm Tank - Water Company	The Dabholm Gut

Label on Fig 9.1	Licence	NGR and approx. distance from nearest Site boundary / direction	Issued Date	Discharge Type	Receiving Water
D41	Qc.25/04/1579	NZ5507024310	26th July 2012	Sewage Discharges - Final/Treated Effluent - Not Water Company	Land In The Tees Catchment
D42	QC.25/04/1578	NZ5518024210	28th April 1999	Sewage Discharges - Final/Treated Effluent - Not Water Company	Land (River Tees)
D43	25/04/1646	NZ5655023780	1st November 2000	Sewage Discharges - Pumping Station - Water Company	Dabholm Gut
D44	254/EPA/028	NZ5470026400	3rd June 1987	Chemical	Tees Estuary
D45	AJ0094	NZ5694027130	18th June 1993	Trade Effluent Discharge-Cooling Water (Direct)	North Sea

Table F2: Abstractions in the Study Area

Fig 9.1 Reference	Licence Holder Name	Abstraction Licence Number	Use	Source Description	National Grid Reference
A1	Sabic UK Petrochemicals	1/25/04/134	Water Supply	Groundwater	NZ51232470
A2	Sabic UK Petrochemicals	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	NZ51282500
A3	KP Snacks Ltd	1/25/04/142	Industrial, Commercial and Public Services	Groundwater	NZ475241
A4	Sabic UK Petrochemicals	1/25/04/134	Water Supply	Groundwater	NZ50702295
A5	Sabic UK Petrochemicals	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	NZ50832340
A6	Sabic UK Petrochemicals	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	NZ51032338
A7	Sabic UK Petrochemicals	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	NZ51182410
A8	Sabic UK Petrochemicals	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	NZ51202437
A9	Sabic UK Petrochemicals	1/25/04/134	Environmental	Groundwater	NZ51232470
A10	Middlesbrough Council	1/25/04/183/R01	Industrial, Commercial and Public Services	Groundwater	NZ4951320865
A11	Sabic UK Petrochemicals	1/25/04/134	Industrial, Commercial and Public Services	Groundwater	NZ50702295
A12	North Tees Ltd	1/25/04/164	Environmental	Groundwater	NZ52312319
A13	Sahaviriya Steel Industries UK Ltd	1/25/04/135	Industrial, Commercial and Public Services	Tidal Waters	NZ547259

Fig 9.1 Reference	Licence Holder Name	Abstraction Licence Number	Use	Source Descripti on	National Grid Reference
A14	British Energy Generation Ltd	1/25/04/120	Production of Energy	Tidal Waters	NZ529268
A15	Able UK Ltd	NE/025/0001/ 018	Industrial, Commercial and Public Services	Tidal Waters	NZ52188269 49
A16	SUEZ Recycling and Recovery Tees Valley Ltd	1/25/04/161	Industrial, Commercial and Public Services	Tidal Waters	NZ48082192
A17	Cleveland Potash Ltd	NE/025/0001/ 011	Industrial, Commercial and Public Services	Tidal Waters	NZ54660235 58
A18	RSPB	NE/025/0001/ 008	Environmental	Surface Water	NZ49732229 92

Table F3: Pollution Incidents to Controlled Waters within 250 m of the Site

Fig 9.1 Ref	Notification ID and Date	Catego ry	National Grid Reference	Pollutant	Probable Receiving Waters
P1	969033 10/03/2012	3 (Minor)	NZ 49573 21710	Atmospheric pollutants and effects - smoke	Tees Estuary
P2	1187178 25/12/2013	3 (Minor)	NZ 49573 21710	Contaminated Water – firefighting runoff	Tees Estuary
P3	1256199 15//07/2014	2 (Signifi cant)	NZ 56608 23878	Crude sewage	Dabholm Gut
P4	1405228 22/01/2016	2 (Signifi cant)	NZ 57917 23982	Oils – Diesel (including agricultural)	Tributary of the Fleet