



# Humber Low Carbon Pipelines

Preliminary Environmental Information Report  
Volume II Chapter 17 Hydrology and Land Drainage  
October 2022

nationalgrid

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# 17. Hydrology and Land Drainage

## 17.1 Introduction

- 17.1.1 This Chapter reports the results of the preliminary assessment of the potential impacts and effects of the Project on Hydrology and Land Drainage and describes:
- Relevant legislation, policy and guidance;
  - Engagement undertaken to date;
  - The proposed assessment methodology and associated significance criteria;
  - Preliminary baseline conditions;
  - Potential impacts of construction, operation, and decommissioning;
  - Potential design, mitigation, and enhancement measures;
  - Summary of the preliminary assessment of potential significant effects; and
  - Next steps.
- 17.1.2 This assessment considers the simultaneous construction of a dual pipeline system (one for carbon dioxide and one for hydrogen), as well as the associated Above Ground Installations (AGIs). The majority of the carbon dioxide pipeline would be up to 600 mm (24”) nominal diameter and the hydrogen pipeline will be up to 900 mm (36”) nominal diameter. This is referred to as the Base Case in this Preliminary Environmental Information Report (PEIR). Also under consideration is the possibility of deploying a larger carbon dioxide pipeline, with a diameter up to 750 mm (30”) (with the hydrogen pipeline remaining the same diameter as within the Base Case). This is referred to in this PEIR as Sensitivity 1. Further details regarding the Base Case and Sensitivity 1, as well as the diameter and capacity of the pipelines are provided in Sections 2.3 and 2.4 of Chapter 2: Project Description (Volume II). This chapter assesses the impacts and effects associated with the Base Case. It is anticipated that the types of potential impacts for the Base Case and Sensitivity 1 would be the same, although the magnitude of impacts may differ. A full assessment of Sensitivity 1 will be undertaken and recorded within the Environmental Statement (ES) if the larger carbon dioxide pipeline diameter is taken forward into the Development Consent Order (DCO) application.
- 17.1.3 This Chapter (and Figures 17.1, 17.2, 17.3 and 17.4 (Volume IV) and Appendix 17.1 (Volume III)) is intended to be read as part of the wider PEIR. Groundwater aspects are covered in Chapter 9: Geology and Hydrogeology (Volume II).

## 17.2 Legislation, policy and guidance

- 17.2.1 A summary of the relevant international and national legislation and relevant national and local planning policy, as well as guidance relevant to the Hydrology and Land Drainage assessment for the Project is set out below.

## Legislation

### **The Floods and Water (Amendment etc.) (EU Exit) Regulations 2017 (Ref 17.1)**

- 17.2.2 The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (as amended) implemented the WFD in England and Wales. Under section 2 of the European Union (Withdrawal) Act 2018, the 2017 Regulations continue to have effect in domestic law following the UK's withdrawal from the European Union (Ref 17.1).
- 17.2.3 The purpose of the WFD is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and ground waters to prevent further deterioration in, and enhance, water quality, and to promote sustainable water use. The 2017 Regulations require the 'appropriate agency' (the Environment Agency, for England) to prepare River Basin Management Plans (RBMPs) for each river basin district (RBD), for the approval of the Secretary of State.
- 17.2.4 The RBMPs describe the current state of the water environment for each RBD, the pressures affecting the water environment, the objectives for protecting and improving it, and the programme of measures needed to achieve the statutory environmental objectives of the WFD (i.e., to enable water bodies to achieve Good status).
- 17.2.5 Under the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (Ref 17.2), an application for a DCO must be accompanied by a plan with accompanying information identifying water bodies in RBMP, together with an assessment of any effects on such water bodies likely to be caused by the development (reg. 5). This is commonly referred to as WFD assessment.

### **The Environment Act 2021 (Ref 17.3)**

- 17.2.6 Part 5 of the Environment Act 2021 (Ref 17.3), brings together measures to strengthen and update the existing regulatory and long-term planning framework for water, helping to reduce environmental risks, including to water quality and land drainage. It also strengthens the regulation of water and sewerage undertakers through the newly established Office for Environmental Protection.

