VikingCCS

Viking CCS pipeline

Preliminary Environmental Information Report Volume II

Main PEIR

Applicant: Chrysoar Production (U.K.) Limited,
a Harbour Energy Company
PINS Reference: EN070008
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Harbour Energy | AECOM

Chapter 11

Water Environment

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11.1 Introduction

11.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the findings of a preliminary 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 Viking CCS Pipeline (hereafter referred to as 'the Project'), as described in *Chapter 3: The Viking CSS Pipeline*.

11.1.2 The scope of this preliminary assessment includes water quality, water resources, hydromorphology, flood risk and drainage.

11.1.3 The preliminary impact assessment has been undertaken in accordance with the following broad stages (as also described in *Chapter 5: PEIR Assessment Methodology*).

- reviewing the planning and legislative context;
- establishing the baseline context;
- appraisal of potential impacts and determining the classification and predicting the significance of effects (including an assessment of the confidence in prediction);
- identification of potential mitigation and enhancement measures; and
- identification of likely remaining residual effects.

11.1.4 Environmental effects have been preliminarily assessed for the construction, operational and decommissioning phases of the Project. 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.

11.1.5 The gathering of environmental information, and analysis of this information against the Project, will continue throughout the pre-application phase of the Project. The full EIA will be reported in an Environmental Statement (ES), containing the information as stated in Regulation 14 of the Infrastructure Planning (EIA) Regulations 2017 and the final ES will be submitted at the same time as the application for the Development Consent Order (DCO).

11.1.6 This chapter is supported by information presented in the following PEIR chapters, figures and appendices:

- *Chapter 3: The Viking CCS Pipeline;*
- *Chapter 6: Ecology and Biodiversity;*
- *Chapter 9: Geology and Hydrogeology*, which deals with impacts to groundwater;
- *PEIR Volume IV - Appendix 11.1: Water Environment Baseline Supporting Information;*
- *PEIR Volume IV - Appendix 11.2: Site Visit Technical Note;*
- *PEIR Volume IV - Appendix 11.3: Preliminary WFD Assessment;* and
- *PEIR Volume IV - Appendix 11.4: Preliminary Flood Risk Assessment.*

11.2 Legislation, Policy and Guidance

Legislative Framework

11.2.1 The potential impact of the Project on the water environment is considered in relation to the following national legislation:

- Environment Act 2021 (Ref 11-1);
- Water Act 2014 (Ref 11-2);
- Flood and Water Management Act, 2010 (Ref 11-3);
- Environment Act 1995 (Ref 11-4);
- Land Drainage Act 1991 (Ref 11-5);
- Water Resources Act 1991 (Ref 11-6);
- Environmental Protection Act 1990 (Ref 11-7);
- Salmon and Freshwater Fisheries Act 1975 (Ref 11-8);
- Control of Pollution Act 1974 (Ref 11-9);
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 11-10);
- Environmental Permitting (England and Wales) Regulations 2016 (Ref 11-11);
- Environmental Damage (Prevention and Remediation) Regulations 2015 (Ref 11-12);
- Flood Risk Regulations 2009 (Ref 11-13);
- Eels (England and Wales) Regulations 2009 (Ref 11-14);
- Groundwater (England and Wales) Regulations 2009 (Ref 11-15)
- Control of Substances Hazardous to Health Regulations 2002 (Ref 11-16); and
- Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref 11-17).

National Policy Guidance

National Policy Statements

11.2.2 National Policy Statements (NPS) for energy infrastructure were designated under the Planning Act 2008. The Overarching NPS for Energy (EN-1) (Ref 11-18) published by The Department of Energy and Climate Change (now the Department for Business, Energy and Industrial Strategy) in July 2011.

11.2.3 A revised (draft) Overarching NPS for Energy was published in September 2021 (Ref 11-61), is currently going through parliamentary review. The relevant sections to this assessment with the main section being:

- Section 4.11: Pollution Control and Other Environmental Regulatory Regimes;
- Section 4.9: Climate Change Adaptation. This sector advises that the resilience of a project to climate change should be assessed in the ES and that future increased risk of flooding would be covered in a Flood Risk Assessment (FRA). The Preliminary FRA for the Project is included in *PEIR Volume IV - Appendix 11.4* and summarised within this chapter.

- Section 5.16: Water Quality and Resources, states 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 5.16.2);
- Paragraph 5.16.5 provides advice on what the ES should describe in the baseline; and
- Paragraphs 5.16.5–5.16.10 outline the decision-making process with regards to water pollution, and more weight is attributed to any impacts that would have an adverse effect on the achievement of environmental objectives established under the WFD. Within paragraphs 5.16.11-5.15.13 it is stated that whether mitigation measures over and above those included within an application are needed should be considered by the Secretary of State.

11.2.4 The NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Ref 11-19) is also relevant and was published in July 2011. As of September 2021, the updated draft report has been made available. This describes the need for assessment of the water environment and potential mitigation measures.

National Planning Policy Framework

11.2.5 The National Planning Policy Framework (NPPF) (Ref 11-20), published by the Ministry of Housing, Communities and Local Government was updated in July 2021, 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 several 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);
- Planning policies and decisions should contribute to and enhance the natural and local 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 air and water quality, taking into account relevant information such as river basin management plans (paragraph 174e).

11.2.6 Paragraphs 159 to 169, states that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.” The paragraphs also state when an FRA is required and sets out the basis of the sequential and exception test.

11.2.7 Paragraph 174 (‘Conserving and enhancing the natural environment’) includes a statement that planning decisions should contribute to enhance the natural and local environment by preventing development that produces unacceptable levels of water pollution.

National Planning Practice Guidance

11.2.8 The Planning Practice Guidance (PPG) Water supply, wastewater and water quality (last updated July 2021) (Ref 11-63), 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.

11.2.9 The NPPF and the Flood Risk and Coastal Change NPPG 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'

11.2.10 In 2018, Defra published the 25 Year Environment Plan (updated October 2021) (Ref 11-21) 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.

11.2.11 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 Water Framework Directive (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 Governments Water Strategy for England

11.2.12 The Government's Future Water Strategy (Ref 11-22) published in 2008 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.

11.2.13 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

11.2.14 Planning policy encourages developers to include sustainable (urban) 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.

11.2.15 Defra published guidance on the use, design and construction of SuDS in 'Non-statutory technical standards for SuDS (Ref 11-23).

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

- C753 The SuDS Manual (Ref 11-24);
- DMRB HA 103/06 (Ref 11-25); and
- DMRB CG 501 Design of Highway Drainage Systems (Ref 11-26).

River Basin Management Plan

11.2.17 At a regional level, water management is coordinated in England through eight River Basin Management Plans (RBMPs). 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. Their review and update of the current RBMPs is underway. The consultation of the draft RBMPs ran from 22 October 2021 to 22 April 2022. 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 Louth Grimsby and Ancholme Management Catchment within the Humber River Basin district and Witham Management Catchment within the Anglian River Basin district.

The Building Regulations 2010 Approved Document Part H: Drainage and Waste Disposal

11.2.18 The Building and Regulations 2010 Approved Document Part H: Drainage and Waste Disposal, published by the Ministry of Housing, Communities & Local Government (Ref 11-27), offers guidance on drainage including foul and surface water and rainwater, and sanitary waste disposal, including pipes, manholes and inspection chambers and is relevant to this assessment with the main sections being:

- Sections 2: Foul Drainage; and
- Sections 3: Surface water drainage.

Local Planning Policies

North East Lincolnshire Local Plan (March 2018)

11.2.19 The northern extent of the Project lies within the administrative area of North East Lincolnshire Council (NELC). NELC has published a Local Plan (Ref 11-28) 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:

- *Strategic Objective SO2 – Climate Change* - Address the causes and effects of climate change by promoting development that minimises natural resource and energy use; reduces waste and encourages recycling; reduces pollution; brings about opportunities for sustainable transport use; responds to increasing flood risk; and incorporates sustainable construction practices. Promote appropriate distribution of development and the role of green infrastructure in mitigating aspects of flood risk. Recognise the increased stress on habitats and species that climate change causes.
- *Strategic Objective SO6 - Built, historic and natural environment* - Ensure that the development needs of the Borough are met in a way that safeguards and enhances the quality of the built, historic and natural environment and ensures that the development needs are met in a way that minimises harm to them. Direct development to locations of least environmental value and proactively manage development to deliver net gains in biodiversity overall. Encourage the use of brownfield land.
- *Policy 6 – Infrastructur*e - Contributions towards infrastructure will be based on the demands created by the specific development. This includes provision of new, or

enhancement of the existing infrastructure and facilities, including, but not necessarily limited to drainage and surface water management (including SuDS maintenance where appropriate).

- *Policy 33 – Flood risk* – In order to minimise flood risk impacts and mitigate against the likely effects of climate change, development proposals should demonstrate that:
  - A. where appropriate, a site-specific flood risk assessment has been undertaken, which takes account of the best available information related to all potential forms of flooding;
  - B. there is no unacceptable increased risk of flooding to the development site or to existing properties;
  - C. the development will be safe during its lifetime;
  - D. Sustainable Drainage Systems (SuDS) have been incorporated into the development unless their use has been deemed inappropriate;
  - E. opportunities to provide natural flood management and mitigation through green infrastructure have been assessed and justified, based upon sound evidence, and, where appropriate, incorporated, particularly in combination with delivery of other aspects of green infrastructure in an integrated approach across the site;
  - F. arrangements for the adoption, maintenance and management of any mitigation measures have been established and the necessary agreements are in place;
- *Policy 34 – Water management*. Development proposals that have the potential to impact on surface and ground water should consider the objectives and programme of measures set out in the Humber River Basin Management Plan. Development proposals should consider how water will be used on the site and ensure that appropriate methods for management are incorporated into the design. Development proposals should demonstrate that:
  - A. adequate and sustainable water supplies are available to support the development proposed;
  - B. provisions are made for the efficient use of water, including its reuse and recycling. Proposals for residential development will be expected to demonstrate that a water efficiency standard of 110 litres per person per day can be achieved; and,
  - C. adequate foul water treatment already exists or can be provided in time to serve the development. Appropriate and sustainable sewerage systems should be provided for the collection and treatment of foul and surface water to ensure new development does not overload the existing sewerage infrastructure, minimising the need to discharge water into sewers, particularly combined sewers.
- Where development is proposed within a Source Protection Zone (SPZ), the potential for any risk to groundwater resources and groundwater quality must be assessed and it must be demonstrated that these would be protected throughout the construction and operational phase of development.

East Lindsey Local Plan (July 2018)

11.2.1 The southern extent of the Project lies within the administrative area of East Lindsey Council (ELC). ELC has published a Local Plan (Ref 11-29) which was adopted in July 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 10 (SP10) – Design* - Development around water sources will only be supported if it contains adequate protection preventing pollution from entering into the water source.
- *Policy 16 (SP 16) – Inland Flood Risk*: The Council will not support development in identified flood storage areas.
  - All new development must show how it proposes to provide adequate surface water disposal, including avoiding impacting on surface water flow routes or ordinary watercourses. The Council will expect this to involve the use of Sustainable Urban Drainage Systems along with other appropriate design features, including the retention of any existing water features on a site.
  - Surface water connections to the combined or surface water system should only be made in exceptional circumstances where it can be demonstrated that there are no feasible alternatives and where there is no detriment to existing users.
  - The Council will support development that demonstrates an integrated approach to sustainable drainage that has positive gains to the natural environment.
  - All new development must show how it can provide adequate foul water treatment and disposal or that it can be provided in time to serve the development.
- *Policy 24 (SP24) - Biodiversity and Geodiversity* - Development proposals should seek to protect and enhance the biodiversity and geodiversity value of land and buildings and minimise fragmentation and maximise opportunities for connection between natural habitats.

West Lindsey Local Plan (July 2018)

11.2.2 The local development plan for this area is found within the Central Lincolnshire Local Plan (adopted 2017) (Ref 11-30). The Central Lincolnshire Local Plan sets out the vision and overall development strategy for the Council's area and how it will be achieved for the period 2012 until 2036. The following policies of the local plan are of relevance to the water environment:

11.2.3 *Policy LP1: A Presumption in Favour of Sustainable Development*:

- The Central Lincolnshire districts of West Lindsey, Lincoln City and North Kesteven will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework. The districts will always work proactively with applicants to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social and environmental conditions in Central Lincolnshire.

11.2.4 *Policy LP14: Managing Water Resources and Flood Risk*:

- Through appropriate consultation and option appraisal, development proposals should demonstrate:
  - That they are informed by and take account of the best available information from all sources of flood risk and by site specific flood risk assessments where appropriate;
  - That there is no unacceptable increased risk of flooding to the development site or to existing properties;
  - That the development will be safe during its lifetime, does not affect the integrity of existing flood defences and any necessary flood mitigation measures have been agreed with the relevant bodies;

- That the adoption, ongoing maintenance and management of any mitigation measures have been considered and any necessary agreements are in place;
- How proposals have taken a positive approach to reducing overall flood risk and have considered the potential to contribute towards solutions for the wider area; and
- That they have incorporated Sustainable Drainage Systems (SuDS) into the proposals unless they can be shown to be impractical.

11.2.5 *Policy LP18: Climate Change and Low Carbon Living*:

- Reducing demand: by taking account of landform, location, layout, building orientation, design, massing and landscaping, development should enable occupants to minimise their energy and water consumption, minimise their need to travel and, where travel is necessary, to maximise opportunities for sustainable modes of travel;
- Resource efficiency: development should (a) take opportunities to use sustainable materials in the construction process, avoiding products with a high embodied energy content; and (b) minimise construction waste;
- Energy production: development could provide site based decentralised or renewable energy infrastructure. The infrastructure should be assimilated into the proposal through careful consideration of design. Where the infrastructure may not be inconspicuous, the impact will be considered against the contribution it will make;
- Carbon off-setting: development could provide extensive, well designed, multi-functional woodland (and, if possible, include a management plan for the long term management of the wood resource which is produced), fenland or grassland. The Central Lincolnshire Biodiversity Opportunity Mapping (or subsequent relevant document) should be used to guide the most suitable habitat in a particular area.

11.2.6 Flood risk has also been assessed in line with the National Planning Policy Framework (NPPF), latest update July 2021, and relevant Planning Practice Guidance – Flood risk and coastal change (PPG-FRCC), latest update August 2022.

Guidance

11.2.7 Embedded Mitigation and Additional Mitigation will be taken into account with reference to best practice (e.g. Guidance on Pollution Prevention and reports prepared by the Construction Industries Research and Information Association (CIRIA)) and the requirements of local planning policy and any supplementary guidance.

11.3 Scoping Opinion and Consultation

11.3.1 A scoping exercise was undertaken in early 2022 to establish the content of the historic environment assessment and the approach and methods to be followed.

11.3.2 The Scoping Report (Ref 11-31) records the findings of the scoping exercise and details the technical guidance, standards, best practice, and criteria to be applied in the assessment to identify and evaluate the likely significant effects of the Project on the water environment.

11.3.3 Following receipt of the Scoping Opinion (*PEIR Volume IV - Appendix 5-2*), the following requirements have been identified by the Planning Inspectorate and a summary of the comments relevant to this assessment are outlined in **Table 11-1,** along with indications of how they have been addressed within the ongoing water environment assessment.

Table 11-1: Summary of the EIA Scoping Opinion in relation to the Water Environment

Section Reference to Scoping Opinion	Applicant's proposed matter	Planning Inspectorate / prescribed consultee comments	Response
Planning Inspectorate Paragraph 11.8.10, Table 11-13	Hydraulic Modelling (pipeline component)	The Inspectorate has considered the information provided and considers that Hydraulic Modelling can be scoped out of the assessment in relation to the buried pipeline. It is noted that assessment of flood risk in relation to the other components of the Proposed Development is to be included in the ES. The approach to this assessment should be discussed with the relevant stakeholders and agreement sought on the methodology applied.	The current approach to assess flood risk is based upon the existing design, however the approach will be revisited through the ES stage to ensure that flood risk is adequately addressed following stakeholder engagement.
Planning Inspectorate Paragraph 11.8.10, Table 11-13	Foul drainage and Potable water Supplies	The Inspectorate considers that matters relating to Foul Drainage and Potable Water supplies should be assessed in the ES, where significant effects may arise as a result of the Proposed Development. The Inspectorate advises that advice is sought from the relevant consultees, in particular Anglian Water, to establish the likely risks in these regards.	These were initially scoped out as the risk from foul drainage / potable supply may be very low if there are few permanent staff on site in the long term. However this has been scoped back into the chapter to ensure that the foul drainage / water demand will not result in any significant effects to surface water features or resources. The supply/demand for these will be identified and addressed within the drainage design, following stakeholder engagement with Anglian water. The Water Environment ES chapter will include an assessment of whether this results in any significant effects.
Planning Inspectorate	Potential effects	In addition to the identified matters Proposed to be assessed, the ES should include an assessment of the likely significant effects of artesian groundwater	The assessment of effects to groundwater, including unique groundwater features, is presented in *Chapter 9: Geology and*

Section Reference to Scoping Opinion	Applicant's proposed matter	Planning Inspectorate / prescribed consultee comments	Response
Section 11.6, Table 11-13		conditions, and the presence of unique groundwater features (e.g. blow wells, chalk streams and springs), where these could occur.	*Hydrogeology*. Where these groundwater features may result in a significant effects to surface water features these have been considered provisionally, including dewatering.
Planning Inspectorate Paragraph 11.2.15	Presence of Ordinary Watercourses	The Scoping Report states that there are likely to be over 100 ordinary watercourses within 500m of the scoping boundary, including streams, drainage dykes, field drains and artificial waterbodies. The ES should provide information on potential likely significant effects on or associated with ordinary watercourses, in particular where they are hydrologically linked to main rivers.	An exercise has been undertaken to identify all watercourses within the Study Area, including Ordinary watercourses. Potential likely significant effects to ordinary watercourses have been identified and are included within this chapter. Stakeholder engagement with the Environment Agency (EA), local drainage boards and Lead Local Flood Authorities (LFAs) is ongoing to better confirm the importance associated with ordinary watercourses.
Environment Agency	Flood Risk and hydraulic modelling	We support that a Flood Risk Assessment (FRA) will be undertaken to support the application. The FRA should follow relevant guidance in national planning policy. The FRA should consider all sources of flooding, which may include tidal, fluvial, ground water, drainage systems, reservoirs, canals and ordinary watercourses. The FRA should demonstrate that the proposal will be safe for the lifetime of the development, without increasing risk elsewhere and where possible reducing flood risk overall. The FRA should also provide evidence that appropriate	A preliminary FRA (*PEIR Volume IV Appendix 11-4*) has been developed that has undertaken an initial assessment of all sources of flooding to the site. This will be developed to an assessment of the potential effects at the full impact assessment stage when detail on the use of these assets are finalised.

