Table of Contents

Tables

Diagrams

9. Surface Water, Flood Risk and Water Resources

9.1 Overview

9.1.1 This chapter of the Environmental Statement (ES) presents an assessment of likely significant effects on the surface water environment (including inland, transitional and coastal surface waters) and flood risk as a result of the Proposed Development, as described in Chapter 4: Proposed Development (ES Volume I, Document Ref. 6.2).

9.1.2 The scope of the assessment includes water quality, water resources, hydromorphology, flood risk, and drainage.

9.1.3 The impact assessment has been undertaken in accordance with the following broad stages (as also described Chapter 2: Assessment Methodology, ES Volume I, Document Ref. 6.2):

- reviewing the planning and legislative context;
- establishing the baseline;
- appraisal of potential impacts and determining the classification and significance of effects;
- identification of potential mitigation and enhancement measures; and
- identification of likely remaining residual effects.

9.1.4 Environmental effects have been assessed for the construction, operational and decommissioning phases of the Proposed Development. The residual effects reported at the end of this chapter take account of embedded mitigation and the implementation of additional mitigation measures as described in this chapter.

9.1.5 The chapter is supported by information presented in the following ES chapters, figures and appendices (ES Volumes I-III, Document Ref 6.2 to 6.4):

- Chapter 4: Proposed Development;
- Chapter 10: Geology and Hydrogeology;
- Chapter 13: Aquatic Ecology and Nature Conservation;
- Chapter 14: Marine Ecology and Nature Conservation;
- Figure 9-1: Surface Water Features and their Attributes;
- Figure 9-2: Groundwater Features and their Attributes;
- Figure 9-3: Ecological Designations;
- Figure 9-4: Environment Agency Fluvial Flood Zones;
- Figure 9-5: Flood Risk from Surface Water;
- Appendix 9A: Flood Risk Assessment (FRA);

- Appendix 9B: Background Water Quality Data Tables and Water Resources Data; and
- Appendix 9C: Water Framework Directive (WFD) Assessment.

9.2 Planning Policy and Legislation

9.2.1 A summary of the legislation and planning policy relevant to the assessment of impacts of the Proposed Development is provided in this section. These have been taken into account in the assessment, with particular regard given to potential impacts in relation to flood risk and water quality.

National Legislation

9.2.2 The following UK Legislation is of relevance to the Proposed Development:

- Water Act 2014;
- Floods and Water Management Act 2010;
- Marine and Coastal Access Act 2009;
- Environment Act 1995;
- Land Drainage Act 1991;
- Water Resources Act 1991;
- Water Industry Act 1991;
- Environment Protection Act 1990;
- Salmon and Freshwater Fisheries Act 1975 (as amended);
- The Water Environment (Water Framework Directive) (England Wales) Regulations 2017;
- Environmental Permitting (England and Wales) Regulations 2016;
- Control of Major Accident Hazards (COMAH) Regulations (2015);
- Environmental Damage (Prevention and Remediation) Regulations 2015;
- Bathing Water (Amendment) (England) Regulations 2018;
- Eels (England and Wales) Regulations 2009;
- Groundwater (England and Wales) Regulations 2009;
- Floods and Water (Amendment) (EU Exit) Regulations 2019;
- Control of Pollution (Oil Storage) (England) Regulations 2001; and
- Control of Substances Hazardous to Human Health (COSHH) Regulations 2002.

National Policy Guidance

National Policy Statements

9.2.3 The Overarching National Policy Statement (NPS) for Energy (EN-1) (DECC, 2011a) is relevant to this assessment with the main sections being:

- Section 4.10: Pollution control and other environmental regulatory regimes;
- Section 5.15: Water Quality and Resources. Stating that: "Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent." (Paragraph 5.15.2); and
- Paragraph 5.15.3 which provides advice on what an Environmental Statement (ES) should describe including:
  - the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges;
  - existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies (CAMS));
  - existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and
  - any impacts of the proposed project on waterbodies or protected areas under the WFD and source protection zones (SPZ) around potable groundwater abstractions.

9.2.4 The NPS for Fossil Fuel Electricity Generating Infrastructure (NPS EN-2) (DECC 2011b) is also of relevance which states that where a project is likely to have effects on water quality or resources, the applicant for development consent should undertake an assessment which should particularly demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. The applicant for development consent should demonstrate measures to minimise adverse impacts on water quality and resources.

9.2.5 The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (DECC, 2011c) is also relevant in that it describes the need for assessment of the water environment and potential mitigation measures.

UK Marine Policy Statement

9.2.6 The Marine Policy Statement (MPS) (Department for Environment, Food & Rural Affairs (DEFRA), 2011a) is the framework for preparing Marine Plans and taking decisions affecting the marine environment. It establishes a vision for the marine environment, which is for 'clean, healthy, safe, productive and biologically diverse oceans and seas'. The MPS underpins the process of marine planning, which establishes a framework of economic, social and environmental considerations in that will deliver these high-level objectives and ensure the sustainable development of the UK marine area.

9.2.7 The draft North East Inshore and North East Offshore Marine Plans (DEFRA, 2020) establishes the plan led system for the marine area in which the riverine parts of the Proposed Development Site are located. The draft was published for consultation in 2020. This was the final stage of statutory public consultation Plans are submitted to the Secretary of State for Environment, Food and Rural Affairs for adoption.

National Planning Policy Framework

9.2.8 The National Planning Policy Framework (NPPF) (Department for Communities and Local Government, 2012a), published by the Ministry of Housing, Communities and Local Government was updated in June 2019, superseding previously published versions. The NPPF has three overarching objectives to contribute to the achievement of sustainable development, one of which is the 'environmental objective'. This objective includes the requirement of "*helping to improve biodiversity, using natural resources prudently, and minimising waste and pollution*" (Paragraph 8c). The NPPF also contains a number of statements which are relevant to water quality. These include:

- strategic policies should set out an overall strategy for the pattern, scale and quality of development, and make provision for conservation and enhancement of the natural, built and historic environment. This includes landscapes and green infrastructure, and planning measures to address climate change mitigation and adaptation (paragraph 20d);
- plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts. Development should not cause unacceptable levels of water pollution and should help improve water quality wherever possible (paragraph 149); and
- planning policies should contribute and enhance the natural environment by preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as water quality, taking into account relevant information such as river basin management plans (paragraph 170e).

National Planning Practice Guidance

9.2.9 The Planning Practice Guidance (PPG) Water supply, wastewater and water quality (last updated July 2019), provides guidance for local planning authorities on assessing the significance of water environment effects of proposed developments. The guidance highlights that adequate water and wastewater infrastructure is needed to support sustainable development.

9.2.10 The NPPF (Department for Communities and Local Government, 2012a) and the Flood Risk and Coastal Change NPPG (Department for Communities and Local Government, 2014) recommends that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and should develop policies to manage flood risk from all sources taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to public and property and manage any residual risk, taking account of the impacts of climate change.

Defra's '25 Year Environment Plan'

9.2.11 In 2018, Defra published the 25 Year Environment Plan (Defra, 2018) setting out the UK Governments goals for improving the environment within a generation and leaving it in a better state than we found it. The plan covers the provision of clean air and water; protection and enhancement of habitats, wildlife and biosecurity; reducing the risk from environmental hazards and mitigating and adapting to climate change; using resources more sustainable and efficiently, minimizing waste and managing exposure to chemicals; enhancing beauty, heritage and engagement with the natural environment.

9.2.12 The Plan includes specific goals to achieve good environmental status in our seas, reduce the environmental impact of water abstraction, meet the objectives of River Basin Management Plans under the WFD, reduce leakage from water mains, improve the quality of bathing waters, restore protected freshwater sites to a favourable condition, and do more to protect communities and businesses from the impact of flooding, coastal erosion and drought. At the heart of the Plan's delivery is the natural capital approach with the aspiring goal of a net gain in biodiversity from new development.

Future Water, The Government's Water Strategy for England

9.2.13 The Government's Future Water Strategy (Defra, 2011b) published in June 2011 sets out the Government's long-term vision for water and the framework for water management in England. It aims to enable sustainable and secure water supplies whilst ensuring an improved and protected water environment. Future Water brings together the issues of water demand, supply and water quality in the natural environment as well as surface water drainage and river/coastal flooding into a single coherent long-term strategy, in the context of the need to reduce greenhouse gas emissions.

9.2.14 The strategy also considers the issue of charging for water. The water environment and water quality have great economic, biodiversity, amenity and recreational value, playing an important role in many aspects of modern-day society, and thus the functions provided must be sustainably managed to ensure they remain available to future generations without compromising environmental quality.

Sustainable Drainage Systems Guidance

9.2.15 Planning policy encourages developers to include sustainable drainage systems (SuDS) in their proposals where practicable. SuDS provide a way to attenuate runoff from a site to the rate agreed with the Environment Agency (EA) to avoid increasing flood risk, but they are also important in reducing the quantities and concentration of diffuse urban pollutants found in the runoff.

9.2.16 Defra published guidance on the use, design and construction of SuDS in 'Non-statutory technical standards for SuDS' (Defra, 2015).

9.2.17 Industry good practice guidance on the planning for and design of SuDS is provided by:

- C753 The SuDS Manual (CIRIA, 2015a);
- DMRB CD532 Vegetated Drainage Systems for Highways Runoff (Highways England, 2020); and
- DMRB CG 501 Design of Highway Drainage Systems (Highways England, 2020).

River Basin Management Plan

9.2.18 River Basin Management Plans (RBMPs) are prepared by the Environment Agency for six-year cycles and set out how organisations, stakeholders and communities will work together to improve the water environment. The most recent plans were published in 2015 (the second cycle) and will remain in place until after 2021. The waterbodies within the Study Area fall under the Tees Management Catchment within the Northumbrian RBMP (Defra, 2016).

Local Planning Policy

Redcar and Cleveland Local Plan (May 2018)

9.2.19 The Proposed Development is predominantly within the administrative area of Redcar and Cleveland Borough Council (RCBC). RCBC has published a Local Plan (RCBC, 2018) which was adopted in 2018 and which outlines the Council strategy up to the year 2032. The following policies of the local plan are of relevance to the water environment:

- Policy SD4 – General Development Principles – Development will not be permitted where it results in an unacceptable loss or significant adverse impact on important open spaces, or environmental, built or heritage assets which are considered important to the quality of the local environment; and development will not be permitted where it results in an increase in flood risk either on site or downstream of the development;
- Policy SD7 – Flood and Water Management – Flood risk will be taken into account at all stages in the planning process to avoid inappropriate development in areas at current or future risk. All development proposals will be expected to be designed to mitigate and adapt to climate change, taking account of flood risk by ensuring opportunities to contribute to the mitigation of flooding elsewhere are taken; prioritising use of SuDS; ensuring full separation of foul and surface water flows; and ensuring development is in accordance with the Redcar and Cleveland Strategic FRA. Further detail is provided regarding requirements for site specific

flood risk assessments, discharge of surface water, and runoff rates. Drainage plans must be submitted incorporating SuDS unless it is demonstrated that they would be inappropriate. The drainage system should not adversely impact water quality of receiving water bodies, both during construction and operation, and should seek to improve water quality where possible, as well as maintaining and enhancing biodiversity and habitat of watercourses.

- Policy N4 – Biodiversity and Geological Conservation – The Local Plan will protect and enhance biodiversity and geological resources. These factors should be considered at an early stage in the development process, with appropriate protection and enhancement measures incorporated into the design of the development proposals, recognising wider ecosystem services and providing net gains wherever possible. Priority will be given to protecting internationally important sites, including the Teesmouth and Cleveland Coast Special Protection Area/Ramsar and European Marine Site. Development which is likely to have a significant effect on any internationally designated site will be subject to an appropriate assessment. Requirements relating to nationally important and locally important sites are also discussed.

Stockton-on-Tees Borough Council Local Plan (January 2019)

9.2.20 The elements of the Proposed Development to the north of the Tees Estuary (i.e. the Natural Gas Connection and CO_2 Gathering Network) are located within the Stockton-on-Tees Borough Council administrative area. Stockton-on-Tees Borough Council published a Local Plan in 2019 (Stockton-on-Tees Borough Council, 2019) which outlines the Council's strategy up to the year 2032. The following policies of the local plan are of relevance to the water environment:

- Policy EG4 – Seal Sands, North Tees and Billingham – Development proposals in the North Tees and Seal Sands are required, as appropriate, to be supported by a site-specific FRA which considers, amongst other matters, emergency access/egress in the event of tidal flooding;
- Policy ENV4 – Reducing and Mitigating Flood Risk – All new development to be directed towards areas of lowest flood risk, with any such risk mitigated through design and implementing SuDS principles. Development on Flood Zones 2 or 3 will only be permitted following successful completion of the Sequential and Exception Tests and a site-specific FRA. All development proposals should seek to minimise flood risk elsewhere, separate foul and surface water flows and prioritise use of SuDs. Surface water run-off should be managed at source and disposed of following the hierarchy of infiltration, discharge to a watercourse (open or closed), or sewer as a last resort. For developments which were previously developed, the peak run-off rate from the development to any drain, sewer or surface water body for the 1-in-100 year rainfall event should be as close as practicable to the greenfield run-off rate from the development for the same rainfall event but should never exceed the rate of discharge from the development prior to redevelopment for that event; and

- Policy ENV7 – Ground, Air, Water, Noise and Light Pollution – All development that may cause groundwater or surface water pollution individually or cumulatively will be required to incorporate measures as appropriate to prevent or reduce their pollution so as not to cause unacceptable impacts on living conditions of all existing and potential future occupants of land and buildings, the character and appearance of the surrounding area and environment. Where contamination may present a risk to the water environment, proposals must demonstrate appropriate mitigation measures and that there would not be unacceptable risks to human health or the environment or cause the surrounding environment to become contaminated. Groundwater and surface water quality will be improved in line with the requirements of the WFD and Northumbrian River Basin Management Plan. The Council will support ecological improvements along riparian corridors; avoid net loss of sensitive inter-tidal or sub-tidal habitats and support creation of new habitats; protect natural water bodies from modification; and support improvement and naturalisation of heavily modified waterbodies (including deculverting and removing barriers to fish migration).

Tees Valley Authorities – Local Standards for Sustainable Drainage

9.2.21 The Tees Valley Authorities (i.e. the local authorities of Hartlepool, Middlesbrough, Redcar and Cleveland, Stockton-on-Tees and Darlington Borough Councils) produced a supplementary planning guidance (SPG) document entitled ‘Local Standards for Sustainable Drainage’ in 2015 (The Tees Valley Authorities, 2015). The document forms the standards for the local authorities and, together with the national standards, strongly promotes the use of SuDS. It indicates the minimum standards to ensure a satisfactory scheme is constructed under the Floods and Water Management Act 2010, but they are not intended to preclude any requirement for a higher standard that may be deemed necessary.

9.2.22 The SPG covers legislative requirements, the application process, design standards and criteria for SuDS, SuDS components, environmental considerations, water quality, green infrastructure, construction issues and maintenance.

9.3 Assessment Methodology

9.3.1 This section of the chapter presents the following:

- the basis of the assessment and the application of the Rochdale Envelope in accordance with the Planning Inspectorates (PINS) Advice Note 9 (The Planning Inspectorate, 2018);
- identification of the information sources that have been used;
- summary of consultations;
- assessment methodology;
- an explanation as to how the identification and assessment of water resources and flooding effects has been reached; and

- the significance criteria and terminology for assessment of the residual effects to water resources and flooding.

Basis of Assessment

9.3.2 The following sources of information that define the Proposed Development have been reviewed and form the basis of this assessment:

- Chapter 4: Proposed Development (ES Volume I, Document Ref.6.2);
- Chapter 5: Construction and Programme Management (ES Volume I, Document Ref. 6.2);
- Figure 1-1: Site Location (ES Volume II, Document Ref. 6.3);
- Figure 3-1: Site Boundary (ES Volume II, Document Ref. 6.3);
- Figure 3-2A to E (ES Volume II, Document Ref.6.3);
- Figure 4-1 (ES Volume II, Document Ref. 6.3); and
- Appendix 9A: Flood Risk Assessment (ES Volume III, Document Ref. 6.4).

Consultation

9.3.3 An EIA Scoping Opinion was requested from PINS in February 2019. The response from PINS was received in April 2019 and a summary of the comments relevant to this assessment are outlined in Table 9-1, along with indications of how they have been addressed within the ES.

9.3.4 Further comments have been received in response to the Preliminary Environmental Information Report in September 2020. Responses from relevant statutory consultees are also included in Table 9-1 along with details as to how their comments have been resolved.

Table 9-1: Summary of Consultation Responses that have Informed the Scope and Methodology of the Surface Water Environment Assessment

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
	Scoping Response - PINS	
Water abstraction and discharge: Should existing abstraction and discharge assets be utilised, there will need to be a clear description and assessment within the ES as to the reliance on existing infrastructure, quantities and licenses and how these will vary in the context of the Proposed Development.	This chapter of the ES assesses impacts relating to water discharge only (as abstraction from the River Tees has been removed from the Proposed Development), - including use of existing Northumbrian Water Ltd. supply, and assessment of surface water and process water discharge to Tees Bay including modelling of thermal impacts of discharge to the Tees Bay.	Refer to Section 9.5: Development Design and Impact Avoidance for description of water supply and discharge arrangements. Refer to Section 9.6 Likely Impacts and Effects for the assessment of water discharge (surface and process water) and water demand.
Changes to surface water flows: It is not clear why the Scoping Report has identified the potential for changes to surface water flows during the construction phase within Flood Zones 2 and 3 only, when the Power, Capture and Compression site (PCC) is located within Flood Zone 1. Changes to surface water flows during construction should be assessed where significant effects are likely. The ES should also clarify the term 'temporary changes'.	Changes to surface water flows have been considered for the construction and operational phases of the Proposed Development. The findings of the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) are summarised within this chapter of the ES, which considers the entire Site i.e. everything within the Site boundary including areas within Flood Zone 1. For the purposes of assessing environmental effects temporary changes are those that only last for a duration of time and which are not permanent.	Refer to the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) for full details. A summary of the flood risk baseline is provided in Section 9.4 of this chapter, and an assessment of the impact of the Proposed Development on flood risk is provided in Section 9.6.
Functional Floodplain: The Proposed Development includes works within Flood Zone 3. The ES should demonstrate that the Proposed Development would not result in a net loss of floodplain storage and would not impede water flows.	An FRA is appended to this chapter of the ES and considers impacts on floodplain storage and impediment of flows. The findings of the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) are also summarised within this chapter of the ES.	Refer to the FRA Section 9.9 (Appendix 9A, ES Volume III, Document Ref. 6.4) for full details. A summary of the flood risk baseline is provided in Section 9.4 of this chapter, and an assessment of the impact of the Proposed Development on flood risk is provided in Section 9.6.
Flood Risk Assessment: All potential sources of flooding which could result in likely significant effects should be assessed in the ES. Consideration should be given to the potential for groundwater, surface water, sewer, tidal and fluvial	An FRA is appended to this chapter of the ES and considers flood risk from all sources, including tidal. The findings of the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) are also	Refer to the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) for full details including flood resistance and resilience measures and Flood

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
flooding across all components of the Proposed Development. The assessment of flood risk should take into account the most recent climate change allowances. Figure 4 of the Scoping Report presents two options for water connections, both of which are located within tidal waters. The ES should include an assessment of impacts to tidal flooding from the Proposed Development, where significant effects are likely. The Applicant should make effort to discuss and agree the need for detailed consideration of flood warning and evacuation plans with relevant consultation bodies.	summarised within this chapter of the ES.	Emergency Response Plan. A summary of the flood risk baseline is provided in Section 9.4 of this chapter, and an assessment of the impact of the Proposed Development on flood risk is provided in Section 9.6.
Water Framework Directive: The Inspectorate welcomes that the ES will consider potential impacts from the direct discharge of effluents and/or cooling water under the WFD and notes that the following waterbodies could be impacted: • Tees Estuary WFD waterbody; • Tees Estuary (S Bank) WFD waterbody; and • Tees Coastal WFD waterbody. The ES should assess impacts on water quality, hydromorphology and geomorphology where significant effects are likely. The Applicant's attention is drawn to the Inspectorate's Advice Note Eighteen: The WFD for further advice on undertaking a WFD assessment.	A WFD assessment is appended to this chapter of the ES (Appendix 9C, ES Volume **III**, Document Ref. 6.4). This includes assessment of surface and groundwater bodies and considers water quality, ecology and hydromorphology. Specifically, the assessment considers whether there is potential for any deterioration in any WFD element or classification, or any prevention of future improvement. The methodology adheres to advice presented in the Planning Inspectorate's Advice Note Eighteen and the Environment Agency's 'Clearing the Waters' guidance.	Refer to Appendix 9C: WFD Assessment (ES Volume **III**, Document Ref. 6.4)

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
Assessment methodology: There is a potential for impacts to water quality from effluent and/or cooling water; consideration should be given to both thermal and chemical changes to water. Thermal modelling should be undertaken and should take into account sea temperature rise due to climate change over the operational lifespan of the Proposed Development. Cumulative effects from all other thermal discharges within the Tees estuary should be considered. Relevant cross reference should be made to the Ecology and Nature Conservation chapter within the ES.	There will be no discharges to the Tees Estuary from the Proposed Development These comments were noted, and thermal modelling of the discharge to the Tees Bay has been undertaken. The results of this modelling are presented in Appendix 14E (ES Volume III, Document Ref. 6.4) and summarised within. Cumulative effects are also considered as part of the thermal discharge modelling. Impact of surface water and process water discharge on water quality in Tees Bay has also been assessed. Relevant cross reference has been made to Chapter 14: Marine Ecology and Nature Conservation within this chapter of the ES, where appropriate.	Refer to Appendix 14E: Coastal Modelling Report (ES Volume III, Document Ref. 6.4) and Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2).
Watercourse crossings: The Scoping Report states that the method for crossing the River Tees for the gas connection and CO_2 gathering network is still under discussion, however there is no indication of whether any other watercourse crossings would be required. The Inspectorate expects the ES (and the FRA) to fully assess the impacts associated with the chosen crossing methods and any culverts or diversion to ordinary and main watercourses that may be required.	Details of watercourse crossings and assessment of their impact and effect are provided in this chapter of the ES.	Refer to Section 9.5: Development Design and Impact Avoidance and Section 9.6: Likely Impacts and Effects.
Drainage: The ES should describe the drainage arrangements for both the construction and operational phase of the Proposed Development.	A summary of potential drainage arrangements are outlined and an assessment of their suitability undertaken within this chapter of the ES.	Refer to Section 9.5 Development Design and Impact Avoidance and Section 9.6 Likely Impacts and Effects.
Coastal Processes: The Scoping Report has not considered the potential impacts to coastal processes from any of the offshore works; any likely significant effects from the Proposed Development should be assessed within the ES.	The offshore works associated with construction and operation of the CO_2 export pipeline beyond Mean Low Water Spring (MLWS) and operation of the off-shore storage facility are not covered by the Development Consent Order and will be consented through a separate Consent via a separate Marine Licence (ML) application to the Marine Management Organisation (MMO) supported by a separate EIA. However,	Refer to Section 9.10 Cumulative Effects