### **Other legislation**

- 17.2.7 The Land Drainage Act 1991 (Ref 17.4) and the Environmental Permitting (England and Wales) Regulations 2016 (Ref 17.5) impose certain controls in relation to the placing of structures and the carrying out of works affecting main rivers and other watercourses.
- 17.2.8 Also relevant to the assessment are the requirements of the Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (Ref 17.6). In accordance with these Regulations, an ES submitted with an application for development consent must set out a description of the likely significant effects of the development on the environment, which includes the water environment (for example, hydromorphological changes, water quantity and water quality).
- 17.2.9 The Marine and Coastal Access Act 2009 (Ref 17.7) is also relevant to the assessment as the Act stipulates that structures proposed to be erected or activities proposed to be carried out in the UK marine area require a marine licence.

## Policy

### National Policy Statement (NPS) for Energy (EN-1) (Ref 17.8)

- 17.2.10 National Policy Statement for Energy (EN-1) (Ref 17.8) states that energy projects have the potential to have adverse effects on the water environment, noting that where significant effects are likely an assessment of the existing status of, and impacts of the Project on, water quality, water resources and physical characteristics of the water environment should be undertaken. Similar statements are also included in the Consultation draft of EN-1 (Ref 17.9). The potential for the Project to result in significant effects on all these aspects of the water environment has been considered herein.
- 17.2.11 Flood risk is also a consideration and paragraph 5.7.4 of EN-1 states “*Applications for energy projects of 1 hectare or greater in Flood Zone 1 in England....and all proposals for energy projects located in Flood Zones 2 and 3... should be accompanied by a flood risk assessment (FRA)...This should identify and assess the risk of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account*”. These criteria are also set out in the consultation draft of EN-1, in which flood risk is addressed in section 5.8. The Project will be subject to an FRA that meets these criteria.
- 17.2.12 EN-1 sets out generic policy with respect to water quality and resources in section 5.16 and section 4.10 sets out policy on the pollution control framework. These topics are also addressed respectively in section 5.16 and section 4.11 of the consultation draft of EN-1.

### NPS for Gas Supply and Oil Pipelines (EN-4) (Ref. 17.10)

- 17.2.13 The protection of water quality and resources is also addressed in section 2.22 of the National Policy Statement for Gas Supply Infrastructure and Oil and Gas Pipelines (EN-4) (Ref 17.10). It is stated that, where a project is likely to have effects on the water environment, an assessment of the impacts should be undertaken as part of an EIA. The consultation draft of EN-4 (Ref 17.11) also advocates this approach. Where effects with respect to water quality and resources during construction have been scoped in for further assessment, these have been assessed in line with EN-1 and EN-4.

### Other policy

- 17.2.14 Other key policies include:
- National Planning Policy Framework (NPPF) (Ref 17.12) and accompany Flood Risk and Coastal Change (Ref 17.13); and Water Quality and Supply planning practice guidance (Ref 17.14); and
  - Relevant policies from the Central Lincolnshire Local Plan (2017) (Ref 17.15), East Riding Local Plan (2016) (Ref 17.16), the North Lincolnshire Local Development Framework Core Strategy (2011) (Ref 17.17) and the Selby District Core Strategy Local Plan (2013) (Ref 17.18).

## Guidance

- 17.2.15 Several standards and non-statutory guidelines, which provide details of assessment methodologies and mitigation techniques, are relevant to the Hydrology and Land Drainage assessment, including:

- Planning Inspectorate Advice Note 18: Water Framework Directive (Ref 17.19);
- Humber 2100+ the Humber Flood Risk Management Strategy (published reports and emerging updates) (Ref 17.20, Ref 17.21);
- East Riding of Yorkshire Council Flamborough Head to Gibraltar Point Shoreline Management Plan (Ref 17.22);
- Construction Industry Research and Information Association (CIRIA) publications (various dates) (Ref 17.23);
- Guidance for Pollution Prevention series (Ref 17.24);
- Design Manual for Roads and Bridges (DMRB) LA113 Road Drainage and the Water Environment (Ref 17.25);
- Sustainable Drainage Systems (SuDS) Guidance from Lincolnshire County Council (Ref 17.26), North Yorkshire County Council (Ref 17.27) and East Riding of Yorkshire Council (Ref 17.28); and
- Action level guidance for dredged material, Cefas (Ref 17.49).

## 17.3 EIA Scoping Opinion and engagement

- 17.3.1 A summary of the EIA Scoping Opinion from the Planning Inspectorate (PINS) and responses to this EIA Scoping Opinion are outlined below. Furthermore, all relevant engagement undertaken to date is outlined in this section.