Section Reference to Scoping Opinion	Applicant's proposed matter	Planning Inspectorate / prescribed consultee comments	Response
		mitigation measures including flood resilience techniques have been incorporated into the development. Paragraph 11.5.12 indicates the project is likely to be defined as Essential Infrastructure. Therefore, we recommend that all critical infrastructures should be located above the flood depths expected for the 0.1% (1 in 1000) scenario including climate change, appropriate to the lifetime of development. Hydraulic Modelling can be scoped out of the assessment in relation to the buried pipeline.	
	Foul drainage, potable water supplies and abstraction licences	Matters relating to Foul Drainage and Potable Water supplies should be assessed in the ES, where significant effects may arise as a result of the Project. The Inspectorate advises that advice is sought from the relevant consultees, in particular Anglian Water, to establish the likely risks in these regards. The requirement for an abstraction licence applies unless the activity is exempt under The Water Abstraction and Impounding (Exemptions) Regulations 2017. If the total programme exceeds 6 months then an abstraction licence will be required.	This chapter of the PEIR provisionally assessed impacts relating to foul drainage and potable water supplies, including use of existing assets. This will be developed at the full impact assessment stage when detail on the use of these assets are finalised.
	Covenham reservoir	The project should consider the potential impacts on Covenham with Anglian Water as well as with the Environment Agency.	Covenham reservoir has been considered within this chapter as a potential receptor.

Section Reference to Scoping Opinion	Applicant's proposed matter	Planning Inspectorate / prescribed consultee comments	Response
	Water Quality Data	Currently online Open WIMS dataset does not include all groundwater or third-party data. Additional data are available on request. Data may also be subject to change after publication.	The Open WIMS dataset has been reviewed for water quality data, and data has been obtained from the EA following consultation. This information has informed the baseline of this chapter to inform the preliminary impact assessment.
	Watercourse crossings	The EA support the proposal that non-intrusive drilling techniques will be used for main river crossings. Non-intrusive crossings are welcomed at all ordinary watercourses.	The preliminary impact assessment is based on an initial crossing schedule, which is subject to further refinement. This chapter recommends non-intrusive drilling techniques are applied for most Main River Crossings and WFD waterbodies (unless justified), and large IDB watercourses, and has incorporated these recommendations into the residual effects.
	FRAP	Please note that under the Environmental Permitting (England and Wales) Regulations 2016, permission must be obtained from the Environment Agency for any proposed activities which will take place: • in, over, under or within 8 metres of a main river (16 metres if tidal) • on or within 8 metres of a flood defence structure or culvert (16 metres if tidal) • on or within 16 metres of a sea defence • within 16 metres of any main river, flood defence (including a remote defence) or culvert for quarrying or excavation • in a flood plain more than 8 metres from the	The exact locations of crossings and methodologies are being developed. Where Flood Risk Activity Permits (FRAPs) are required these will be noted within the full ES.

Section Reference to Scoping Opinion	Applicant's proposed matter	Planning Inspectorate / prescribed consultee comments	Response
		riverbank, culvert, or flood defence structure (16 metres if tidal) if planning permission has not already been granted for the works	
North East Lindsey Drainage Board	IDB Consents	The prior written consent of the Board is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion. The prior written consent of the Board is required for any proposed temporary or permanent works or structures in, under, over or within the byelaw distance of 9m from the top of the bank of a Board maintained watercourse. All drainage routes through the Sites should be maintained both during the works and after completion of the works. Provisions should be made to ensure that upstream and downstream riparian owners and those areas that are presently served by any drainage routes passing through or adjacent to the sites are not adversely affected by the development.	Initial consultation has taken place with Internal Drainage Boards (IDB) to identify all IDB waterbodies. These are identified within this chapter and provisionally assessed for impacts. Further consultation and stakeholder feedback to this chapter is welcomed to inform the ES.
	Ordinary Watercourses and agricultural drainage	The ES should provide information on potential likely significant effects on or associated with ordinary watercourses, in particular where they are hydrologically linked to main rivers. The ES should also explain whether significant effects could arise from impacts to existing agricultural drainage, including effects on habitats	This chapter has identified all mapped drainage features and has provisionally assessed the effects to Ordinary Watercourses and agricultural drainage, including hydrological changes and water quality. This will be further developed at the full impact assessment stage.

Section Reference to Scoping Opinion	Applicant's proposed matter	Planning Inspectorate / prescribed consultee comments	Response
		outside of agricultural land relating to hydrological changes or degradation of water quality.	
North Lincolnshire Council	SuDS and surface water drains	Surface water flood risk compliance needs to be mitigated against and the need to comply with SuDS requirements. The local internal drainage boards will need to be consulted, including NLC as the Lead Local Flood Authority where ordinary watercourse consents are required for alterations/connections to the local watercourse network.	Sustainability Urban Drainage Systems (SuDS) are implemented in the provisional outline design for above ground infrastructure, this will continue to be updated and refined through the Project design.

Consultation

11.3.4 Consultation with relevant parties to discuss impacts, mitigation and possible enhancement opportunities is ongoing. Key stakeholders consulted include:

- Environment Agency;
- Lead Local Flood Authorities (LLFA);
- Internal Drainage Boards (IDB);
- Natural England;
- Canal & Rivers Trust; and
- Anglian Water.

11.3.5 The details of consultation to date is contained in *Chapter 4: Consultation*.

11.4 Assessment Method

11.4.1 This section provides a description of the tools and techniques used to undertake the preliminary water environment impact assessment. It also outlines the significance criteria used with reference to any relevant legislation and/or guidance.

11.4.2 The preliminary assessment of impacts will be undertaken using a source-pathway-receptor model:

- *Source* – proposed Project change (e.g. release of chemical pollutant, physical impact to the form of a waterbody, or change in flood risk etc);
- *Pathway* – the method or route by which the source could affect the receptor; and
- *Receptor* – the feature that may be affected by the outcomes of the Project.

11.4.3 The below policy and guidance is in addition to those listed within *Chapter 5: PEIR Assessment Methodology*.

Identification of Receptors

11.4.4 All the receptor categories identified below have been preliminarily assessed within the zones of influence outlined in Section 11.5. The potential receptors associated with the Project have been identified to include:

- Surface watercourses (including WFD designated, Main Rivers, and Ordinary Watercourse (including drains);
- Standing waterbodies (i.e. ponds);
- Coastal and transitional waterbodies;
- Water dependent designated and non-designated sites;
- Water resources, including reservoirs, water abstractions, foul drainage and water supply; and
- Flood risk receptors (including people, property and infrastructure).

11.4.5 The importance and / or where appropriate, the sensitivity of the receptors will be defined during the PEIR and ES using the criteria outlined in **Table 11-2**. The potential impacts to groundwater receptors, including aquifers and artesian waterbodies will be covered within *Chapter 9: Geology and Hydrogeology*.

Significance Criteria

11.4.6 The preliminary assessment broadly follows the guidance and methodologies set out in the DMRB Sustainability and Environment; LA113 Road Drainage and the Water Environment (Ref 11-32). Whilst the DMRB is not specific to the assessment of a CO_2 pipeline, it provides an accepted approach to the assessment of development impacts for linear projects.

11.4.7 Following a review of the baseline information, likely 'impacts' on the environment (i.e. the changes resulting from an action) and their 'effects' (i.e. the consequences of those impacts) will be identified.

11.4.8 The duration of effects have been determined using a scale of short term, medium term or long term:

- *Short term*: Project activities that are predicted to last only for a limited period (up to 6 months);
- *Medium term*: Impacts from Project activities that will last more than 6 months, and whose effects may continue after the completion of the project activity but will in total be less than 2 years.
- *Long term*: Impacts from Project activities whose effects will occur longer than 2 years.

11.4.9 Following the identification of an effect, the 'importance' of the receiving receptor will be defined.

11.4.10 The importance of a hydrological receptor is largely determined by its quality, rarity, and scale, see **Table 11-2**. Value is used preferentially for the water environment as low value receptors can sometimes be the most sensitive to change and this could lead to an inappropriately large effect.

11.4.11 The significance of environmental effect is typically a function of the value/importance of a receptor and the magnitude of an impact. The methodology to characterise the impacts, and to determine the significance of effects is contained in *Chapter 5: PEIR Assessment Methodology*.

11.4.12 A precautionary approach to the preliminary assessment has been undertaken to ensure that where uncertainty currently lies with any assessment work, a reasonable worst-case assessment has been made to the identification of a particular effect's significance. A full assessment of the significance of environmental effects, detailing the specific magnitude of impact scores with embedded/standard mitigation, and then with additional mitigation, will be undertaken within the ES.

Table 11-2: Importance (and sensitivity) Criteria[1]

Importance	General criteria	Surface Water	Hydromorphology[2]	Flood Risk
Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or of international importance.	EC Designated Salmonid / Cyprinid fishery; Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 ≥ 1.0m^3/s; site protected / designated under EC or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site. Critical social or economic uses (e.g., public water supply and navigation).	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river and lake type.	Essential Infrastructure or highly vulnerable development.
High	The receptor has low ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.	Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 < 1.0m3/s; Major Cyprinid Fishery; Species protected under EC or UK habitat legislation. Critical social or economic uses (e.g., water supply and navigation). Important social or economic uses such as water supply, navigation or mineral extraction.	Conforms closely to natural, unaltered state and will often exhibit well-developed and diverse geomorphic forms and processes characteristic of river and lake type. Deviates from natural conditions due to direct and/or indirect channel, floodplain, bank modifications and/or catchment development pressures.	More vulnerable development.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some	Watercourse detailed in the Digital River Network but not having a WFD classification as shown in a RBMP. May be designated as a local wildlife site (LWS) and support a small /	Shows signs of previous alteration and/or minor flow / water level regulation but still retains some natural features or may be recovering towards conditions indicative of the higher category.	Less vulnerable development.

Importance	General criteria	Surface Water	Hydromorphology[2]	Flood Risk
	environmental value or is of regional importance.	limited population of protected species. Limited social or economic uses.		
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.	Surface water sewer, agricultural drainage ditch; non-aquifer WFD Class 'Poor' or undesignated. Low aquatic fauna and flora biodiversity and no protected species. Minimal economic or social uses.	Substantially modified by past land use, previous engineering works or flow / water level regulation. Watercourses likely to possess an artificial cross-sector (e.g., trapezoidal) and will probably be deficient in bedforms and bankside vegetation. Watercourses may also 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 will fall into this category.	Water compatible development.
Negligible	The receptor is resistant to change and is of little environmental value	Not applicable.	Not applicable.	Not applicable.

Note 1: Professional judgement is applied when assigning an importance category to all water features. The WFD status of a watercourse is not an overriding factor, and, in many instances, it may be appropriate to upgrade a watercourse which is currently at poor or moderate status to a category of higher importance to reflect its overall value in terms of other attributes and WFD targets for the watercourse. Likewise, a watercourse may be below Good Ecological Status, this does not mean that a poorer quality discharge can be emitted. 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 waterbody 'Reach Conservation Status' presently being adopted for a major infrastructure project (and developed originally by Atkins) and developed from Environment Agency conservation status guidance as LA113 does not provide any criteria for morphology.

* *As defined in IV Table 2 of the Planning Practice Guidance - Flood Risk and Coastal Change (March 2014), UK Government*

Water Framework Directive Assessment

11.4.13 A preliminary WFD assessment has been prepared for the Project. This is presented within *PEIR Volume IV - Appendix 11-3*. The overarching aim of the WFD is to protect and enhance watercourses.

11.4.14 There is no fixed method for WFD assessment: the nature of the water environment and the breadth of the legislation mean that assessments are tailored on a case-by-case basis. However, a stepwise approach consisting of Screening, Scoping, and Impact Assessment is generally followed to: (a) rationalise the levels of WFD assessment and impact mitigation that are required; and (b) verify that proposals meet the requirements of the WFD.

Stage 1: Screening

11.4.15 Screening identifies the zone of influence of a project, and if proposed activities pose a risk to the water environment. It is used to identify if there are activities that do not require further consideration for WFD objectives, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline.

Stage 2: Scoping

11.4.16 Scoping is used to identify any potential impacts of the proposed activities to specific WFD receptors and their water quality elements. This involves review of WFD impact pathways, shortlisting which WFD water bodies and quality elements could or could not be affected by proposed activities, and collecting baseline information from the relevant RBMP on the status and objectives for each water body.

Stage 3: Impact Assessment

11.4.17 This involves rationalised assessment of water bodies and quality elements that could be affected by proposed activities, in order to identify any areas of WFD non-compliance. Proposed activities are reviewed in terms of both positive and negative impacts, and the baseline mitigation measures, enhancements, and contributions to the WFD objectives described in the RBMP. Any proposed activities with potentially deleterious impacts are reviewed simultaneously with their corresponding mitigation proposals, to determine a net effect on WFD objectives.

Flood Risk Assessment (FRA)

11.4.18 A preliminary site-specific FRA has been prepared for the Project. This is presented within *PEIR Volume - Appendix 11-4*. The Preliminary FRA has been prepared in accordance with the requirements of the NPPF (Ref 11-20) and the accompanying NPPG, regional and local policy, and considering future climate change. It includes a full review of the flood sources to the Project, however at this stage in the project an assessment of effects is not possible, and that will be undertaken at the ES stage of the project. The FRA (*PEIR Volume IV - Appendix 11-4*) also demonstrates how the Sequential Test and Exception Test are being considered.

11.4.19 Assumptions and limitations relating to flood risk are outlined in the FRA (*PEIR Volume IV - Appendix 11-4*).

11.5 Baseline Environment and Study Area

11.5.1 The local hydrological area of influence is defined by the potential for direct impacts on surface water resource and flood risk receptors (refer to Section 11.6) from the construction, operation and decommissioning of the Project.

11.5.2 The local hydrological zone of influence (i.e. Study Area) is considered to be a 500m buffer each side of the Draft Order Limits. It is considered that this Study Area will allow all

waterbodies that may be impacted to be identified. However, impacts to surface waterbodies and flood risk receptors could result in indirect impacts further upstream and downstream, or associated waterbodies and receptors downstream (including people, property and infrastructure) of the local hydrological area of influence. Attributes of any watercourses identified will be considered downstream by a distance depending on the zone within which adverse impacts may occur (which is usually a few kilometres). In terms of flood risk, the Study Area takes into consideration the crossing of Main Rivers and Ordinary Watercourses including the crossing of associated floodplains which may be physically impacted. The extent of the Study Area will be reviewed during the development of the ES and extended if deemed necessary.

11.5.3 For the Project, it is assumed that indirect impacts associated with the Project will be negligible to surface water resource receptors (excluding people, property and infrastructure) located over 1 km away from the Draft Order Limits. Therefore, only surface water resource receptors (excluding people, property and infrastructure) within the 1 km buffer will be assessed. The surface water features within the Study Area are shown on **Figure 11-1**.

11.5.4 Groundwater is included in the baseline; however, this topic is considered further in *Chapter 9: Geology and Hydrogeology*. A buffer zone of 500m extending from the Draft Order Limits is considered an appropriate Study Area for the assessment of hydrogeological effects.

11.5.5 Due to the large spatial nature of the Project, the baseline has subsequently been split into the route sectors based on key road intersections:

- Section 1 - Rosper Road (Immingham) to A180;
- Section 2 - A180 to A46;
- Section 3 - A46 to Pear Tree Lane);
- Section 4 - Pear Tree Lane to Manby Middlegate (B1200); and
- Section 5 - Manby Middlegate (B1200) to Theddlethorpe and down to MLWS.

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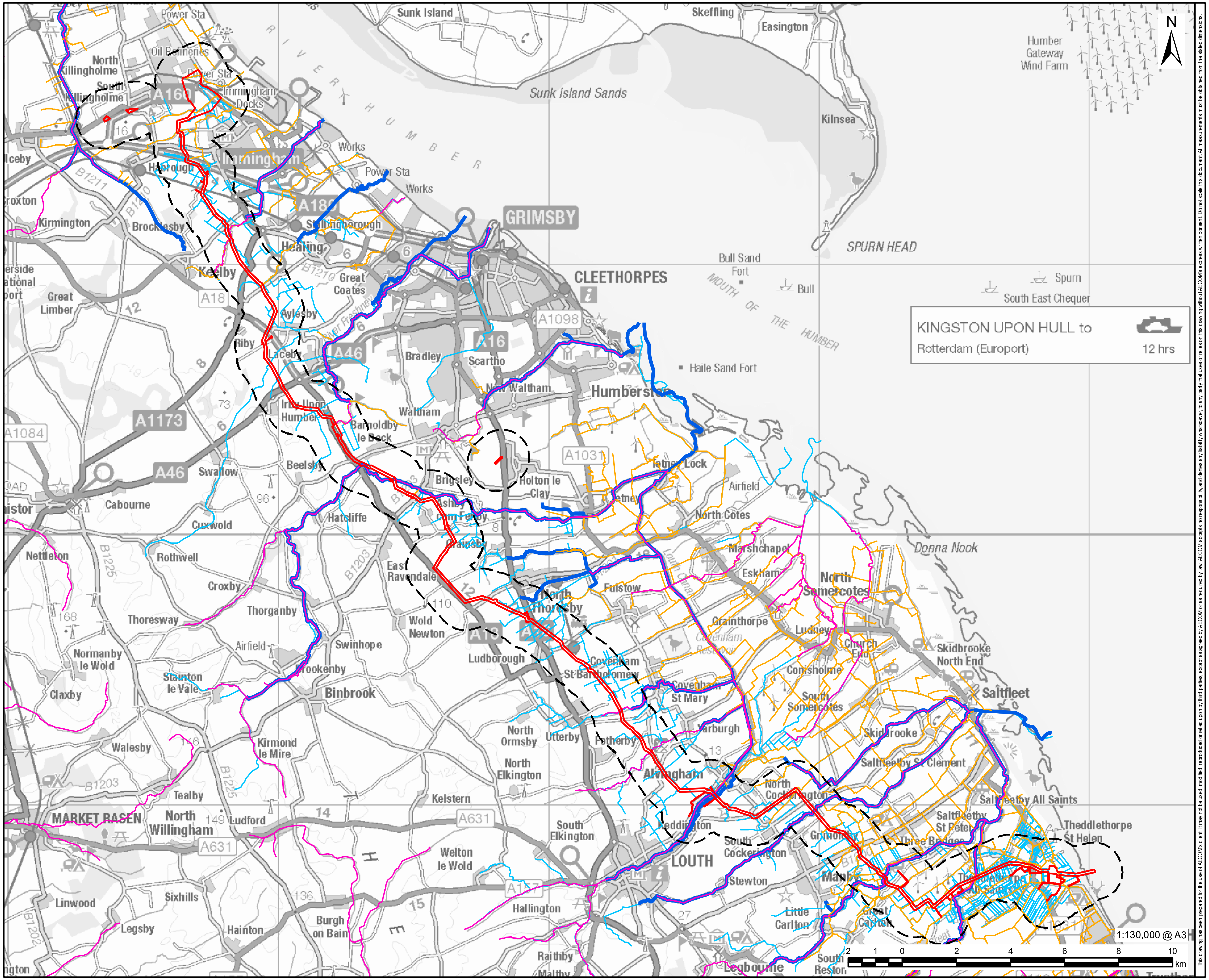

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- 1km Study Area
- EA Main River
- IDB Maintained Watercourse
- WFD River, Canal and Surface Water Transfer Water Bodies
- All Other Identified Waterbodies - Working

NOTES:

FIGURE TITLE

Figure 11-1
Surface Water Features

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221102_PEIR_11-1

Data Sources

11.5.6 Desk based research has been undertaken to identify the waterbodies within and adjacent to the Project, 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.