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
	environmental effects from the construction and operation of the offshore elements of the development will be considered as part of the cumulative impact assessment.	
Receptors: The Scoping Report figures show reservoirs close to the electrical connection corridors around Lazenby; however, these have not been identified as environmental receptors in Chapter 2 of the Scoping Report. Any likely significant effects on these receptors should be identified and assessed within the ES.	Potentially impacted water environment receptors have been re-considered within the baseline of this chapter of the ES, and potential impacts assessed fully as appropriate. Electrical connection corridor modified to remove section near Lazenby	Refer to Section 9.4 Baseline and Section 9.6 Likely Impacts and Effects.
Environment Agency Response – Section 42 Consultation		
The DCO application should include an assessment of these impacts and specifically: - the requirements of the WFD via the submission of a WFD Assessment; - how the development will achieve a biodiversity net gain; and - the cumulative impacts of this development in combination with other developments in the Tees.	A WFD assessment is included as appended to this chapter (Appendix 9C, ES Volume **III**, Document Ref. 6.4). Net gain is outlined in Chapter 12: Terrestrial Ecology (ES Volume **I**, Document Ref. 6.2). Cumulative assessments with regard to the water environment are assessed in Chapter 24: Cumulative and Combined Effects (ES Volume **I**, Document Ref. 6.2).	Refer to WFD Assessment (Appendix 9C, ES Volume **III**, Document Ref. 6.4). Net gain is outlined in Chapter 12 Terrestrial Ecology (ES Volume **I**, Document Ref. 6.2). Cumulative assessments with regard to the water environment are assessed in Chapter 24: Cumulative and Combined Effects (ES Volume **I**, Document Ref. 6.2) and within Section 9.10 of this chapter.
As part of the DCO, we would welcome clarity of the pipeline network, a detailed 3D map of the proposed structure, detailing the underground pipe network, depth underground, locations and pipe size. Additionally, further details are required for the trenchless technology technique, the feasibility, limitations, and likely features underground that may interrupt the instillation and scenarios which force the instillation to use open trenches.	The pipeline network is detailed in the Application, Figure 5-2, ES Volume **II**, Document Ref. 6.3 and Document Refs. 4.7, 4.8, 4.9, 4.10, 4.11 and 4.12 and is above ground utilising existing pipe racking, pipe bridges and culverts. No open trench crossings of watercourses or water features are proposed. Trenchless technologies also to be used for crossings of Coatham Dunes and Sands. Ground conditions are assessed in Chapter 10: Geology & Hydrogeology and Contaminated Land (ES Volume **I**, Document Ref. 6.2).	Refer Figure 5-2, ES Volume **II**, Document Ref. 6.3 and Document Refs. 4.7, 4.8, 4.9, 4.10, 4.11 and 4.12 for the pipeline network. Refer to Chapter 10 Geology & Hydrogeology and Contaminated Land (ES Volume **I**, Document Ref. 6.2).

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
WFD: The proposal represents a significant opportunity to redirect existing and future treated and untreated effluent discharges away from the Tees estuary and into the North Sea and thus achieving WFD objectives by integrating an industrial and domestic effluent collection system within the proposed 'CO_2 Gathering Network'**.** We would encourage the applicant to work with the sewerage undertakers and other sewerage utility providers to develop an integrated scheme that ensures legally binding environmental targets for the water environment are met	There will be no discharge to the Tees Estuary in the Proposed Development. The Water Discharge Connection Corridor includes aa number of options yet to be finalised. One option includes a pipeline from the PCC Site to Bran Sands Wastewater Treatment Works (WwTW) as a potential wastewater treatment option for one of the waste effluent streams. This corridor is sufficiently wide that it could also be used for another parallel pipeline to convey final treated effluent from Bran Sands WwTW back towards the site for onward discharge to Tees Bay. This 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. Both commercial and regulatory agreement will be necessary for this to occur and at this stage this is outside of the draft DCO. For the avoidance of doubt this particular option within the Application only considers discharge of effluent from NZT treated by Northumbrian Water and discharged to Dabholm Gut.	Not applicable
Discharges from Power Plant: The impact of the discharges has not been assessed as regards to the quality impact. None of the documents list the likely make up of the effluent whether directed towards Bran Sands and treatment at Northumbrian Water's sewage works or treated and discharged on site. The Northumbrian RBMP requires the restoration and enhancement of water bodies to prevent deterioration and promote recovery of water bodies. The proposal may cause deterioration of a quality element to a lower status class and/or prevent the water body reaching its objective. An assessment of the impact of the discharge should be undertaken to demonstrate what the likely impact will be.	Assessment of discharges from the Scheme are included within this chapter of the ES and considered in terms of impacts on waterbody objectives in the WFD assessment. However, it is not yet possible to specify the emissions due to not knowing who the licensor is and their exact solvent composition. An H1 screening assessment will be undertaken during the process of obtaining an Environmental Permit, along with further assessment and treatment if adverse impacts on water quality cannot be screened out	Refer to Section 9.5: Development Design and Impact Avoidance and Section 9.6 Likely Impacts and Effects.

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
Surface Water Quality Parameters: The WFD water quality parameters that have been used to compare the chosen closest sample sites to are incorrect. Different quality elements are used depending on the type of waterbody. The sample sites chosen reflect a transitional waterbody and as such these EQS values should be used, as well as the elements which do not have an EQS but a high, good, moderate, poor, and bad classification like Dissolved Inorganic Nitrogen. The EQS parameters can be found here: https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit	Noted. Water quality data presented within this chapter has been reviewed and updated where necessary based on this statement.	Refer to Section 9.4: Baseline Conditions.
Dredging impacts: Consideration should be given to the impact of sediment contamination affecting the water quality and chemical status of the waterbody it's carried out in. This may require further testing and leachate samples from marine sediments listed over CEFAS level 1.	Dredging is no longer required for the Proposed Development, and so is no longer included in this assessment.	Not applicable
Abstraction Licence: The proposal has not confirmed if the existing abstraction licence associated with the site will form part of the final development, and, have also identified possible other alternate sources of water. The existing licence is currently held by a third party; advice has been previously offered (Scoping Opinion Response) to highlight that if this third party (SSI UK Limited) is dissolved then the option to transfer the licence will no longer be possible. If the licence is revoked prior to transfer then a new application for an abstraction will be required. There is no guarantee the licence will be issued. The proposal has identified that if the existing abstraction is to be utilised then upgrade to the take-off infrastructure will be required in order to comply with the Eel Regulations.	Water will be supplied to the Proposed Development by Northumbrian Water Ltd. without the requirement to use the existing water abstraction intake from the Tees Transitional waterbody.	Not applicable
Buffer Zones from Watercourses: Development that encroaches on watercourses can have a potentially severe impact on their ecological value. Encroachment from	Noted – and the potential for habitat loss, disturbance and nutrient enrichments is assessed within this Environmental Statement.	Refer to Chapter 12: Terrestrial Ecology (ES Volume I, Document Ref. 6.2) and Chapter 13: Aquatic Ecology (ES

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
development activities has potential to cause habitat loss, disturbance and nutrient enrichment. The setback development area needs to maintain this corridor around any watercourses on site and should be maintained and enhanced as part of the development work.		Volume I, Document Ref. 6.2)
Discharge of treated water and outfall construction: Any outfall structure / discharge that is required to be constructed may require a flood risk activity permit under the Environmental Permitting (England and Wales) Regulations 2016. The DCO should also take into account impacts to protected and notable species and habitats along these watercourses, with survey information informing these impacts. The design of any outfall should be sympathetic to the water environment and low impact design options that mimics greenfield runoff should be considered and not drain onto or impact Habitats of Principal Importance (such as mudflats or saltmarsh).	A potential new discharge outfall will be required at Tees Bay should the existing pipeline and outfall head be in a poor state of repair. The morphological effects of construction of this pipeline are considered within this chapter of the ES. Effects on marine habitats and species are considered in Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2). 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. This is discussed further within the chapter.	Refer to Section 9.6 Likely Impacts and Effects for assessment of morphological impacts related to outfall construction. Refer to Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2) for assessment of impacts on marine habitats and species.
Geomorphology: With respect to geomorphology, detailed plans and designs should be submitted as part of the DCO in order to assess potential impacts to watercourses and wider WFD objectives.	Proposed Development plans are provided as part of the Application Document Ref. 4.6 to 4.15. There are no new structures or crossings beneath watercourses related to the Proposed Development with the exception of the trenchless crossings of the Tees Estuary. Instead, existing pipe racks and pipe bridges are used. Impacts of WFD objectives for all waterbodies in the Study Area are assessed in Appendix 9C: WFD Assessment (Volume III, Document 6.4).	Refer to Document Refs. 4.6 to 4.15. Refer to Section 9.5 for further description of crossings and their locations. Refer to Section 9.6 Likely Impacts and Effects for assessment of morphological impacts. For assessment against WFD objectives refer to Appendix 9C: WFD Assessment (Volume III, Document 6.4).
Marine Management Organisation Response - Section 42 Consultation		
The MMO note that the applicant has identified the historical industrial inputs of metals, hydrocarbons and organic chemical compounds that continue to impact the River Tees. The ubiquitous spread of these compounds in the Tees is exacerbated by their persistence,	As there will be no works within the Tees Estuary there is no requirement of an assessment of water quality impacts relating to disturbance of bed sediment in the Tees Estuary in this chapter. Marine ecology impacts are considered in Chapter 14: Marine	Refer to Section 9.6 Likely Impacts and Effects and Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2).

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
and when considering the process of siltation and sediment movement, these compounds can become suspended within subsurface sediments (i.e. compacted below the seabed). Whilst the applicant has noted the risk posed by their proposed work on the remobilisation of suspended contaminants, the MMO consider that this is not covered in significant details and has not been identified as a relevant impact pathway.	Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2) and within the WFD Assessment (Appendix 9C, ES Volume III, Document Ref. 6.4).	
The MMO note that the applicant has based the physiochemical baseline of the River Tees on sediment sampling datasets which have been used to support marine licence decisions from 2006-2018. This predominantly describes the results of trace metal and arsenic analysis at Able Seaton (2017), Northern Gateway Container Terminal (2016), York Potash (2016) and QE II Berth (2008). It concludes that whilst elevated levels of trace metal analytes were observed, they were not deemed unsuitable for disposal at sea. It has been noted that these analytes were not deemed unsuitable for disposal. The applicant notes that for QE II Berth elevated levels above Cefas Action Level 2 were observed which therefore, required mitigation.	Noted – this is a summary of the baseline presented in the PEIR Report.	Not applicable.
The MMO consider further consideration is required into polycyclic aromatic hydrocarbons (PAHs) in the Tees. The applicant notes that PAH's and polychlorinated biphenyls (PCBs) have been observed at elevated levels in the past but have not precluded sediment from disposal at sea. The MMO believe that this assertion lacks nuance, in that, it does not consider the differences between the action levels of PCBs and PAH's when compared to trace metals. This is particularly noticeable with PAHs, where no upper action level exists.	The need for a preparatory dredge which would have required disposal of sediment is no longer required for the Proposed Development.	Not applicable.
The MMO would expect to see reference to polybrominated diphenyl ethers (PBDEs) or organotin content in the Tees river, as although largely regulated can still be observed in	The need for a preparatory dredge which would have required disposal of sediment is no longer required for the Proposed Development.	Not applicable

Consultation Response	Response Provided in the ES / DCO Application	Relevant Section of chapter / ES
localised elevations or 'hotspots' throughout the UK. PBDE's tend to be associated with more specialist industrial input, and as such, are not as frequently analysed as trace metals, organotins and PAHs. However, the Tees river is associated with elevated PBDE levels (Assunção et al., 2020; Boon et al., 2002; Webster et al., 2006). No action levels for PBDE content currently exist so any elevations must be considered with greater stringency to ensure that an appropriately precautionary approach is followed.		
The applicant has identified that separate marine licences will be required for various dredging activities that may occur, and that pre-application sediment sampling under OSPAR guidelines will be required. It is suggested that the applicant engages early with the MMO in regard to this.	The need for a preparatory dredge which would have required disposal of sediment is no longer required for the Proposed Development. Engagement with the MMO has been undertaken during development of the ES and draft Marine Licence.	Not applicable
MMO could not find a detailed breakdown of the sediments within the estuary. These should certainly be included within the application as this will help assess the potential impact of the project on the local sediment dynamics.	A baseline of sediment quality for the Study Area is included within this chapter of the ES, based on available data from previous planning applications. However there will be no works within the Tees Estuary.	Refer to Section 9.4Baseline.

Baseline Data Collection

9.3.5 For the purposes of the water quality 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 based on professional judgement. As flood risk impact can also impact upstream and downstream, the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) also considers a wider Study Area, where relevant. Professional judgement has been applied to identify the extent to which such features are considered. 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 Wastewater Treatment Works (WwTW) does not have capacity).

Desk Study

9.3.6 Desk based research has been undertaken to identify the waterbodies within and adjacent to the Site, and to gather and critically evaluate relevant data and information on their condition and attributes. The Environment Agency's online Main Rivers and flood maps have also been reviewed.

9.3.7 In summary, the key background reports, websites and data used include the following (all web sources last accessed in January 2021):

- Redcar and Cleveland Borough Council's Local Plan (2018) (RCBC, 2018);
- Stockton-on-Tees Borough Council's Local Plan (2019) (Stockton-on-Tees Borough Council, 2019);
- British Geological Survey's Geological Mapping Viewer, 'Geoindex' (British Geological Society, no date (n.d).);
- Environment Agency's Catchment Data Explorer (Environment Agency, n.d.a);
- Environment Agency's Guidance on discharges to surface water and groundwater: environmental permits (Environment Agency, 2016);
- Environment Agency's Flood Risk Maps (Environment Agency, n.d.b);
- Centre for Ecology and Hydrology (CEH)'s National River Flow Archive (CEH, n.d.);
- Cranfield University's 'Soilscapes' (Cranfield University, n.d.);
- Met Office's Climate averages data (Met Office, n.d.);
- Defra's Multi-Agency Geographic Information for the Countryside (MAGiC) website (Defra, n.d.);
- Ordnance Survey (OS) maps and aerial photography (Bing, n.d.);
- Data requested from the Environment Agency with regard to water quality of receptors in the Study Area, water resources (licensed abstractions and discharge consents), pollution incidents, fisheries and aquatic ecology data and WFD information and data; and
- Information available in previous Planning Applications relating to Tees Estuary and Tees Bay – Improvement of the Inter Terminals (MLA/2019/00151), Teesside Offshore Windfarm (32421/040319/14), Able Seaton Berth Dredging (MLA/2015/00334/4), York Potash Harbour Facilities Order (TR 030002).

Site Surveys

9.3.8 A Site walkover was undertaken on 22nd January 2020 by a surface water quality specialist and hydromorphologist in cold, dry and fair conditions. The walkover focused on surface waterbodies 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.

9.3.9 A further Site walkover was undertaken of Coatham Dunes in the Teesmouth and Cleveland Coast Site of Special Scientific Interest (SSSI) on the 17th September 2020 in warm, sunny conditions. The purpose of this site visit was to identify any surface water bodies within the sand dune complex.

Subsequent to this site visit, a programme of water quality and water level monitoring was undertaken of a single pond between October 2020 and January 2021. The results of this monitoring are summarised later in section 9.4 and presented in full in Appendix 9C, Annex E (ES Volume III, Document Ref. 6.4).

Source-Pathway-Receptor Approach

9.3.10 The impact assessment is based on a source-pathway-receptor approach. 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. water bodies and the services they support); and
- a pathway or pathways by which the two are linked.

9.3.11 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 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 the 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).

9.3.12 The assessment of the likely significant effects is qualitative, and considers construction, operational and decommissioning 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, operational and decommissioning activities, particularly in relation to those water features which are within or close to the Site. The risk of pollution from urban runoff and the increased demand on water resources has also been considered so that appropriate measures (e.g. SuDS, proprietary treatment devices, and water conservation measures) can be incorporated into the design of the Proposed Development.

9.3.13 Some specific assessments have been undertaken to support this impact assessment process. These are described in more detail in the following sections.

Assessment of Surface Water Runoff for the Operational Phase

9.3.14 During operation, surface water runoff from the Proposed Development may contain pollutants derived from urban surfaces (e.g. inert particulates, litter, hydrocarbons, metals, nutrients and de-icing salts). This mixture of pollutants is collectively known as 'urban diffuse pollutants,' and although each pollutant may itself not be present in harmful concentrations, the combined effects over the long term can cause chronic adverse impacts. Changes in impermeable surfaced area within the Proposed Development may lead to increases in the rate and quantities of these pollutants from the Site to receiving watercourses. An assessment is therefore needed to determine the potential risk to the receiving watercourses and to inform the development of suitable treatment measures.

9.3.15 The appropriateness of the surface water drainage measures in terms of providing adequate treatment of diffuse urban pollutants has been assessed with reference to the Simple Index Assessment method described in the SuDS Manual (CIRIA, 2015a). The Simple Index Approach follows three steps:

- Step 1 – Determine suitable pollution hazard indices for the land use(s);
- Step 2 – Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index (for three key types of pollutants - total suspended solids, heavy metals and hydrocarbons). Only 50% efficiency should be applied to second, third etc. treatment train components; and
- Step 3 – If the discharge is to a water body protected for drinking water, consider a more precautionary approach.

9.3.16 The SuDS Manual (CIRIA, 2015a) only provides a limited number of land use types so these have been chosen as the most suitable for the components of the Proposed Development. Where more than one pollution hazard category applies to a component of the Proposed Development, the worst pollution hazard has been selected. Please note that for areas where site specific industrial activities may take place or there is a greater risk of a chemical spillage, a process specific risk assessment may need to be undertaken at the full impact assessment stage, where appropriate.

Water Framework Directive Assessment

9.3.17 A qualitative assessment of the compliance of the Proposed Development against the WFD objectives for those WFD waterbodies that could be affected has been undertaken. This includes the assessment of the potential construction/decommissioning (where they are of sufficient scale and duration that they may affect status) and operational phase impacts of the Proposed Development on hydromorphological, biological and physico-chemical parameters with respect to the WFD objectives of no deterioration and failure to prevent improvement. For the purposes of the assessment, decommissioning phase impacts would be likely to be similar to construction phase impacts and therefore are not considered separately. The assessment takes into account proposed mitigation measures where the water body is not at Good Ecological Status/Potential or better, the objectives of relevant Protected Area designated under other EU Directives, and adjacent WFD waterbodies, see WFD Assessment (Appendix 9C, ES Volume III, Document Ref. 6.4) for further details

Flood Risk Assessment

9.3.18 A Site-wide FRA is provided as Appendix 9A (ES Volume III, Document Ref. 6.4), which assesses the current risk of flooding from all sources including fluvial, surface water, groundwater, tidal, artificial sources and drainage infrastructure. The FRA includes a full description of the flood risk baseline, which is also summarised in Section 9.4 of this ES chapter.

Classification of Effects and Significance Criteria for EIA Assessment

9.3.19 There is no standard guidance in place for the assessment of the likely significant effects on the water environment from developments of this type. Based on professional judgement and experience of other similar schemes, a qualitative assessment of the likely significant effects on surface water quality and water resources has been undertaken.

9.3.20 The classification and significance of effects has been determined using the principles of the guidance and the criteria set out in DMRB LA 113 (Highways England, 2019) adapted to take account of hydromorphology. Although these assessment criteria were developed for road infrastructure projects, this method is suitable for use on any development project and it provides a robust and well tested method for predicting the significance of effects. The methodology also considers advice set out in Department of Transport TAG Unit A3, Environmental Impact Appraisal (Department for Transport, 2019).

9.3.21 Approaches to mitigating potential impacts during construction and operational phases have been described with reference to good practice guidance and design.

9.3.22 Following the DMRB LA 13 (Highways England, 2019) guidance, the importance of the receptor (Table 9-2) and the magnitude of impact (Table 9-3) are determined independently and are then used to determine the overall classification and significance of effects (see Table 9-4). Where significant adverse effects are predicted, options for mitigation have been considered and proposed where possible. The residual effects of the Proposed Development with identified mitigation in place have also been assessed.

9.3.23 Whilst other disciplines may consider 'receptor sensitivity', 'receptor importance' is considered here. This is because when considering the water environment, the availability of dilution means that there can be a difference in the sensitivity and importance of a water body. For example, a small drainage ditch of low conservation value and biodiversity with limited other socio-economic attributes, is very sensitive to impacts, whereas an important regional scale watercourse, that may have conservation interest of international and national significance and support a wider range of important socio-economic uses, is less sensitive by virtue of its ability to assimilate discharges and physical effects. Irrespective of importance, all controlled waters in England are protected by law from being polluted.

Table 9-2: Evaluating the Importance for Surface Water, Flood Risk, and Water Resources

Importance	Surface Water[1]	Morphology	Flood Risk
Very High	Watercourse having a WFD classification shown in a RBMP and Q95≥1.0 m^3/s. Sites protected/designated under a EC or UK legislation (SAC, SPA, SSSI, Ramsar, salmonid water) / Species protected by EC legislation Ecology and Nature Conservation.	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river type.	Essential infrastructure or highly vulnerable development
High	Watercourse having a WFD classification shown in a RBMP and Q95<1.0 m^3/s. Species protected under EC or UK legislation Ecology and Nature Conservation.	Conforms closely to natural, unaltered state and would often exhibit well-developed and diverse geomorphic forms and processes characteristic of river type, with abundant bank side vegetation. Deviates from natural conditions due to direct and/or indirect channel, floodplain, and/or catchment development pressures.	More vulnerable development
Medium	Watercourses not having a WFD classification shown in a RBMP and Q95 >0.001m^3/s.	Shows signs of previous alteration and / or minor flow regulation but still retains some natural features or may be recovering towards conditions indicative of the higher category.	Less vulnerable development
Low	Watercourses not having a WFD classification shown in a RBMP and Q95 ≤0.001m^3/s.	Substantially modified by past land use, previous engineering works or flow regulation and likely to possess an artificial cross-section (e.g. trapezoidal) and would probably be deficient in bedforms and bankside vegetation. Could be realigned or channelised with hard bank protection, or culverted and enclosed. May be significantly impounded or abstracted for water resources use. Could be impacted by navigation, with associated high degree of flow regulation and bank protection, and probable strategic need for maintenance dredging. Artificial and minor drains and ditches would fall into this category.	Water compatible development

Note 1 Professional judgement is applied when assigning an importance category to all water features.
All controlled waters are protected from pollution under the Environmental Permitting (England and Wales) Regulations 2016 and the Water Resources Act 1991 (as amended), and future WFD targets also need to be considered.