### Response to the EIA Scoping Opinion

- 17.3.2 An EIA Scoping Opinion (Appendix 1.2: EIA Scoping Opinion (Volume III)) was received by the Applicant from PINS on 20 May 2022. Table 17.1 lists the comments that PINS and consultation bodies made in relation to Hydrology and Land Drainage and shows how the Applicant is responding to these.

**Table 17.1: Summary of EIA Scoping Opinion in relation to Hydrology and Land Drainage**

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
3.13.1	Existing surface water abstractions and discharges – all phases	<p><i>The Applicant proposes to scope this matter out of further assessment on the basis that no new consumptive use of surface water resources is proposed, and safeguards will be put in place to protect surface water quality so there would be no impacts on the integrity of existing water interests.</i></p> <p><i>The Inspectorate agrees that, subject to no large volumes of dewatering needing to be undertaken, the potential for existing surface water features and surface and groundwater abstractions to be impacted upon and the potential for significant effects is unlikely. The Inspectorate is therefore content that this matter can be scoped out of further assessment on this basis.</i></p>	<p>Agreement noted. Impacts on existing surface water abstractions and discharges are not assessed further within the Hydrology and Land Drainage chapter of the PEIR, however, should water abstraction be confirmed as needed to support trenchless crossing construction for example, effects on relevant receptors will be assessed within the ES.</p> <p>Groundwater abstractions and discharges and the potential need for, and effects of dewatering will be covered in Chapter 9: Geology and Hydrogeology (Volume II).</p>
3.13.2	Watercourses and waterbodies – operational and decommissioning phases	<p><i>The Applicant proposes to scope this matter out of further assessment on the basis that, once the land is reinstated, there would be no impact pathway. In addition, the banks and riparian corridors of watercourses would not be disturbed and there would be a suitable separation distance between channel beds and the crest of the buried pipelines.</i></p> <p><i>The Inspectorate agrees that, on this basis, the potential for significant effects is unlikely and is therefore content that this matter can be scoped out of further assessment.</i></p>	<p>Agreement noted. This matter is not assessed further within the PEIR and will not be assessed within the ES.</p>

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
3.13.3	Surface water quality – operational and decommissioning phases	<p><i>The Applicant proposes to scope this matter out of further assessment on the basis that no operational discharges of effluents would be generated that would be discharged to surface waters and a suitable post construction land drainage scheme would also be implemented.</i></p> <p><i>The Inspectorate is content with this approach.</i></p>	Agreement noted. This matter is not assessed further within the PEIR and will not be assessed within the ES.
3.13.4	Flood risk from rivers, the sea and surface water; and effects on the land drainage regime (quantity and quality of flows) – decommissioning phase	<p><i>The Applicant proposes to scope these matters out of further assessment on the basis that the pipelines would remain in-situ, all AGIs would be removed and the land reinstated.</i></p> <p><i>The Inspectorate considers that works to remove AGIs during decommissioning may potentially take place within areas at risk of flooding. The impacts of these works will need to be assessed and mitigation measures put in place, as necessary.</i></p> <p><i>The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i></p>	This matter has been scoped into the assessment and will be further addressed within the FRA that will be produced in support of the ES.
3.13.5	Flood risk from other sources (groundwater, artificial sources) – all phases	<p><i>The Applicant proposes to scope this matter out of further assessment on the basis that there would be limited barriers to existing groundwater flow paths, due to the generally shallow excavations required in order to</i></p>	Groundwater flood risk has been scoped into the assessment and will be considered within the FRA that will be produced in support of the ES.

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
		<p><i>create the pipeline trenches and considers that the project is of low vulnerability to flooding from 'other' sources.</i></p> <p><i>The Inspectorate considers that, as artesian groundwater conditions are prevalent along sections of the corridor route, this matter should remain within the scope of assessment for all phases of the Proposed Development. There is potential for impact on groundwater flow pathways/ sub-surface flows and groundwater ingress into excavations. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i></p>	<p>Artesian groundwater conditions, groundwater flow pathways, sub-surface flows and groundwater ingress are addressed in Chapter 9: Geology and Hydrogeology (Volume II).</p>
3.13.6	Water quality and coastal processes in the intertidal zone – operational and decommissioning phases	<p><i>The Applicant proposes to scope this matter out of further assessment on the basis that once construction works are complete, all infrastructure in the intertidal zone would be buried to a suitable depth of cover and no operational discharges are proposed. The pipeline infrastructure would remain in-situ following project decommissioning. In addition, due to the eroding coastline and dynamic coastal processes in the intertidal zone, monitoring measures would be in place to ensure that the pipeline does not become exposed.</i></p> <p><i>The Inspectorate is satisfied that, subject to the inclusion of further details of relevant design and monitoring measures being</i></p>	<p>Agreement noted. This matter is not assessed further within the PEIR and will not be assessed within the ES. Further detail of relevant design and monitoring measures has been provided within the PEIR and will be provided in the ES.</p> <p>Relevant design and monitoring measures include the burial of the pipeline to the prescribed depth and the relevant maintenance surveys (beach walkover or side-scan sonar or Remotely Operated Vehicle (ROV) inspections as relevant to the water depth) to ensure the pipeline remains buried.</p> <p>A programme of post-consent water quality monitoring at the exit pit and within the intertidal zone would possibly be a condition of</p>