11.5.7 The baseline information for this chapter has been derived from:

- Online Ordnance Survey (OS) maps viewed to identify any surface water bodies within 1 km of the Scheme as well as general topography and land uses (Ref 11-33);
- Land Use Mapping (Ref 11-34);
- British Geological Survey (BGS) online Borehole and Geology Mapping (Ref 11-35);
- Cranfield Soilscapes Map (Ref 11-36);
- National Rivers Flow Archive website (Ref 11-37);
- Meteorological Office website for general climate information for the Study Area (Ref 11-38);
- Defra's Multi-agency geographical information for the countryside website (MAGIC) map (Ref 11-39);
- Environment Agency Catchment Data Explorer tool (Ref 11-40);
- Environment Agency Online Interactive Maps (Ref 11-41, Ref 11-42) and:
  - Flood map for planning (rivers and sea);
  - Risk of flooding from surface water;
  - Risk of flooding from reservoirs; and
  - Flood warning areas and risk.
- Environment Agency Main River Network Map (Ref 11-43);
- Information available from the Natural England Designated Sites website (Ref 11-44);
- North and North East Lincolnshire Strategic Flood Risk Assessment 2011 (Ref 11-45); and
- East Lindsey Strategic Flood Risk Assessment (Ref 11-46).

11.5.8 A more detailed baseline study will be undertaken to establish the wider conditions of the environmental features with relevance to the water environment for the EIA. Information will be drawn from a variety of sources, including the Environment Agency, Natural England, Local Planning Authorities (LPAs) (i.e. Private Water Supplies), British Geological Society (BGS) website, Internal Drainage Boards and future site reconnaissance surveys. Other information to be gathered is illustrated in **Table 11-3**.

Table 11-3: Data Required for the Assessment

Data	Source
Hydraulic modelling (including existing flood model results, flood outlines, hydrology data and boundary conditions)	Environment Agency/ Local Lead Flood Authorities / Internal Drainage Boards
Topographic survey	Project
Unlicenced (private) Surface water abstractions	Local Authorities

Data	Source
NVZs Licenced abstractions, Surface water discharges and past water pollution events from the National Incident Recording Systems	Environment Agency
Statutory Designated sites (RAMSAR, SAC, SPA, MMO, SSSI, NVZ, LNR)	Natural England via Project ecology assessment
Non-statutory designated sites (LWS, SINC, PHI, SNCI)	Local Authority and Local Wildlife Trust via Project ecology assessment
Q_{95} - low flows	Environment Agency
Committed developments (for cumulative assessment)	Project
Q_{med} or bank full level	Environment Agency
Locations of weir or mills or other artificial impoundments	Environment Agency
DG5 registers of any recorded incidents, historic data and any pipe/sewer plans for the areas where the preliminary DC cable route alignment is going to cross	Local Lead Flood Authorities / Internal Drainage Boards / Anglian Water
Internal drainage board boundaries and maintained watercourses	Internal drainage boards

11.5.9 Other information required to assess the potential interactions between surface water and groundwater with implications for surface water resources is covered in *Chapter 9: Geology and Hydrogeology*.

Site Walkover

11.5.10 An initial site walkover was undertaken on 25 and 26 May 2022 by a surface water specialist and hydromorphologist in warm, 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 Project. A summary of the site walkover is provided in *PEIR Volume IV - Appendix 11-2: Site walkover technical note*. Further site visits are planned as part of the full impact assessment to be undertaken as part of the DCO application.

Topography and Land Use

11.5.11 Generally, the topography for the entire Study Area is relatively subdued, with elevations typically ranging from 4m above ordnance datum (AOD) to approximately 50 mAOD within the route sectors. This is due to the Project's proximity to the coast, which is typically formed of low-lying farmland and marshland.

Section 1

11.5.12 The topography of this section ranges from 2 mAOD towards the northeast of the sector and generally increases westwards towards the Lincolnshire Wolds, at a maximum of 15 mAOD, just south of South Killingholme. Within the north of the area is dominated by urban to sub-urban land use, associated with the area of Immingham. Throughout Immingham there are small patches of deciduous and coniferous woodland associated with green parks and a historic golf course.

Section 2

11.5.13 The topography associated with this section ranges from approximately 11 mAOD towards the northeast of the section and generally increases south-westwards towards the Lincolnshire Wolds, at a maximum of 50 mAOD. The land use is predominately arable with patches of deciduous woodland throughout. Within the 1km buffer lies the village of Aylesby.

Section 3

11.5.14 The topography associated with this section ranges from approximately 6 mAOD towards the northeast of the section and generally increases south-westwards towards the Lincolnshire Wolds, at a maximum of 100 mAOD. The land use towards the north of the and south of the section is predominantly arable with sporadic deciduous woodland throughout. There are several small villages within the area including Barnoldby le Beck, Brigsley, Ashby cum Fenby, North Thorseby and Ludborough.

Section 4

11.5.15 The topography associated with this section ranges from approximately 7 mAOD towards the northeast of the section and generally increases south-westwards towards the Lincolnshire Wolds, at a maximum of 25 mAOD. The land use is predominately arable with patches of deciduous woodland throughout. There are several small villages within the area including Alvingham, North Cockerington and South Cockerington.

Section 5

11.5.16 The topography associated with this section ranges from approximately <2 mAOD, towards the east where the section comes to terminus towards the coast. The land use within this area is primarily arable, similarly to the other sections, with patches of deciduous woodland spread throughout. There are also small patches of sub-urban areas such as the villages of Theddlethorpe St Helen.

Geology, Hydrogeology and Soils

11.5.17 Geology, hydrogeology, and soils is included in the baseline; however, this topic is considered further in *Chapter 9: Geology and Hydrogeology* and *Chapter 10: Agriculture and Soils.*

11.5.18 A review of publicly available British Geological Survey (BGS) geological maps indicates that the Study Area within this section travels over five different Superficial Deposits (from most present to least):

- Glacial Till (a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape (diamicton);
- Tidal Flat Deposits (consolidated soft silty clay, with layers of sand, gravel and peat);
- Glaciofluvial Deposits (sand and gravel with rare clay interbeds; often cross-bedded; of glacial origin); Alluvium present in localised channels between Immingham and Aylesby (comprise soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel); and
- Lacustrine Deposits (laminated clay and silt and can contain thin layers of organic material or sand).

Table 11-4: Study Area Geology

Section	Bedrock	Superficial deposits
1	The bedrock geology underlying this section is Chalk of the Burnham Chalk Formation. Comprising white, thinly bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams.	
2	The northern part of this section is underlain by Chalk of the Burnham Chalk Formation. Chalk of the Welton Chalk Formation is present and underlies the majority of this section, the chalk tends to follow the orientation of A18 between Aylesbury and Brigsley. Generally comprising white, massive, or thickly bedded chalk with common flint nodules, lacking tabular flint bands.	The majority of this sector is underlain by Glacial Till. Glaciofluvial deposits are also present throughout this sector. Lacustrine Deposits are present surrounding Irby Upon Humber. Finally, Alluvial Deposits are also present between Aylesby and Brigsley.
3	Most of the bedrock geology in this section comprises Chalk of the Welton Chalk Formation. Chalk of the Burnham Chalk Formation is also present in this section.	This section is predominantly underlain by Glacial Till. Alluvium, Lacustrine and Glaciofluvial Deposits are also present within this sector but form smaller localised features.
4	Bedrock geology in this section comprises Chalk of the Welton Chalk Formation.	Most of this section is underlain by Glacial Till. Lacustrine, Alluvial and Glaciofluvial Deposits are also present within this section.
5	Most of this section is underlain by Chalk of the Welton Chalk Formation. As the section moves East past Great Carlton the bedrock geology is observed to change to Chalk of the Burnham Formation.	Most of this section is underlain by Glacial Till and Tidal Flat Deposits. Alluvium is also present in smaller localised channels cross cutting this section between Covenham St Mary and Manby.

Groundwater

11.5.19 Groundwater level monitoring data was received from the Environment Agency from six boreholes. These are shown in *PEIR Volume IV - Appendix 11.1: Baseline Environment Supporting information*.

11.5.20 *PEIR Volume IV - Appendix 11.1: Figure 1.1* shows that there is likely good connectivity between groundwater and surface water towards the low-lying coastal areas to the east of the Study Area; for example the borehole at Immingham lies next to North Beck Drain, which at the time of the initial walkover survey (See *PEIR Volume IV - Appendix 11-2: Walkover Site Visit*), held water. However, the borehole at Washingdales shows that surface water is

unlikely in connectivity with groundwater as it is at least 5m below ground level, this borehole is towards the west and at a higher elevation.

Rainfall

Section 1, Section 2 and Section 3

11.5.21 The nearest weather monitoring station to these sections is Cleethorpes, Haverstoe Park which is located to the southeast of Grimsby on the Lincolnshire coast. Based on the available data from this weather station (1991 – 2020), it is estimated that the Study Area is likely to receive an average of 600.71 mm of rainfall per year, with it raining (greater or equal to 1mm of rain) on approximately 119 days per year. This suggests that rainfall in the area is low, and the area can be considered dry, in comparison to most of the United Kingdom (1,163.04 mm of rainfall per year and 159.09 days of rain ≥1 mm). Rainfall is highest from mid-autumn to winter; however, the summer is more wet in comparison to the late winter and spring and generally peaking in November, with the least rainfall falling in March on average (*PEIR Volume IV - Appendix 11.1 Figure 1-2*).

11.5.22 The same weather station reports that the area generally gets around 25.05 days of air frost a year, distributed across October to April, with the majority (7 days) occurring in December. Using minimum air temperature as a general indicator of air temperatures, frost cover may not be a consideration for the Project (*PEIR Volume IV - Appendix 11.1 Figure 1-3*).

Section 4 and Section 5

11.5.23 The nearest weather monitoring station to these sections is Manby, which is located approximately 8km east from the town of Louth. Based on the available data from this weather station (1991 – 2020), it is estimated that the Study Area is likely to receive an average of 634.53 mm of rainfall per year, with it raining (greater or equal to 1mm of rain) on approximately 119 days per year. This suggests that rainfall in the area is low and the area can be considered dry, in comparison to most of the United Kingdom (1,163.04 mm of rainfall per year and 159.09 days of rain ≥1 mm). However, in comparison to Cleethorpes weather station, it is slightly wetter. Rainfall is highest from mid-autumn to winter with rainfall peaks in November, with the least rainfall falling in March on average. However, the summers are wetter in comparison to the late winter and spring (*PEIR Volume IV - Appendix 11.1 Figure 1-4*).

Surface Water Features

11.5.24 Surface watercourses within the Study Area generally flow from west to east. The northern part of the Study Area is within Humber River Basin District (RBD) as set out in the Humber River Basin Management Plan (RBMP), and the southern part of the Study Area is within the Anglian RBD as set out in the Anglian RBMP. The Project has the potential to affect a total of 14 WFD waterbodies. However, the WFD applies to all surface watercourses within each waterbody catchment including minor tributaries, ditches and surface water drains that are connected to the WFD waterbodies.

11.5.25 The Project has the potential to affect over 100 waterbodies (see *PEIR Volume IV - Figure 11-1: Surface Water Features*). The watercourses in the Study Area are a mix of Main Rivers and Ordinary Watercourses. Main Rivers are usually larger rivers and streams. The Environment Agency carries out maintenance, improvement, or construction work on Main Rivers to manage flood risk. An Ordinary Watercourse is defined as “every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a Main River”. Lead local flood authorities and internal drainage boards have responsibility for flood risk management on Ordinary Watercourses.

11.5.26 Surface watercourses are summarised below based on their WFD assessed waterbody - a more detailed breakdown of watercourses impacted by the Project will be provided in the ES.

11.5.27 Surface water flow for gauged waterbodies is contained in *PEIR Volume IV - Appendix 11.1: Baseline Supporting Information.*

WFD Waterbodies

11.5.28 The Project potentially affects (within 2km Study Area) 14 WFD surface waterbodies. Ten of the waterbodies are within the Becks Northern Operational Catchment, and four are within the Steeping and Eaus Operational Catchment. All WFDs are shown in **Table 11-5** and **Figure 11-2.**

11.5.29 The WFD is implemented through RBMPs which set out statutory objectives for river, lake, groundwater, estuarine and coastal waterbodies and summarise the measures needed to achieve them. The Study Area is covered by the Humber RBMP and Anglian RBMP (both published in February 2016).

11.5.30 The status of the WFD surface waterbodies within the Study Area are detailed in **Table 11-5** and **Figure 11-2**. The WFD overall and ecological status is listed according to the current River Basin Management Plan (RBMP), which is RBMP Cycle 2, dated 2015. Under the WFD, the Environment Agency is obligated to review and update RBMPs every six years, so Cycle 3 RBMPs were due to be published in 2021, however as of preparation of this chapter, have not yet been issued. It is important to note that waterbody WFD classifications and objectives may change and will need to be reviewed in the context of the proposed Project. It is also worth noting that during 2022 the UK Government is expected to publish at least one additional water quality target as they are required to do under the Environment Act 2021.

Table 11-5: WFD Surface Waterbody Status within the 1km of the Draft Order Limits

Operational catchment	Waterbody Name (ID)	Waterbody Database ID	Potential impact pathway	Hydromorphological designation	Current Status/Potential (2019)			Chemical Failing Elements	Reasons for not achieving good status	Objectives
					Ecological	Chemical	Overall			
Becks Northern	North Beck Drain (GB104029067575)	R_A1	Crossed by Section 2	Heavily modified	Moderate	Fail	Moderate	Mercury and its Compounds PBDE	Suspect data, flow	Good by 2027
	Mawnbridge Drain (GB104029067540)		Catchment crosses Section 2	Heavily modified	Moderate	Fail	Moderate	Mercury and its Compounds, PBDE	Physical modification, flow.	Good by 2027
	Laceby Beck / River Freshney (to N Sea) (GB104029067530)	S_B1, S_B2	Crossed Section 3	Heavily modified	Bad	Fail	Bad	Mercury and its Compounds, PBDE	Sewage discharge (continuous and intermittent), poor nutrient management, poor soil management, flood protection – structures,	Moderate by 2027

Operational catchment	Waterbody Name (ID)	Waterbody Database ID	Potential impact pathway	Hydromorphological designation	Current Status/Potential (2019)			Chemical Failing Elements	Reasons for not achieving good status	Objectives
					Ecological	Chemical	Overall			
									urbanisation, invasive species, groundwater abstraction, barriers – ecological discontinuity, land drainage, trade/industry discharge.	
	Waithe Beck lower (to Tetney Lock) (GB104029062100)	S_B3	Crossed by Section 3	Heavily modified	Moderate	Fail	Moderate	Mercury and its Compounds, PBDE	Sewage discharge (continuous), poor nutrient management, flood protection.	Good by 2027
	New Dike (trib of Louth Canal) (GB104029062030)	LD_D2	Crossed by Section 3	Heavily modified	Moderate	Fail	Moderate	Mercury and its	Physical modification	Good by 2027

Operational catchment	Waterbody Name (ID)	Waterbody Database ID	Potential impact pathway	Hydromorphological designation	Current Status/Potential (2019)			Chemical Failing Elements	Reasons for not achieving good status	Objectives
					Ecological	Chemical	Overall			
								Compounds, PBDE		
	Land Dike Drain to Louth Canal (West) (GB104029062162)		Catchments crosses Section 3	Heavily modified	Bad	Fail	Bad	Mercury and its Compounds, PBDE	Saline or other intrusion, poor nutrient management, natural conditions, land drainage.	Good by 2027
	Black Dyke (trib of Louth Canal) (GB104029062000)	LD_E2	Crossed by Section 3	Heavily modified	Moderate	Fail	Moderate	Mercury and its Compounds, PBDE	Land drainage	Good by 2021
	Poulton Drain (trib of Louth Canal) (GB104029062010)	LD_E1	Crossed by Section 4	Heavily modified	Moderate	Fail	Moderate	Mercury and its Compounds, PBDE	Land drainage, physical modification	Good by 2027
	Louth Canal (GB104029061990)	CNL_E1	Crossed by Section 4	Heavily modified	Poor	Fail	Poor	Mercury and its	Sewage discharge	Moderate by 2027

Operational catchment	Waterbody Name (ID)	Waterbody Database ID	Potential impact pathway	Hydromorphological designation	Current Status/Potential (2019)			Chemical Failing Elements	Reasons for not achieving good status	Objectives
					Ecological	Chemical	Overall			
								Compounds, PFOS[1], PBDE.	(continuous), urbanisation, poor livestock management, land drainage, presence of invasive species.	
	Covenham Reservoir Water Body (GB30432209)			Artificial	Moderate	Fail	Moderate	Mercury and Its Compounds, PBDE	Sewage discharge, physical modification	Good by 2027
Steeping and Eaus	South Dike and Grayfleet Drain (GB105029061680)	S_E6, LD_E9	Crossed by Section 4	Heavily modified	Moderate	Fail	Moderate	Mercury and its Compounds, PBDE	Physical modification	Good by 2027
	Long Eau (GB105029061670)	LD_E28	Crossed by Section 5	Heavily modified	Moderate	Fail	Moderate	Mercury and its	Poor livestock management,	Moderate by 2015

[1] Perfluorooctane sulphonate (PFOS)

Operational catchment	Waterbody Name (ID)	Waterbody Database ID	Potential impact pathway	Hydromorphological designation	Current Status/Potential (2019)			Chemical Failing Elements	Reasons for not achieving good status	Objectives
					Ecological	Chemical	Overall			
								Compounds, PBDE	sewage discharge (continuous), poor soil management, urbanisation, land drainage, poor nutrient management, physical modification.	
	Great Eau (d/s of South Thoresby) (GB105029061660)	R_E2	Crossed by Section 5	Heavily modified	Poor	Fail	Poor	Mercury and its Compounds, PBDE	Poor nutrient management, poor livestock management, barriers – ecological discontinuity, flow, trade/industry discharge,	Good by 2027

Operational catchment	Waterbody Name (ID)	Waterbody Database ID	Potential impact pathway	Hydromorphological designation	Current Status/Potential (2019)			Chemical Failing Elements	Reasons for not achieving good status	Objectives
					Ecological	Chemical	Overall			
									physical modification, poor soil management, presence of invasive species.	
	Trusthorpe Pump Drain (upper end) (GB105029061640)		Catchment crosses Section 5	Artificial	Moderate	Fail	Moderate	Mercury and its Compounds, PBDE	Sewage discharge (intermittent)	Good by 2027

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PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- 1km Study Area
- WFD River Waterbody Catchment Boundary

WFD River, Canal and Surface Water Transfer Waterbody

Ecological Classification

- Good
- Moderate
- Poor
- Bad

FIGURE TITLE

Figure 11-2
WFD Waterbodies

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221102_PEIR_11-2

Main Rivers

11.5.31 The Project crosses seven watercourses classified as a Main River by the Environment Agency, with a further nine which are connected to a watercourse that is potentially impacted by the Project. The Main Rivers potentially impacted by the Project are listed in **Table 11-6** and shown on **Figure 11-3**.