Note 2 Based on the water body 'Reach Conservation Status' presently being adopted for the High Speed 2 project (developed originally by Atkins) and developed from EA conservation status guidance (Environment Agency 1998a, Environment Agency, 1998b) as DMRB guidance does not currently provide any importance criteria for morphology.

9.3.24 The magnitude of impact will be determined based on the criteria in Table 9-3 taking into account the likelihood of the effect occurring. The likelihood of an impact occurring is based on a scale of certain, likely or unlikely. Likelihood has been considered in the case of water resources only, as likelihood is inherently included within the flood risk assessment.

Table 9-3: Evaluating Magnitude for Surface Water, Flood Risk, and Water Resources

Impact	Criteria	Description and Examples
Major Adverse	Results in a loss of attribute and/or quality and integrity of the attribute	Loss or extensive change to a fishery. Loss of regionally important public water supply. Loss or extensive change to a designated Nature Conservation Site. Reduction in water body WFD classification Increase in peak flood level (>100mm)[1]
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification. Increase in peak flood level (>50 mm).
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	Minor effects of water supplies. Increase in peak flood level (>10mm).
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	No risk identified to surface water quality or hydromorphology Negligible change in peak flood level (≤+/- 10 mm).
Minor Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative effect occurring	Contribution to minor improvement in water quality, but insufficient to raise WFD classification. Creation of flood storage and decrease in peak flood level (>10 mm).
Moderate beneficial	Results in moderate improvement of attribute quality	Contribution to improvement in waterbody WFD classification. Creation of flood storage and decrease in peak flood level (>50 mm).
Major beneficial	Results in major improvement of attribute quality	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification. Creation of flood storage and decrease in peak flood level (>100 mm).

[1] All references to peak flood level in this table are for a 1% annual probability event, including climate change. Note: adapted from DMRB LA113 (Highways England, 2019)

Classification and Significance of Effect

9.3.25 Once the magnitude of impact and the receptor importance have been defined, the classification and significance of the potential effect can be derived by combining both assessments in a simple matrix as shown in Table 9-4. Effects classed as moderate or greater are considered significant in EIA terms (i.e. shaded cells). Where there is a range of effects (e.g. large / very large) professional judgement has been used to determine the residual effect.

Table 9-4: Classification and Significance of Effect

Magnitude of Impact	Importance of Attribute			
	Low	Medium	High	Very High
No change	Neutral	Neutral	Neutral	Neutral
Negligible	Neutral / Slight	Neutral / Slight	Slight	Slight
Minor	Neutral / Slight	Slight	Slight / Moderate	Moderate / Large
Moderate	Slight	Moderate	Moderate / Large	Large / Very Large
Major	Slight / Moderate	Moderate / Large	Large / Very Large	Very Large

Note: adapted from DMRB LA104 (Highways England, 2020)

Rochdale Envelope

9.3.26 The assessment 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.

9.3.27 Key principles in the context of the Application process are given in the Planning Inspectorate's 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.

9.3.28 The following are the reasonable worst case scenario assumptions (maximum parameters) for the purposes of the Water Environment 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 CO_2 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 m^2, 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, direct contact cooler (contains ammonia or urea)
  5. Process water from CO_2 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, 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. 4.4 and 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.
- The Tees crossings for the gas connection and CO_2 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 the nearby Northumbrian Water 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.
- Assumptions relating to the thermal discharge modelling from the Tees Bay outfall are all outlined in the modelling report (see Appendix 14E: Coastal Modelling Report in ES Volume III, Document Ref. 6.4).

Limitations and General Assumptions

9.3.29 The EIA process enables good decision-making based on the best possible available information about the environmental implications of a proposed development. 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 under a Rochdale Envelope approach as outlined above.

9.3.30 The assessment has been undertaken using available data and Proposed Development design details at the time of writing in January 2021. It is also based on understanding of flow pathways as observed during the site walkover. However, many of the watercourses in the Study Area are in culvert and underground for significant sections, and so assumptions have been made regarding flow pathways for these culverted sections, based on Ordnance Survey mapping. Understanding of flow pathways is described for each watercourse in the baseline (Section 9.4).

9.3.31 Assumptions and limitations relating to flood risk are outlined in the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4).

9.3.32 Assumptions and limitations relating to the thermal discharge modelling from the Tees Bay outfall are all outlined in the coastal modelling report (Appendix 14E: Coastal Modelling Report, ES Volume III, Document Ref. 6.4).

9.3.33 No Construction Method Statements are available at the time of writing, although a reasonable assumption has been made that all works will take place using best practice, as set out and secured in the Framework Construction Environmental Management Plan (CEMP) (Appendix 5A in ES Volume III, Document Ref. 6.4).

9.3.34 Aside, from Pond 14 (the only open water pond remaining within the Teesmouth and Cleveland Cost SSSI), no water quality monitoring has been undertaken. Background water quality has been determined from the nearest Environment Agency monitoring stations. This is considered sufficiently robust 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 depositions of nitrogen to this open water pond.

9.3.35 The understanding of drainage arrangements assessed herein is based on information provided by bp. 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 Construction Industry Research and Information Association (CIRIA) C753 The SuDS Manual (CIRIA, 2015a) 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 example land use used, and what treatment a particular option may provide, taking into account the design of the SuDS feature and whether it is considered to be ‘optimum’ or ‘sub-optimum’ for whatever reason.

9.4 Baseline Conditions

9.4.1 The relevant baseline physical characteristics of the Study Area and the water features present are described in this section. Please refer to Figure 9-1: Surface Water Features and Their Attributes throughout.

Land Use, Topography and Rainfall

9.4.2 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). The PCC Site is currently industrial, comprising former steelworks structures. Dormanstown is located southeast of the PCC Site.

9.4.3 The Site boundary extends north of the PCC Site across Coatham Sands into Tees Bay in two locations (for the Water Discharge Connection and CO_2 Export Pipeline/alternative water discharge pipeline location), 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 discharge infrastructure that may be retained for use by the Proposed Development and the Natural Gas Connection Corridor and CO_2 Gathering Network Corridor (see Figure 9-1, ES Volume II, Document Ref. 6.3).

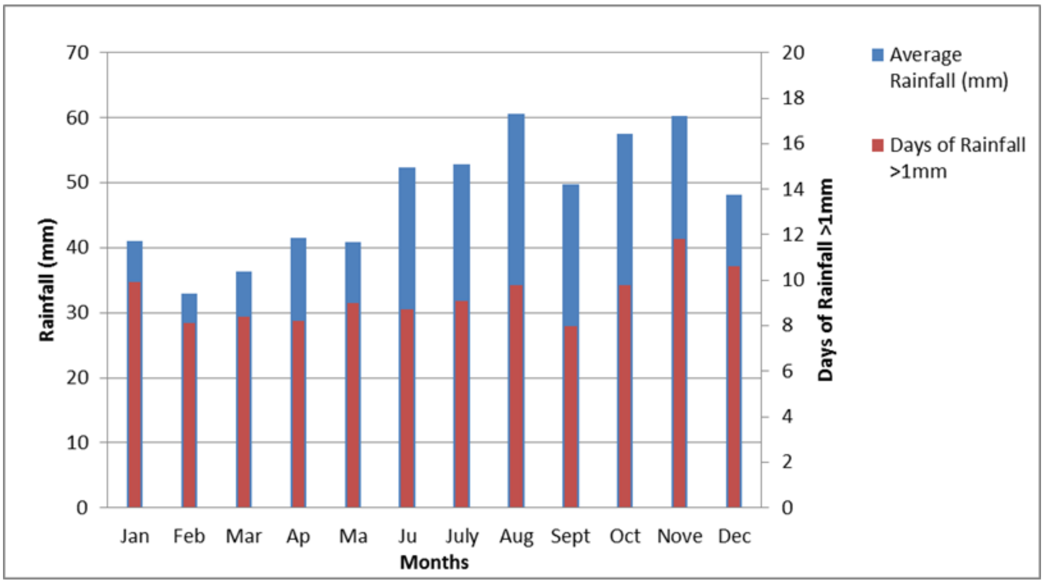
9.4.4 The Site boundary extends south and southwest of the PCC Site in order to accommodate the Natural Gas Connection Corridor and CO_2 Gathering Network Corridor and highways connections for indivisible loads.

9.4.5 The section of the Site comprising the Natural Gas Connection Corridor and CO_2 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 at Seal Sands 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 Seaton Carew Road. The CO_2 Gathering Network then follows existing pipelines across Saltholme Nature Reserve, and into the industrial area at the eastern edge of Billingham. This whole section of the Site is very flat, being between 0 and 10 m AOD. The immediate surroundings include heavy industry on the banks of the Tees, mudflats to the north, marshland at Saltholme and Cowpen Marsh, 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 Special Protection Area (SPA) designations).

9.4.6 The nearest weather station on the Met Office website (Met Office, n.d.) 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 (as the most recent data available)) 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. For more information on storm rainfall events see Appendix 9A: FRA (ES Volume III, Document Ref. 6.4).

9.4.7 Diagram 9-1 illustrates 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.

Diagram 9-1: Stockton-on-Tees Weather Station – Average rainfall per month (1981-2010) and average days per month with >1mm of rainfall (1981-2010)



Water Features

9.4.8 A Site Walkover was undertaken on 22nd 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[2], a summary list of the surface waterbodies and where relevant to the assessment, groundwater waterbodies listed in Table 9-5 were identified within the Study Area and are presented on Figure 9-1: Surface Water Features and Their Attributes and 9-2: Groundwater Features and Their Attributes (ES Volume II, Document Ref. 6.3). Further details on these are presented in Tables 9-6 to 9-7 below.

Surface Waterbodies

9.4.9 The Environment Agency's Catchment Data Explorer website (Environment Agency, n.d.a) confirms that the estuarine and coastal waterbodies in the Study Area are contained within the Northumbrian River Basin District, the Northumbrian Transitional and Coastal (TraC) Management Catchment, and the Tees Lower and

[2] https://environment.data.gov.uk/catchment-planning/

Estuary TraC Operational Catchment. The fluvial waterbodies are contained within the Northumbrian River Basin District, Tees Management Catchment and Tees Lower and Estuary Operational Catchment.

9.4.10 There are three WFD designated surface water bodies within the Study Area, and these are described briefly in Table 9-6 (see also Figure 9-1, ES Volume II, Document Ref. 6.3). Although these are the WFD reporting reaches, WFD principles and objectives apply to all tributaries of these watercourses. The WFD waterbodies include one coastal waterbody (Tees Coastal Water), one estuarine waterbody (TEES transitional waterbody) and one river (The Fleet - designated as Tees Estuary (S Bank)).

9.4.11 Within the catchments of the WFD waterbodies outlined in Table 9-6, there are also a number of named watercourses shown on Ordnance Survey mapping (Bing, n.d.), and these are described in Table 9-7 (cross refer to Figure 9-1, ES Volume II, Document Ref 6.3).

9.4.12 In addition to the watercourses described in Tables 9-6 and 9-7, 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 for part of their course and so their exact path is unclear. These ditches are not included within any nature conservation designations and due to largely being in culvert 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, intermittent or 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 that result in habitat diversity).

Table 9-5: Surface and Groundwater Waterbodies Identified Within the Study Area

Waterbody	Type of waterbody	WFD designation or associated WFD waterbody (where applicable)
Tees Bay	Coastal	Tees Coastal Water (GB650301500005)
Tees Estuary	Watercourse (Main River)	TEES Transitional Waterbody (GB510302509900)
The Fleet	Watercourse (Ordinary)	Tees Estuary (S Bank) (GB1030250723320)
Main's Dike	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Mill Race	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Dabholm Gut	Watercourse (Ordinary)	Designated under the TEES Transitional Waterbody (GB510302509900)
Dabholm Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Kettle Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Kinkerdale Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody

Waterbody	Type of waterbody	WFD designation or associated WFD waterbody (where applicable)
Knitting Wife Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Holme Fleet	Watercourse (Main River)	Tributary of the Tees Transitional WFD Waterbody
Belasis Beck	Watercourse (Ordinary)	Tributary of Holme Fleet and therefore associated with the Tees Transitional WFD Waterbody
Cross Beck	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Greatham Creek	Watercourse (Main River)	Designated under the Tees Transitional WFD Waterbody
Mucky Fleet	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Swallow Fleet	Watercourse (Ordinary)	Tributary of the Tees Transitional WFD Waterbody
Saltholme Nature Reservoir Ponds, Brine Reservoirs, Brine Field and refinery ponds	Stillwater	Catchment of Tees Transitional WFD Waterbody
Lake at Charlton's Pond Nature Reserve	Stillwater	Catchment of Tees Transitional WFD Waterbody
Ponds at Billingham Technology Park	Stillwater	Catchment of Tees Transitional WFD Waterbody
Ponds within Coatham Dunes and Bran Sands	Stillwater	Catchment of Tees Coastal WFD waterbody
Ponds at Coatham Marsh	Stillwater	Catchment of Tees Estuary (S Bank)
Numerous industrial ponds and artificial waterbodies across the area including Lazenby Reservoirs and Salthouse Brine Reservoirs	Stillwater	Catchment of Tees Transitional WFD Waterbody
Tees Sherwood Sandstone	Groundwater	WFD designation (GB40301G702000)
Tees Mercia Mudstone & Redcar Mudstone	Groundwater	WFD designation (GB40302G701300)

Table 9-6: 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.
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.					
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 and Table 9-14 (Water Activity Permits). 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					

Waterbody	Ecological Status / Potential	Chemical Status	Overall Target Objective	Hydromorphological Designation	Designated Reach
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 SSSI.					
Tees Estuary (South Bank) (GB1030250723320)	Moderate Ecological Potential	Fail	Good (2027)	Heavily Modified	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.
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 2m 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 crossing 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. 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.					

Table 9-7: 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 WFD 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 Saltholme 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	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 Gut.	Refer to the Dabholm Gut description under the Tees Transitional Waterbody description above.
Kettle Beck	Tees Transitional Waterbody	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 (Lackenby), and beyond the A1053 before discharging to the Tees. The exact course of the watercourse is no clear from online mapping north of the	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 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

Name	Tributary of	Watercourse Description	Site Observations
		A1085 as the watercourse is culverted.	observation site, which consisted of 6 small diameter (~0.5 m) pipes. The banks rose steeply from the channel bed and were incised meaning the channel is likely disconnected from the floodplain.
Holme Fleet	Tees Transitional Waterbody	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	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	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 Waterbody	The Lackenby Channel is a drainage cut between the Lackenby steelworks (NZ 55305 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,	Lackenby Channel was not visited during the site visit, but aerial photography available online indicates 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.

Name	Tributary of	Watercourse Description	Site Observations
		Kinkerdale Beck and Kettle Beck to the Tees.	
Main’s Dike	The Fleet	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	The Fleet (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 remerges 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	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

9.4.13 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 Reserve, and they are small (1-2 m wide) low gradient, single thread, meandering waterbodies that are closely connected to their floodplains.

9.4.14 Other waterbodies shown in Figure 9-1 (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.

9.4.15 In total, there are 138 still waterbodies within 250 m of the Site boundary (see Chapter 13: Aquatic Ecology, ES Volume I, Document Ref. 6.2) the majority of which are small ponds or artificial standing waterbodies. The majority of these on the southeast bank of the Tees are small artificial waterbodies and ponds related to the surrounding industrial land use. To the northeast of the Tees there are further artificial and industrial waterbodies, such as the large brine reservoirs immediately north of the Site boundary at Saltholme. The surrounding wetlands here also includes several large, interconnecting waterbodies 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.

9.4.16 The ponds within Coatham Dunes have been surveyed (see Appendix 9C, Annex D, ES Volume III, Document Ref. 6.4) 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.

Tees Estuary

9.4.17 The present-day Tees Estuary has a largely anthropogenic character due to land reclamation, canalisation and channel deepening that began in the mid-nineteenth century. Originally the estuary was surrounded by extensive wetlands and 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).

9.4.18 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.

9.4.19 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.

9.4.20 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).

9.4.21 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 9-8.

Table 9-8: 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

9.4.22 The data in Table 9-8 indicate 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. For further information on storm surge events see Appendix 9A: FRA (ES Volume III, Document Ref. 6.4).

9.4.23 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 m^3/s, with a 10% exceedance (Q10) of 46.5 m^3/s, and a 95 exceedance (Q95) of 3.07 m^3/s.

9.4.24 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.

9.4.25 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 (210-217ºN), although the largest wind events (i.e. of over 40 m/s) tend to be from the north (HR Wallingford, 2006).

9.4.26 Extreme wave heights for defined return periods, as previously reported for the waverider buoy north of the Tees North Buoy, are presented in Table 9-9. 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 9-9: 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

9.4.27 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.

9.4.28 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 reminder 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 m^3 to 330,000 m^3 per year (Royal Haskoning, 2016d).

Tees Bay

9.4.29 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.

9.4.30 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.).

9.4.31 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.).

9.4.32 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).

9.4.33 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

9.4.34 The Tees Estuary and adjacent Tees Bay is subject to significant commercial vessel traffic. The Navigational Risk Assessment (Appendix 20B, ES Volume III, Document Ref. 6.4) includes data for the York Potash Harbour development (Royal Haskoning, 2016c) which provided a summary of vessel movements within the Tees Estuary for 2013-2014, which are shown in Table 9-10. 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 9-10: 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

9.4.35 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.).

9.4.36 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.

9.4.37 Refer to the Navigational Risk Assessment (Appendix 20B, ES Volume III, Document Ref. 6.4) for further details.

Surface Water Quality

9.4.38 The Tees Coastal WFD waterbody is currently failing to meet Good 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.

9.4.39 The Tees Transitional WFD waterbody is currently failing to meet Good 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.

9.4.40 The Tees Estuary (South Bank) waterbody is currently failing to meet Good Chemical Status under the WFD Cycle 2 classifications (2019), due to failures for 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.

9.4.41 Water quality data has been obtained from the Environment Agency's Water Quality Archive (Environment Agency, n.d.c) for the Tees Estuary. Annual average values for the period 2009-2019 are summarised in Table 9-11 for a sampling point close to the mouth of the Tees at the Gares, 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). The parameter values presented Table 9-11 are compared against WFD standards where they apply to transitional waters.

Table 9-11: 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 Good)	Tees Mouth 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 (ºC)	-	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 DDT	0.01	-	-	-	0.0012	-
Chloroform		-	1.060	0.116	-	-
Hexachlorobenzene	0.05	-	-	-	0.0004	-
Hexaclorobutadiene	0.6	-	-	-	0.0004	-

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

9.4.42 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 waterbody.

9.4.43 The Water Quality Archive website (Environment Agency, n.d.c) also provides water quality for other waterbodies and sites in close proximity to the Proposed Development, spanning the period 2009-2019 inclusive. Data tables are provided in Appendix 9B: Background Water Quality Data Tables and Water

Resources Data, for Brans Sands at Teesmouth, the Wilton Complex Effluent Composite, Dabholm Gut upstream of the Tees, Greatham Creek and Billingham Beck. A summary is provided in Table 9-12 indicating parameters that were measured and a brief overview of water quality implications.

Table 9-12: 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 waste water 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: NZ5570026600	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: NZ5550024500	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: NZ5249026490	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	2000-2019	River	Physico-chemical parameters (e.g. pH, temp, dissolved oxygen); Nutrients and sanitary products (e.g. nitrate, ammoniacal nitrogen,	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 10th percentile value. However, the standard applies to bioavailable

Monitoring Station	Duration of Sampling	Type of Water Sampled	Parameters	General Quality Comments
NGR: NZ4747020507			orthophosphate); Intermittent metals monitoring until 2014 following which monitoring was regular.	copper, and there is insufficient data to determine bioavailability. The mean concentration of zinc is just below the WFD Standard of 10.9 µg/l (plus ambient)
Billingham Beck at Billingham Bottoms NGR: NZ4549522393	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).

9.4.44 The data presented in Table 9-12 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.

9.4.45 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.

9.4.46 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)[3].

[3] Bathing Water Classifications were not assessed in 2020 due to the impact of the COVID-19 pandemic on the sampling programme.

9.4.47 The Environment Agency's Bathing Water Quality website (Environment Agency n.d.d) 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.

9.4.48 The southern extent of the Seaton Carew North Gare Bathing Water is also within the 2 km of the Site and also has a classification of Excellent for 2019 (Environment Agency n.d.d).

9.4.49 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.

9.4.50 Mean electrical conductivity was 2250 µS/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.

9.4.51 Certain metals including boron and molybdenum were elevated with recorded mean 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. Total iron was also found to be elevated with an average value of 795 µg/l; however dissolved iron was far lower at 30.17 µg/l only slightly above the LoD of 20 µg/l.

9.4.52 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 within Appendix 9C: WFD Assessment for more details (ES Volume III, Document Ref. 6.4).

Sediment Quality

9.4.53 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 Cefas[4] 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 the dredged material is suitable for sea disposal. However, dredged material with contaminant levels above Action Level 2 is generally considered unsuitable for sea disposal.

9.4.54 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

[4] Centre for Environment, Fisheries and Aquaculture Science

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 9-13. 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 9-13: 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)

9.4.55 The DCO Application relating to York Potash Harbour Facilities in 2016 (Royal Haskoning, 2016a) also included sediment sampling in the main Tees Estuary downstream of Dabholm Gut. The sampling was undertaken in 2014 and full results are available in Royal Haskoning (2016b).

9.4.56 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.

9.4.57 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.

9.4.58 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.

9.4.59 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).

9.4.60 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 was not considered suitable in these cases.

Marine Ecology Overview

9.4.61 Full details regarding marine ecology within the Study Area are provided in Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2). A brief summary is provided below.