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
		<i>provided within the PEIR and ES, this matter can be scoped out of further assessment.</i>	the marine licence, subject to further assessment.
3.13.7	Scope of assessment – Study Area	<i>Justification should be provided with regards to the study area buffer of 500m from the boundary of the scoping route corridor, as there is the potential that the buffer may need to be increased in some cases to assess the full potential impact on receptors (e.g. where open cut watercourse crossings are being considered, because the impact may extend further). The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i>	Further justification and explanation of the Study Area is included in Section 17.4 of this Chapter.
3.13.8	Scope of assessment – open cut watercourse crossings	<i>Any open cut watercourse crossings should be fully assessed in the ES where appropriate, due to the potential for impacts with regards to the hydrology and hydromorphology of WFD waterbodies within the study area. Details of the method of works and mitigation should be included.</i>	Details of watercourse crossing designs are continuing to evolve and will be fully assessed in the ES and WFD Screening Report. Appropriate embedded design and mitigation measures will be detailed in the ES and secured within the Register of Commitments.
3.13.9	Scope of assessment – future baseline	<i>The Applicant is advised to consider changes in land use and habitat along the route of the pipeline and in the vicinity of the AGIs in future years, as the area adapts to the impact of a changing climate. The implications of the installation of the pipelines on future land use change should be considered, including infrastructure improvements. The Applicant's attention is drawn to the consultation</i>	Future baseline conditions are addressed in Section 17.5 of this Chapter with reference to Hydrology and Land Drainage specifically.

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
		<i>response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i>	
3.13.10	Scope of assessment – washlands	<p><i>The proposed pipeline route passes over an uncontrolled washland near the River Aire. The Inspectorate advises that the ES should include information to demonstrate that the function of the washland would not be compromised by the construction of the Proposed Development. In addition, consideration must be given to whether there may be any impacts of having a pipeline under the washlands, for example through loading or future maintenance needs.</i></p> <p><i>The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion).</i></p>	<p>Following further engagement with the Environment Agency it has been confirmed that the uncontrolled washland near the River Aire was a data error on their maps. The Environment Agency have confirmed there are no washlands within the proposed Study Area.</p> <p>In agreement with the Environment Agency, this matter has therefore been scoped out of further assessment.</p>
3.13.11	Impacts from bentonite breakout	<i>The ES should include consideration of the impacts from bentonite breakout during Horizontal Directional Drilling (HDD) works on aquatic environment receptors and water resource receptors.</i>	This matter has been scoped into the assessment and is addressed in Section 17.7.
3.13.12	Scope of assessment – FRA	<i>The FRA underpinning the ES assessment should additionally cover matters including the effect that permanent ground raising or temporary mounds of soil in the floodplain could have on flood risk, the volumes of water displacement involved and mitigation measures where necessary and the landfall pits for the Humber tunnel and any mitigation/</i>	These aspects will be considered in the FRA that will be produced in support of the ES. Engagement is ongoing with the Environment Agency to obtain information on flood defences and projects such as those noted by the Inspectorate.