Table 11-6: Main Rivers Potentially Impacted by the Project

Section	ID	River Name	Description
Section 2	R_A1	North Beck Drain	North Beck Drain is crossed by the Draft Order Limits where the watercourse is classified as an Ordinary Watercourse, the river is classified as a Main River downstream of the route. The River originates in Suddle Wood and flows in a north-easterly direction to the Humber Estuary.
Section 3	S_B1, S_B2	Laceby Beck / River Freshney	Laceby Beck / River Freshney is within 2km of the Draft Order Limits and receives flows from several ordinary watercourses crossed by the Project. Laceby Beck originates at Laceby Golf club and flows in a northerly direction to Laceby, and then in a north-easterly direction to Grimsby where it becomes the River Freshney. The river flows through Grimsby to the Humber estuary via the Grimsby Docks.
	S_B3	Waithe Beck	Waithe Beck flows initially northwards from TF 1879 9399 through the villages of Brookenby, Thorganby, and Hatcliffe, at which point it turns to the east and crosses the Draft Order Limits (TA 2399 0205). At TA 3080 0065 it then flows into Tetney Drain, which eventually discharges into the North Sea via Louth Canal at TA 3354 0783.
	LD_A10	Old Fleet Drain	Old Fleet Drain is within 500m of the Draft Order Limits and may receive flows from some unidentified field drains crossed by the route. The Old Fleet Drain originates east of the Draft Order Limits, to the south of North Thoresby, and flows in an easterly direction to Black Leg Drain, and then New Dike, prior to the confluence with the Louth Canal.
	LD_C4	Black Leg Drain	Black Leg drain is within 500 m of the Draft Order Limits. The watercourse originates to the south of North Thoresby, and flows in a north-easterly direction to New Dike, which then flows into the Louth Canal.
	LD_D2	New Dike	New Dike is within 2 km of the Draft Order Limits. The watercourse receives flows from Old Fleet Drain, Black Leg Drain and Ordinary watercourses within 500m of the Draft Order Limits and may receive flows from unmapped field drains crossed

Section	ID	River Name	Description
			by the Draft Order Limits. The Main River originates at Thoresby Road and flows in an easterly direction to the Louth Canal.
Section 4	LD_E1	Poulton Drain	Poulton Drain approaches the village of Covenham St Mary from the southwest, entering the sector at TF 3357 9389, just downstream of the village. Downstream of the village, it flows approximately 2km further and enters Louth Canal at TF 3683 9461.
	LD_E2	Black Dike	Black Dike is downstream of and within 2km of the Draft Order Limits. The watercourse originates south of Little Grimsby where it is known as Yarburgh Beck (ordinary watercourse) which flows in a north-easterly direction across the Draft Order Limits, following which it becomes Black Dike. Black Dike flows into Louth Canal at TF 3716 9373.
	CNL_E1	Louth Canal	Louth Canal begins in the town of Louth at TF 3212 8724. It flows through the canal and then north and east, through the section at TF 3628 9060, and is joined by numerous rivers and drains and discharges to the North Sea at TA 3354 0783.
	R_E1	River Lud	The Lud flows within Louth Canal through the town of Louth, but then splits shortly after at TF 34552 88439. From this point, it runs alongside the canal, crossing into the sector at TF 3639 9049. After passing through the section, it continues to flow alongside the canal and then splits into the Seven Towns North Eau and the Old Eau at the Eau Meet, just to the southeast of Alvingham.
	S_E6	South Dike / North Creek	South Dike / North Creek is downstream of and within 2km of the Draft Order Limits. The river receives flows from Harrowsea Drain (ordinary watercourse) which is crossed by the Draft Order Limits. South Dike originates to the east of North Cockerington and flows in a south-easterly direction to Marsh Lane, and then flows in a north-easterly direction to Saltfleet, where the river becomes North Creek. North Creek discharges to Saltfleet Haven, which flows into the North Sea.
	LD_E9	Grayfleet Drain	Grayfleet Drain rises in the south of Louth at TF 3333 8636 and flows northeast, bisecting the villages of South Cockerington and Grimoldby, just before entering the section at TF 3910 8934. It then continues northeast, discharging into the North Sea at Saltfleet at TF 46963 93507.
Section 5	LD_E28	Long Eau	Rising to the east of Legbourne (TF 3574 8373), the Long Eau flows eastwards towards and past the

Section	ID	River Name	Description
			village of Little Carlton, entering the section at TF 4235 8717. Once through the section, it continues flowing east, eventually joining the Great Eau at TF 4613 8939.
	R_E2	Great Eau	The Great Eau flows northeast from TF 4028 7778, past Claythorpe and Withern and into the section at TF 4505 8633. It then continues northeast, is joined by the Long Eau at TF 4613 8939, and then discharges into the North Sea at Saltfleet at TF 46963 93507.

Ordinary Watercourses

11.5.32 In addition to these, an initial review indicates that there is likely to be over one hundred Ordinary Watercourses crossed by, or within 500m of, the Draft Order Limits. An initial high-level review of these has been undertaken based on the Ordnance Survey (OS) Open Rivers data (Ref 11-3), the MAGIC map (Ref 11-39) and OS online mapping (Ref 11-33). These Ordinary Watercourses are likely to include natural streams, drainage dikes, field drains and other artificial waterbodies.

11.5.33 There is also the possibility that these Ordinary Watercourses are likely to be intermittently flowing or ephemeral along the Draft Order Limits. These will be identified (where reasonably practical to do so) following site visits.

11.5.34 However, it will not be possible to identify all of the smallest, minor and temporary ditches and thus the ES will include a general impact assessment to cover all of these minor features. More detailed pre-construction surveys would locate them and ensure that the suite of mitigation that will be described in the ES can be appropriately applied.

Standing Waterbodies

11.5.35 The Project's Draft Order Limits has the potential to impact upon a large number of standing waterbodies. These waterbodies generally comprise small farm or water treatment ponds, and none of these waterbodies is designated as a lake under the WFD.

11.5.36 The Draft Order Limits (Section 4) is located 1.5 km west, and upstream of, the Covenham Reservoir, and therefore has the potential to be impacted by the Project. This is a 218 ha reservoir acts as storage for times of low aquifer recharge. It hosts a water sports centre for recreational use such as sailing, water-skiing and diving. The perimeter is bordered by a public walkway.

11.5.37 A full database and maps of standing waterbodies will be developed for the ES.

Internal Drainage Boards

11.5.38 Internal Drainage Boards are public bodies that manage water level and reduce the risk from flooding within an area (known as the internal drainage district), where there is specific need for drainage.

11.5.39 The Draft Order Limits crosses two internal drainage boards (IDB): North East Lindsey IDB which covers the coastal area around Immingham; and Lindsey Marsh Drainage Board, which covers the coastal area around Theddlethorpe.

11.5.40 North East Lindsey IDB extends over an area of 112.5 km^2 and covers the coastal area that extends from the Humber bridge southwards towards Grimsby. The board is responsible for a total of 130 km of watercourse of which 27 km are vital to the protection of intensely developed areas. Lindsey Drainage Board has the largest concentration of industry including petrochemical plants and other industrial complexes.

11.5.41 Lindsey Marsh Drainage Board is the largest drainage board in England, extending over an area 527.57 km^2 of covering a total 938 km of watercourse and 30 pumping stations.

11.5.42 Watercourses within the 1km buffer around the Draft Order Limits that pertain to the North East Lindsey IDB are shown in **Table 11-7**.

Table 11-7: North East Lindsey Internal Drainage Board Watercourses

Section	IDB watercourses crossed by preferred route	Other IDB waterbodies within 1km	IDB
Section 1	Haborough Marsh Drain Branch 4	Marsh Drain Branch 2; South Killingholme Drain; South Killingholme Drain Branch 1; Haborough Marsh Drain; Haborough Marsh Drain Branch 2	North East Lindsey
	Haborough Marsh Drain Branch 3		
	Haborough Marsh Drain Branch 1		
Section 2	North Beck/Caddle Beck	Old Fleet Drain	North East Lindsey
Section 3	Laceby Beck	Team Gate Drain	North East Lindsey
	-	Brigsley Village Drain	Lindsey Marsh
Section 4	Harrowsea Drain	Poulton Gravity Area; Upper South Drain; Mill Stream; Green Dyke; Harniss Drain; Howdales Drain; Old North Drain; Grimoldby Ings Drain; Middle Sykes Road Sewer; Ings Lane Drain; Fleet Drain	Lindsey Marsh
	Manby Middlegate Drain		
Section 5	Manby Middle Drain	Sykes Drain; Ings Drain; Little Mardyke Branch; Mardyke Drain; Little Mardyke Connection Drain; Saltfleetby South Ings Drain; David Morris Drain; Dowsey Fen Drain Branch; Dowsey Fen Drain; Duckpond Sewer East; Mablethorpe Upper Cut; Plantation Sewer; Thacker Bank Drain; Carlton Land Drain; Old Highland Drain; Beangare Drain; Will Row Drain East; Grove road	Lindsey Marsh
	Little Mardyke		
	Head Dyke		
	Mablethorpe Middle Cut (The Cut Drain)		
	Two Mile Bank Drain		
	Gayton North Fen Drain		
	New Gayton Engine Drain		
	Old Engine Drain		

Section	IDB watercourses crossed by preferred route	Other IDB waterbodies within 1km	IDB
	Grove Road Drain	Drain Diversion; Air Force Sewer; West Drain; Butt Lane Drain; Butt Lane Drain Branch; Vicarage Drain; Middle Drain; Highgate Connection Drain; Highgate Drain; Millfield Drain; Plough Lane Drain; Sudales Drain; Scarsbridge Sewer West; Scarsbridge Sewer East; Crook Bank Drain West; Crook Bank Drain East Branch; Mardyke Drain; Meers Bank North Drain; Mablethorpe Urban Cut; Heading Drain	
	Mill and Harps Drain		
	Rotten Row Drain		
	Mablethorpe Lower Cut (The Cut)		

Coastal and estuarine receptors

11.5.43 The project crosses two WFD coastal and estuarine watercourses which are detailed in **Table 11-8**.

Table 11-8: Coastal and Estuarine Receptors

Waterbody	Waterbody type	Ecological Status / Potential	Chemical Status	Hydromorphological Designation	Designated Reach
Humber Lower Waterbody (GB530402609201)	Transitional water	Moderate	Fail	Heavily modified	The Humber Lower waterbody stretches from central Hull to Donna Nook, a point on the north Lincolnshire coast. It covers an area of approximately 247 km^2.
Lincolnshire Waterbody (GB640402492000)	Coastal water	Moderate	Fail	Heavily modified	The Lincolnshire waterbody stretches from the edge of the

					Humber Lower waterbody along the coast of Lincolnshire towards Skegness. It covers an area of approximately 170 km^2.

Walkover Site Visit

11.5.44 An initial site visit was undertaken by an AECOM water scientist and a hydromorphologist to observe major watercourses that are likely to be crossed by the pipeline. This was to classify the hydromorphological attributes of each waterbody, to understand the general characteristics of the waterbodies, and to provide a basis of the baseline and PEIR assessment. The initial site visit took place on the 25 and 26 of May 2022.

11.5.45 A more detailed site visit will be undertaken prior to the preparation of the ES, once there is further clarity on the alignment and available access.

11.5.46 The list of surveyed locations and information is provided in *PEIR Volume IV Appendix 11-2: Site Visit.*

Water Quality

11.5.47 The Environment Agency's Water Quality Archive website contains surface water quality data for several waterbodies that either lie within the Draft Order Limits or are hydraulically connected to a waterbody that lies within. Summary water quality data stations for the years 2018 – 2022 and the water quality results are presented in *PEIR Volume IV - Appendix 11.1 – Section 1.5* which occur in or near the Study Area.

Aquatic Ecology and Designated Sites

11.5.48 It is important that any water dependent nature conservation sites and protected species are identified for each waterbody receptor so that they may be considered by the impact assessment (i.e., a waterbody that has a higher conservation status will be considered a more important and potentially sensitive receptor).

11.5.49 Aquatic ecology data from the Environment Agency has shown that a total of nine monitoring points have been surveyed across the catchments within the Study Area and the 1 km buffer from 2017 – 2022, these are shown in *PEIR Volume IV - Appendix 11.1 – Baseline Supporting Information.*

11.5.50 Within the Study Area, there are no designated protected areas within Sections 1-4 including: Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), National Nature Reserves (NNRs) or Local Nature Reserves (LNRs).

11.5.51 There are several nationally significant ecologically designated sites within the Section 5 Study Area:

- One biological SSSI, Saltfleetby - Theddlethorpe Dunes is located along the north-east coast of Lincolnshire which stretches for a total length of 8km. The monitored features of the site include:

- aggregation of non-breeding birds;
- assemblages of breeding birds;
- fixed dune grassland;
- humid dune slacks;
- littoral sediment; and
- saltmarshes.

- One Special Area of Conservation (SAC): Saltfleetby - Theddlethorpe Dunes; and
- One National Nature Reserve (NNR): Saltfleetby - Theddlethorpe Dunes & Gibraltar Point.

Water Resources

11.5.52 Water resources within the Study Area are shown in Table 11-9.

Table 11-9: Water Resources within Study Area

Section	Water resources
1	This sector of contains three Source Protection Zones within the 1km Draft Order Limits: • Zone I – both Inner and Outer Protection Zone, present from Immingham Docks to Immingham town; • Zone II – Outer Protection Zone, present from southern Immingham Docks to the south of Immingham; • Zone III – both Inner and Outer Protection Zone, present across all the sector. There are no Drinking Water Safeguard Zones (Groundwater) within this section. There are no Drinking Water Safeguard Zones (Surface Water) within this section. This section is within a Nitrate Vulnerable Zone and can be split up into three sub zones (2017): • Surface Water S359 – North Beck Drain NVZ; and • Surface Water S361 – Skitter Beck / East Halton Beck NVZ.
2	This sector of contains one Source Protection Zone within the 1km Draft Order Limits: • Zone I – both Inner and Outer Protection Zone, surrounding Little London; • Zone II – Outer Protection Zone, present from western Grimsby to eastern Great Limber; and • Zone III – both Inner and Outer Protection Zone, present between Immingham and Aylesbury. This sector contains three Drinking Water Safeguard Zone (Groundwater): • Ref: GWSGZ0284 – Present between Keelby and Riby; and • Ref: GWSGZ0283 – Present between Riby and Aylesby. This section contains no Drinking Water Safeguard Zones (Surface Water): This section is within a Nitrate Vulnerable Zone and can be split up into three sub zones (2017): • Surface Water S359 - North Beck Drain NVZ; • Surface Water S361 – Skitter Beck / East Halton Beck NVZ; and

Section	Water resources
	• Surface Water S357 – Laceby Beck / River Freshney Catchment (to N Sea) NVZ.
3	This section of contains two Source Protection Zones within the 1km Draft Order Limits: • Zone I – Outer Protection Zone, present surrounding Barnoldby le Beck, Cadeby and Top Farm; • Zone II – Outer Protection Zone, present from North Thoresby to Ashby cum Fenby and from south of Ashby cum Fenby to Ludborough; and • Zone III – Outer Protection Zone, present throughout entire section. Within this sector of the Draft Order Limits there are four Drinking Water Safeguard Zones (Ground Water): • Ref: GWSGZ0015 – Land from beginning of sector to Barnoldby le Beck; • Ref: GWSGZ0282 - Land surrounding Brigsley; • Ref: GWSGZ0288 – Present between Brigsley and Ashby cum Fenby; and • Ref: GWSGZ0285 – Present between Keelby and Aylesby. From Barnoldby le Beck, the entire of this sector is within a Drinking Water Safeguard Zones (Surface Water) ref: SWSGZ1001. This sector is within a Nitrate Vulnerable Zone and can be split up into three sub zones (2017): • Surface Water S357 - Lacby Beck / River Freshney Catchment (to N Sea) NVZ; • Surface Water S354 - Waithe Beck lower catchment (to Tetney Lock) NVZ; and • Surface Water S353 - Louth Canal NVZ.
4	This sector of contains one Source Protection Zone within the 1km Draft Order Limits: • Zone IIc – Outer Protection Zone, present surrounding Grimoldby Within this sector of the Draft Order Limits there are no Drinking Water Safeguard Zone (Groundwater). All of this sector is within a Drinking Water Safeguard Zones (Surface Water) up until North Cockerington ref: SWSGZ1001. This sector is within two Nitrate Vulnerable Zone and can be split up into one sub zones (2017): • Surface Water S353 - Louth Canal NVZ • Surface Water S366 - South Dike and Grayfleet Drain NVZ Whilst Covenham Reservoir lies outside of the Study Area, due to its proximity to the boundary, it is considered within scope and therefore included in this assessment.
5	This sector of contains one Source Protection Zone within the 1km Draft Order Limits: • Zone IIc – Outer Protection Zone, present surrounding Manby Within this sector of the Draft Order Limits there are no Drinking Water Safeguard Zones (Ground Water) This sector is within one Drinking Water Safeguard Zones (Surface Water) • Ref: SWSGZ1002 Louth Canal, Great Eau and Covenham Reservoir

Section	Water resources
	This sector is within a Nitrate Vulnerable Zone and can be split up into two sub zones (2017): • Surface Water S365 - Great Eau (downstream of South Thoresby) NVZ • Surface Water S363 - Woldgrift Drain NVZ

Flood Risk

11.5.53 The Environment Agency carries out maintenance, improvement, or construction work on Main Rivers to manage flood risk. Information on flood risk for this chapter has been obtained from the Environment Agency Flood Maps for Planning (FMfP) and initial consultation with the Environment Agency. Flood risk from all sources for the Project have been summarised in the preliminary FRA (*PEIR Volume IV: Appendix 11-4*) and has been subsequently split by Draft Order Limits sectors**.**

11.5.54 Other rivers are called 'Ordinary Watercourses'. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses. The Draft Order Limits crosses two IDB: North East Lindsey IDB and Lindsey Marsh Drainage Board. The Draft Order Limits passes through two district councils, North East Lincolnshire Council and East Lindsey District Council (who will be the Lead Local Flood Authorities).