9.4.62 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.

9.4.63 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 (Environment Agency, 2019) 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 has generally declined in recent years but with a notable increase in 2020, with total fish counted being 498 (2016), 297 (2017), 217 (2018), 204 (2019) and 328 (2020) (Environment Agency, 2019).

9.4.64 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.

9.4.65 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[5].

9.4.66 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).

9.4.67 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.

9.4.68 With regard to zooplankton, several invasive non-native species (INNS) are known to have been introduced to the North Sea e to human activities and have responded to favourable conditions, but no protected species have been identified.

9.4.69 Results of the Intertidal benthic Phase I and Phase II surveys and subtidal benthic sampling are reported in Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2). 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

9.4.70 Full details regarding marine 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.

9.4.71 There is only one riverine WFD waterbody within the red line boundary of the Proposed Development and this is the Tees Estuary South Bank (GB103025072320). Routine WFD monitoring is therefore limited in the area

---

[5] The Habitats Directive is transposed in England by Part I of the Wildlife and Countryside Act 1981, the Conservation of Habitats and Species Regulations 2017 and the Offshore Marine Habitats and Species Regulations 2017.

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 availability, further aquatic baseline surveys have been undertaken to gather more robust data to inform the assessment.

9.4.72 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).

9.4.73 In the past 5 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 3 years. Further surveys have been undertaken to inform the Proposed Development, but no notable species were recorded.

9.4.74 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 waterbody 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.

9.4.75 On the basis of available data, there are no notable or protected macrophyte species recorded within the Study Area.

9.4.76 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 nuttalii*). 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 observed was floating pennywort, which was identified in The Fleet.

Sites of Ecological Importance

9.4.77 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 and the CO_2 Gathering Network and Natural Gas Connection Corridor (where it crosses the Tees Estuary) of the Proposed Development cross the Teesmouth and Cleveland Coast Site of Special Scientific Interest (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.

9.4.78 The coast either side of Teesmouth is also designated as being of international importance as the Teesmouth and Cleveland Coast SPA which is designated under the Conservation of Habitats and Species Regulations (2017), 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 fall cross the Proposed Development boundary at its northern extent for the water discharge corridor.

9.4.79 Seaton Dunes and Common Local Nature Reserve (LNR) (part of the Teesmouth and Cleveland Coast SSSI) is located just over 2km 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.).

9.4.80 Charlton's Pond LNR is located approximately 1 km west of the western 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.

9.4.81 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 and Geological Features

9.4.82 Full details of geology and groundwater are provided in Chapter 10: Geology Hydrogeology Contaminated Land (ES Volume I, Document Ref. 6.2) and are shown in Figures 10.1 to 10.3. In summary, the British Geological Society Geoindex viewer (British Geological Society, n.d.) indicates that the solid geology beneath the study site consists of strata of Triassic and Jurassic age.

9.4.83 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 Triassic Penarth Group. 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.

9.4.84 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, Saltholme and the town of Billingham.

9.4.85 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 and the southern extent of the Wilton International Site are 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.

9.4.86 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. Principal aquifers 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.

9.4.87 The Mercia Mudstone bedrock deposits surrounding the Tees are classified as a Secondary B aquifer. Secondary B aquifers 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.

9.4.88 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.

9.4.89 The Study Area to the east and south of the Tees estuary is 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 km^2.

9.4.90 The Study Area to the west and north of the Tees Estuary is mainly within the Tees Sherwood Sandstone WFD groundwater body (GB40301G702000), with the exception of an isolated point around Port Clarence, which remains in the Tees Mercia Mudstone & Redcar Mudstone WFD groundwater body. The Tees Sherwood Sandstone groundwater body is at Good Overall Status, with Good Quantitative and Chemical Elements. The waterbody has an area of 293.01 km^2.

9.4.91 There are no Groundwater Dependent Terrestrial Ecosystems (GWDTE) which are likely to be affected by activities related to the Proposed Development.

9.4.92 Cranfield University's Soilscapes 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 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 Resources

9.4.93 The Study Area is not within a Nitrate Vulnerable Zone, Drinking Water Protected Area, Drinking Water Safeguard Zone or near any Source Protected Zones.

9.4.94 The following provides information on water activity permits (i.e. discharges), water abstractions and past pollution incidents.

Water Activity Permits

9.4.95 The Envirocheck report (Landmark Information Group, 2019) 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 Appendix 9B (ES Volume III, Document Ref. 6.4) Table G and locations are shown in Figure 9-1 (ES Volume II, Document Ref 6.3). A request was made to the Environment Agency for data up to 1 km from the Site, but this data has not been provided.

9.4.96 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

9.4.97 Data provided by the Environment Agency indicates that there are 18 licensed water abstractions within 2 km of the Site, which are presented in Appendix 9B (ES Volume III, Document Ref. 6.4) Table 9C-8 and the water attributes plan (presented in Figure 9-1, ES Volume I, Document 6.2).

9.4.98 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.

9.4.99 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.

9.4.100 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

9.4.101 The Envirocheck report (Landmark Information Group, 2021) 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 Table 9-14 and locations are shown in Figure 9-1: Surface Water Features and Their Attributes.

Table 9-14: Pollution Incidents to Controlled Waters within 250 m of the Site

Fig 9.1 Ref	Notification ID & Date	Category	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 (Significant)	NZ 56608 23878	Crude sewage	Dabholm Gut
P4	1405228 22/01/2016	2 (Significant)	NZ 57917 23982	Oils – Diesel (including agricultural)	Tributary of the Fleet

9.4.102 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.

Flood Risk

9.4.103 This section provides a summary of the baseline Flood Risk data available for the Site. Refer to Appendix 9A: FRA (ES Volume III, Document Ref. 6.4) for a more detailed description of the baseline environment in relation to flood risk.

9.4.104 The Environment Agency's 'Flood Map for Planning' (Environment Agency, n.d.b) identifies areas subject to fluvial/tidal flood risk for the present day but does not include the benefits or impacts of any existing flood defences. These have been illustrated on Figure 9-4: Environment Agency Fluvial Flood Zones (ES Volume II, Document Ref. 6.3) and should be referred to throughout.

9.4.105 The Flood Zone definitions for the flood zones used on the Flood Map for Planning, are defined in Table 9-15 below.

Table 9-15: Flood Zone Definitions (source Table 1 of the PPG; Department of Communities and Local Government, 2012b)

Flood Zone	Definition	Probability of Flooding
Flood Zone 1	Land that has a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding (<0.1%))	Low
Flood Zone 2	Land that has a medium probability of flooding (between 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1-1%), or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1-0.5%)	Medium
Flood Zone 3a	Land that has a high probability of flooding (1 in 100 year or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%)	High
Flood Zone 3b (Functional Floodplain)	Land where water has to flow or be stored in times of flood based on flood modelling of a 5% AEP event (1 in 20 chance of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP).	Very High

Tidal Sources

9.4.106 The River Tees is classified as a Main River and is tidal as it passes through the Study Area, with the normal tidal limit approximately 14 km upstream (at the Tees Barrage).

9.4.107 Greatham Creek, a Main River, is a tidal watercourse which flows in an easterly direction, following the Stockton on Tees Borough Council boundary, and discharges into the Tees at Seal Sands. Its tidal limit extends to a weir, which is approximately 300 m upstream of the confluence with Cowbridge Beck, outside of Stockton Borough. Greatham Creek is crossed by bridges which carry the A178 trunk road and the emergency access road to Seal Sands. There is a history of tidal flooding and breach of the defences at Greatham Creek.

9.4.108 The online Flood Map for Planning (Environment Agency, n.d.b) illustrates that the entirety of the PCC Site and the connection corridors on the south bank of the Tees Estuary are located within Flood Zone 1 (i.e. a low risk of flooding from tidal sources). The exceptions to this are an area of Flood Zone 3a (i.e. a high risk of flooding from tidal sources) across Coatham Dunes and Coatham Sands down to MLWS which would be crossed by the water discharge corridor and CO_2 Export corridor. The Natural Gas Connection and CO_2 Gathering Network cross the River Tees, which is also Flood Zone 3a. Refer to Figure 9-4 for spatial extent of these Flood Zones (ES Volume II, Document Ref. 6.3).

9.4.109 Flood risk is more extensive to the north of the River Tees including large areas of the very low-lying Seal Sands, Cowpen Marsh, Saltholme and Port Clarence, with flooding predominantly associated with the River Tees and Greatham Creek. The connection corridor that extends out towards Billingham crossing land between the two tidal watercourses is located across Flood Zone 1 (low risk), Flood Zone 2 (medium risk) and Flood Zone 3a (high risk) with the main area at risk located to the north of Port Clarence. There is no land within the proposed DCO boundary within Flood Zone 3b (Functional Floodplain).

9.4.110 The Environment Agency own and maintain a number of flood defence assets along the River Tees near the Site. This includes a series of embankments and walls upstream and downstream of the Transporter Bridge. There are also demountable defences (that when erected create a wall with the same standard of protection as the surrounding defences). These are privately owned and maintained by Wilton International Site.

9.4.111 The tidal defences in proximity to the Site consist of a combination of high ground and raised defences, including floodwalls and flood banks. According to information provided by the Environment Agency they are in ‘very good to good’ condition and reduce the risk of flooding up to a 0.5% AEP (1 in 200 chance in any year) event. The Environment Agency inspects these defences routinely to ensure potential defects are identified.

9.4.112 The Environment Agency provided modelled tidal peak water levels for the tidal Tees area for the 0.5% AEP (1 in 200 year), 0.1% AEP (1 in 1000 year) and 0.1% AEP with climate change scenario flood events to inform the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4). The model demonstrated that during a 0.1% AEP (1 in 1000 chance) event based upon the existing (2019) scenario, tidal levels in the Tees Estuary could rise up to 4.33 m AOD at the mouth of the estuary and up to 4.40 m AOD where the A19 crosses the Tees near Portrack.

9.4.113 The Environment Agency climate change guidance was recently updated with revised sea level allowances up to the year 2125. Applying these sea level allowances to the existing (2019) scenario indicates water levels along the estuary could increase by 1.32 m. This would result in a rise up to 5.40 m AOD and 5.65 m AOD for the 0.5% AEP and 0.1% AEP respectively at the mouth of the estuary and up to 5.48 m AOD and 5.72 m AOD near Portrack. For details of different modelled scenarios refer to the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4), as water levels do vary depending on the time horizons used in the analysis. In reality, given the expected lifetime of the development (up to 40 years), climate change flood water levels will be significantly less than those shown in Table 9A-17 above with a decrease of 0.5m for the Higher Central allowance water levels and a 0.68m decrease for the Upper End allowance water levels.

9.4.114 Whilst ground levels on the PCC Site are currently between 4 and 8 mAOD, the elevation of the construction platform (post site clearance and reclamation) anticipated to be constructed in 2023, will be at least 7.5 mAOD.

9.4.115 Based on the information provided by the Environment Agency, it has been determined that the PCC Site (following site clearance and the construction of the development platform) and the majority of the connection corridors are at a low risk of flooding from tidal sources. However, the section of the Natural Gas Connection Corridor and the CO_2 Gathering Network crossing the River Tees and the section of corridor route to the east of Billingham, located between the tidal River Tees and Greatham Creek is at high risk of tidal flooding.

9.4.116 The PCC Site, with existing ground elevations between 4 – 8 m AOD and post development levels of at least 7.5 mAOD, is at low risk of flooding across the majority of the site up to the 0.1% AEP scenario where ground levels are above 5.74 m AOD. However, where the site is below 5.74 m AOD there is a medium risk from overtopping of the defences during the 0.1% AEP (1 in 1000 chance) event, taking into account climate change. Furthermore, following site clearance and the construction of the development platform (anticipated to be in 2023, See Chapter 5: Construction and Programme Management (ES Volume I, Document Ref. 6.2), the elevation of the PCC Site will be at least 7.5 mAOD preventing the risk of flooding.

9.4.117 If the defences adjacent to Port Clarence and along the southern bank of Greatham Creek were to overtop or fail/breach the connection corridor, located between the two watercourses, would be at 'high' risk of flooding from both the existing scenario 0.5% or 0.1% AEP (1 in 1000 chance) events and future climate change scenarios.

9.4.118 The risk of tidal flooding to this section of the connection corridor is not likely to increase due to climate change. However, if a flood event did occur, the impact of climate change would result in an increase in the depth of floodwater across this area of the site affected by flooding from this source during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

Fluvial Sources

9.4.119 The nearest fluvial watercourses to the PCC Site are The Fleet (otherwise known under the WFD as 'Tees Estuary (S Bank)'), located approximately 275 m to the south east of the PCC Site (but flowing through the Site boundary), and Dabholm Gut, located approximately 1 km to the south of the PCC Site and along the Site boundary.

9.4.120 Numerous other Ordinary Watercourses intersect the connection corridor routes including: Mains Dike, The Mill Race, Kinkerdale Beck, Kettle Beck and Knitting Wife Beck to the south of the River Tees and Belasis Beck, Mucky Fleet and Swallow Fleet to the north of the River Tees near Billingham. The position and direction of flow of these watercourses has been described earlier. These watercourses all pose a potential risk of fluvial flooding to the connection corridors.

9.4.121 The Environment Agency's online Flood Map for Planning (Environment Agency, n.d.b) illustrates that the entirety of the PCC Site and the connection corridors on the south bank of the River Tees are located within Flood Zone 1 (i.e. a low risk of flooding from fluvial sources). The exception to this is an area of Flood Zone 2 (i.e. a medium risk of flooding) associated with The Fleet, and an area of Flood Zone 2 and Flood Zone 3a (i.e. a high risk of fluvial flooding) associated with the Dabholm Gut.

9.4.122 Although tidal flood risk is the greatest risk to the north of the Tees Estuary, there are Ordinary Watercourses, such as the Mucky Fleet, Swallow Fleet, and Belasis Beck that could pose a fluvial flood risk to small sections of the CO_2 Gathering Network corridor, predominantly where the connection corridor crosses a watercourse/ drain.

9.4.123 It considered that during the existing scenario the PCC Site and the majority of the connection corridors to the north and south of the River Tees are at 'low' risk of flooding from fluvial sources.

9.4.124 Where the risk of flooding from fluvial sources is currently assessed as high, the risk category of flooding to the site is not likely to increase due to climate change, although flooding is likely to be more frequent and to a greater extent. If a flood event did occur, the impact of climate change would result in an increase in the depth and extent of floodwater across the areas of the site affected by flooding from this source during a 1% (1 in 100 chance) event.

Groundwater Flood Risk

9.4.125 Groundwater flooding can occur when groundwater levels rise above ground surface levels. The underlying geology has a major influence on where this type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers), i.e. to the north of the Tees.

9.4.126 The Environment Agency have no groundwater level monitoring sites within 2 km of the Study Area (the closest groundwater level data held is from a site approximately 8.2 km north-north-west of the Site boundary). However, the bedrock groundwater level is expected to be around the ordnance datum given the proximity to the coast and the prevailing flat, low gradient topography of the Study Area.

9.4.127 The Tees Catchment Flood Management Plan (CFMP) (Environment Agency, 2009) states "there is little documented evidence of groundwater flooding in the Tees catchment and groundwater flooding is not known to be a major problem due to the geology of the catchment". This is particularly true for Stockton on Tees Borough Council area as the main geology is of sandstone and mudstone. There are no sources of groundwater flooding as the aquifers within these sandstones are not artesian even in very wet conditions.

9.4.128 The Environment Agency's Areas Susceptible to Groundwater Flooding map is illustrated in the Redcar and Cleveland Borough Council and Stockton on Tees Borough Council Preliminary Flood Risk Assessment (PFRA) report (Stockton-on-Tees Borough Council, 2011). The Areas Susceptible to Groundwater Flooding map is divided into 1 km^2 grid-squares in which a percentage is given for what proportion of the 1 km^2 is considered to be susceptible to groundwater emergence. Within both the Redcar and Cleveland Borough Council and Stockton on Tees Borough Council areas the map shows the Site lies predominantly in an area where 75% or more of the area is considered to be potentially at risk of groundwater emergence.

9.4.129 Based on this information the risk of flooding from groundwater sources is considered to be a medium risk for those parts of the development to the north of the Tees.

Surface Water Runoff to the Site

Overland Flow of Rainfall Runoff

9.4.130 Overland flow results from rainfall that fails to infiltrate the surface and travels over the ground surface; this is exacerbated where the permeability of the ground is low due to the type of soil and geology (such as clayey soils) or urban development with more impermeable surfaces.

9.4.131 Surface water flooding is the main source of flood risk in the Redcar and Cleveland Borough Council area with regular flooding occurring in Eston, Redcar and Guisborough. This flooding is due to insufficient capacity within surface water drainage systems, combined sewer and culverted watercourse to convey the rainfall away. The Redcar and Cleveland Borough Council PFRA (Redcar and Cleveland Borough Council, 2011) states "*In general, this local flooding occurs regularly, but it is not particularly hazardous and individual incidents do not affect a large number of properties*".

9.4.132 The Environment Agency's online Risk of Flooding from Surface Water maps (Environment Agency, n.d.b) indicate areas at risk from surface water flooding, when rainwater does not drain away through the normal drainage systems or soak into the ground, but instead lies on or flows over the ground. This is illustrated on Figure 9-5: Flood Risk from Surface Water (ES Volume II, Document Ref.6.3). Environment Agency mapping indicates that the PCC Site and the associated connection corridors are generally at very low risk (<0.1% AEP event) of flooding from surface water. The risk of surface water flooding within the PCC Site from elsewhere is considered to be low to very low.

9.4.133 However, there are small, isolated areas of high, medium and low flood risk where water is seen to pond during more significant rainfall events. These areas are constrained to be topographical low spots within the Site boundary. The main locations of identified surface water flooding are:

- Approximately 275 m to the south-east of the PCC Site where water is seen to flood around the A1085/ Broadway East roundabout junction. Land in this area is at low to high risk of surface water flooding; and
- Land located to the west between the A1185 and Cowpen Bewley Road, approximately 8 km to the west of the PCC Site. Land in this area is at low to medium risk of surface water flooding.

9.4.134 Based on the above information, the risk of surface water runoff to the Site is considered to be Low.

Existing Drainage Infrastructure

9.4.135 The existing surface water drainage systems within the PCC Site collect runoff from buildings, hardstanding areas and gullies etc., which then discharge into the surrounding sewer network and/ or Tees Bay via the existing outfall under the conditions of an Environmental Permit.

9.4.136 Northumbrian Water's Bran Sands WwTW is immediate to the south of the PCC Site and discharges into the Dabholm Gut.

9.4.137 According to the local SFRA (Redcar and Cleveland Borough Council, 2016) there has been in total 234 records of historical sewer flooding incidents in the Redcar and Cleveland Borough Council area. Information provided in their SFRA indicates that no historical sewer flooding has occurred in close proximity to the PCC Site and connection corridors to the south of the River Tees. Flooding from drainage infrastructure within the Redcar and Cleveland Borough Council area tends to occur in predominantly residential areas, with Eston (located to the south west of the Site), identified as a critical drainage area.

9.4.138 Based on the available records and information, the Site is considered to be at low to medium risk of flooding from drainage infrastructure.

Artificial Waterbodies

9.4.139 Artificial flood sources include raised channels such as canals or storage features such as ponds and reservoirs.

9.4.140 A review of online Ordnance Survey mapping indicates that there are no canals located in close proximity to the Site.

9.4.141 The Reservoir Act 1975 defines a large reservoir as one that holds over 25,000 cubic metres (m^3) of water, although this is expected to be reduced to 10,000 m^3 under a review into the safety legislation and regulation of reservoirs and is expected to be phased in by the Environment Agency once this comes into effect under the Flood and Water Management Act 2010.

9.4.142 The risk of flooding associated with reservoirs is residual and is associated with failure of reservoir outfalls or dam breaching. This risk is reduced through regular maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no incidents resulting in the loss of life since 1925.

9.4.143 The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers. In addition, Local Authorities are responsible for coordinating emergency plans for reservoir flooding and ensuring communities are well prepared.

9.4.144 The Environment Agency's online Long-Term Flood Risk Mapping (Environment Agency, n.d.b) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds but does not give any information about the depth or speed of the flood waters. The mapping shows that the connection corridor, located to the north of the River Tees, crosses an area at residual risk of flooding from a reservoir (Crookfoot Reservoir, NZ 43115 31173) as a result of structural failure or breach. This area, across Cowpen Marshes in proximity to the Holme Fleet (to the east of Billingham), is the only section of the DCO Application Site at residual risk from reservoir flooding.

9.4.145 Based on the information above the current residual risk of flooding from artificial sources is considered to be low.

Future Baseline

Construction (2022)

9.4.146 As outlined in Chapter 5: Construction and Management (ES Volume I, Document Ref. 6.2) the peak of construction is expected to occur in 2024, and so this year has been adopted as the future baseline for construction as a worst case scenario.

9.4.147 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.

9.4.148 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.

9.4.149 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.

9.4.150 Under the WFD, the Tees Coastal waterbody 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. As all waterbodies are currently at this overall status there must be no deterioration from this, and there are also objectives for individual elements of the WFD classification that are to be achieved (e.g. biological quality elements, physico-chemical parameters). It is assumed that these objectives are achieved following the completion of the Proposed Development.

9.4.151 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.

9.4.152 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)

9.4.153 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).

9.4.154 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.

9.4.155 There is potential for improvement opportunities for the pond within Coatham dunes adjacent to the Proposed Development which are within the Site

Boundary. The pond are within the Teesmouth and Cleveland Coast SPA, with the ponds falling under the designation due to providing open water for use by redshank (*Tringa totanus*) during high tide. However, with the exception of Pond 14 all of these ponds have succeeded to a fully vegetated state with no open water. There is therefore the potential opportunity to improve the condition of the SPA by clearing vegetation and to enable open water for bird use. As such, there may be greater open water in Coatham sands during the operational phase of the Proposed Development than is currently the case.

Importance of Receptors

9.4.156 The importance of the local water resource receptors within the Study Area is described in Table 9-16. Importance is based on the criteria outlined above in Table 9-2.