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
		<p><i>defences around the construction pits that may be required to prevent these from becoming flow routes when water levels in the Humber are high. In addition, capital projects near East Halton Skitter Beck to improve defences in the vicinity of the pipeline route on the south bank of the Humber should be considered, to ensure that the schemes will not interfere with each other. Potential impacts on the River Trent flood defence should be considered, as the proposed pipeline route crosses existing flood defences along this watercourse. Moreover, the Applicant is advised to consult with the relevant stakeholders with regards to the scope of future assessment work. The Applicant's attention is drawn to the consultation response from the Environment Agency in this regard (see Appendix 2 of this Opinion). With regard to published guidance on climate change allowances, the Inspectorate advises that the Environment Agency published revised peak rainfall allowances in May 2022, which should be used in the FRA.</i></p>	<p>Updates to climate change allowances for rainfall will be adopted.</p>
<p>Natural England Consultation Response (received after Scoping Opinion)</p>	<p>Water pollution, water dependent protected nature conservation sites and nutrient neutrality or Diffuse</p>	<p>Natural England stated the following:  <i>"The planning system plays a key role in determining the location of developments which may give rise to water pollution, and hence planning decisions can have a significant impact on water quality, and land. The assessment should take account of the</i></p>	<p>These matters are scoped into the assessment, have been included in the PEIR (Section 17.7 of this Chapter and within Chapter 7: Ecology and Biodiversity (Volume II)) and will be further assessed in the ES.</p>

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
	Water Pollution Plans	<p><i>risks of water pollution and how these can be managed or reduced. A number of water dependent protected nature conservation sites have been identified as failing condition due to elevated nutrient levels and nutrient neutrality is consequently required to enable development to proceed without causing further damage to these sites. The ES needs to take account of any strategic solutions for nutrient neutrality or Diffuse Water Pollution Plans, which may be being developed or implemented to mitigate and address the impacts of elevated nutrient levels. Further information can be obtained from the Local Planning Authority."</i></p>	
Environment Agency	FRA Scope – decommissioning phase	<p>The Environment Agency stated the following:</p> <p><i>"The decommissioning phase of this matter has been scoped out. However, we recommend it should be scoped in because the reinstatement works to remove all AGIs during decommissioning may potentially take place within areas at risk of flooding. The flood risk of this activity will need to be assessed and mitigation measures put in place. Flood risk from surface water and effects of the land drainage regime (quantity and quality of flows) - The decommissioning phase of this matter has been scoped out. We recommend it is included in the scope for the same reasons as above".</i></p>	<p>This matter has been scoped into the assessment and will be further addressed within the FRA that will be produced in support of the ES.</p>

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
Environment Agency	Justification of Study Area	<p>The Environment Agency stated the following:</p> <p><i>“The Study Area buffer of 500 m from the boundary of the scoping route corridor seems appropriate, although we expect the Environmental Statement (ES) to provide justification as to why this was selected. This buffer may need to be increased in some cases to assess the full potential impact on receptors. This would specifically need to be done where open cut watercourse crossings are being considered, because the impact may extend further. In this case a 1 km buffer may be required, 500 m upstream and 500 m downstream at open cut trench crossings.”</i></p>	Further justification and explanation of the Study Area is included in Section 17.4 of this Chapter.

## Engagement undertaken to date

17.3.3 Table 17.2 provides a summary of the engagement with relevant stakeholders undertaken to inform the assessment to date.

**Table 17.2: Summary of engagement undertaken**

Consultee	Date and method of engagement	Summary of issues raised	Response
Environment Agency	8 November 2021 (Introductory meeting)	The FRA should be informed by the emerging Humber strategy and should make use of EA flood model data. The Project should also engage with the relevant Internal Drainage Boards (IDBs).	It was agreed that: <ul style="list-style-type: none"> <li>• The Project will follow the progress of the emerging Humber Strategy and assessments will consider relevant information;</li> <li>• Data from Environment Agency flood models will be requested and used to inform the Project's FRA; and</li> <li>• The Project will engage with IDBs as important stakeholders.</li> </ul>
North Lincolnshire Council LLFA (Lead Local Flood Authority)	24 November 2021 (Meeting)	Effects on flood risk and land drainage during operation of the Project	Due to the nature of the Project, following reinstatement of the land within the construction working width (after construction), effects on flood risk and land drainage would be minor. Agreement was noted and matter assessed as part of the preliminary assessment in this Chapter.
		Requested information on drainage proposals for AGIs	Permanent AGIs with a footprint exceeding 500 m <sup>2</sup> would be expected to be drained to achieve greenfield runoff rates during storm events up to and including the 1 in 100 year plus climate change event.
		Requested information of the FRA scope for Pump Facility	At the Pump Facility, a detailed FRA would be expected, demonstrating that the infrastructure is flood resilient and that development does not increase flood risk elsewhere. These points will be addressed by the Project's FRA which will be produced to support the ES.