Flood Risk Summary

11.5.55 The Environmental Agency classifies areas at risk of fluvial, surface and reservoir flooding through the three magnitude rainfall events:

- Zone 1, Low Probability: land assessed as having a less than 1 in 1,000 annual probability of flooding (<0.1% Annual Exceedance Probability (AEP)).
- Zone 2, Medium Probability: land assessed as having flooding between 1 in 100 (1% AEP) and 1 in 30 (3.3% AEP) annual probability of flooding.
- Zone 3, High Probability: land assessed as having greater than 1 in 30 annual probability of flooding (3.3% AEP).

11.5.56 The Strategic Flood Risk Assessments of North and North East Lincolnshire (Ref 11-45) and East Lindsey Strategic Flood Risk Assessment (Ref 11-46) will be reviewed during the ES to distinguish between Flood Zones 3a and 3b (functional floodplain). There are no Flood Storage Areas within the Draft Order Limits.

11.5.57 Flooding associated with each section of the Pipeline Corridor can is shown in **Table 11-10** - **Table 11-14**, and on **Figure 11-3** and **Figure 11-4**.

Table 11-10: Section 1 of Pipeline Corridor within Draft Order Limits

Flood Risk Source	Comments
Rivers and Sea	This section predominately lies within Flood Zone 1 associated with flooding from rivers and the sea. There are patches of Flood Zone 2 extending from Humber Road to the coast and one area of Flood Zone 3 associated with a pond in Homestead Park.
Surface Water	In comparison to fluvial, there is generally a lower chance of flood risk from surface water sources within this corridor. The highest flood risk within this corridor is associated with the urban

Flood Risk Source	Comments
	area of Immingham and around Mayflower Woods which varies from Flood Zone 1 to 3. Within the wider corridor there are patches of Flood Zone throughout that are generally associated with watercourses, ponds and topographic depressions.
Groundwater	Shallow Groundwater (3-5m below ground level) could risk groundwater flooding during excavations during construction phase.
Sewers	No sewer information provided by the LLFA. Either information is not available or there is no sewer flood risk in these areas.
Reservoirs	There is no risk associated with reservoir flooding in this corridor.
Climate Change	Climate change allowances are to be included within the assessment of flood risk in line with Environment Agency published flood maps.
Residual Flood Risk	To be identified when FRA is complete.
Flood Alert Areas	The first 3km of the western half of this sector lies within the Flood Risk Area that is associated with the tidal flooding near the South Humber Bank from Barton Upon Humber to Humberston and the furthest extent of tidal flooding on the South Humber Bank from Whitton to Humberston.
Flood Warning Areas	The north of this sector lies within a Flood Warning Area that is associated with the Tidal flooding of low-lying areas from New Holland to Immingham Dock. Just south of this, the section crosses an area of Flood Warning Area of Tidal flooding from the Humber estuary to Immingham Dock and then a Flood Warning Area at risk from the furthest extent of tidal flooding from South Killingholme to Grimsby.
Flooding Defences	There are no flood defences within this section.

Table 11-11: Section 2 of Pipeline Corridor within Draft Order Limits

Flood Risk Source	Comments
Rivers and Sea	The risk of flooding from rivers and the sea is generally very low within this corridor, with isolated patches of Flood Zone 3 associated with drains.
Surface Water	The risk of surface water flooding is generally very low within this corridor, with isolated patches of Flood Zones 1- 3 associated with drains and waterbodies that are present within the area.

Flood Risk Source	Comments
Groundwater	Shallow Groundwater (0.3 -7m below ground level) could risk groundwater flooding during excavations during construction phase.
Sewers	No sewer information provided by the LLFA. Either information is not available or there is no sewer flood risk in these areas.
Reservoirs	There is no risk associated with reservoir flooding in this corridor.
Climate Change	Climate change allowances are to be included within the assessment of flood risk in line with Environment Agency published flood maps.
Residual Flood Risk	To be identified when FRA is complete.
Flood Alert Areas	This sector does not lie within a Flood Warning Area.
Flood Warning Areas	This sector does not lie within a Flood Warning Area.
Flood Defences	Bordering either side of North Beck Drain lies high ground with the principal purpose of flood risk management. This defence appears to start where the waterbody is culverted under Immingham Road (TA 18863 11658) and ends with its drainage into the Humber Estuary (TA 22919 14084). Although it is outside of the Draft Order Limits, there is flooding defences bordering Old Fleet Drain from where the waterbody is culverted under Healing Road (TA 20683 10810) to its drainage into the Humber Estuary (TA 23920 13172) and consists of embankments and high ground.

Table 11-12: Section 3 of Pipeline Corridor within Draft Order Limits

Flood Risk Source	Comments
Rivers and Sea	Similarly, to Section 2, the flood risk along this corridor is generally very low. There are two isolated patches of Flood Zone 2-3 that the corridor intersects that are associated with Waithe Beck and drains that lie directly north and south of North Thoresby.
Surface Water	This corridor intersects with several surface water food risk areas that range from Zones 1-3. The most significant of these areas correspond to the waterbodies and drains that cross the sector, specifically Waithe Beck lower catchment (to Tetney Lock) which flows parallel to the sector for a reach and the channels associated with this waterbody, Old Fleet drain and Black Leg Drain . Within the wider corridor there are patches of Flood Zone 2 and 3 throughout that are generally associated with watercourses, ponds and topographic depressions.

Flood Risk Source	Comments
Groundwater	Shallow Groundwater (5 - 18m below ground level) could risk groundwater flooding during excavations during construction phase.
Sewers	No sewer information provided by the LLFA. Either information is not available or there is no sewer flood risk in these areas.
Reservoirs	There is no risk associated with reservoir flooding in this corridor.
Tidal	There is no risk associated with tidal flooding in this corridor.
Climate Change	Climate change allowances are to be included within the assessment of flood risk in line with Environment Agency published flood maps.
Residual Flood Risk	To be identified when FRA is complete.
Flood Alert Areas	This section intersects a Flood Alert Area that is associated with the Laceby Beck waterbody for a length of approximately 100m towards the farthest end of the sector. Within this corridor, there is a small Flood Alert Area that is associated with the Waithe Beck waterbody around Brigsley village, where the northern boundary of the sector intersects.
Flood Warning Areas	Within this corridor, there is a small Flood Warning Area that is associated with the Waithe Beck waterbody around Brigsley village.
Flood Defences	Bordering either side of Laceby Beck lies high ground with the principal purpose of flood risk management. This defence appears to start in the grounds of Laceby golf course (TA 22603 04948) and ends with its drainage into the Humber Estuary (TA 26303 11080). Bordering either side of Waithe Beck lies high ground with the principal purpose of flood risk management. This defence appears to start in Swinhope (TF 21448 96093) and ends with its drainage into the Humber Estuary (TA 35417 03195). Bordering either side of Black Dike lies high ground with the principal purpose of flood risk management. This defence appears to start at TF 35332 92713 and ends with its confluence with Louth Canal.

Table 11-13: Section 4 of Pipeline Corridor within Draft Order Limits

Flood Risk Source	Comments
Rivers and Sea	Fluvial flood risk through this corridor is extremely low, with isolated patches associated with the Poulton Drain, Yarburgh Beck, waterbody at the southern end of the reach (Flood Zone 2-3).

Flood Risk Source	Comments
Surface Water	This corridor intersects with several surface water flood risk areas (Zones 1-3) which are predominately associated with drains crossing the corridor. Within the wider corridor there are patches of Flood Zone 1-3 throughout that are generally associated with watercourses, ponds and topographic depressions.
Groundwater	Shallow Groundwater (3 - 18m below ground level) could risk groundwater flooding during excavations during construction phase.
Sewers	No sewer information provided by the LLFA. Either information is not available or there is no sewer flood risk in these areas.
Reservoirs	There is a small area of the beginning of the section that is at risk from reservoir flooding, specifically from Covenham Reservoir around Covenham St Mary.
Climate Change	Climate change allowances are to be included within the assessment of flood risk in line with Environment Agency published flood maps.
Residual Flood Risk	To be identified when FRA is complete.
Flood Alert Areas	Within this section there are several Flood Alert Areas that are intersected. The first is associated with the Louth Canal waterbody, which covers the corridor for a length of approximately 60m. Approximately 2.3 km to the southeast of this, the corridor intersects another area at risk from the Louth Canal waterbody that covers an area of approximately 320 m. The next area lies approximately 2.8 km to the southeast of this where the corridor crosses Grayfleet drain.
Flood Warning Areas	Within this section, there are several Flood Warning Areas that are intersected. The first is associated with the Louth Canal waterbody and crosses the corridor for a length of approximately 305 m. The next area lies approximately 2.8 km to the south east of this where the corridor crosses Grayfleet drain.
Flood Defences	Bordering either side of Poulton Drain lies high ground with the principal purpose of flood risk management. This defence appears to start before the waterbody flows through Covenham St Mary (TF 33268 93568) and ends with its confluence with Louth Canal. Bordering either side of Louth Canal lies high ground with the principal purpose of flood risk management. This defence appears to start in the town of Louth (TF 32106 87241) and ends with the outflow of Louth Canal into the Humber Estuary at Tetney Marshes Nature Reserve. They are in fair condition and reduce the risk of flooding (at the defence) to a 50% (1 in 2) chance of occurring in any year.

Flood Risk Source	Comments
	Bordering either side of the River Lud lies high ground with the principal purpose of flood risk management. This defence appears to start outside the town of Louth (TF 34503 88351) and ends with the confluence of Louth Canal. They are in fair condition and reduce the risk of flooding (at the defence) to a 50% (1 in 2) chance of occurring in any year. Bordering either side of South Dike lies high ground with the principal purpose of flood risk management. This defence appears to the north east of North Cockerington (TF 38696 91775) and ends with the confluence of Louth Canal. Bordering either side of Grayfleet Drain lies high ground with the principal purpose of flood risk management. This defence appears to start in the town of Louth (TF 33324 86361). The classification of the defence changes from high ground to embankment at TF 39883 89831, until the waterbody reaches the Humber Estuary at TF 46013 93485.

Table 11-14: Sector 5 of Pipeline Corridor within Draft Order Limits

Flood Risk Source	Comments
Rivers and Sea	This section carries the largest risk of flooding from river and sea sources due to the high number of river and drain crossings through this reach and its proximity to the coast. The areas that carry the highest risk are Long Eau crossing (Zone 2-3), the Great Eau crossing.
Surface Water	This section carries the largest risk of flooding from surface water sources due to the high number of river and drain crossings throughout this reach. The areas with the highest risk associated with them are the intersections with Long Eau and the larger drains within the area. Within the wider sector there are patches of Flood Zone 1-3 throughout that are generally associated with watercourses, ponds and topographic depressions.
Groundwater	Shallow Groundwater (0.2 - 6m below ground level) could risk groundwater flooding during excavations during construction phase.
Sewers	No sewer information provided by the LLFA. Either information is not available or there is no sewer flood risk in these areas.
Reservoirs	There is no risk associated with reservoir flooding in this corridor.
Tidal	Since 1994, the Environmental Agency have been artificially supplying sand to recharge locations along a 20km frontage of the Lincolnshire east coast known as the Saltfleet to Gibraltar Point Beach Management scheme. Approximately 550,000m^3 of sand is placed annually. This scheme, in combination with the existing hard defences, reduces the risk from tidal flooding with a 0.5% chance of occurring in any one year.
Climate Change	Climate change allowances are to be included within the assessment of flood risk in line with Environment Agency published flood maps.

Flood Risk Source	Comments
Residual	To be identified when FRA is complete.
Flood Alert Areas	The last 9 km of this corridor intersects two overlapping Flood Alert Areas which are associated with the Great Eau, Long Eau waterbodies and the far extent of tidal flooding from the Lincolnshire Coastline.
Flood Warning Areas	The last two areas cover entirety of the sector which is associated with the furthest extent of tidal flooding from North Somercotes to Bilsby (North Sea) and the wider area at risk of tidal flooding between Theddlethorpe and Huttoft. There are also overlapping layers of Flood Warning Areas along this stretch including areas at risk from the Long Eau waterbody (TF 42372 87131) and the Great Eau waterbody (TF 45723 87181).
Flood Defences	Bordering either side of Long Eau are embankments with the principal purpose of flood risk management. This defence appears to start at TF 38198 84091 and ends where the waterbody discharges into the Great Eau at TF 46176 89430. They are in fair condition and reduce the risk of flooding (at the defence) to a 50% (1 in 2) chance of occurring in any year. Bordering either side of Great Eau are embankments with the principal purpose of flood risk management. This defence appears to start at TF 40268 77795 and ends where the waterbody discharges into the Humber Estuary at TF 46034 93461. They are in fair condition and reduce the risk of flooding (at the defence) to a 50% (1 in 2) chance of occurring in any year. The existing tidal defences protecting this area consist of natural sand dunes which are supplemented by beach nourishment to maintain foreshore levels. They are in good condition and reduce the risk of flooding (at the defence) to a 0.5% (1 in 200) chance of occurring in any year.

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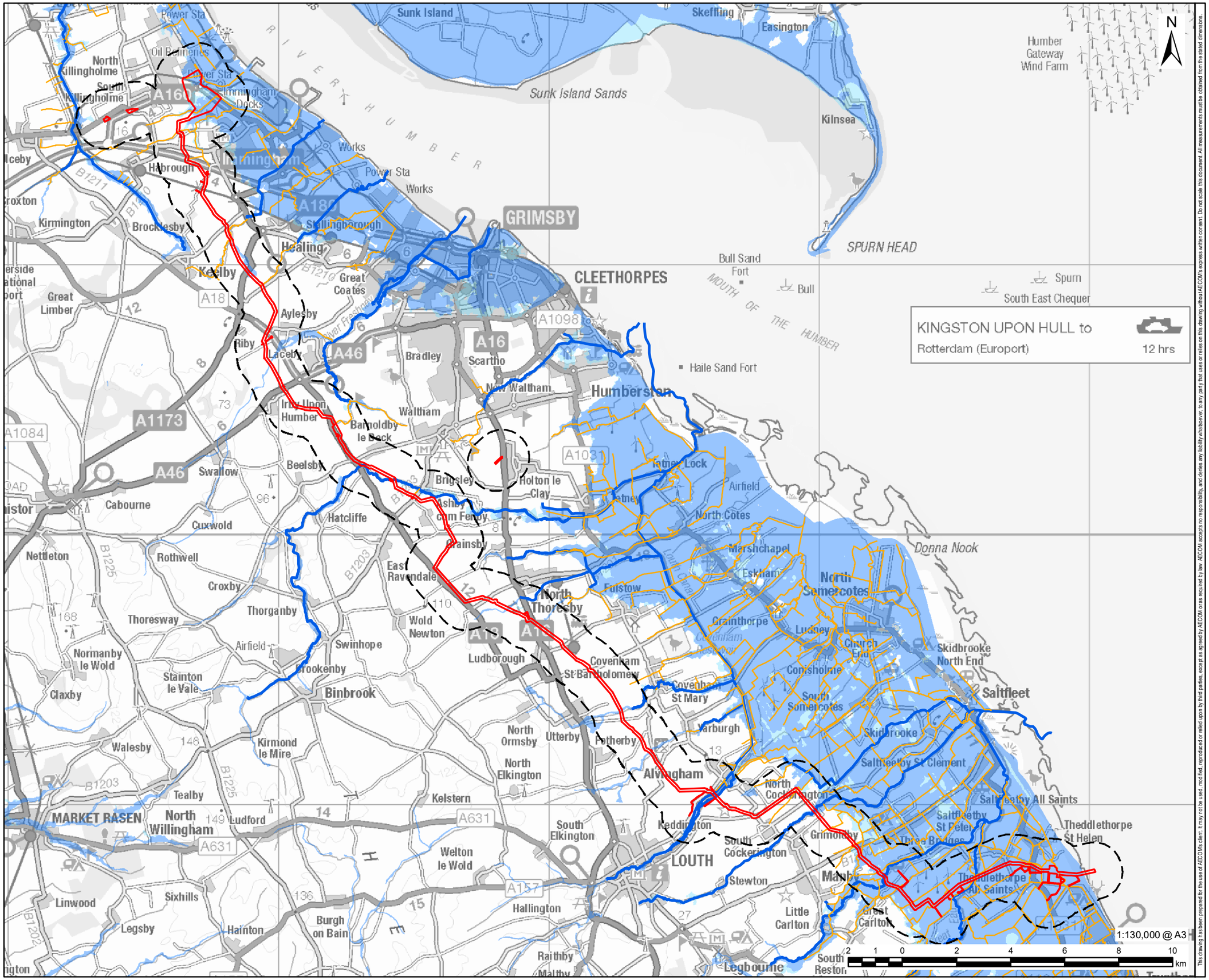

VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- 1km Study Area
- IDB Maintained Watercourse
- EA Main River
- Flood Zone 2
- Flood Zone 3