Table 9-16: Importance of Receptors

Watercourse	Importance Descriptions
Tees Bay	The Tees Coastal waterbody is considered a Very High importance receptor on the basis of being WFD designated and including sites protected / designated under EU (e.g. Teesmouth and Cleveland Coast Special Protection Area, bathing waters) and UK legislation (Teesmouth and Cleveland Coast SSSI). Morphology is of Low importance as a WFD Heavily Modified Waterbody, dominated in this area by breakwaters.
Tees Estuary	The Tees Estuary is considered a Very High importance receptor for water quality on the basis of its scale, being WFD designated and supporting and range of internationally, nationally and locally protected nature conservation sites (Teesmouth and Cleveland Coast SSSI). This is despite significant modifications to the channel and flow regime, and the presence of contamination within fine sediments. It is also important for the dilution and dispersion of treated/untreated sewerage/trade/process wastewater, which at the same time influence water quality and present a risk of chemical spillages. Water is also abstracted from the estuary for industrial use (e.g. cooling water supply). However, the morphology is considered Low importance due to significant modifications of the channel, particularly along the banks, and flow and tidal conditions being influenced by the Tees Barrage and breakwaters. The channel is also important for navigation and commercial activities (which also require maintenance dredging).
The Fleet (Tees Estuary (S Bank) WFD waterbody)	The Fleet (freshwater reach) is considered a High importance receptor for water quality on the basis of being WFD designated (as Tees Estuary S Bank), and having an estimated Q95 <1.0 m^3/s. Although the upper reaches flow through the Teesmouth and Cleveland Coast SPA/SSSI sites, these are upstream of the Proposed Development. It is also possible that fine sediments are contaminated and that these may be leaching into the water depending on the prevailing conditions. The Fleet is considered a Low importance receptor for morphology on the basis of being substantially modified by past land use, having an artificial cross section and being culverting over significant lengths.
Main’s Dike	Main’s Dike is considered a Medium importance receptor for water quality on the basis of not being designated under the WFD in its own right, its size and scale, and with estimated Q95 >0.001m^3/s. It is also possible that fine sediments are contaminated and that these may be leaching into the water depending on the prevailing conditions. It is considered a Low importance receptor for morphology on the basis of being largely artificial in character as a straightened channel and deficient in bedforms.
Mill Race	The Mill Race is considered a Medium importance receptor for water quality on the basis of its relatively small size and scale, not being designated under the WFD as its own waterbody and having an estimated It is also possible that fine sediments are contaminated and that these may be leaching into the water

Watercourse	Importance Descriptions
	depending on the prevailing conditions. Q95 >0.001 m^3/s. It is considered a Low importance receptor for morphology on the basis of being largely artificial in character with deficiency of bedforms, with significant stretches of culvert.
Dabholm Gut	Dabholm Gut is connected to and designated as part of the Tees transitional waterbody. As such, it is considered a Very High importance receptor for water quality as per the Tees Estuary above. The morphology is considered Low importance due to being an artificial channelised watercourse, over-widened in places and with artificial banks.
Lackenby Channel	Lackenby Channel is considered a Medium importance receptor for water quality on the basis of not being designated under the WFD as its own waterbody, its relatively small size and scale, and an estimated Q95 >0.001 m^3/s. Unlike Dabholm Gut, its final reach is believed to be culverted beneath PD Teesport and thus it does not have an open connection to the Tees Estuary. The morphology is considered Low importance due to being an artificial, straight, channelised watercourse with artificial banks.
Kettle Beck	Kettle Beck is considered a Medium importance receptor for water quality on the basis of not having a WFD classification but is estimated to have a Q95 >0.001 m^3/s. It is also possible that fine sediments are contaminated and that these may be leaching into the water depending on the prevailing conditions. It is considered a Low importance receptor for morphology on the basis of being largely artificial in character (i.e. straight ditch course with steep banks) with deficiency of bedforms, and significant stretches of culvert.
Kinkerdale Beck	Kinkerdale Beck is considered a Medium importance receptor for water quality on the basis of not having a WFD classification but is estimated to have a Q95 >0.001 m^3/s. It is also possible that fine sediments are contaminated and that these may be leaching into the water depending on the prevailing conditions. It is considered a Low importance receptor for morphology on the basis of being largely artificial in character (i.e. straight ditch course with steep banks) with deficiency of bedforms, and significant stretches of culvert.
Knitting Wife Beck	Knitting Wife Beck is considered a Medium importance receptor for water quality on the basis of not having a WFD classification but is estimated to have a Q95 >0.001 m^3/s. It is also possible that fine sediments are contaminated and that these may be leaching into the water depending on the prevailing conditions. It is considered a Low importance receptor for morphology on the basis of being largely artificial in character (i.e. ditch course with steep banks) with deficiency of bedforms, and significant stretches of culvert.
Holme Fleet	Holme Fleet is considered Very High importance for water quality on the basis of flowing through the Teesmouth and Cleveland Coast SSSI, although it does not have a specific WFD classification. Whilst not visited on site, aerial imagery suggests that morphologically Holme Fleet is a High importance receptor as it exhibits diverse geomorphic forms and bank side vegetation but deviates from natural conditions due to various floodplain and catchment pressures.
Belasis Beck	Belasis Beck is considered a Very High importance for water quality on the basis of flowing through the Teesmouth and Cleveland Coast SSSI, although it does not have a specific WFD classification. Morphologically, it is considered a High importance receptor as it exhibits a variety geomorphic forms and bank side vegetation but deviates from natural conditions due to various floodplain and catchment pressures.
Greatham Creek	The tidal lower reaches of Greatham Creek are designated under the Tees transitional waterbody. As such, it is considered a Very High importance receptor for water quality as per the Tees Estuary above. No morphological importance has been provided as this waterbody will not be physically impacted.
Mucky Fleet / Swallow Fleet	Mucky Fleet and Swallow Fleet within Cowpen Marsh are considered Very High importance for water quality on the basis of flowing through the Teesmouth and Cleveland Coast SSSI, although they do not have specific WFD classifications. No

Watercourse	Importance Descriptions
	morphological importance has been provided as this waterbody will not be physically impacted.
Lake at Charlton's Pond Nature Reserve	The pond is considered High Importance for water quality due to having a local designation as a nature reserve, but Low importance for morphology as an artificial waterbody originally constructed for clay extraction for the adjoining brickworks.
Waterbodies within Coatham Marsh, Saltholme Nature Reserve and Bran Sands	These are considered Very High importance receptors for water quality as they are within the Teesmouth and Cleveland Coast SSSI and several fall under the Teesmouth and Cleveland Coast SPA designation, thereby supporting bird populations. Waterbodies at Coatham Marsh, Saltholme Nature Reserve and Bran Sands are considered High Importance for morphology as they have a natural form and bank side vegetation but deviate from natural conditions due to various floodplain and catchment pressures.
Pond 14 (open water pond) within Coatham Dunes – all other ponds in Coatham Dunes identified by mapping have now succeeded to fully vegetated wetlands and are not open water ponds requiring assessment.	Pond 14 is considered a Very High importance receptor for water quality as it 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 waterbody 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. Pond 14 is considered of Low Importance for morphology due to its artificial nature, having been formed from slag deposits from the adjacent former steelworks. All other waterbodies within Coatham Sands are fully vegetated wetlands and so are not considered to be ponds requiring assessment.
Numerous industrial ponds and artificial waterbodies across the area including Lazenby Reservoirs, Salthouse Brine Reservoirs and Ponds at Billingham Technology Park	As industrial, artificial waterbodies lacking any protected species (as far as is currently known) or designations, these are considered Low Importance waterbodies for water quality and morphology.

Floodplain Sensitivity for Impact Assessment

9.4.157 For the construction assessment, the key receptor in terms of all forms of flood risk are the construction workers present on Site, who are considered to be of Very High sensitivity. It is considered that the risk to surrounding residential, commercial and ecological receptors is no greater than in the baseline scenario for the construction phase.

9.4.158 For the operational assessment, the importance is based on understanding of the receptors present within areas at risk of flooding (i.e. the Proposed Development and other infrastructure) and the existing risk of flooding from all sources. The floodplain around the Tees in the Study Area and within the majority of the Site Boundary is predominantly in Flood Zone 1, where sensitivity of the floodplain for impact assessment purposes is considered Low. The entirety of the PCC Site is within Flood Zone 1, but there are small areas of Flood Zone 2 and 3a associated with the connection corridors, and which relate to tidal and fluvial flooding. To the south of the Tees these areas are notably around the connection corridor across Coatham Dunes and

Coatham Sands, and also around Dabholm Gut, The Mill Race and The Fleet. To the north of the Tees, there are similarly areas of Flood Zone 2 and 3a to the south of Seal Sands, around Haverton Hill and from Port Clarence north through Saltholme and Cowpen Marsh. Overall, it has been assessed that the PCC Site and the majority of the connection corridors are at a 'low' risk of flooding from tidal sources. However, the section of the connection corridor crossing the River Tees and the section of the CO_2 Gathering Network route to the east of Billingham, located between the tidal River Tees and Greatham Creek is at 'high' risk of tidal flooding. In EIA terms these areas are of Very High sensitivity to tidal and fluvial flooding due to proximity of essential infrastructure (see Table 9-2).

9.4.159 The criteria described in Table 9-2 do not provide examples of sensitivity for other forms of flood risk and so the sensitivity is based on the existing baseline risk described earlier in this chapter. For the purpose of this impact assessment the sensitivity of non-fluvial forms of flood risk is as follows:

- flooding from surface water – mainly Low Sensitivity, with localised areas of Medium to Very High Sensitivity, mainly associated with watercourses and ponds (refer to Figure 9-5, ES Volume II, Document Ref. 6.3);
- flooding from artificial sources – Low Sensitivity;
- flooding from groundwater – Medium Sensitivity; and
- flooding from existing drainage infrastructure – Low to Medium Sensitivity.

9.5 Development Design and Impact Avoidance

9.5.1 The following impact avoidance measures have either been incorporated into the design (i.e. embedded mitigation) or are standard construction or operational practices (i.e. essential mitigation). These measures have, therefore, been taken into account during the impact assessment and will be secured through the draft DCO. The construction mitigation measures will be secured through the Framework CEMP (ES Volume III Appendix 5A, Document Ref. 6.4) and the operational measures through the Commitments Register (Appendix 25A, ES Volume III, Document Ref. 6.4).

Construction

Surface Water

9.5.2 During construction, water pollution may occur directly from spillages of polluting substances into waterbodies, or indirectly by being conveyed in runoff from hard standing, other sealed surfaces or from construction machinery. Site clearance and remedial works on the PCC Site may require the dismantling and removal of existing drainage infrastructure. This will be managed by the remediation contractor with contaminated water either treated onsite or removed from site for disposal in accordance with a suitable Remediation Strategy (please refer to Chapter 10: Geology and Hydrogeology for full details). Fine sediment may also be disturbed in waterbodies directly or also wash off working areas and hard standing (including approach roads) into waterbodies indirectly via existing drainage systems or overland. 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.

9.5.3 Prior to construction starting on Site, a Final Construction Environmental Management Plan (CEMP) will be prepared by the Contractors. The Final CEMP would outline the measures necessary to avoid, prevent and reduce adverse effects where possible upon the local surface water (and groundwater) environment. This will be detailed within a Water Management Plan (WMP) that will form a technical appendix to the Final CEMP. A Framework CEMP is provided in Appendix 5A (ES Volume III, Document Ref. 6.4).

9.5.4 The CEMP will need to be reviewed, revised and updated as the project progresses towards construction to ensure all potential impacts and residual effects are considered and addressed as far as practicable, in keeping with available good practice at that point in time. 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.

9.5.5 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.

9.5.6 The Final CEMP will be supported by a WMP that would be included as a technical appendix. The WMP will provide greater detail regarding the mitigation to be implemented to protect the water environment from adverse impacts during construction.

9.5.7 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 which will be described in the WMP in the Final CEMP.

Good Practice Guidance

9.5.8 The following relevant Guidance for Pollution Prevention (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.

- GPP 1: Understanding your environmental responsibilities – good environmental practices;
- GPP 2: Above ground oil storage;
- GPP 3: Use and design of oil separators in surface water drainage systems;
- GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer;

- GPP 5: Works and maintenance in or near water;
- GPP 8: Safe storage and disposal of used oils;
- GPP 13: Vehicle washing and cleaning;
- GPP 19: Vehicles: Service and Repair;
- GPP 20: Dewatering underground ducts and chambers;
- GPP 21: Pollution Incident Response Plans;
- GPP22: Dealing with spills; and
- GPP26: Safe storage – drums and intermediate bulk containers.

9.5.9 Where new GPPs are yet to be published, previous Environment Agency Pollution Prevention Guidance (PPGs) still provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, although they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. Construction phase operations would be carried out in accordance with guidance contained within the 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).

9.5.10 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 Run-off

9.5.11 Measures to manage fine sediment in surface water runoff as a result of construction activities during 2023-2024 are included in the Framework CEMP (Appendix 5A, ES Volume III, Document Ref. 6.4) and will be developed with further detail in the WMP (to accompany the Final CEMP). There are a wide range of measures that can be adopted by the Contractor to reduce the risk of excessive fine sediment in runoff (timing of works, minimising earthworks and seeding or covering them), to intercept runoff to prevent uncontrolled runoff from the site (e.g. by using cut off drains, fabric silt fences, bunds and straw bales, designated areas for cleaning plant and equipment, wheel washes and road sweepers), and to treat runoff to remove excessive levels of fine sediment (e.g. settlement lagoons, sumps, spraying on to land or even proprietary measures such as lamella clarifiers). It will be for the Contractor to continually monitor the need for measures depending on the nature of the works being undertaken the weather conditions, and the performance of sustainable drainage systems installed.

Management of Construction Spillage Risk

9.5.12 Measures will be implemented to manage the risk of accidental spillages on site and potential conveyance to nearby waterbodies via surface runoff or land drains. These measures relating to the control of spillages and leaks are summarised in the Framework CEMP (Appendix 5A, ES Volume III, Document Ref. 6.4) and will be included in the WMP in the Final CEMP and adopted during the construction works. Measures will be in accordance with prevailing pollution prevention legislation and following best practice guidance summarised earlier. They will include details of how fuel and other chemicals (including cement) will be stored, used on site, and equipment and plant cleaned, as well as how leaks and spillages will be prevented or remediated if needed. This will also include the implementation of a Pollution Prevention Plan and an Emergency Response Plan. 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.

Works to the Water Discharge Outfall

9.5.13 Although still operational for small discharges, the condition of the existing outfall from the former steelworks for long term use for this project is unconfirmed. However, it is assumed that any works that might be required would likely be less than the installation of a new outfall as discussed below. Therefore, only the outcome of the impact assessment for a new outfall is presented in this assessment. If it is not either technically or commercially possible to re-use the existing discharge outfall, a new pipeline would be installed adjacent to the CO_2 Export Pipeline as shown on ES Figure 3-2A (ES Volume II, Document Ref. 6.3). This would be installed using trenchless technologies (a micro-bored tunnel) from the PCC Site beneath Coatham Dunes and Sands and off-shore to the proposed outfall location. Construction would be carried out at the same time as the CO_2 Export Pipeline (see below).

9.5.14 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 jack up or spud legged barge 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.

9.5.15 The construction of a new outfall head for either the existing or replacement discharge outfall would involve the following potential activities:

- 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 m^3 equating to an area on 100 m^2);
- 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.

9.5.16 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.

Construction of CO_2 Export Pipeline

9.5.17 Construction of the CO_2 Export Pipeline (Work No. 9) from the Compressor Station (Work No. 8) 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 installed using trenchless technologies (HDD) from the PCC Site, beneath the dunes and sands and out into Tees Bay. The corridor within which the CO_2 Export Pipeline will run as shown on Figure 3-2A (ES Volume II, Document Ref. 6.3) and on the CO_2 Export Pipeline Plans (Document Ref. 4.12.)

9.5.18 The section of CO_2 Export Pipeline installed by HDD techniques will extend from the PCC Site beyond MLWS to approximately 3 km offshore. The export pipeline would then be extended beyond this point to connect to the off-shore storage facility, however, consent for the section below MLWS of the pipeline is not being sought as a part of the Application but is considered in Chapter 24: Cumulative and Combined Effects (ES Volume I, Document Ref. 6.2).

9.5.19 The use of trenchless technologies beneath the foreshore would minimise direct impact to the sea bed and associated sediment mobilisation and scour. The HDD could either be drilled from onshore at the PCC to off-shore or from off-shore to onshore. Either case would require the presence of a jack-up or spud legged barge at the break-out (or alternatively of-shore HDD launch point) through the seabed and the presence of vessels such as work boat(s) and/or barge(s) to support the refurbishment process.

Construction of CO_2 Gathering Network and Natural Gas Connection

9.5.20 The CO_2 Gathering Network will be an above ground pipeline installed utilising existing support infrastructure (i.e. existing pipe racks, sleeper tracks, culverts and pipe bridges) and crossing the Tees via a tunnel or HDD (see below). In the event that a pipe rack is at capacity, the pipe rack will be extended to accommodate the additional line. The proposed routing for the CO_2 Gathering Network pipelines are shown on Figure 3-2E (ES Volume II, Document Ref. 6.3). There are no new watercourse crossings required with the exception of the trenchless crossing beneath the Tees Estuary.

9.5.21 The Natural Gas Connection will be an underground pipeline from either Seal Sands or Bran Sands. The former will require a crossing of the Tees.

9.5.22 Both the CO_2 Gathering Network and one of the routes of the Natural Gas Connection will need to cross the Tees Transitional waterbody. This will use trenchless techniques beneath the waterbody. A temporary works compound will be required at the drilling launch site and at the drilling exit site.

9.5.23 The Natural Gas Connection will use a micro-bored tunnel from Navigator Terminals to the Teesworks Site which will be shared with CO_2 Gathering Network pipeline.

9.5.24 If the CO_2 Gathering Network only requires a crossing of the Tees this will be constructed using a Horizontal Directional Drilled boring from Navigator Terminals to the north bank of the Dabholm Gut.

Construction of Electrical Connection Corridor

9.5.25 The Electrical Connection (Work No. 4) between the Electricity Generating Station (Work No. 1) 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 ES Figure 3-2C: Development Areas (ES Volume II, Document Ref. 6.3). As with the CO_2 Gathering Network, no open-cut crossings of watercourses are required with any crossings constructed using trenchless technologies (HDD or auger bore).

Water Quality Monitoring

9.5.26 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, and which will be secured in the Commitments Register (Appendix 25A, ES Volume III, Document Ref. 6.4). 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 the Pollution Prevention Plan.

9.5.27 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.

Management of Flood Risk

9.5.28 All construction materials and temporary compounds associated with the construction of the Proposed Development will be located in Flood Zone 1 where possible. During the construction phase, the Contractor will monitor weather forecasts and plan works accordingly. In addition, the Contractor will sign up to Environment Agency flood warning alerts and describe in the Emergency Response Plan the actions it will take in the event of a possible flood event. These actions will be hierarchal meaning that as the risk increases the Contractor will implement more stringent protection measures. This is important to ensure all workers, the construction site and third-party land, property and people are adequately protected from flooding during the construction phase.

9.5.29 If water is encountered during below ground construction, suitable de-watering methods will be used. Any significant groundwater dewatering required will be undertaken in line with the requirements of the Environment Agency (under Water Resources Act 1991 as amended) and Environmental Permitting Regulations (2016).

9.5.30 Safe egress and exits are to be maintained at all times when working in excavations. When working in excavations a banksman is to be present at all times. Refer to the FRA for further details of the flood resistance and resilience measures, see Appendix 9A (ES Volume III, Document Ref. 6.4).

Operation

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

9.5.32 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 numerous and have been classified as set out in Section 9.3:

- Clean surface water which is not classed as effluent and that can be discharged with minimal treatment;
- Potentially contaminated surface water (no amine contamination), process water (except from the Carbon Capture Plant) and blowdown waste water, which can be discharged following onsite treatment (e.g. chemical dosing);
- Process water from the Carbon Capture Plant direct contact cooler 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);
- Waste water requiring off-site treatment or disposal (i.e. hazardous liquid wastes including amine contaminated water); and

- Foul water treated at Northumbrian Water's Marske-by-the-Sea treatment plant.

Surface Water Drainage

9.5.33 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 hard standing, with foul systems for welfare facilities and process wastewater generated by the site operations. The connection corridors will not require additional drainage as they will be using existing pipe racks, pipe bridges or culverts or otherwise installed underground.

9.5.34 A schematic of the potential drainage philosophy is included on the Indicative Surface Water Drainage Plans (Document Ref. 4.13). This will be further defined in consultation with the Environment Agency and the LLFAs (RCBC and STBC) as the project progresses, taking into account suitable water quality assessment to define treatment requirements.

9.5.35 The proposed surface water drainage system is to include the use of sustainable drainage systems (SuDS) to provide treatment of runoff from urban areas where there is a low risk of contamination by any chemicals used by the energy generation processes to ensure potential adverse effects on water quality and habitat of receiving water bodies are avoided. The drainage system will be designed to be inherently safe and protect the local environment from urban diffuse pollutants that may be present. Clean surface water runoff will be segregated from contaminated/potentially contaminated water, which will be directed to the on-site package treatment plant or in the case of amine contaminated water for off-site disposal. Gravity drainage is also used wherever practicable.

9.5.36 The open drainage system consists of the following, and is summarised conceptually in Diagram 9-2:

- clean surface water runoff;
- potentially contaminated surface water (PCSW) runoff (non-amine contaminated);
- power plant surface water drainage;
- capture plant area surface water drainage;
- common utilities area surface water drainage; and
- diesel generator, tankage area and central chemical storage area surface water drainage.

9.5.37 Process operations on site will require the storage and use of a range of potentially polluting chemicals such as biocides, amine, ammonia, nitrates and phosphates, lubricating/hydraulic oils, di-ethyl hydroxyl (DEHA) and detergents. Waste water may also have low pH, be contaminated with high levels of total suspended solids (e.g. iron corrosive products) and have the potential to exert a chemical oxygen demand on receiving watercourses. The surface water drainage system for areas of site drainage that may contain chemical pollutants from minor leaks and spills (i.e. surface water drainage near chemical storage tanks or overlying pipework etc.) will therefore need to be separated from the main 'clean' surface water drainage system using appropriate methods such as kerbs, bunds, sumps. Some areas may also be covered with rain shelters to reduce the ingress from rainfall to minimise the volume of potentially contaminated runoff that needs to be managed on the site. Bunded areas may contain valves that can remain closed until the water stored in the bunded area has been tested. Where water is contaminated this will be directed to the on-site package treatment plant.

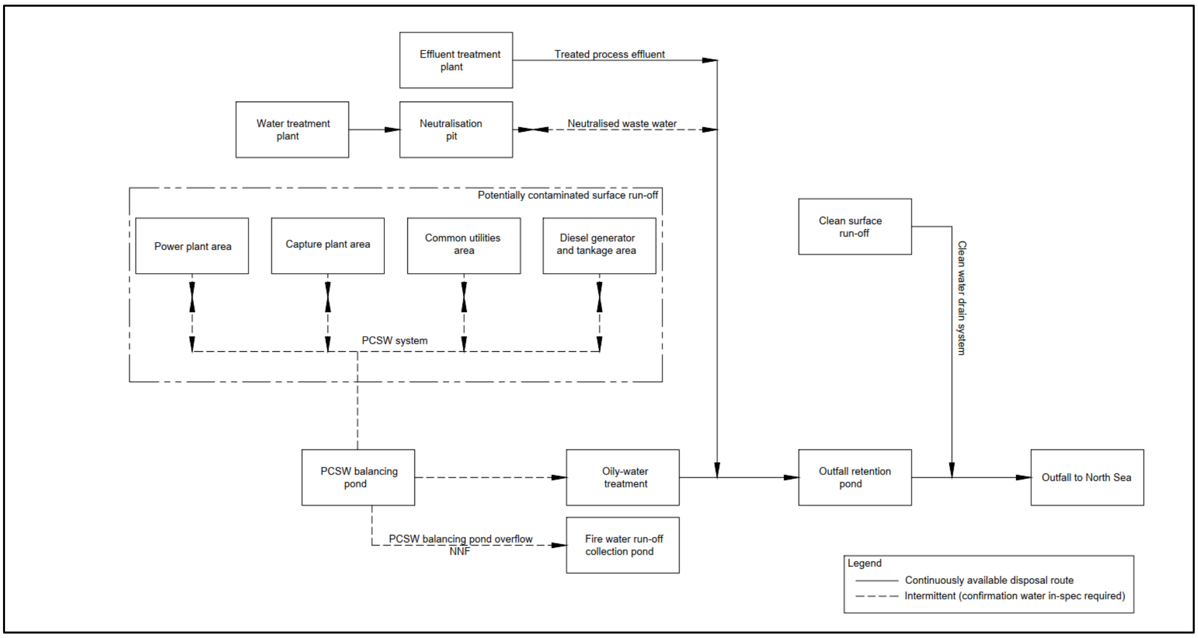


Diagram 9-2: Open Drainage System conceptual flow diagram (BP supplied)

9.5.38 In addition to the above sources of surface water, under exceptional circumstances firewater may be generated. run-off collection. Fire-fighting water may contain chemicals that can be harmful to the water environment. Therefore, the surface water drainage system will include suitable measures for fire-fighting water to be diverted from the existing surface water SuDS system to a dedicated storage facility (which may be a basin or tank system) where the contaminated fire water can be stored prior to being pumped out for appropriate off-site disposal at a licenced waste facility. The storage requirements and the method by which fire-fighting water is diverted (i.e. an automatic or manual operated system) will be determined in consultation with the EA, LLFAs and the Fire Service post-DCO consent during detailed design.

9.5.39 The Commitments Register (Appendix 25A, ES Volume III, Document Ref. 6.4) includes the requirement for a detailed Drainage Strategy to be developed. The drainage strategy will also outline the consequences for the drainage system should the Proposed Development close or be decommissioned. A Surface Water Maintenance and Management Plan will also be provided by the operator in response to a requirement set out in the Commitments Register (Appendix 25A, ES Volume III, Document Ref. 6.4). This would detail the requirements of access and frequency for maintaining all drainage systems proposed on the Site. It is anticipated that this will be prepared at the detailed assessment stage post DCO consent. The maintenance regime must be properly implemented to ensure all treatment measures and processes operate as intended for the lifetime of the Proposed Development.

9.5.40 Process waste waters may be generated on Site from the following operational activities including:

- gas and steam turbines;
- heat recovery steam generator;
- heat recovery steam generator blowdown;
- direct contact cooler blowdown;
- compression and dehydration water; and
- cooling tower blowdown.

9.5.41 Sanitary waste water 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 NWL foul sewer connection and treated at Marske-by-the-Sea.

9.5.42 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. Process water from the Carbon Capture Plant (excluding amine contaminated water) 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 NWL, 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 (refer to Work no. 5C, Document Ref. 4.4 and 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.

9.5.43 Amine utilised in the Capture Plant will not be discharged to any open drain systems or to the outfall to Tees Bay. Disposal of degraded amine will be via tanker and off-site disposal at a suitably permitted waste facility. Surface water runoff 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 for off-site disposal.

9.5.44 It is anticipated that the wastewater environmental regulatory emission limit values (ELVs) that apply within the Environmental Permit will 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 (European Commission, 2016).

9.5.45 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 a sufficient 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.

Management of Hazardous Substances on Site

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

9.5.47 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. The Emergency Response Plan will set out the emergency spill control procedure that will include the actions adapted from the Health and Safety Executive's Emergency Response / Spill Control Technical Measures Document (Health and Safety Executive, n.d.).

9.5.48 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).

Water Demand

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

- Cooling water make-up;
- Fire water storage;
- Utility stations;;
- Boiler feed water make-up; and
- Amine solution make-up.

9.5.50 The raw water supply for this will be directly supplied by Northumbrian Water via the Water Supply Connection (see Indicative Water Connection Plans, Document Ref. 4.9).

Decommissioning

9.5.51 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.

9.5.52 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.

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

9.6 Likely Impacts and Effects

9.6.1 The Proposed Development has the potential to cause adverse effects to the water environment during construction, operation and decommissioning phases. Potential impacts are described below.

Construction Phase Impacts

9.6.2 During the construction phase the following surface water environment 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 Tees Bay as a result of potential installation of existing or replacement water discharge pipeline and associated outfall head and associated use of marine plant.
- Potential increase in volume and rate of surface water runoff from new impervious areas, leading to an impact on flood risk.
- Increased risk of groundwater flooding or recharge as a result of the below ground installation of the CO_2 Export Pipeline, Natural Gas Connection Corridor, Electrical Connection Corridor and CO_2 Gathering Network.
- Alteration in fluvial and overland flow paths as a result of works associated with the Natural Gas Connection Corridor, Electrical Connection Corridor and CO_2 Gathering Network.

9.6.3 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 Chapter 10: Geology, Hydrogeology and Contaminated Land (ES Volume I, Document Ref. 6.2). 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).

9.6.4 Construction activities such as earthworks, excavations, site preparation, levelling and grading operations may result in the disturbance of soils and, in the case of the PCC Site, mobilise contamination. 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 industrial activities within the Site Boundary. 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. 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.

9.6.5 Allowing 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), and therefore measures to control the storage, handling and disposal of such substances will need to be in place prior to and during construction.

9.6.6 Any construction works in Flood Zones 2 and 3a also have the potential to increase the rate and volume of runoff, change surface water flow pathways, and increase the risk of blockages in watercourses that could lead to flow being impeded, and a potential rise in flood risk.

Surface Water Quality – Suspended Fine Sediments

9.6.7 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 CO_2 Export Pipeline as shown on ES Figure 3-2A (ES Volume II, Document Ref. 6.3). The water discharge and CO_2 Export pipelines would be installed beneath the seabed using trenchless technologies and thereby avoiding significant 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.

9.6.8 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 waterbody. 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.

9.6.9 During the construction of the replacement outfall pipeline the MBT machine will break-out into the subtidal environment when it is likely that some drilling fluid will be released into the marine environment. The drilling fluid will be a water-based mud (WBM) containing bentonite and barite, fine particulate materials, which serve as a lubricant during boring and drilling activities. Thus, at the break-out point there will be a release of WBM which could result in increased suspended solids and turbidity, which would remain in suspension for longer than coarser substrates (e.g. sand which typifies the sediment found in Tees Bay) because of the particle size. This has the potential to affect a larger distance. However, as the WBM lubricant is not under any pressure during drilling operations the release is expected to be small, short term and therefore, localised.

9.6.10 In light of this, the release of suspended sediment and subsequent deposition during MBT is not expected to significantly alter the geomorphology or structure of substrates such that there is likely to be indirect effects to marine ecology.

9.6.11 Sediment chemistry investigations in Tees Bay show very low levels of sediment bound contaminants in this area (Appendix 14A: Intertidal Benthic Ecology Survey Report, ES Volume III, Document Ref. 6.4), and the mobilisation of sediments in Tees Bay is not considered to pose a contamination risk and any disturbed sediments would disperse and settle out and the potential for impact on water quality would be limited.

9.6.12 It is not considered that any sediment plume arising from MBT 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.

9.6.13 There is potential to have a short-term temporary impact on the 'Redcar Coatham' Bathing Water from works around the discharge point. With EA agreement, bathing in the affected area would not be advised during works until the turbidity has dispersed.

9.6.14 Across the wider Proposed Development site there will be works in close proximity to Belasis Beck, Dabholm Gut, The Fleet (Tees Estuary (S Bank)), Lackenby Channel and The Mill Race for the Natural Gas Connection Corridor and the Electrical Connection Corridor and Belasis Beck and minor tributaries of these watercourses for the CO_2 Gathering Network on the north bank of the Tees. There are no direct works to these watercourses for crossings or outfalls.

9.6.15 There would be the potential for conveyance of fine sediment to any of these water bodies through uncontrolled site runoff from the construction works or through any existing drains that discharge to these watercourses, if not mitigated. All of these waterbodies ultimately discharge to Tees Estuary, where there is potential for a cumulative impact in terms of fine sediment impacts on water quality. Furthermore, any existing drainage assets on the PCC Site that receive runoff laden with fine sediment may eventually discharge to Tees Bay through the existing outfall.

9.6.16 Section 9.5 describes the broad range of surface runoff control measures that will be utilised on the Site, which will be described by the Principal Contractor in a WMP accompanying a CEMP, and confirmed with the Environment Agency, MMO and Northumbrian Water as part of future permit applications. All conditions of the permits would be adhered too.

9.6.17 With the embedded mitigation measures described in Section 9.5 in place, it is considered that there could be short term, localised and negligible adverse impact to Tees Bay would result from works to install the new outfall head (if required). With this receptor being of very high importance (see Table 9-18), a temporary negligible magnitude of impact would give a worst case Slight adverse effect (not-significant). There would not be expected to be any long-term effect on the waterbody given the brevity of the impact. Furthermore, the impact to Tees Bay will not occur should the existing water discharge pipeline and outfall head be in a usable state.

9.6.18 As no other watercourses across the Site (including the Tees Estuary) will be worked on directly, and given the proposed mitigation, any impact from suspended sediment in runoff would be negligible with the mitigation proposed. For the very high importance Belasis Beck this would give a Slight adverse effect (not significant). For the high important waterbody 'The Fleet (Tees Estuary (S Bank))' this would give a Slight adverse effect (not significant). For the medium importance waterbodies within and adjacent to the Site (The Mill Race and Lackenby Channel) a minor magnitude impact would give a Neutral effect (not significant).

9.6.19 Given the embedded mitigation to deal with fine sediment from runoff and construction there would be no impact to downstream waterbodies, including watercourses and online ponds (e.g. in Cowpen Marsh).

9.6.20 There will be no open-cut trenching across open water bodies that require morphological assessment.

Surface Water Quality – Chemical Spillages

9.6.21 If appropriate mitigation measures are implemented as described in Section 9.5, including water quality monitoring, then there would be only an unlikely, short-term, minor adverse impact on the very high importance Tees Bay, given that they may be worked on directly. This would include use of marine plant, a jack-up-barge (or similar) at Tees Bay. This worst case would give a localised temporary Moderate effect (significant).

9.6.22 There will be works in close proximity to, but not directly within, the very high importance Belasis Beck, the high importance The Fleet (Tees Estuary (S Bank)) and medium importance waterbodies The Mill Race and Lackenby Channel. This will include work to existing pipe bridges and so will require work over watercourses. However, no new structures are proposed for these waterbodies. Despite mitigation measures the risk of a chemical spillage remains given the proximity of construction works to the channel, meaning that an unlikely, short-term and localised Minor adverse impact may occur to these watercourses resulting in a Moderate effect (significant) for Belasis Beck and Slight effect (not significant) for The Fleet (Tees Estuary (S Bank)), Mill Race and Lackenby Channel.

9.6.23 Given the embedded mitigation to deal with chemical spillages there is expected to be no impact to downstream waterbodies (e.g. Holme Fleet, Swallow Fleet, Mucky Fleet and Greatham Creek), or online ponds (e.g. in Cowpen Marsh) or those artificial ponds within the Site Boundary which are not directly impacted.

Morphological Effects to Waterbodies

9.6.24 Should the existing Tees Bay water discharge outfall be used, then only minor refurbishment is assumed and there would be no morphological impacts to the waterbody. However, if a new water discharge pipeline is required, then a new outfall consisting of a diffuser head weighed down with rock armour will be installed as described in Section 9.5. The water discharge and CO_2 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 of the subtidal seabed for the outfall structure itself and potential sediment disturbance beneath the jack-up-barge legs. Given the dynamic nature of the waterbody with significant sediment transport, any disturbance beneath the jack-up-barge legs would be naturally restored quickly after the jack-up-barge was removed. 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 m^3 as a worst case scenario. Given the abundance of similar surrounding substrate, this is considered a minor impact. As Tees Bay is considered low importance for morphology this gives a Slight effect (not significant).

9.6.25 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 connection corridors (Natural Gas Connection Corridor, Electrical Connection Corridor, CO_2 Gathering Network) and so there would be no disturbance of riverbeds or banks. Where crossings are needed these are to use existing pipe racks, sleeper tracks, culverts and existing pipe bridges. As such there are no morphological impact to fluvial watercourses.

Potential Flood Risk – Tidal and Fluvial Sources During Construction

9.6.26 The construction phase of the Proposed Development would involve works in areas of Flood Zone 2 and 3a, and close to and within the floodplains of the Tees, The Fleet (Tees Estuary (S Bank)), Belasis Beck, Dabholme Gut, the Mill Race, plus small ditches across the Site, particularly in the vicinity of Saltholme. Should a fluvial flood event occur during construction, this could be a potential high risk to construction workers in the immediate vicinity (very high importance receptors). The baseline risk could be exacerbated during construction works by the temporary increase in the rate and volume of surface water runoff from an increase in impermeable areas such as compacted soils and the presence of stockpiled materials and equipment temporarily stored on the floodplain. Sediment, construction materials and equipment may also be washed downstream where it may block the channel and lead to or increase the risk of flooding.

9.6.27 However, with the implementation of standard construction methods and mitigation as described in the FRA, Final CEMP and WMP, this risk can be effectively managed (for example by monitoring weather forecasts and Environment Agency flood warnings, by undertaking works close to watercourses during periods of dry weather, by ensuring an adequate temporary drainage system is in place and maintained throughout the construction phase and avoiding stockpiling material on floodplains). As such, the magnitude of flooding from these sources during construction, on site and further downstream, is considered to be negligible resulting in a Slight effect (not significant).

Potential Flood Risk – Surface Water Sources During Construction

9.6.28 The Site would in general be at a low risk from surface water flooding, although in some areas associated with watercourses there are areas of medium and high risk as outlined in the baseline and the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4). However, during the works, existing surface flow paths may be disrupted and altered due to site clearance, earthworks, and excavation work. The exposure and compaction of bare ground and the construction of new embankments and impermeable surfaces may increase the rates and volume of runoff and increase the risk from surface water flooding. However, with the implementation of standard construction methods and mitigation measures (see Section 9.5), this risk can be effectively managed. As such, the impact of flooding from these sources on construction workers is considered to be negligible resulting in a Slight effect (not significant).

Potential Flood Risk – Groundwater Sources During Construction

9.6.29 The Site is considered to be at medium risk of flooding from groundwater sources. Excavation of cuttings has the potential to liberate groundwater in some areas, and open excavations in some locations may also be more prone to becoming inundated by groundwater. With the implementation of the measures outlined in the CEMP and WMP (presented in Section 9.5), a negligible magnitude of impact is predicted to construction workers resulting in a Slight effect (not significant).

Potential Flood Risk – Drainage Infrastructure and Artificial Sources During Construction

9.6.30 The Proposed Development is at low to medium risk of flooding from sewers and other water supply infrastructure. With the implementation of the measures outlined in the CEMP and WMP and other flood risk mitigation as outlined in section 9.5, flooding from these sources is considered to be negligible to construction workers given the implementation of standard good practice construction techniques, resulting in a Slight effect (not significant).

9.6.31 Environment Agency mapping and the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) indicates that the Site is not at risk of flooding from reservoirs or artificial waterbodies. As such, flooding from these sources is considered to have a negligible effect on construction workers, which gives a Slight effect (not significant).

Operation Phase

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

- impacts on receiving waterbodies from diffuse urban pollutants in surface water runoff, or as a result of accidental spillages;
- changes in water quality within Tees Bay from operational discharges from the PCC including the discharge of treated process wastewater and water from the cooling system;

- potential nutrient enrichment of ponds located adjacent to the PCC from atmospheric deposition of nitrogen emitted from the Power and Capture Plant.
- potential increase in volume and rate of surface water runoff from new impervious areas, leading to an impact on flood risk, upstream and downstream of the Proposed Development;
- increased local demand for potable water supply; and
- potential morphological and hydrological impacts to waterbodies.

9.6.33 It is important that the water supply and foul water requirements for the Proposed Development are determined so that these can be managed accordingly by the public water company and sewage undertaker without causing significant adverse effects to the water environment. Unlike other aspects of this assessment, the potential impact from foul water discharges is difficult to assess because the consequences are often indirect and distant from the Proposed Development (e.g. the water supply or the river into which treated final effluent is discharged) and a component of a larger, existing issue. Furthermore, water supply and sewage treatment is a highly regulated industry with existing processes and mechanisms to ensure the supply of services for major developments. Statutory requirements are also placed upon statutory wastewater undertakers to upgrade their infrastructure when required, whilst ensuring they operate within requirements of water abstraction licences and water activity permits to discharge to rivers.

Potential Pollution of Tees Bay due to Surface Water Routine Runoff and Accidental Spillages

9.6.34 The Proposed Development is an industrial site with constant use of a range of fuels, oils and other chemicals. There is therefore potential for contaminants to be mobilised by surface water runoff and to discharge into Tees Bay via the drainage pipeline and outfall if not controlled. Discharge of a range of pollutants 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 waterbody. There is also a risk that a significant chemical spillage or pollution incident occurs on the Site and is discharged to Tees Bay via the outfall.

9.6.35 These potential impacts are proposed to be managed and treated by appropriate measures as summarised in Section 9.5. All potentially contaminated surface water (PCSW) runoff is to be discharged to an attenuation pond prior to treatment (including chemical dosing and using an oil/water interceptor), and then discharged to the Tees Bay via the outfall retention pond, as described in Diagram 9-2. The two ponds are the SuDS features provided for the Proposed Development.

9.6.36 The SuDS Manual's Simple Index Approach (CIRIA, 2015a) has been applied to assess the suitability of the proposed SuDS treatment train for surface water runoff and spillages (for areas draining PCSW runoff, the Power Plant surface water drainage and some of the common utilities areas as described in Section 9.5 and shown in Diagram 9-2). The High Pollution Hazard Index has been adopted to assess runoff from the Proposed Development, as this is described in the SuDS Manual as, "*Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites, trunk roads and motorways*". It is thus deemed the most appropriate hazard index available for the Proposed Development.

9.6.37 Table 9-18 shows the pollutant hazard index score for different pollutants (total suspended solids, metals and hydrocarbons) for the High Pollution Hazard Level, as outlined in the SuDS Manual (CIRIA, 2015a).

9.6.38 The two proposed ponds (balancing pond and outfall retention pond as described in Section 9.5 and Diagram 9-2) would provide storage for potential flood and pollution events, prior to discharging at a controlled rate to the North Sea via Tees Bay. Table 9-18 also shows the treatment potential of the ponds when compared against the pollution hazard index. To achieve a pass the total mitigation index must meet or surpass the pollution hazard index. Under the Simple Index Approach the effectivity of the second treatment train (i.e. second pond) is considered to be 50% compared to the first pond. On this basis, the mitigation index fails to meet the pollution hazard index for hydrocarbons but passes the assessment for total suspended solids and metals.

9.6.39 Additional treatment has been proposed between the ponds using an oil/water interceptor (see Section 9.5 and Diagram 9-2). Proprietary treatment systems such as these are not considered within the Simple Index Assessment as the performance varies between available products. The majority of available oil interceptors would provide sufficient treatment for hydrocarbons to ensure that the treatment train passes the assessment, however, the appropriateness of the chosen product for providing the additional treatment required for runoff will be confirmed through consultation with the Environment Agency. The selected product should include sensor capability to detect presence of any oils prior to discharge, and alarms to indicate when the device is nearing capacity and requires maintenance.

Table 9-17: Pollution Hazard Indices and the Total Pollutant Mitigation Index for each Pollutant

Proposed Development land use	SuDS train	Total Suspended Solids	Metals	Hydrocarbons
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites, trunk roads and motorways	Pond 1	0.7	0.7	0.5
	Pond 2	0.35	0.35	0.25
	Pollution Hazard Index	0.8	0.8	0.9
	Total Mitigation Index	1.05	1.05	0.75
	Final Mitigation Index (with integration of an appropriate oil/ water interceptor)	**Pass**	**Pass**	**Pass**

9.6.40 As outlined in Chapter 4: Proposed Development (ES Volume I, Document Ref. 6.2) an inventory of hazardous substances used on site will be developed throughout the design process. In each case the product will have a Material Safety Data Sheets providing guidance on the safe disposal of waste chemicals, that the operator of the facility will adhere to the guidance stated in section 9.5 regarding the disposal of product containers and chemical waste, and the impact avoidance measures described above.

9.6.41 The Drainage Philosophy will require provisions for dealing with chemical spillages and firewater. This includes kerbed / bunded areas, valves (i.e. penstocks), sluices and interception sumps for isolating spillages or contaminated water. Water quality monitoring will be regularly undertaken by the sites 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 permitted 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 in Section 9.5.

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

9.6.43 Given that the Drainage Strategy will have to meet standards required by the environmental permit and the expected local policy requirements, and that measures are in place for dealing with spillages and firewater (including water quality monitoring) then a negligible impact is predicted to the North Sea at Tees Bay. Given that this is a very high importance receptor, this would result in a Slight effect (not significant).

Potential Impacts on Water Quality of Tees Bay from Operational Discharges

9.6.44 Cooling water blowdown from the Power and Capture Plant will discharge to Tees Bay 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.