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FIGURE TITLE

Figure 11-3
Fluvial and Tidal Flood Risk

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221102_PEIR_11-3

Revision: 2 Drawn: LC Checked: DF Approved: KB Date: 2022-11-02

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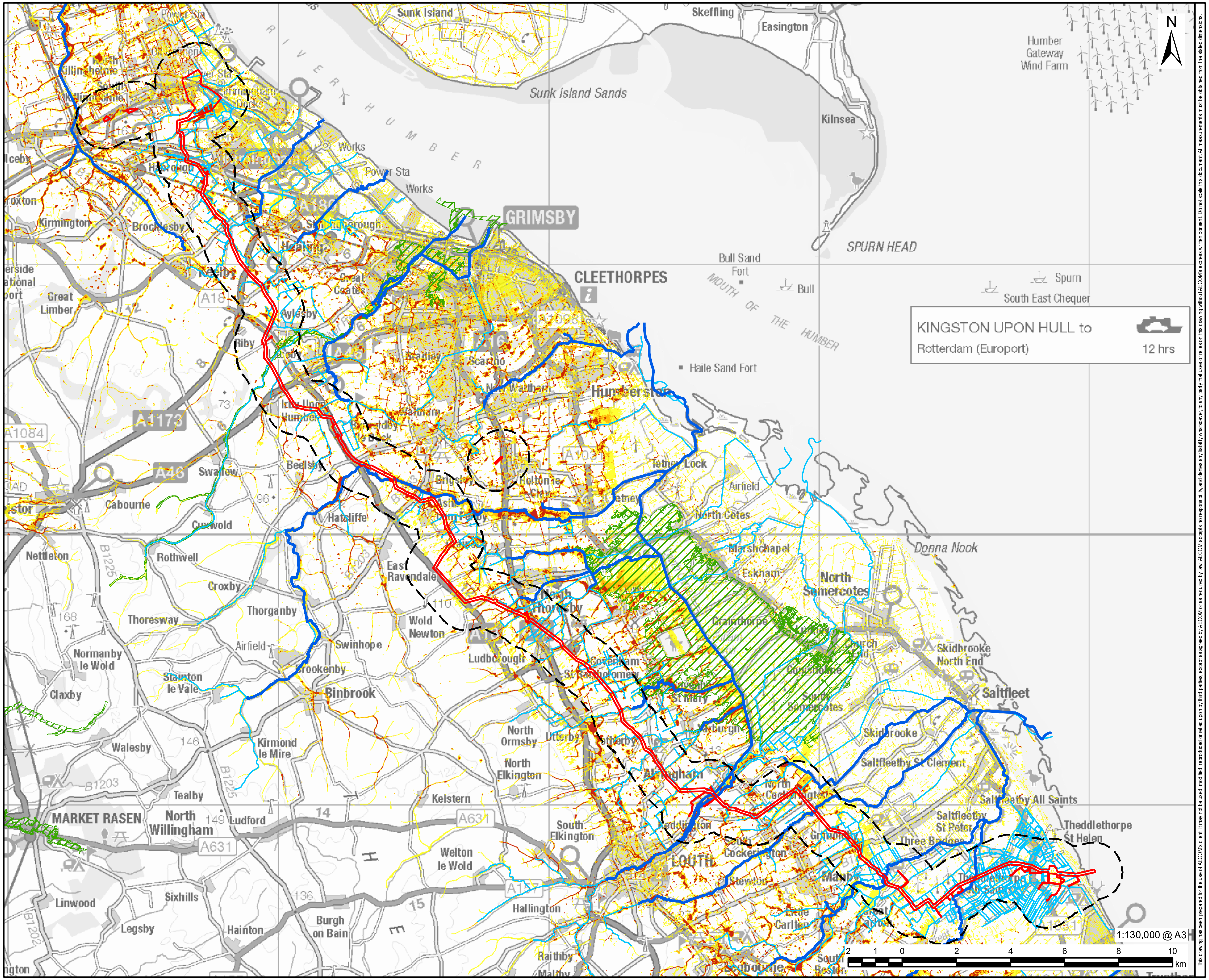

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VikingCCS

AECOM

PROJECT

Viking CCS Pipeline

LEGEND

- Draft Order Limits
- 1km Study Area
- EA Main River
- All Other Identified Waterbodies - Working
- Reservoir Flood Extents - Wet Day

Risk of Flooding from Surface Water

- 3.3% Annual Chance
- 1% Annual Chance
- 0.1% Annual Chance

NOTES:

FIGURE TITLE

Figure 11-4
Surface Water and Reservoir Flood Risk

ISSUE PURPOSE

PEIR

PROJECT NUMBER / REFERENCE

60668955 / VCCS_221102_PEIR_11-4

Future Baseline

Construction

11.5.58 As outlined in *Chapter 3: The Viking CCS Pipeline* the peak of construction is expected to be in 2026 and complete in 2027.

11.5.59 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.

11.5.60 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.

11.5.61 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.

Operation

11.5.62 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).

11.5.63 The wider area around Immingham is allocated in the local plan for industrial development, and if the Project 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.

Decommissioning

11.5.64 The pipeline will be designed for a minimum operational life of 25 years, and it may be possible for measures to be taken to extend its operational lifecycle. It is considered that continued environmental improvements, tighter regulation at both national, regional, and local scales, and environmental enhancements would lead to a gradual improvement over current baseline conditions in terms of water quality.

11.5.65 Climate change has the potential to significantly impact on drainage and flood risk. However, the design of the Project will incorporate the climate change projections required by the Environment Agency to ensure that potentially increased surface water flows are accounted for and managed across the lifetime of the Project.

Importance of receptors

11.5.66 **Table 11-15** provides a summary of the waterbodies that may be impacted by the Project (i.e. there is a source and a possible pathway), a description of their attributes, and states the initial importance of the waterbody as used in this preliminary impact assessment. Importance is based on the criteria presented in **Table 11-2** and will be kept under review as further information and data becomes available. Please note that separate importance classifications are provided for water quality and morphological aspects of waterbodies as it is not always appropriate to have the same rating (e.g. a waterbody may be heavily modified or even artificial and thus have a low morphology importance, but the water quality may be high by virtue of supporting protected species or other important potable or socio-economic and recreational uses).

Table 11-15: Importance of Receptors

Section	Waterbody	Importance		
		Surface Water	Hydromorphology	Flood Risk
Section 1 - 4	Humber Estuary (SAC)	Very High Importance on the basis of being a WFD designated waterbody; being designated as a SSSI and SAC immediately downstream of the DCO Site Boundary and within the Study Area.	Low Importance due to the significant modifications of the channel and the flow and tidal conditions.	Not a flood risk receptor
Section 4 and 5	Lincolnshire Waterbody (coastal WFD)	High Importance on the basis of being a WFD designated coastal waterbody	Low Importance due to the significant modifications of the channel and the flow and tidal conditions.	Not a flood risk receptor
Section 1	Internal Drainage Board waterbodies (including Harborough Marsh Drain)	As industrial, artificial waterbodies lacking any protected species (as far as is currently known) or designations, these are considered Low Importance waterbodies for surface water.	Low importance, artificial or heavily modified waterbodies with artificial cross-sections (may change following detailed site visits)	Medium importance as located within an area with industrial / less vulnerable development
	Other permanent waterbodies	Medium Importance receptor for water quality on the basis of not having a WFD classification but is estimated to have a Q95 flow >0.001 m^3/s.	Low to moderate importance, to be clarified following site visits.	
Section 2	North Beck Drain (GB104029067575)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Low Importance on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places.	Medium importance as located within an area with agricultural / less vulnerable development

Section	Waterbody	Importance		
		Surface Water	Hydromorphology	Flood Risk
	Mawnbridge Drain(GB104029067540)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s.	Low Importance receptor for morphology on the basis of being largely artificial in character as a straightened channel.	
	Internal Drainage Board waterbodies (including Old Fleet Drain)	As agricultural, artificial waterbodies lacking any protected species (as far as is currently known) or designations, these are considered Low Importance waterbodies for surface water.	Low importance, artificial or heavily modified waterbodies with artificial cross-sections (may change following detailed site visits)	
	Other permanent waterbodies	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.	Low to moderate importance, to be clarified following site visits.	
Section 3	Laceby Beck / River Freshney (to N Sea) (GB104029067530)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Medium Importance on the basis of showing signs of previous alteration but still retaining some natural features.	Medium importance as located within an area with agricultural / less vulnerable development
	Waithe Beck lower (to Tetney Lock) (GB104029062100)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s and	Medium Importance on the basis of showing signs of previous alteration but still retaining some natural features.	
	New Dike (trib of Louth Canal) (GB104029062030)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s.	Low to moderate importance, to be clarified following site visits.	

Section	Waterbody	Importance		
		Surface Water	Hydromorphology	Flood Risk
	Land Dike Drain to Louth Canal (West) (GB104029062162)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s.	Low to moderate importance, to be clarified following site visits.	
	Other permanent waterbodies	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.	Low to moderate importance, to be clarified following site visits.	
Section 4	Covenham Reservoir Water Body (GB30432209)	Very High Importance on the basis of being a WFD designated waterbody and having a critical social or economic uses (e.g., public water)	Low Importance for morphology as an artificial waterbody – however over 1km from Draft Order Limits therefore scoped out of the assessment.	Low importance as a water compatible feature.
	Poulton Drain (trib of Louth Canal) (GB104029062010)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Low Importance on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places.	Medium importance as located within an area with agricultural / less vulnerable development
	Black Dyke (trib of Louth Canal) (GB104029062000)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Low Importance on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places.	
	Louth Canal (GB104029061990)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s.	Low importance due to being an artificial, straight, channelised watercourse with artificial banks.	

Section	Waterbody	Importance		
		Surface Water	Hydromorphology	Flood Risk
	South Dike and Grayfleet Drain (GB105029061680)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Low Importance on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places.	
	Other permanent waterbodies	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.	Low to moderate importance, to be clarified following site visits.	
Section 5	Long Eau (GB105029061670)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Low Importance on the basis of showing evidence of substantial modification and realignment, being artificially straight with steep, incised banks in places.	Medium importance as located within an area with agricultural / less vulnerable development
	Great Eau (d/s of South Thoresby) (GB105029061660)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s	Medium Importance on the basis of showing signs of previous alteration but still retaining some natural features.	
	Trusthorpe Pump Drain (upper end) (GB105029061640)	High Importance on the basis of being a WFD designated watercourse but with a Q95 flow of <1.0 m^3/s.	Low to moderate importance, to be clarified following site visits.	
	Other permanent waterbodies	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.	Low to moderate importance, to be clarified following site visits.	

Section	Waterbody	Importance		
		Surface Water	Hydromorphology	Flood Risk
All	Ephemeral and/or artificial drains, ditches	Low Importance waterbodies as industrial, artificial and ephemeral waterbodies lacking any protected species (as far as currently known)	Low importance due to likely comprising ephemeral waterbodies.	Low importance due to small catchment area and ephemeral nature
	Other Internal Drainage waterbodies	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.	Low importance, artificial or heavily modified waterbodies with artificial cross-sections (may change following detailed site visits)	Medium importance as located within agricultural or industrial areas / less vulnerable development

11.6 Mitigation

11.6.1 The following impact avoidance measures have either been incorporated into the design (i.e., embedded mitigation) or are standard construction or operational practices. These measures have, therefore, been considered during the preliminary impact assessment.

Embedded Mitigation

11.6.2 EIA is an iterative process which informs the development of the project design. Where the outputs of the preliminary assessment identify likely significant effects changes to the design can be made or mitigation measures can be built-in to the proposal to reduce these effects.

11.6.3 This type of mitigation is defined as embedded mitigation, as mitigation measures which have been identified and adopted as part of the evolution of the project design ("embedded" into the project design).

11.6.4 The design of the Project will be further developed to reflect the findings of ongoing environmental studies, comments raised during this statutory consultation and ongoing engagement with stakeholders. As the design develops, the embedded mitigation measures will also be refined as part of an iterative process.

11.6.5 At this stage of the Project's development, the following key embedded mitigation is proposed as described in **Table 11-16**.

Table 11-16: Key Embedded Mitigation

Topic	Key embedded mitigation	Summary
Watercourse crossings	Pipeline crossing techniques and locations	A variety of trenchless crossing techniques may be used when open-cut methods are not appropriate, including: auger boring; horizontal Directional Drilling (HDD), micro-tunnelling and guided auger boring. The current Preliminary Crossing Schedule includes a variety of these techniques. Larger crossings are identified as non-intrusive crossings. Design work is currently ongoing to identify the preferred method required for each crossing and details will be discussed with the relevant statutory consultees at a later stage. The ES will include a full impact assessment of the preferred crossing methods for each watercourse.
Hydrostatic testing	Water sourcing and discharge	After the pipeline sections are cleaned and gauged they are subjected to hydrostatic test. Temporary test ends are welded or bolded to both end of the pipeline which is then filled with water. The water would be sourced from a local watercourse and subsequently discharged into the same watercourse after use subject to agreement with stakeholders. If local watercourses are unsuitable, water would either be brought in by tanker or draw off a mains water stand-pipe supply. Design details are currently evolving to cover this component and details relating to the proposed

Topic	Key embedded mitigation	Summary
		sources and disposal methods will be included within the ES.
Soil reinstatement	Ground reinstatement	Along the pipeline route, the ground will be reinstated with stored topsoil and subsoil following trenching, within the same year as construction should weather conditions allow. Restoration activities will include reseeding of pasture land and reinstatement of field boundaries. The applicant is committed to making a positive contribution to biodiversity net gain and additional details will be included within the ES.
Land drainage	Land drainage reinstatement	The location and condition of existing land drainage would be investigated prior to construction. Where necessary, field drainage would be newly installed or restored elsewhere to enable landowners field drains to continue working throughout the construction period. A specialist Land Drainage contractor would be procured to undertake this work, and a post construction drainage scheme will be designed by a land drainage expert. All relevant permits and consents will be sought from the Environment Agency, LLFA, Internal Drainage Board and River Trust where necessary.
Dewatering	Dewatering discharge	Dewatering of the trench and other excavations may be required in some areas to stabilise the surrounding ground during construction. This activity would be subject to a separate consent under the Environmental Permitting (England and Wales) Regulations and an approved Permit to Pump would be required for all pumping operations (before dewatering or discharges commence). Water will never be pumped directly to a watercourse or be allowed to directly enter a watercourse or be discharged to ground
Permanent drainage	SuDS	The Block Valve Station's surface will be constructed so that rainfall can drain to existing open ground, to soakaways or to existing drainage facilities as appropriate. The majority of the site will have permeable surface to minimise runoff. Swales and soakaways will be utilised to promote sustainable drainage, and cut-off drainage channels will be provided to prevent surface water ingress onto the site.

11.6.6 Given that the design work is currently ongoing, additional mitigation is identified within this chapter that may be incorporated into the final design of the Project prior to submission of the ES. These recommended additional mitigations are included in **Table 11-17**.

Table 11-17: Recommended Embedded Mitigation

Topic	Key mitigation	Mitigation Summary
Construction phase		
Pipeline watercourse crossing methodology	Non-intrusive crossings	It is recommended that trenchless, non-intrusive crossings are used for pipeline installation across all larger WFD waterbodies (main stem channels), Main Rivers and for larger IDB managed waterbodies, unless the risks of trenchless waterbodies are considered more likely to result in impacts (i.e. excessive dewatering). There is the potential that non-intrusive crossings may result in more significant impacts than open-cut, due to the requirement for the auger pits either side of the watercourse. Where groundwater levels are high, this could require significant pumping, which may result in localised dewatering. Therefore it is recommended that the crossing methodology for more sensitive waterbodies is considered on a case by case basis with consultation from stakeholders.
	Open-cut crossing calculations	Where open-cut crossings of minor watercourses are required, a pre-works survey is required to provide a full description of the location prior to any works being carried out, and which can inform channel reinstatement (although where there are opportunities to reinstatement with morphological enhancement this should be considered). Provision should be made for over-pumping or fluming to allow the continued passage of water through the working area. The works should be undertaken during periods of lower flow to avoid potential flooding or pollution incidents. Any over pumping should be designed to the appropriate flow standard, and provision for pollution control, erosion protection, and flood storage should be made to ensure to temporary effects to receptors. Where there are coarse sediments in the channel this 'bed' material should be carefully removed first and stored separately so that it can be reinstated on completion of the pipe installation works.
Temporary access track methodology	Identification of appropriate crossing methodology on a case by case basis	It is assumed at this stage that the majority of watercourses crossed by the pipeline will also require access track crossings. This may not be required in some locations due to suitable public road crossings being located within a close vicinity of the pipeline crossing. The crossing of each waterbody should be considered on a case-by-case basis based on WFD and

Topic	Key mitigation	Mitigation Summary
		flood risk effects. Clear span bridges should be provided where practicable. Some larger watercourses with non-intrusive crossings might not be crossed due to environmental constraints. Consultation with relevant stakeholders will be undertaken.
Dewatering	Dewatering treatment	Where dewatering is required, a dewatering scheme will be developed prior to construction (in consultation with the EA) to demonstrate that there is an effective strategy to manage water arising from the operations and, where required, sufficient proposals to treat the water prior to controlled discharge. Any such assessment will consider the effects of any draw down or impacts on nearby abstractions or resources.
Construction drainage	Covenham reservoir	Surface water and groundwater discharges should not be made upstream of the abstraction points of Louth Canal, Great Eau and Long Eau to Covenham Reservoir.
	Settlement	Surface water run-off and excavation dewatering would be captured and settled out or filtered prior to disposal to any surface water features. Any contaminants to be removed prior to discharge from the Site, including the use of construction SuDS features or proprietary measures such as settlement tanks or lamella clarifiers etc.
Watercourse buffers	Watercourse buffers	With the exception of watercourse crossings, a suitable buffer of 10m from the edge of large watercourses and 10m from the centre line of minor watercourses, where the channel is less than 5m wide, should be applied around all surface waterbodies to reduce the ingress of sediment and other contaminated materials.
Storage of materials	Floodplain exclusion	Storage of materials should be outside of the mapped flood zone 3 where possible. Any temporary storage within the floodplain would be subject to Environment Agency guidance. In the event that storage is within the floodplain, provisions to prevent stored material being washed into watercourses during a flood should be undertaken, and this should be outlined within the Flood Evacuation and Management Plan to prevent risk to the environment or people.
Hydrostatic testing	Water resources assessment	As noted in the embedded mitigation, the source of the hydrostatic testing water is not confirmed, however it may be sourced from local waterbodies. This may involve abstraction and discharge licences, and as such a water resources assessment should be undertaken to identify the sustainable source of water, and additionally water should be discharged to the point at which it was

Topic	Key mitigation	Mitigation Summary
		extracted following appropriate treatment. This will be a single event and will ensure that an appropriate amount of water is abstracted which does not affect downstream abstractions or the water environment.
Offset mitigation	Potential for riparian mitigation	There is the potential that there are unavoidable significant impacts that may be identified during the ES stage of the development, especially associated with temporary riparian vegetation losses. Therefore it is recommended that local locations for potential off-set mitigation are identified to allow for measured to be offset and provide a biodiversity net gain. These areas should be identified through stakeholder engagement and site walkovers.
Operational phase		
Above ground drainage	Runoff rate	The drainage strategy for above ground infrastructure has not been developed at this stage. It is currently being recommended that all above ground infrastructure achieves a greenfield runoff rate to ensure no increased runoff downstream receptors.
	SuDS	The embedded mitigation incorporates SuDS measures included swales, permeable paving and soakaways. These mitigation measures should be applied for all above ground infrastructure following the SuDS treatment train to be determined using the Simple Index Approach as described in the C753 The SuDS Manual 2nd edition (Ref 11-24).