9.6.45 To better understand the consequences of this discharge of cooling water, near-field and far-field thermal discharge modelling and assessment has been undertaken for both potential outfall points within Tees Bay - see Appendix 14E: Coastal Modelling Report (ES Volume III, Document Ref. 6.4).

9.6.46 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 m^3/s and a density of 1,018 and 1,020 kg/m^3 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).

9.6.47 The modelling was based on three CCGT trains whereas there will now only be a single CCGT train, and as such is highly precautionary.

9.6.48 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.

9.6.49 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.

9.6.50 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.

9.6.51 In summary taking into account the modelling result and the findings of Chapter 14: Marine Ecology and Nature Conservation (ES Volume I, Document Ref. 6.2) it can be assessed at this stage that as the impacts from the thermal discharge are localised it does not threaten the temperature status on the scale of the whole waterbody. Crucially, they do not present a barrier to migratory routes for fish. In EIA terms the impact is therefore negligible, which gives a Slight effect (not significant) to the very high importance Tees Bay in terms of thermal discharge effects.

9.6.52 There is further potential for physico-chemical water quality impacts at the Tees Bay outfall, from the discharging of process water. The Tees Coastal WFD waterbody is currently at Good Chemical Status and Good Status for Physico-chemical Quality Elements, and the Proposed Development must not lead to deterioration of this status. 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).

9.6.53 As outlined above in Section 9.5 process water from the above sources will be treated on site to an appropriate standard as agreed with the Environment Agency, 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 for discharge to Tees Bay via the outfall.

9.6.54 Following treatment, process water that is to be discharged would flow via the outfall retention pond upstream of the outfall to Tees Bay. The outfall retention pond would provide a sufficient 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 Environment Agency (as the permitting authority).

9.6.55 Given the requirements for the effluent from the Proposed Development to meet conditions of an environmental permit (with an associated H1 screening assessment plus more detailed assessment if required), plus the low predicted rate of treated effluent that will be discharged, it is considered that there is limited potential for widespread pollution from the outfall, especially given the large capacity for dilution and dispersal offered by the open coastline of Tees Bay. As such, a negligible impact is predicted at this stage, with no changes likely to impact on WFD classifications for the larger waterbody. Given that the outfall is to a very high importance receptor this results in a Slight effect (not significant).

Surface Water Ponds: Water Quality

9.6.56 It is considered that there would be limited potential for adverse impacts resulting from receiving ‘unclean’ water or accidental spillages during operation on any existing ‘natural’ ponds (i.e. excluding new ponds that may be constructed as part of the Proposed Development for drainage purposes). This is based on all routine runoff during operation being directed to the outfall to Tees Bay, and not to the surface water ponds in the area. Overall, the magnitude of impact is expected to be negligible for all ponds within the Site Boundary, resulting in a potential Neutral effect (not significant). There should be no impact to ponds that are outside the Site Boundary but within the Study Area.

9.6.57 There is potential for atmospheric deposition of nitrogen emitted from the Power and Capture Plant to impact adjacent waterbodies, notably open water within Coatham Dunes, where Pond 14 is the only open water pond. Over time, the deposition of nitrogen can lead to the enrichment of still waterbodies, especially where there is limited overturn of the water column and a long residence time, as is the case at Pond 14 where there is little to no groundwater interaction. This in turn has potential consequences for the wider habitat and species that make use of the pond.

9.6.58 An assessment of atmospheric deposition has been undertaken in Chapter 8: Air Quality (ES Volume I, Document Ref. 6.2). Emissions from the Proposed Development have been assessed using the Environment Agency’s Risk Assessment methodology (Defra and EA, 2017). Detailed dispersion modelling using the atmospheric dispersion model ADMS (currently ADMS 5.2.2) has been used to calculate the concentrations of pollutants at identified receptors. These concentrations have been compared with the defined Air Quality Assessment Levels (AQALs) for relevant pollutants.

9.6.59 An assessment of nutrient nitrogen enrichment has been undertaken by applying published deposition velocities to the predicted annual average nitrogen dioxide (NO_2) and ammonia (NH_3) concentrations at the Teesmouth and Cleveland Coast SPA, determined through dispersion modelling, to calculate nitrogen deposition rates (expressed as kilograms per hectare per year, Kg/ha/yr). These deposition rates have then been compared to the Critical Loads for nitrogen published by UK Air Pollution Information System (APIS) (Centre for Ecology and Hydrology and APIS, 2016), taking into consideration the baseline deposition.

9.6.60 Water quality monitoring of Pond 14 between October 2020 and January 2021 indicates a maximum total nitrogen concentration value of 1.6 mg/l (6th 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 22nd October 2020). Based on the maximum recorded total nitrogen baseline value of 1.6 mg/l in Pond 14, a predicted deposition of 0.25 kg/N/ha/yr as a worst case scenario would cause an increase in total nitrogen concentration to 1.72 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.

9.6.61 Given the low level of enrichment of Pond 14 a negligible impact is predicted for this very high importance receptor. This results in a **Slight adverse effect** (not significant) for Pond 14.

Potential Morphological and Hydrological Impacts to Waterbodies

9.6.62 The new diffuser head and associated rock armour is predicted (as a worst case) to have a total footprint of 100 m^2.The placement of a new diffuser head has the potential to induce localised scouring of the seabed. This is likely to occur quite rapidly after construction 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 in the form of rock armour around the diffuser is therefore proposed to minimise this impact. The design of the diffuser head and scour protection will be undertaken post-DCO consent and will include appropriate hydrodynamic assessment of the risk of erosion. As a worst case it is considered that there may be a moderate adverse but very localised impact. Given that the waterbody is low importance for morphology, this results in a Slight effect (not significant).

Demand for Water

9.6.63 The Proposed Development has a significant demand for water as outlined in Section 9.5, albeit less than for the former steelworks. The preferred option is that Northumbrian Water Ltd provide the required water, however, this is subject to ongoing consultation with regard to availability and commercial terms.

9.6.64 Northumbrian Water’s Water Resources Management Plan 2019 (Northumbrian Water, 2019) indicates that there should be sufficient resources within the network to accommodate this, if required. The plan undertook a supply and demand forecast for each Water Resource Zone (WRZ) in their jurisdiction (with the Industrial WRZ being relevant for the Proposed Development) for a scenario of a worst historical drought and a 1 in 200 year return period drought. Based on licensed quantities from the River Tees there is 170M l/d of water available for the Industrial WRZ under normal operation. In the 1 in 200 design drought year there is only 130 Ml/d of water available for the Industrial WRZ. This means that based on a current demand of 82M l/d the WRZ has a headroom of 48M l/d in the design drought year. Furthermore, given advancements in water efficiency in industry, future demand is expected to decline.

9.6.65 The Plan confirms that a water supply surplus will be maintained up to 2060. Furthermore, the volume of water forecast to be abstracted over the planning period will not lead to deterioration in the status of the waterbodies from which Northumbrian Water abstract.

9.6.66 On the basis that NWL has a supply surplus (although some improvements to transmission infrastructure may be required), or that water will be abstracted from the Tees Estuary in a similar way to the former Redcar Steelworks but involving substantially less water, a negligible impact is predicted giving a Neutral effect (not significant).

Foul Water Discharge

9.6.67 It has been assumed that all foul water from welfare facilities will either be directed to the nearby NWL 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. On-site treatment would require an application for a new Environment Permit from the Environment Agency. As part of this application there would be assessment of the risks and required permit limits, and thus treatment processes following Best Available Techniques (BAT) that are needed to ensure no significant adverse environmental impacts on the receiving waterbody. Furthermore, the operator will be required to implement an Environmental Management System and programme of monitoring to ensure compliance with the agreed permit limits. Should the water be treated by NWL 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.

9.6.68 As such, the impact of treated foul water discharge is considered to be negligible to Tees Bay, giving a Slight effect (not significant).

Flooding from Tidal and Fluvial Sources during Operation

9.6.69 The FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) indicates that the PCC Site and the majority of the connection corridor routes are at a ‘low’ risk of flooding from tidal sources (River Tees and Greatham Creek) during events that exceed a 0.5% AEP (1 in 200 chance) flood event. This includes access roads to the east of the PCC Site.

9.6.70 During a future scenario resulting from climate change up to 2125 the PCC is at ‘medium’ risk of flooding where the current ground level is below 5.74 m AOD during events that exceed the 0.1% AEP (1 in 1000 chance) event. It is at ‘low’ risk where ground level is above 5.74 m. However, the elevation of the PCC Site will be raised to a minimum of 7.5 mAOD during site construction (expected to be in 2023).

9.6.71 The western extent of the connection corridor located between the tidal River Tees and Greatham Creek is at high risk of flooding from tidal sources during events that exceed a 0.5% AEP (1 in 200 chance) flood event and the climate change flooding scenarios. This section of the Site is also at high residual risk of flooding should a failure or breach of the flood defences occur.

9.6.72 All runoff from the Site is to the proposed outfall discharging to Tees Bay. As such, the risk of flooding should not be exacerbated by the Proposed Development.

9.6.73 In EIA terms, tidal flooding is considered of Very High Importance due to the nature of the development as essential infrastructure (i.e. Power and Capture Plant). Given that the proposed development is expected to have negligible impact on flood levels on or off site, then a Slight effect (not significant) is anticipated in terms of tidal and fluvial flooding (based on the classification approach in table 9-4).

9.6.74 However, the western extent of the connection corridor located between the tidal River Tees and Greatham Creek is at high risk of flooding from tidal sources during events that exceed a 0.5% AEP (1 in 200 chance) flood event and the climate change flooding scenarios. This section of the site is also at high residual risk of flooding should a failure or breach of the flood defences occur. Appropriate mitigation measures are therefore required to be implemented at the Site to mitigate this risk. These are described further in the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) and below in Section 9.7 and would include a Flood Emergency Response Plan.

Flooding from Surface Water Sources during Operation

9.6.75 The risk of surface water flooding within the Site from elsewhere or generated within the Site is considered to be 'low to very low'.

9.6.76 A Drainage Strategy will be prepared for the Proposed Development which covers the use of SuDS, site discharge rates and surface water management/ exceedance flows. Given the implementation of this proposed strategy, surface water from the Proposed Development will be carefully managed, treated and directed to the Tees Bay outfall at controlled rates. Given this increased management of surface water runoff from the development there would likely be a reduction in the surface water flood risk in comparison to existing conditions where the drainage arrangements are dated.

9.6.77 It is considered that the Proposed Development would have a negligible impact, resulting in a Neutral effect (not significant) on surface water flood risk.

Flooding from Ground Water Sources during Operation

9.6.78 The risk of groundwater flooding within the Site is considered to be medium. However, should the Proposed Development comprise below ground development within strata where groundwater is recorded as present, mitigation measures, including those outlined in British Standard 8102 (BS8102) will be required to reduce the risk of groundwater flooding to underground structures as is best practice. BS8102 includes guidance on waterproofing barrier materials applied to structures, structurally integral watertight construction and drained cavity construction. This is described further in the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4). Assuming this to be the case, the magnitude of impact from groundwater flooding during operation is considered negligible. As such, the effect is Neutral (not significant).

Flooding from Drainage Infrastructure during Operation

9.6.79 Land between the north bank of the River Tees and the south bank of Greatham Creek is located in an area at residual risk of flooding should a failure or breach of a reservoir occur. However, this is considered very unlikely and so a magnitude of minor adverse is considered appropriate. A Slight effect (not significant) is predicted as a worst case scenario.

9.6.80 Flooding from drains, sewers and surface waters are normally interconnected. Insufficient or reduced drainage capacity within the sewer network can result in drainage capacity being exceeded causing extensive surface water flooding. Likewise, increased volumes of surface water can overload sewers and drains, causing the drainage network to backup and surcharge causing surface water flooding. All new pipes to be installed for the Proposed Development will be appropriately sized to accommodate their calculated capacity requirements. The impact of climate change on expected flows will be accommodated in the design of drainage infrastructure. Given this, the magnitude of impact is considered to be minor adverse, a Slight effect (not significant) effect as the worst case scenario is predicted.

Decommissioning Phase

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

9.6.82 On this basis, decommissioning impacts are expected to be limited to waterbodies in close proximity to the PCC Site (i.e. Tees Estuary, Tees Bay, The Fleet (Tees Estuary (S Bank)), some ponds and potentially waterbodies close to any AGIs along the various connection corridors) and will be similar to the impacts reported for the construction phase, but with fewer earthworks, excavations and tunnel arisings to manage.

9.6.83 A detailed Decommissioning Environmental Management Plan will be prepared to identify required measures to prevent pollution during this phase of the development, based on the detailed decommissioning plan.

9.6.84 There is likely to be a marginal improvement to the water quality of the Tees Coastal waterbody following decommissioning of the Proposed Development, with the discharge of cooling waters and other effluent ceasing.

9.6.85 Overall, no significant effects are anticipated during decommissioning provided that the appropriate mitigation is implemented.

9.7 Mitigation and Enhancement Measures

Construction Phase

9.7.1 Mitigation of adverse impacts on the water environment during the construction phase will be achieved principally through embedded measures identified in Section 9.5, notably the adoption of a CEMP and WMP.

9.7.2 A water quality monitoring programme will be set out in the WMP within the final CEMP. This will need to be further developed by the Principal Contractor in consultation with the Environment Agency (due to works potentially impacting flow in a Main River and WFD waterbodies), the LLFA (due to works potentially impacting flow in an Ordinary Watercourse), the MMO and potentially Natural England during the process of obtaining Environmental Permits/Consents/Licences for works affecting, or for temporary discharges to, waterbodies during the construction period.

9.7.3 The programme will be expected to include a combination of daily observations and monitoring using a calibrated, handheld water quality probe through the upstream and downstream reaches of water features hydrologically-connected to the Site. It is expected that water quality sampling will be undertaken on a periodic as well as ad-hoc basis, dependent upon circumstances / activities onsite. Monitoring and sampling will be undertaken prior to the commencement of construction as to allow a sufficient baseline data.

Operation Phase

9.7.4 The need for a number of additional mitigation strategies will be considered during the design process for the Proposed Development to ensure the operation of Site is maintained in the event of an extreme flood or significant pollution event. These strategies include:

- A Flood Emergency Response Plan - providing flood resistance and resilience measures into the design of the buildings (i.e. minimum floor levels) and designing for failure, maintenance and capacity exceedance of the surface water drainage network. More details are provided in the FRA (Appendix 9A, ES Volume III, Document Ref. 6.4).
- An Emergency Response Plan – setting out how the risk of large emergency and pollution incidents will be managed during the operation of the Proposed Development.

9.7.5 It is assumed that the need for long term water quality monitoring will be set out and agreed with the Environment Agency through the environmental permitting process and thus no details of what this may involve are described here.

9.8 Limitations or Difficulties

9.8.1 The EIA process enables good decision-making based on the best possible available information about the environmental implications of a proposed development. However, there is often a degree of uncertainty as to the exact scale and nature of the environmental impacts, and in such cases the reasonable worst case scenario has been considered.

9.8.2 This assessment has been undertaken using available data and Proposed Development design details at the time of writing in January 2021. However, at this stage many details of the Proposed Development remain uncertain or under development, such as the exact location of the water discharge outfall. The assumptions used are listed in Section 9.3 and have followed the Rochdale Envelope approach. As such, the assessment is a worst case scenario, and actual effects may be less than those presented herein.

9.9 Cumulative Effects

9.9.1 This section of the chapter assesses the potential effects of the Proposed Development in combination with the potential effects of other development schemes (referred to as 'cumulative developments') within the surrounding area, as listed within Chapter 24: Cumulative and Combined Effects (ES Volume I, Document Ref. 6.2) and shown in Figure 24-1 (ES Volume II, Document Ref. 6.3). Of those developments listed, the following are considered to have potential for cumulative effects with regard to the water environment, due to being located in the Study Area or which might drain to Tees Bay, Tees Estuary or its upstream tributaries, which are potentially also impacted by the Proposed Development:

- The off-shore Net Zero Teesside project (ID 1), including the breakout of the HDD bores for the CO_2 Export Pipeline in Tees Bay approximately 3 km off-shore and the commencement of the connection to the off-shore pipeline to the Endurance storage facility.
- York Potash Harbour Facilities Order (ID 2 – see Figure 24-2 (ES Volume II, Document Ref. 6.3) - The installation of wharf/jetty facilities with two ship loaders capable of loading bulk dry material at a rate of 12m tons per annum (dry weight). Associated dredging operations to create berth. Associated storage building with conveyor to wharf/jetty. Including a materials handling facility (if not located at Wilton) served by a pipeline (the subject of a separate application) and conveyor to storage building and jetty. Potential for cumulative construction impacts to Tees Estuary.
- Tees CCPP (ID 3) - Sembcorp Utilities (UK) Limited - a gas fired combined cycle gas turbine (CCGT) power station with a maximum generating capacity of up to 1,700 MWe (assuming carbon capture and storage requirements are met). The project will utilise existing Gas and National Grid connections. The site is adjacent to Kettle Beck which could be subject to water quality impacts related to this site and the Proposed Development during construction. Drainage and effluent from the Tees CCPP is proposed to discharge the Wilton Site Drainage System, and ultimately the Tees Estuary, and so there should be no potential for cumulative impacts during operation.
- Dogger Bank Teesside A / Sofia Offshore Wind Farm (ID 4) - Forewind Ltd. (formerly Dogger Bank Teesside B) - Project previously known as Dogger Bank Teesside A&B. Dogger Bank Teesside A & B is the second stage of Forewind's offshore wind energy development of the Dogger Bank Zone (Zone 3, Round 3). Dogger Bank Teesside A & B will comprise up to two wind farms, each with an installed capacity of up to 1.2GW, which are expected to connect to the National Grid at the existing National Grid substation at Lackenby, near Eston. The cable routes to Lackenby substation could cause cumulative impact to the Tees Bay waterbody.
- Director of Regeneration and Neighbourhoods Hartlepool (ID 16) - outline application for the construction of an energy recovery facility (ERF) and associated development, Grangetown Prairie Land east of John Boyle Road and west of Tees Dock Road, Grangetown. This is adjacent to Knitting Wife Beck where there is potential for cumulative impacts during construction and to the downstream receptor Tees Estuary.
- Homes and Communities Agency (ID 17) - outline planning application for up to 550 residential units with associated access, landscaping and open space, land north of Kirkleatham Business Park and west of Kirkleatham Lane, Redcar. This is adjacent to a tributary of The Fleet, and so there is potential for cumulative construction and operational discharges to this waterbody.
- Sirius Minerals (ID 27) - outline planning application for an overhead conveyor and associated storage facilities in connection with the York potash project, land between Wilton International and Bran Sands,

Redcar. This is adjacent to the Fleet (Tees Estuary (S Bank) WFD waterbody) and so there is potential for cumulative construction and operational discharges to this waterbody.

- Forewind (ID 31) - outline application (all matters reserved) for installation of two underground sections of high voltage electrical cables and fibre-optic cable associated with Dogger bank Teesside A & B offshore wind farms, land at Wilton International, Redcar. There is potential for cumulative construction impacts to watercourses potentially crossed including Main's Dike.
- Redcar and Cleveland LP (ID 51) – Local Plan 2018 indicates 550 houses. This is adjacent to a tributary of The Fleet, and so there is potential for cumulative construction and operational discharges to this waterbody.
- South Tees Development Corporation, South Bank (ID 66) - Full planning application: Demolition of structures and engineering operations associated with ground preparation and temporary storage of soils and its final use in the remediation and preparation of land for regeneration and development. This site is adjacent to Lackenby Channel and there is potential for cumulative impacts to this watercourse and Tees Estuary downstream.
- MGT Teesside Ltd (ID 68) Proposed construction of a 300 MW biomass fired renewable energy power station on land adjacent to the main southern dock at Teesside on the south bank of the Tees Estuary. The site is adjacent to the Tees Estuary and there could be cumulative impacts during construction or operation.
- York Potash Ltd (ID 71) - Full planning application: including the construction of an underground tunnel between Doves Nest Farm and land at Wilton that links to the mine below, comprising 1 shaft at Doves Nest Farm, 3 intermediate access shaft sites, each with associated landforming of associated spoil, construction of buildings, access roads and car parking, landscaping, restoration and aftercare, the construction of a tunnel portal at Wilton comprising buildings, landforming of spoil and associated works. Works at the Wilton International Site could cause cumulative construction impacts to watercourses including The Mill Race which is in close proximity.
- South Tees Development Corporation, South Bank (ID 73) - Outline planning application for demolition of existing structures on site and the development of up to 418,000 sqm (gross) of general industry (use class B2) and storage or distribution facilities (use class B8) with office accommodation (use class B1), HGV and car parking and associated infrastructure works all matters reserved other than access. The site is adjacent to the Tees Estuary and there could be cumulative impacts during construction.
- Redcar Holdings Ltd (ID 77) - Full planning application: Construction of the Redcar Energy Centre (REC) consisting of a material recovery facility incorporating a bulk storage facility; an energy recovery facility; and an incinerator bottom ash recycling facility along with ancillary infrastructure

and landscaping. Adjacent to Tees Estuary and Tees Bay with potential for cumulative construction and operational discharges.

- Port Clarence Energy Ltd (ID 78) - Full planning application: Proposed 45MWe renewable energy plant. Adjacent to Tees Estuary with potential for cumulative impacts during construction.
- PD Teesport (ID 79) - Northern Gateway Container Terminal, Teesport - Adjacent to Tees Estuary with potential for cumulative impacts during construction.
- South Tees Development Corporation, Dorman Point (ID 83) Outline planning application for the development of up to 139,335 sqm (gross) of general industry (Use Class B2) and storage and distribution facilities (Use Class B8) with ancillary office accommodation (Use Class E), HGV and car parking and associated works. All matters reserved other than access. Dorman Point is adjacent to Lackenby Channel which discharges to the Tees Estuary, and so there is potential for cumulative impacts during construction.
- South Tees Development Corporation, Lackenby (ID 84) Outline planning application for the development of up to 92,903 sqm (gross) of general industry (Use Class B2) and storage and distribution facilities (Use Class B8) with ancillary office accommodation (Use Class E), HGV and car parking and associated works. All matters reserved other than access. This site is adjacent to Lackenby Channel and Dabholm Gut (upstream of Tees Estuary) and so there is potential for cumulative impacts during construction.
- South Tees Development Corporation, the Foundry (ID 85) Outline planning application for the development of up to 464,515 sqm (gross) of general industry (Use Class B2) and storage and distribution facilities (Use Class B8) with ancillary office accommodation (Use Class E), HGV and car parking and associated works. All matters reserved other than access. The Foundry is adjacent to Tees Estuary and Tees Bay with potential for cumulative construction and operational discharges.
- South Tees Development Corporation, Long Acres (ID 86) Outline planning application for the development of up to 185,806 sqm (gross) of general industry (Use Class B2) and storage and distribution facilities (Use Class B8) with ancillary office accommodation (Use Class E), HGV and car parking and associated works. All matters reserved other than access. Long Acres is adjacent to The Fleet and Tees Bay and so there is potential for cumulative impacts during construction and operation.
- South Tees Development Corporation, Steel House (ID 87) Outline planning application for the development of up to 39,948 sqm (gross) of office accommodation and incubator space (Use Class E), car parking and associated works. All matters reserved other than access. Steel House is adjacent to The Fleet and Tees Bay and so there is potential for cumulative impacts during construction and operation.