Additional Mitigation

Construction Phase

11.6.7 A Preliminary Draft Construction Environmental Management Plan (CEMP) has been prepared as part of this PEIR and can be found in *PEIR Volume IV - Appendix 3.1*. This sets out the preliminary additional and enhancement mitigation measures identified at this stage of the process as the PEIR has been developed. This section summarises the types of mitigation measures that will be considered to mitigate against the effects on the water environment where required. These measures should be adopted during the construction phase and will be refined and be developed as part of the construction assessment for the ES:

- ***G1**: Prepare a Flood Warning and Evacuation Plan which contains information on flood emergency response actions;*
- ***G2**: Establish the location and condition of existing land drainage and compile a record. Subject to landowner/occupier agreement, existing drains should be restored, or new drains established to help prevent damage to soil structure, maintain work areas in a dry condition and to enable current drainage systems to continue to operate through the construction period;*

- ***G3**: The design of these drainage schemes will be agreed by Harbour Energy, the Contractor(s), and the landowners / occupiers. A specialist drainage contractor in most instances will carry out the work. Permanent records of the land drainage locations will be produced;*
- ***G4**: Seek the relevant permits / consents where required from the Environment Agency and Lead Local Flood Authority where necessary;*
- ***G5**: Prepare a Pollution Prevention Plan with measures necessary for the effective prevention of pollution;*
- ***G6**: Produce an Environmental Emergency Response Plan documenting measures to prevent pollutants infiltrating into the soils beneath the site and reaching surface and groundwater receptors;*
- ***G7**: Temporary access and pipeline crossings of watercourses will be undertaken in accordance with good practice guidance: Environment Agency and Construction Industry Research and Information Association (CIRIA) Pollution Prevention Guidelines (although revoked represent good practice), including CIRIA Report C750 'Groundwater Control: Design and Practice' and C648 'Control of Water Pollution from Linear Construction Projects';*
- ***G8**: Crossing locations will be selected to make the crossing as close to perpendicular to the watercourse as reasonably practicable, ensuring the crossing is as short as possible and for open cut / temporary access crossings reducing the risk of localised scour at the structures;*
- ***G9**: The watercourse crossings will be designed to maintain downstream flows and to allow continued and unobstructed passage for aquatic organisms and mammals (otter and water vole) using river corridors;*
- ***G10**: Flumes will be sized to maintain the current land drainage regime and the existing flow, following a study to understand the hydrology of the watercourse being crossed in order to assess the range of flows likely during the temporary works;*
- ***G11**: Following installation of the pipeline, topsoil and excavated material will be reinstated and a post-construction drainage system installed to ensure no detriment to the existing land drainage regime;*
- ***G12**: At the temporary construction compounds, materials will be stored in accordance with good practice and the compounds will have suitable surface water and foul water drainage provision. This will prevent pollution of the water environment;*
- ***G13**: Appropriate equipment (e.g. spill kits) will be made available for all items of plant on site to deal with accidental spillages and Pollution Prevention Plan will provide a full list of protocols and communication channels with the Environment Agency in the event of an accidental pollution incident;*
- ***G14**: Surface water runoff from the pipeline spread will be managed to prevent discharge of silted water into any surface watercourse or drain. Details to be included in the Drainage Management Plan;*
- ***G15**: Where practicable, plant to be filled with biodegradable oil, in line with the plant manufacturer's instruction, to reduce the potential for pollution to watercourses in the event of a hydraulic oil pipe failure;*
- ***G16**: Watercourses near work sites would be inspected daily when work activity is being carried out. Inspections will look for signs of siltation or other forms of pollution for the*

duration of the period of ground disturbance and work site drainage would be inspected and maintained as required, so that it continues to operate to their design standard;

- ***G17**: If a wheel washing system is required, the wash down of construction vehicles and equipment should take place in designated washdown areas within construction compounds. Waste wash water should be prevented from passing untreated into watercourses or groundwater. Appropriate measures will include use of sediment traps;*
- ***G18**: Consider battery powered plant when working close to watercourses;*
- ***G19**: Implement working methods that reduce water consumption and measures that improve water-use efficiency on site;*
- ***G20**: Undertake water audits that identify all water-using processes, activities and equipment on Site (these will be updated periodically to reflect any significant changes in site activities through the Project life cycle);*
- ***G21**: Develop an action plan, including staff engagement and training for relevant staff, to reduce water consumption by all water-using processes, activities and equipment on site;*
- ***G22**: Undertake monitoring regime to assess the effectiveness of water conservation measures in the action plan (G21);*
- ***G23**: Establish a reporting regime to advise on the effectiveness of the action plan (G21) (which will be completed at a minimum of annually); and*
- ***G24**: Where necessary and subject to agreement with the landowner/occupier, new field drains will be installed to aid recovery from the construction activities and ensure site work areas are appropriately drained.*

11.6.8 A CEMP helps to ensure that construction work considers aspects of environmental protection within the context of compliance with local legislation and minimisation of the impacts on humans and the environment. A CEMP allows a proactive approach in controlling potentially polluting activities to prevent adverse public health impacts, nuisance, and hazards to the natural and human environment.

11.6.9 The Preliminary Draft CEMP (*Appendix 3-1*) includes provision for a Water Management Plan (WMP), Drainage Management Plan (DMP), Flood Warning and Evacuation Plan, Water Efficiency Management Plan, and a number of other Environmental Control Plans. The WMP would include more specific detail on the measures to manage excess fine sediment in runoff, spillage risk and spills, emergency response, and flood risk management. The WMP will also set out the scope of any water quality monitoring to be undertaken during the works.

11.6.10 The Preliminary Draft CEMP (*Appendix 3-1*) will be updated as the project progresses and submitted as part of the DCO application. This will be implemented by the Principal Contractor and would detail the types of risks pertinent to the construction works and the mitigation measures that would be required to avoid, minimise and reduce impacts of activities as far as practicable. 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.

Good Practice Guidance

11.6.11 The CEMP and WMP will comprise good practice methods that are established and effective measures to which the development will be committed through the development consent. The measures include:

- Setting out details of any water quality monitoring to be undertaken during construction;
- Controlling and minimising the risk of pollution to surface waters and groundwater by managing construction site runoff and the risk of chemical spillages;
- Measures to control the storage, handling and disposal of potentially polluting substances during construction;
- Management of water removed from excavations. Managing the risk from groundwater flooding through appropriate working practices (during excavations) and with adequate plans and equipment in place for de-watering to ensure safe dry working environments; and
- Appropriate methods and mitigation measures when undertaking works within, over, under and adjacent to waterbodies'.

11.6.12 The following relevant Guidance for Pollution Prevention (GPP) have been released to date on the NetRegs website (Ref 11-49) 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.

11.6.13 Where new GPPs are yet to be published, previous 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 (Ref 11-50);
- PPG7: Safe storage – the safe operation of refuelling facilities (Ref 11-51); and
- PPG18: Managing fire water and major spillages (Ref 11-52)

11.6.14 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 (Ref 11-52);
- British Standards Institute (2013) BS8582 Code of Practice for Surface Water Management of Development Sites (Ref 11-54);
- C753 (2015) The SuDS Manual (second edition) (Ref 11-24);
- C741 (2015) Environmental good practice on site guide (fourth edition) (Ref 11-55)
- C648 (2006) Control of water pollution from linear construction projects, technical guidance (Ref 11-56);
- C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice (Ref 11-57);
- C532 (2001) Control of water pollution from construction sites – Guidance for consultants and contractors (Ref 11-58); and
- C736F Containment systems for prevention of pollution (Ref 11-59).

11.6.15 During the construction phase, discharges from the works to surface waterbodies or to ground containing potentially polluting substances may require an Environmental Permit from the Environment Agency. Works undertaken above, below or within 8 m of a watercourse or flood defence or on the floodplain may also require a Flood Risk Activity Permit from the Environment Agency, unless a defined exemption applies. Furthermore, dewatering operations, watercourse diversions and realignments may require abstraction, transfer or impoundment licences from the Environment Agency, again unless an exemption applies (e.g. compliance with a Regulatory Position Statement).

11.6.16 Any temporary or permanent works that may affect the flow in an Ordinary Watercourse may require a Land Drainage Consent from the LLFA and the design compliant with any byelaws. The Project will also develop an artificial land drainage strategy, led by a land drainage specialist, for both pre-construction and post-construction.

11.6.17 It is anticipated that monitoring of watercourses at risk of pollution during the construction phase will be undertaken. This will include a period of baseline data collection in advance of the works.

11.6.18 The full suite of appropriate mitigation measures will continue to be developed and will be set out in detail in the final ES.

Operational Phase

11.6.19 The design of above ground infrastructure would include an appropriately designed surface water collection and treatment system, as well as design measures to ensure that the Project does not generate any adverse flood risks to adjacent areas (e.g., appropriate design of watercourse crossings and potential floodplain compensation provisions). Option-specific mitigation measures have not been identified at this stage - these will be identified in the ES.

11.6.20 Sustainable drainage systems (SuDS) would provide a way to attenuate runoff from the Project to a rate agreed with the Environment Agency and / or the LLFA to avoid increasing flood risk, but they are also important in reducing the quantities and concentration of diffuse urban pollutants found in runoff. Their design and use would depend on factors, such as site-specific constraints. Ponds, wetlands and swales are preferred sustainable solutions, as these options mimic natural drainage and can be used to deliver other environmental benefits. However, in some situations where space is constrained or there is a particularly

high risk, sustainable measures may be proposed in a treatment train with proprietary measures such as vortex flow separators.

11.6.21 The development of SuDS would take account of Defra guidance on the use, design and construction of SuDS, and current best practice guidance on the planning for and design of SuDS treatment contained in CIRIA's SuDS Manual (Ref 11-24), DMRB CD532 Vegetated Drainage Systems for Highway Runoff (Ref 11-25), and DMRB CG501 Design of Highways Drainage Systems (Ref 11-26). The location, design and management of SuDS would be agreed with the relevant consultation bodies prior to construction.

11.6.22 The routine operation of the Project is not likely to have significant effects on the water environment as it is assumed that the principal watercourses crossed by the Project would be non-intrusive and drilled / bored beneath the bed at a sufficient depth to avoid exposure. If required, the sensitive design of watercourse crossing points is an essential part of minimising this impact and would be considered as the Project's design progresses. The Environment Agency, LLFAs and IDBs will be consulted on the appropriate design of any required watercourse crossing structures.

11.6.23 Any increases in hardstanding within the surface water drainage catchment may increase surface water runoff and may impact on flood risk to and from the Project. An FRA has been developed in *Appendix 11-4* and will be developed further in the ES. Any heightened flood risk must be mitigated through design or compensatory storage.

Decommissioning Phase

11.6.24 The decommissioning phase would apply similar design and mitigation measures as the Construction Phase. Standard pollution prevention and construction best practices would be adopted to mitigate potential impacts upon the water environment where required and reasonably practicable. Such measures would be included in an EMP developed specifically for the Decommissioning phase.

11.6.25 The CEMP (Decommissioning) would be prepared and submitted prior to decommissioning of the Project for approval by the relevant bodies. The Decommissioning EMP would be implemented by the Principal Contractor and would detail the types of risks pertinent to the construction works and the mitigation measures that would be required to avoid, minimise and reduce impacts of activities as far as practicable. Specific examples of the types of mitigation likely required for decommissioning will be detailed within the ES.

11.7 Likely Impacts and Effects

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

Construction Phase

11.7.2 During construction, there is a risk of pollution to surface water from activities involving polluting substances such as fuels, cementitious products and other chemicals as well as from excessive fine sediment in runoff from the disturbance of soil during earthworks etc., and potential effects to flood risk associated with construction activities, including:

- Pollution of surface waterbodies due to deposition or spillage of soils, sediment, oils, fuels, or other construction chemicals, or through uncontrolled site run-off;
- Temporary impacts on sediment dynamics and hydromorphology within watercourses and waterbodies, especially where watercourses need to be crossed by the pipeline or access tracks;

- Temporary changes in flood risk from changes in surface water runoff and exacerbation of localised flooding, due to deposition of silt, sediment in drains and ditches or works on the floodplain;
- Temporary changes in flood risk due to general site clearance, construction works, and the creation of site compounds and storage facilities, which alter surface water runoff;
- Potential impacts on local water supplies; and
- Hydrostatic testing of the pipeline may result in potential for effects to water resources (for abstraction and disposal), potential introduction of sediment and other pollutants, and potential of seepage into surface water receptors.

11.7.3 Impacts to groundwater are considered in *Chapter 9: Geology and Hydrogeology*.

11.7.4 The method to cross each watercourse would involve either trenchless or open cut (intrusive) methods. This specification is yet to be fully determined and would be dependent on various factors inclusive of size of crossing and stakeholder feedback. In addition, watercourses would also be crossed by haul roads, but the location or design is yet to be determined for this.

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

11.7.6 Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation. 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.

11.7.7 Generally, excessive fine sediment in runoff is chemically inert and affects the water environment through smothering riverbeds and plants, temporarily changing water quality (e.g., increased turbidity and reduced photosynthesis) and causing physical and physiological adverse impacts on aquatic organisms (such as abrasion or irritation).

11.7.8 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.

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

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

11.7.11 Any construction works on the floodplain 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.

Operational Phase

11.7.12 During the operational phase of the Project, the following water environment impacts may occur:

- Impacts on water quality in waterbodies that may receive surface water runoff or be at risk of chemical spillages from above ground facilities for the Project (e.g., Pipeline Offtake Facility) from diffuse pollutants in runoff, operational discharges and the risk of chemical spillages;
- Hydromorphological impacts to waterbodies including changes to physical form which underpin habitats;
- Impacts on flood risk from increased runoff from new impervious areas at above ground facilities for the Project;
- Potential impacts on hydrology as a result of the Project by changing the way water infiltrates into the ground and supports baseflow to waterbodies; and
- Permanent loss of floodplain within areas classified as Flood Zone 2 and 3.

Decommissioning Phase

11.7.13 The decommissioning phase of the Project may involve the removal of some above ground infrastructure, although some infrastructure may be left in situ including all or most of the underground infrastructure; the exact decommissioning strategy is not known at this stage of the Project.

11.7.14 However, based on professional judgement, decommission effects would be expected to be similar (albeit perhaps on a smaller scale) to the construction effects already described and could result in a temporary risk of pollution to surface water and potential effects to flood risk. Decommissioning would be subject to a further assessment in the future, however potential effects will be included within the ES Chapter.

11.8 Preliminary Assessment of Effects

11.8.1 The preliminary assessment of effects of the construction phase can be found in **Table 11-18**, the operation phase in **Table 11-19.** The decommissioning phase will result in similar effects to construction, therefore has not been included individually.

11.8.2 Confidence will be improved to “High” for all receptors within the ES based on further understanding of waterbody importance through site visits, further consultation with stakeholders, and through further design detail and mitigation measures.”

Table 11-18: Preliminary Assessment of the Water Environment during the Construction Phase

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
Surface water effects						
Section 1 - 4	Humber Estuary (Very High)	Surface water quality: suspended fine sediments in runoff	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP commitments (sediment)[2]	**Not Significant** – estuarine environments tend to be adapted to higher suspended sediment loads. Best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective. Confidence will be improved to "High" for the ES following site visits and further design progress.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP commitments (spills)[3]	**Not Significant** due to best practice and distance from scheme.	
Section 4 and 5	Lincolnshire Waterbody (coastal WFD) (High)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP commitments (sediment)[2]	**Not Significant** – Best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other

[2] Embedded mitigation and CEMP commitments relevant to all suspended fine sediment - See Section 11.6 for Mitigation and Appendix 3.2 Section 1.7 for commitments B14, B15, E2, F1, F2, F5, F9, G2, **G5**, **G6**, G7, G8, G11, G12, G13, **G14, G16, G17** in the CEMP.

[3] Embedded mitigation and CEMP commitments relevant to chemical spillages - See Section 11.6 for Mitigation and Appendix 3.2 Section 1.7 for commitments E2, E6, E7,G2, G5, G6, G7, **G12**, **G13**, **G15**, **G16**, **G17** in the CEMP.

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied and distance from scheme.	similar developments. Best practice mitigation measures are well known and effective.
Section 1	Internal Drainage Board waterbodies (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP commitments (sediment)[2]	**Not Significant** – Best practice mitigation measures will reduce sediment in runoff from the Site. Where intrusive crossings are proposed some localised fine sediment impacts during set up of the dry working area, bank disturbance and reinstatement may result in short term impacts.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Other permanent	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and Preliminary Draft CEMP	**Not Significant** due to best practice mitigation measures being applied.	Low as the crossing type is not currently confirmed and the importance of the

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	Watercourses (Medium)			commitments (sediment)[2]		waterbodies may change following site visit and further desk study.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied and distance from scheme.	
	Ephemeral and/or artificial drains, and ditches (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** – Best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied and distance from scheme.	
Section 2	North Beck Drain (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as indicated to be auger bore / non-intrusive crossing and best practice mitigation measures will reduce sediment in runoff from the Site.	High as the crossing type is confirmed as auger bore / non-intrusive, baseline is complete, and best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP	**Not Significant** due to best practice mitigation measures being applied and distance from scheme.	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
				commitments (spills)[3]		
	Mawnbridge Drain (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as waterbody is not directly crossed by the pipeline and best practice mitigation measures will reduce sediment in runoff from the Site.	High as the crossing will not directly cross the waterbody.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)	**Not Significant** as waterbody is not directly crossed by the pipeline and best practice mitigation measures will reduce sediment in runoff from the Site.	
	Internal Drainage Board waterbodies (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	Other permanent Ordinary Watercourses (Medium)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied.	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Ephemeral and/or artificial drains, ditches (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** – Best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
Section 3	Laceby Beck / River Freshney (to N Sea) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as although indicated to be open cut, however best practice mitigation measures will reduce sediment in runoff from the Site. Where intrusive crossings are proposed	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					some localised fine sediment impacts during set up of the dry working area, bank disturbance and reinstatement may result in short term impacts.	mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Waithe Beck lower (to Tetney Lock) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as indicated to be auger bore / non-intrusive crossing and best practice mitigation measures will reduce sediment in runoff from the Site.	High as the crossing type is confirmed as auger bore / non-intrusive, baseline is complete, and best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	New Dike (trib of Louth Canal) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied and the waterbody not being directly crossed by the proposed pipeline.	High as the crossing will not directly cross the waterbody.