Cumulative Effects during Construction

9.9.2 There is likely to be overlap between construction of several of these adjacent or nearby schemes and construction of the Proposed Development. Thus, there is the potential for short term, temporary construction related pollutants generated from both the Proposed Development and all of the above schemes to impact on watercourses in the Study Area (with watercourses affected included in the list above). Impacts of the breakout of the HDD bores for the off-shore Net Zero project are assessed to be similar to breakout of the MTB boring machine as part of this development but with greater potential for dispersion of sediment and WBM. However, provided that standard and good practice mitigation is implemented on the above construction sites through their respective CEMPs and as per the conditions of the relevant planning permission, environmental permits and licences, as is being proposed for this development, the cumulative risk can be effectively managed and there would not be a significant increase in the risks to any waterbodies. As such, there would not be any additional cumulative impacts during construction on the basis of the above assessment. In terms of water quality, there will remain a temporary and localised Slight adverse effect (not-significant) to Tees Bay with regard to mobilisation of sediment, but no other significant effects.

Cumulative Effects during Operation

9.9.3 It is assumed that drainage strategies for all of the above developments have been or will be produced with reference to the relevant policies and guidance documents outlined in Section 9.2. The Proposed Development assessed in this chapter will similarly be designed to ensure no long-term deterioration in water quality or increase in flooding. Attenuation and treatment will be provided for runoff from the Proposed Development prior to discharge to waterbodies. As such, provided that all the mitigation measures are implemented for all schemes, then the cumulative impacts from the Proposed Development and the above schemes will have negligible impact on flooding leading to a neutral effect (not significant).

9.10 Residual Effects and Conclusions

9.10.1 A summary of residual effects on water resources and flood risk and their significance is provided in Table 9-18.

9.10.2 Potential moderate adverse (significant) temporary and localised effects could occur to water quality in Tees Bay relating to accidental spillages given that they are to be worked on directly. There could also be significant moderate adverse effects to Belasis Beck as work will occur close to this watercourse. However, it is proposed that a programme of water quality monitoring is undertaken during construction to identify any pollution, and remedial measures implemented. With appropriate monitoring as outlined in Section 9.7, it is considered that the significance of effect can reasonably be lowered to slight adverse (not significant) for these waterbodies.

9.10.3 All other residual effects are considered to be neutral to slight (not significant), provided that the embedded mitigation measures are implemented as outlined in this chapter.

Table 9-18: Summary of Residual Impacts and Effects

Description of effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and monitoring	Residual Effect Significance
Construction					
Surface Water Quality – suspended fine sediments	Tees Estuary, Tees Coastal Waterbody (Tees Bay), Belasis Beck: Very High The Fleet (Tees Estuary (S Bank)): High The Mill Race, Lackenby Channel, Knitting Wife Beck, Kinkerdale Beck: Medium Coatham Dunes Ponds: Very High Drain, ditches and ponds on Site: Low	Tees Estuary: Negligible (temporary) Tees Coastal Waterbody (Tees Bay): Negligible adverse (temporary) Belasis Beck: Negligible The Fleet (Tees Estuary (S Bank)): Negligible The Mill Race, Main's Dike, Lackenby Channel, Knitting Wife Beck, Kinkerdale Beck, ditches, ponds: Negligible	Tees Estuary: Negligible Tees Coastal Waterbody (Tees Bay): Slight adverse (not significant) Belasis Beck: Slight adverse (not significant) The Fleet: Slight adverse (not significant) The Mill Race, Lackenby Channel, Knitting Wife Beck, Kinkerdale Beck: Neutral (not significant) Drain, ditches and ponds: Neutral (not significant)	Further to the implementation of the CEMP and WMP (embedded mitigation), water quality monitoring pre-construction and during construction will be undertaken.	Tees Estuary: Neutral Tees Coastal Waterbody (Tees Bay): Slight adverse (not-significant) Temporary Belasis Beck: Slight adverse (not- significant) The Fleet: Slight adverse (not significant) The Mill Race, Lackenby Channel: Slight adverse (not significant) Drain, ditches and ponds: Neutral (not significant)
Surface Water Quality – chemical spillages	Tees Estuary, Tees Coastal Waterbody (Tees Bay), Belasis Beck, Greatham Creek, Mucky Fleet, Swallow Fleet, Holme Fleet: Very High The Fleet (Tees Estuary (S Bank)): High The Mill Race, Lackenby Channel, Knitting Wife	Tees Estuary: Minor adverse (temporary) Tees Coastal Waterbody (Tees Bay): Minor adverse (temporary) Belasis Beck: Minor adverse (temporary) The Fleet (Tees Estuary (S Bank)): Minor adverse (temporary)	Tees Estuary: Moderate adverse (significant) Tees Coastal Waterbody (Tees Bay): Moderate adverse (significant) Belasis Beck: Moderate adverse (significant) The Fleet: Slight adverse (not significant)	Further to the implementation of the CEMP and WMP (embedded mitigation), water quality monitoring pre-construction and during construction will be undertaken.	Tees Estuary: Slight adverse (not significant) Tees Coastal Waterbody (Tees Bay): Slight adverse (not significant)) Belasis Beck: Slight adverse (not significant) The Fleet: Slight adverse (not significant)

Description of effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and monitoring	Residual Effect Significance
	Beck, Kinkerdale Beck: Medium Drain, ditches and ponds on Site: Low	The Mill Race, Lackenby Channel, ditches, ponds: Minor adverse (temporary)	The Mill Race, Lackenby Channel: Slight adverse (not significant) Greatham Creek, Mucky Fleet, Swallow Fleet, Holme Fleet: No impact		The Mill Race, Lackenby Channel: Slight adverse (not significant) Greatham Creek, Mucky Fleet, Swallow Fleet, Holme Fleet: No impact
Morphological Effects to waterbodies	Tees Coastal Waterbody (Tees Bay): Low (for morphology)	Tees Coastal Waterbody (Tees Bay): Minor adverse	Tees Coastal Waterbody (Tees Bay): Slight adverse (not significant)	None proposed – however, this effect may not occur should the existing outfall be in a suitable condition for continued use.	Tees Coastal Waterbody (Tees Bay): Slight adverse (not significant)
	Tees Estuary: Low (for morphology)	Tees Estuary: Negligible	Tees Estuary: Neutral (not significant)	None proposed – however, this effect may not occur should Northumbrian Water provide water to the Site.	Tees Estuary: Neutral (not significant)
Flooding from fluvial sources during construction	Flood Risk: Very High (construction workers)	Negligible	Slight (not significant)	Implementation of temporary site drainage system as described in future CEMP and WMP (embedded mitigation).	Slight adverse (not significant)
Flooding from surface water sources during construction	Flood Risk: Very High (construction workers)	Negligible	Slight (not significant)	Implementation of temporary site drainage system as described in future CEMP and WMP (embedded mitigation).	Slight adverse (not significant)
Flooding from groundwater sources during construction	Flood Risk: Very High (construction workers)	Negligible	Slight (not significant)	Implementation of temporary site drainage system as described in	Slight adverse (not significant)

Description of effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and monitoring	Residual Effect Significance
				future CEMP and WMP (embedded mitigation).	
Flooding from drainage artificial sources and drainage infrastructure during construction	Flood Risk: Very High (construction workers)	Negligible	Slight (not significant)	None proposed.	Slight adverse (not significant)
Operation					
Potential Pollution of Surface Watercourses: Routine Runoff and Accidental Spillages	Tees Coastal Waterbody (Tees Bay): Very High	Negligible	Tees Coastal Waterbody (Tees Bay): Slight adverse (not significant)	Implementation of Drainage Strategy which is still to be produced (embedded mitigation).	Tees Coastal Waterbody (Tees Bay): Slight adverse (not significant)
Potential Impacts on water quality of Tees Bay due to thermal discharges	Tees Coastal Waterbody (Tees Bay): Very High	Negligible (TBC)	Slight adverse (not significant)	Implementation of Drainage Strategy which is still to be produced (embedded mitigation).	Slight adverse (not significant)
Potential Impacts on water quality of Tees Bay due to receipt of industrial discharges from the Proposed Development	Tees Coastal Waterbody (Tees Bay): Very High	Negligible	Slight adverse (not significant)	Implementation of Drainage Strategy which is still to be produced (embedded mitigation). Water sampling facilities are to be provided for manual sampling of water. The frequency of testing and parameters to be tested will be agreed with the permitting authority. In situ continuous monitoring of	Slight adverse (not significant)

Description of effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and monitoring	Residual Effect Significance
				flow, temperature, conductivity and pH measurement shall also be undertaken.	
Pond 14: Water Quality impacts due to atmospheric deposition of nitrogen.	Pond 14: Very High	Ponds 14: Negligible	Pond 14: Slight adverse (not significant)	None required.	Pond 14: Slight adverse (not significant)
Potential impacts on morphology from installation of the diffuser head at the new outfall point (if required)	Tees Coastal Waterbody (Tees Bay): Very High	Negligible	Slight adverse (not significant)	Scour protection	Slight adverse (not significant)
Increase in potable water demand	Potable Water Supply: Very High Importance	Negligible	Neutral (not significant)	Northumbrian Water WRMP indicates sufficient resource available. Ongoing consultation with Northumbrian Water.	Neutral (not significant)
Foul water discharge	Dabholm Gut (Tees Estuary) – Very High	Negligible	Slight adverse (not significant)	Consultation to be undertaken with Northumbrian Water.	Slight adverse (not significant)
Flooding from fluvial sources during operation	Flood Risk: Low to Very High	Negligible	Slight adverse (not significant)	Implementation of the drainage strategy (embedded mitigation)	Slight adverse (not significant)
Flooding from pluvial sources during operation	Flood Risk: Low to Very High	Negligible	Neutral (not significant)	Implementation of the drainage strategy (embedded mitigation)	Neutral (not significant)

Description of effect	Importance of Receptor (sensitivity for Flood Risk)	Magnitude of Impact	Initial Classification of Effect (with embedded mitigation)	Additional Mitigation and monitoring	Residual Effect Significance
Flooding from groundwater sources during operation	Flood Risk: Low	Negligible	Neutral (not significant)	Implementation of the drainage strategy (embedded mitigation)	Neutral (not significant)
Flooding from drainage infrastructure and artificial waterbodies during operation	Flood Risk: Low	Minor adverse	Slight adverse (not significant)	Implementation of the drainage strategy (embedded mitigation)	Slight adverse (not significant)

9.11 References

Able UK (2018). *Seaton Port Dredge, Water Framework Directive Assessment.*

ABPmer (2002). *Tees Entrance Channel Study. Conceptual Model of Estuary Processes. Report R.972.*

Bing (n.d.). *Maps* [Online]. Available at: https://www.bing.com/maps

British Geological Society (n.d.). *Onshore 'GeoIndex'* [Online]. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html

British Standards Institute (1990). *BS 5908 Code of practice for fire precautions in the chemical and allied industries*. London: British Standards Institution.

British Standards Institute (2009). *BS6031:2009 Code of Practice for Earth Works*. London: British Standards Institute.

British Standards Institute (2013a). *BS8582 Code of Practice for Surface Water Management of Development Sites*. London: British Standards Institute.

British Standards Institute (2013b). *BS 10175: 2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice*. London: British Standards Institute.

CEH (n.d.). *National River Flow Archive* [Online]. Available at: http://nrfa.ceh.ac.uk/

CIRIA (2001). *C532 Control of water pollution from construction sites – Guidance for consultants and contractors*. London: CIRIA.

CIRIA (2004). *C609 Sustainable Drainage Systems, hydraulic, structural and water quality advice*. London: CIRIA.

CIRIA (2006). *C648 Control of water pollution from linear construction projects, technical guidance*. London: CIRIA.

CIRIA (2015a). *C753 The SuDS Manual*. London: CIRIA. [Online]. Available at: https://www.ciria.org/ItemDetail?iProductCode=C753&Category=BOOK&WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91v

CIRIA (2015b). *C744 Coastal and marine environmental site guide (second edition)*. London: CIRIA.

CIRIA (2015c). *C741 Environmental good practice on site guide* (fourth edition). London: CIRIA

Control of Pollution (Oil Storage) (England) Regulations 2001. London: The Stationery Office.

Control of Substances Hazardous to Health Regulations 2002. London: The Stationery Office.

Cranfield University (n.d.). *Soilscapes* [Online]. Available at: http://www.landis.org.uk/soilscapes

Department for Communities and Local Government (2012a). *National Planning Policy Framework*. London. The Stationery Office.

Department for Communities and Local Government (2012b). *National Planning Practice Guidance*. London. The Stationery Office.

Department for Communities and Local Government (2014). *Flood Risk and Coastal Change*. London: The Stationary Office.

Department of Energy and Climate Change (2011a). *The Overarching NPS for Energy (EN-1).* London: The Stationery Office.

Department of Energy and Climate Change (2011b) National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2). Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37047/1939-nps-for-fossil-fuel-en2.pdf

Department of Energy and Climate Change (2011c) *National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipeline (EN-4)*. London: The Stationery Office.

DEFRA (2011a) *UK Marine Policy Statement*. Available online: https://www.gov.uk/government/publications/uk-marine-policy-statement

Defra (2011b). *Future Water: The Government's Water Strategy for England*. London: The Stationery Office.

DEFRA (2014) Draft North East Inshore and North East Offshore Marine Plans.

Defra (2015). *Sustainable Drainage Systems: non-statutory technical standards*. London: The Stationery Office.

Defra (2016) *Northumbrian River Basin District River Basin Management Plan*. Bristol: Environment Agency.

Defra (2018). *A Green Future: Our 25 Year Plan to Improve the Environment*. London: The Stationery Office.

Defra (n.d.). *Multi-Agency Geographic Information for the Countryside (MAGiC)* [Online]. Available at: http://www.magic.gov.uk/

Department for Transport (2019). *TAG unit A3 Environmental Impact Appraisal* [Online]. Available at: https://www.gov.uk/government/publications/webtag-tag-unit-a3-environmental-impact-appraisal-december-2015;

EDF Energy (n.d.). *Teesside Offshore Wind Farm: Operations & Maintenance Licence Application: Supporting Environmental Information.*

Eels (England and Wales) Regulations 2009 (SI 2009/3344). London: The Stationery Office.

Environment Agency (1998a) *River Geomorphology: a practical guide*. Bristol: Environment Agency.

Environment Agency (1998b). *Geomorphological approaches to river management. Project record W5A/i661/1*. Bristol: Environment Agency.

Environment Agency (2001). *Pollution Prevention Guidance* [Online]. Available at: https://www.gov.uk/government/collections/pollution-prevention-guidance-ppg

Environment Agency, (2004). *CLR 11 Model Procedures for the Management of Land Contamination*. Bristol: Environment Agency.

Environment Agency (2009). *Tees Catchment Flood Management Plan: Summary Report*. Leeds: Environment Agency.

Environment Agency (2010). GPLC1 Guiding Principles for Land Contamination in Assessing Risks to Controlled Waters [Online]. Available at: https://webarchive.nationalarchives.gov.uk/20140328173027/http://cdn.environment-agency.gov.uk/geho1109brgy-e-e.pdf

Environment Agency (2016). *Discharges to surface water and groundwater: environmental permits* [Online]. Available at: https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits.

Environment Agency (2019). *River Tees fish counts* [Online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/860612/Tees_monthly_counts.pdf

Environment Agency (n.d.a). *Catchment Data Explorer* [Online]. Available at: http://environment.data.gov.uk/catchment-planning/

Environment Agency (n.d.b). *Flood Risk Maps for Planning* [Online]. Available at: https://flood-map-for-planning.service.gov.uk/

Environment Agency (n.d.c). *Water quality data archive website* [Online]. Available at: https://environment.data.gov.uk/water-quality/view/landing

Environment Agency (n.d.d). *Find a bathing water* [Online]. Available at: https://environment.data.gov.uk/bwq/profiles/

European Commission (2016) *Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector* [Online]. Available at: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC103096/jrc103096_cww_bref_10_2016.pdf

Health and Safety Executive (1992). *HS(G)71 Chemical warehousing: the storage of packaged dangerous substances*. Sudbury: HSE Books.

Health and Safety Executive (1999). *HS(G)191 Emergency planning for major accidents: Control of Major Accident Hazards Regulations 1999 (COMAH)*. Sudbury: HSE Books.

Health and Safety Executive (n.d.). *Emergency response / spill control* [Online]. Available at: http://www.hse.gov.uk/comah/sragtech/techmeasspill.htm accessed January 2020.

Highways Agency (2006a). *Design Manual for Roads and Bridges HD 103/06, Vegetated Drainage Systems for Highway Runoff*. Birmingham: Highways Agency.

Highways Agency (2006b). *Design Manual for Roads and Bridges HD 33/16, Surface and Subsurface Drainage Systems for Highways*. Birmingham: Highways Agency.

Highways England (2019). *Design Manual for Roads and Bridges LA113 Road Drainage and the Water Environment.* Birmingham: Highways England.

Highways England (2020) *Design Manual for Roads and Bridges L104 Environmental Assessment and Monitoring*. Birmingham: Highways England.

HR Wallingford (2006). *Northern Gateway Container Terminal. Hydrodynamic and sedimentation studies.*

Landmark Information Group (2019). *Envirocheck Report, Order 218629364_1_1: Teesside Clean Gas*.

Maritime and Coastguard Agency (n.d.). *Maritime and Coastguard Agency* [Online]. Available at https://www.gov.uk/government/organisations/maritime-and-coastguard-agency, accessed February 2020.

Met Office (n.d.). *Climate averages data* [Online]. Available at: http://www.metoffice.gov.uk/public/weather/forecast

Natural England (n.d.). *Seaton Dunes and Common SSSI* [Online]. Available at https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1000150, accessed February 2020

NetRegs (n.d.). *Environmental Guidance for your Business in Northern Ireland and Scotland* [Online]. Available at: http://www.netregs.org.uk/environmental-topics/pollution-preventionguidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

Northumbrian Water (2019). *Final Water Resources Management Plan* [Online]. Available at: https://www.nwg.co.uk/globalassets/corporate/reports/nw-final-wrmp19.pdf

OGCI (2019a). *Gas Power – Water Treatment Options Assessment Report*.

OGCI (2019b). *Gas Power – Cooling System Analysis Report*.

Redcar and Cleveland Borough Council (2011). *Redcar and Cleveland BC Preliminary Flood Risk Assessment* [Online]. Available at: https://webarchive.nationalarchives.gov.uk/20140328094438/http://www.environment-agency.gov.uk/research/planning/135528.aspx#1 Prepared by JBA Consulting.

Redcar and Cleveland Borough Council (2016). *Redcar & Cleveland Borough Council Level 1 Strategic Flood Risk Assessment Update* [Online]. Available at: https://www.redcar-cleveland.gov.uk/resident/planning-and-building/local-plan/Local%20Plan%20Documents/Redcar%20and%20Cleveland%20Strategic%20Flood%20Risk%20Assessment%20(Level%201)/RCBC%20Level%201%20SFRA%20Update%202016.pdf Prepared by JBA Consulting.

RCBC (2018). *Redcar & Cleveland Local Plan* [Online]. Available at: https://www.redcar-cleveland.gov.uk/resident/planning-and-building/local-plan/areagrowth/Local%20Plan%20Adopted%20May%202018.pdf

Royal Haskoning (2014). *Dogger Bank Teesside A&B Environmental Statement Chapter 6 Appendix D: Coastal Cable Corridor Assessment* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/EN010051-000256-6.6.4%20ES%20Chapter%206%20Appendix%20D.pdf

Royal Haskoning (2016a). *York Potash Harbour Facilities Order – Environmental Statement Section 7 Marine Sediment and Water Quality* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030002/TR030002-000442-ES%20Section%207%20Marine%20sediment%20and%20water%20quality.pdf

Royal Haskoning (2016b). *York Potash Harbour Facilities Order – Environmental Statement Appendix 7.2 Sediment Quality Data* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030002/TR030002-000472-Section%207%20App%207.2%20Sediment%20quality%20data.pdf

Royal Haskoning (2016c). *York Potash Harbour Facilities Order – Environmental Statement Chapter 16 Commercial Navigation* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030002/TR030002-000451-ES%20Section%2016%20Commercial%20navigation.pdf

Royal Haskoning (2016d). *York Potash Harbour Facilities Order – Environmental Statement Section 5 Hydrodynamics and Sedimentary Regime* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR030002/TR030002-000440-ES%20Section%205%20Hydrodynamic%20and%20sedimentary%20regime.pdf

Stockton-on-Tees Borough Council (2011). *Preliminary Flood Risk Assessment* [online]. Available at: https://www.stockton.gov.uk/media/5452/preliminary-flood-risk-assessment.pdf (and Stockton-on-Tees Borough Council (2017). *Preliminary Flood Risk Assessment addendum* [online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698472/PFRA_Stockton-on-Tees_Borough_Council_2017.pdf)

Stockton-on-Tees Borough Council (2019). *Stockton-on-Tees Borough Council Local Plan* [Online]. Available at: https://www.stockton.gov.uk/media/1585775/localplanmainreportcontents.pdf

The Planning Inspectorate (2018). *Advice Note 9: Using the Rochdale Envelope* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

The Tees Valley Authorities (2015). *Local Standards for Sustainable Drainage* [Online]. Available at: https://www.hartlepool.gov.uk/downloads/file/2472/tees_valley_authorities_local_standards_for_suitable_drainage

UKHO (2006). *Admiralty Tide Tables Vol 1 – United Kingdom and Ireland.* Taunton: UK Hydrographic Office.