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Land Dike Drain to Louth Canal (West) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as waterbody is not directly crossed, and best practice mitigation measures being applied.	High as the crossing will not directly cross the waterbody.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied and distance from scheme.	
	Internal Drainage Board waterbodies (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Other permanent	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP	**Not Significant** – Best practice mitigation measures will reduce	Low as the crossing type is not currently confirmed and the

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	Watercourses (Medium)	reaching waterbody		commitments (sediment)[2]	sediment in runoff from the Site.	importance of the waterbodies may change following site visit.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Ephemeral and/or artificial drains, ditches (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** – best practice mitigation measures are likely to reduce sediment and any sediment likely to settle prior to reaching waterbodies.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
Section 4	Poulton Drain (trib of Louth Canal) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice and trenchless installation method	High as the crossing type is confirmed as auger bore / non-intrusive, baseline is complete, and best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP	**Not Significant** due to best practice mitigation measures being applied.	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
				commitments (spills)[3]		
	Black Dyke (trib of Louth Canal) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as indicated to be auger bore / non-intrusive crossing and best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Louth Canal (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as indicated to be auger bore / non-intrusive crossing and best practice mitigation measures will reduce sediment in runoff from the Site.	High as the crossing type is confirmed as auger bore / non-intrusive, baseline is complete, and best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	South Dike and Grayfleet Drain (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as although indicated to be open cut, however best practice mitigation measures will reduce sediment in runoff from the Site. Where intrusive crossings are proposed some localised fine sediment impacts during set up of the dry working area, bank disturbance and reinstatement may result in short term impacts.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Internal Drainage Board waterbodies (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practices mitigation measures being applied.	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
						are well known and effective.
	Other permanent Watercourses (Medium)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied.	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Ephemeral and/or artificial drains, ditches (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** – as best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
Section 5	Long Eau (High)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as indicated to be auger bore / non-intrusive crossing and best practice mitigation measures will reduce	High as the crossing type is confirmed as auger bore / non-intrusive, baseline is complete, and best

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					sediment in runoff from the Site.	practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Great Eau (d/s of South Thoresby) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as indicated to be auger bore / non-intrusive crossing and best practice mitigation measures will reduce sediment in runoff from the Site.	High as the crossing type is confirmed as auger bore / non-intrusive, baseline is complete, and best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Trusthorpe Pump Drain (upper end) (High – WFD waterbody)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** as waterbody is not directly crossed and best practice mitigation measures being applied.	High as the baseline is complete, best practice mitigation measures are effective, and the waterbody is not directly crossed.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP	**Not Significant** due to best practice mitigation measures being applied and distance from scheme	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
				commitments (spills)[3]		
	Internal Drainage Board waterbodies (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** due to best practice mitigation measures being applied.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
	Other permanent waterbodies (Medium)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** – Best practice mitigation measures will reduce sediment in runoff from the Site. Where intrusive crossings are proposed some localised fine sediment impacts during set up of the dry working area, bank disturbance and reinstatement may result in short term impacts.	Low as the crossing type is not currently confirmed and the category of the waterbodies may change following site visit.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP	**Not Significant** due to best practice mitigation measures being applied.	

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
				commitments (spills)[3]		
	Ephemeral and/or artificial drains, ditches (Low)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[2]	**Not Significant** – as best practice mitigation measures will reduce sediment in runoff from the Site.	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts	Embedded mitigation and CEMP commitments (spills)[3]	**Not Significant** due to best practice mitigation measures being applied.	
Hydromorphology effects						
Section 1	Internal Drainage Board waterbodies (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.

[4] Embedded mitigation and CEMP commitments relevant to all suspended fine sediment - See Section 0 for Mitigation and Appendix 3.2 Section 1.7 for commitments B9, B10, B11, B15, B16, F1, F2, F5, F9, F10 G2, G3, G8, G9, G10, G11, G14, G16 in the CEMP.

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	Other permanent waterbodies (Medium)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
	Ephermal and/or artificial drains, ditches (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.
Section 2	North Beck Drain (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore / non-intrusive and baseline is complete.
	Internal Drainage Board waterbodies (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term	Moderate. The assessment is informed by professional judgement and experience of other

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					impacts whilst reinstatement takes effect	similar developments. Best practice mitigation measures are well known and effective.
	Other permanent waterbodies (Medium)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
	Ephermal and/or artificial drains, ditches (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other Projects.
Section 3	Laceby Beck / River Freshney (to N Sea) (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Potentially Significant** as indicated to be open cut. However this crossing is at the upper reach of the WFD designation and open cut is most suitable methodology due to ground	Low. There is a general understanding of the Project activities being undertaken and the associated impacts based on

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					conditions. Best practice mitigation measures detailed within the Draft CEMP (Appendix 3-1) are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect. Additional mitigation may be recommended at the ES stage.	other Projects. However importance of waterbody will be confirmed with site visit which may reduce the impact significance, additionally alternative methodologies may be considered.
	Waithe Beck lower (to Tetney Lock) (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore / non-intrusive and baseline is complete.
	New Dike (trib of Louth Canal) (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other Projects. Site visit should bring confidence to High.

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	Internal Drainage Board waterbodies (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other Projects. Site visit should bring confidence to High.
	Other permanent waterbodies (Medium)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
	Ephermal and/or artificial drains, ditches (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Moderate. The assessment is informed by professional judgement and experience of other similar developments. Best practice mitigation measures are well known and effective.

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
Section 4	Poulton Drain (trib of Louth Canal) (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore / non-intrusive and baseline is complete.
	Black Dyke (trib of Louth Canal) (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore / non-intrusive and baseline is complete.
	Louth Canal (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore / non-intrusive and baseline is complete.
	South Dike and Grayfleet Drain (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Potentially Significant** as indicated to be open cut, however conservative assumption. This crossing is in a location with artificial plan form and low morphological value. May result in short to medium term impacts whilst reinstatement takes effect. Additional mitigation may	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other Projects. However importance of waterbody will be confirmed with site

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					be recommended at ES stage.	visit. which may reduce the impact significance, additionally alternative methodologies may be considered.
	Internal Drainage Board waterbodies (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
	Other permanent waterbodies (Medium)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.
	Ephermal and/or artificial drains, ditches (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term	Moderate. There is a general understanding of the Project activities being undertaken and the associated

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					impacts whilst reinstatement takes effect	impacts based on other projects.
Section 5	Long Eau (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore and baseline is complete.
	Great Eau (d/s of South Thoresby) (High)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** as indicated to be auger bore / non-intrusive crossing	High as the crossing type is confirmed as auger bore and baseline is complete.
	Internal Drainage Board waterbodies (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts whilst reinstatement takes effect	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
	permanent ordinary waterbodies (Medium)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term	Low as the crossing type is not currently confirmed and the importance of the waterbodies may change following site visit.

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
					impacts whilst reinstatement takes effect	
	Ephermal and/or artificial drains, ditches (Low)	Temporary morphological impacts to waterbodies: crossings for the pipeline corridor	Medium term impacts	Embedded mitigation and CEMP commitments (sediment)[4]	**Not Significant** – best practice mitigation measures are likely to reduce morphological impacts, however open cut may result in short term impacts	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
Flood Risk and Water Resources Effects						
All sections	Flood risk: Construction workers (High)	Flooding from fluvial and sea sources during construction	Medium term impacts	See Section 11.6 for Mitigation and Appendix 3.2 Section 1.7 for commitments F5, G1, G2, G3, G4 G10, G11, G12, G16, G24 in the CEMP. Implementation of Water Management Plan which is still to be produced (embedded mitigation).	**Not Significant** – best practice mitigation measures are likely to reduce the risk, while incorporating flood warning and evacuation measures will reduce the risk.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
		Flooding from surface water sources during construction				
		Flooding from groundwater sources during construction				
		Flooding from drainage artificial sources and drainage				

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
		infrastructure during construction				
Section 1	Flood Risk: Immingham Industrial area (medium)	Temporary increases in flooding to offsite receptors due to temporary crossings, diversions and sediment	Medium term impacts	See Section 11.6 for Mitigation and Appendix 3.2 Section 1.7 for commitments F5, G1, G2, G3, G4 G10, G11, G12, G16, G24 in the CEMP. Implementation of Water Management Plan which is still to be produced (embedded mitigation).	**Not Significant** – best practice mitigation measures are likely to reduce most risk, and pipe crossings and construction crossings to be designed to ensure no significant increase in flood risk. Potential for small, localized increases in flooding.	Low as the crossing types is not currently confirmed and further review of flood risk is required.
Sections 2 – 5	Flood Risk: agricultural land (medium)		Medium term impacts			
All sections	Flood Risk: residential areas (high)		Medium term impacts		**Not Significant** – pipeline does not cross within a residential area, and any increases in flooding likely to be localized and not impact on residential properties.	
Sections 4 and 5	Potable water supply: Covenham Reservoir Water Body (Very High)	Surface water quality: suspended fine sediments	Medium term impacts	Embedded mitigation and CEMP commitments Implementation of Water Management Plan which is still to be produced	**Not Significant** – abstractions for the reservoir are significantly downstream of the potential crossings, therefore embedded mitigation and monitoring should prevent any	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
		Surface water quality: chemical spillages, hydrostatic testing	Medium term impacts			

Section	Receptor and importance of receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
				(embedded mitigation).	significant impact on potable water supply.	
All sections	Foul Drainage: Waterbodies and/or Anglian water drainage network (Medium to High)	Increased foul drainage discharge due to construction workers	Medium term impacts	See Section 11.6 for Mitigation and Appendix 3.2 Section 1.7 for commitments G12 in the CEMP .	**Not Significant** – foul drainage arrangements will be decided following consultation with stakeholders and incorporate best practice.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
All sections	Potable water supply (Very High)	Effects on water resources demand due to construction	Medium term impacts	See Section 11.6 for Mitigation and Appendix 3.2 Section 1.7 for commitments E4, F6, G12, G19, G21, G22 in the CEMP.	**Not Significant** – potable water supply will incorporate best practice and will be decided following consultation with stakeholders	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.

Table 11-19: Preliminary Assessment of the Water Environment during the Operational Phase

Section	Receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
All sections	Water quality: All waterbodies (Low to High)	Potential pollution from pipeline leakage	Long term impacts	See *Chapter 3: The Viking CCS Pipeline*	**Not Significant** – no long-term pollution from the pipeline due to CO_2	High as the application of mitigation measures

Section	Receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
		Runoff from above ground infrastructure / parking to waterbodies	Long term impacts	and see Section 11.6 for Mitigation	**Not Significant** – SuDS measures will treat runoff prior to entering waterbodies	has proven to be effective in other pipeline / similar projects and there are limited effects of the Project during operation on the water environment.
	Hydromorphology: All waterbodies (Low to High)	Changes to watercourse morphology (riparian zones, riverbeds and banks, shading) due to pipeline	Long term impacts	See *Chapter 3: The Viking CCS Pipeline* and see Section 11.6 for Mitigation	**Not Significant** – Pipeline to be buried below bed of crossings, therefore no anticipated effects.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
		Permanent above ground crossings resulting in changes to watercourse morphology	Long term impacts		**Not Significant** – Any permanent water crossings (if required) will be designed in accordance with stakeholder input and relevant guidance.	Low as the locations and designs of any permanent waterbody crossings are not confirmed (may not be required)
	Flood Risk: Project above ground infrastructure / essential	Flooding from fluvial and sea sources during operation	Long term impacts	See Section 11.6 for Mitigation Implementation of the drainage strategy / water	**Not Significant** – Design of above ground infrastructure will be in line with the NPPF and take account of all sources of flooding.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts
		Flooding from surface water				

Section	Receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
	infrastructure (Very high)	sources during operation		management plan (embedded mitigation)	Flood Warning plans to be developed to mitigate any residual risk.	based on other projects.
		Flooding from groundwater sources during operation				
	Flood Risk: industrial and agricultural land (Medium)	Increased risk of groundwater flooding due to pipeline	Long term impacts	See Section 11.6 for Mitigation Implementation of the drainage strategy / water management plan (embedded mitigation)	**Not Significant** – any increases in groundwater flow paths would be localized, and unlikely to result in additional flooding.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.
		Increased hard standing due to above ground infrastructure resulting in increased flooding to offsite receptors	Long term impacts		**Not Significant** – although drainage design has not been developed, it will incorporate SuDS measures, and recommended to incorporate greenfield runoff rates therefore mitigating any additional hard standing	
	Potable water supply: Anglian Water (Very High)	Increase in potable water demand due to operational staff facilities	Long term impacts	See Section 11.6 for Mitigation	**Not Significant** – low staff anticipated, therefore low potable water usage. Water supply will be identified following consultation with stakeholders.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts

Section	Receptor	Potential Impact	Duration	Mitigation	Likely significance of effect	Confidence in Prediction
						based on other projects.
	Foul Drainage: Waterbodies and/or Anglian water drainage network (Medium to High)	Foul water discharge	Long term impacts	See Section 11.6 for Mitigation	**Not Significant** – low staff anticipated, therefore low foul drainage for disposal. Foul drainage arrangements will be identified following consultation with stakeholders.	Moderate. There is a general understanding of the Project activities being undertaken and the associated impacts based on other projects.

11.9 Summary and Next Steps

11.9.1 This chapter has identified baseline conditions and an initial assessment of the potential effects of the Project on the surface water environment, water resources and flood risk within the Draft Order Limits and potential downstream receptors within the Study Area. Below is a summary of this PEIR chapter:

- The Draft Order Limits crosses or is potentially in hydraulic connectivity to over 100 watercourses, including 16 watercourses designated as a Main River, and a large number of other water features;
- Surface watercourses along the Draft Order Limits generally flow from west to east to the Humber Estuary (which is a SSSI, Ramsar site, and SAC), and while Section 5 and the lower part of Section 4 flow into Saltfleetby – Theddlethorpe Dunes SSSI and SAC;
- The northern part of the Study Area is within both Humber RBD, and the southern part of the Study Area is within the Anglian RBD as set out in the Anglian RBMP. The Project has the potential to affect a total of fourteen WFD waterbodies, all of which are classified as heavily modified or artificial;
- The flood risk along the Draft Order Limits has been summarised from the Environment Agency online mapping and early consultation response from the Environment Agency:
  - There are fluvial floodplains associated with most Main Rivers along the entire Draft Order Limits;
  - There is surface water flood risk associated with minor watercourses, ponds and urban areas along the entire Draft Order Limits;
  - There is shallow groundwater along the entire Draft Order Limits, therefore there may be the risk of groundwater flooding;
  - The coastal area, associated with Section 1 and Section 5 has a high risk (Flood Zone 2 and 3) of tidal flooding from the Humber Estuary.
  - There is no risk of reservoir flooding along the entire Draft Order Limits.
- The Draft Order Limits crosses two internal drainage boards (IDB): North East Lindsey IDB which covers the coastal area around Immingham; and Lindsey Marsh Drainage Board, which covers the coastal area around Theddlethorpe. The Draft Order Limits crosses or is in 1 km of a large number of IDB managed waterbodies, especially within Sections 4 and 5.

11.9.2 Further assessment of baseline conditions, including water resources, will be undertaken as part of the ES through a detailed site walkover, and further consultation with stakeholders as the Project's design progresses. The draft database of the watercourses and standing waterbodies will be updated and developed further during the PEIR stage, based on the detailed site visit and further consultation, and the importance / sensitivities of receptors may be updated based on this additional information. Impacts to groundwater are considered in *Chapter 9: Geology and Hydrogeology*.

11.9.3 The principal potential effects identified at this stage that could occur during the construction phase are those associated with:

- Deposition or spillage of soils, sediment, oils, fuels, or hydrostatic testing fluid, resulting in pollution of surface water features, local water supplies, hydromorphology, or flood risk;

- Temporary watercourse crossings or the pipeline and access route that could impact on hydromorphology and flood risk; and
- Temporary changes in surface water runoff due resulting in changes to flood risk.

11.9.4 During the construction phase, standard pollution prevention and construction best practices would be adopted to mitigate potential impacts upon the water environment, which are included in the draft CEMP, which will be developed and updated as part of the ES to include the recommended additional mitigation. In addition, a WMP will also prepared, which would include more detail on the measures to manage water quality and flood risk. The WMP will also set out the scope of any water quality monitoring to be undertaken during the works.

11.9.5 During operation, there are unlikely to be any significant effects on water quality or hydromorphology, given that the pipeline crossings will be beneath the bed at a sufficient depth to avoid exposure. The key potential effects at the operational phase are associated with above ground infrastructure (including the Pipeline Offtake Facility and the offshore pipeline tie-in and outlet). Above ground infrastructure could provide a source of surface water pollution, alter surface water flow paths and increase flood risk.

11.9.6 Above ground infrastructure will be designed to include an appropriately designed surface water collection and treatment system, and will take account of SuDS, and be documented in the Drainage Strategy. The Drainage Strategy has not been developed at this stage, however the Project remains committed to providing SuDS measures and will aim to achieve greenfield runoff rates. Infrastructure would include design measures to ensure that the Project does not generate any adverse flood risks to adjacent areas (e.g. appropriate design of watercourse crossings and potential floodplain compensation provisions). Any heightened flood risk must be mitigated through design or compensatory storage.

11.9.7 A preliminary WFD Assessment (*PEIR Volume IV - Appendix 11-3*) has been carried out, including the scoping and screening stages. A full WFD will be carried out in order to ensure compliance by further assessing the impacts of the Project on geomorphology, water quality and ecological elements during EIA stage of the Project.

11.9.8 A preliminary FRA (*PEIR Volume IV - Appendix 11-4*) has been developed which identifies flood sources and guidance in relation to the project, however at this stage it is not possible to undertake a full assessment of effects. A full FRA will be undertaken at the EIA stage to establish the level of flood risk from all sources of flooding in the baseline and which remain after mitigation. The FRA will support the DCO application.

11.9.9 The decommissioning strategy has not been fully developed at this stage, however much of the below ground infrastructure is likely to remain in-situ, with above ground infrastructure being removed. The potential effects that could occur during the decommissioning phase similar to the construction phase, and similar mitigation measures will be applied as for the construction phase. The decommissioning will be subject to a further assessment in the future, however the likely effects and mitigations will be included within the ES chapters.

11.10 References

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