Consultee	Date and method of engagement	Summary of issues raised	Response
Marine Management Organisation	27 January 2022 (Meeting)	Scoping out coastal processes at the landfall may be possible depending on design proposals	An introduction to the Project was provided. It was agreed that it may be possible to scope out an assessment of coastal processes at the landfall during construction, should a trenchless construction methodology be adopted. It has not been possible to scope out the coastal processes assessment as the Project still retains a number of options for the construction methodology.
North Lincolnshire Council,	February/March 2022  (Written correspondence)	The Project issued an assessment methodology and scoping letter which outlined the proposed methodology for assessment of effects on Hydrology and Land Drainage	North Lincolnshire Council confirmed agreement with the proposed approach and scope of the assessment.
East Riding of Yorkshire Council			East Riding of Yorkshire Council confirmed agreement with the proposed approach and scope of the assessment.
North Yorkshire Council			North Yorkshire Council confirmed agreement with the proposed approach and scope of the assessment.
Lincolnshire County Council			Lincolnshire Council confirmed agreement with the proposed approach and scope of the assessment. The Project team clarified that proposals for mitigating flood risk at AGIs will be SUDs compliant.
East Riding of Yorkshire Council,	February/March 2022  (Written correspondence)	Coastal erosion of the Project's lifetime should be considered in the design and measures included to prevent exposure of the pipelines at landfall and across the inter-tidal zone.	Given the optionality with regard to construction methodology, East Riding of Yorkshire Council noted their satisfaction that coastal processes would be considered in the assessment and noted that robust mitigation would be needed to prevent exposure of the pipelines over the operational lifetime of the Project due to future coastal erosion. Further meetings were held to discuss coastal erosion as detailed below.

Consultee	Date and method of engagement	Summary of issues raised	Response
East Riding of Yorkshire Council	February/March 2022 (Written correspondence)	Methods of riverbank reinstatement at open cut crossings should be sufficiently robust to prevent slippages where there is a high sand content.	The Project will determine watercourse crossing and reinstatement methods with reference to available ground investigation information and following site surveys, to ensure methods suited to local ground conditions are adopted.
Internal Drainage Boards (IDBs)	8 March 2022 (Introductory meeting)	IDB data, existing land drainage, watercourse crossings and strategy for consenting	It was agreed that: <ul style="list-style-type: none"> <li>• Data identifying IDB watercourses and Pump Facility would be shared;</li> <li>• The Project would collect information on existing land under drainage pipes from landowners and that where these are severed, they would be suitably reinstated by the Project;</li> <li>• Watercourse crossing methodologies and depths of cover between the pipelines and channel beds would be further discussed and agreed; and</li> <li>• Drainage Byelaws would be reviewed by the Project and a strategy for consenting in channel and riparian works would be agreed.</li> </ul>
Environment Agency	February/March 2022 (Written correspondence)	The Project issued an assessment methodology and scoping letter which outlined the proposed methodology for assessment of effects on Hydrology and Land Drainage	The Environment Agency confirmed agreement with the proposed approach and scope of the assessment, noting their satisfaction that effects on water quality and coastal processes in the intertidal zone have been scoped in for the construction phase, given the current optionality with regard to construction methodology. Further discussion was requested regarding the proposed landfall location and future protection against coastal erosion and regarding inclusion of operational effects on coastal processes and water quality in the inter-tidal zone.

Consultee	Date and method of engagement	Summary of issues raised	Response
			Further meetings were held to facilitate the further discussion requested as detailed below.
		The Environment Agency stated that <i>“the FRA should consider all relevant sources of flooding and provide evidence that appropriate mitigation measures have been incorporated.”</i>	The proposed scope includes for preparation of a FRA that assesses flood risk to the Project, and flood risk arising from the Project. The assessment will address all relevant sources of flood risk and identify suitable flood risk management and mitigation measures, which will be secured via the DCO.
		The Environment Agency requested that the assessment scope includes the potential for effects on the integrity of existing flood defences and a design that ensures that access to these for future maintenance is not compromised.	The Project design will ensure access to flood defences and use construction methods that do not compromise the integrity of the flood defences during the duration of the construction works.
		The Environment Agency requested that details are provided of proposals to manage surface water runoff from the Project.	A drainage strategy setting out proposals for the management of surface water runoff from permanent AGI will be prepared.
		The FRA should include for assessment of climate change according to the lifetime of the AGI and should also assess residual flood risk in case of a defence breach.	The Project has committed to include these aspects within the FRA that will be prepared to support and inform the ES.

Consultee	Date and method of engagement	Summary of issues raised	Response
Environment Agency and East Riding of Yorkshire County Council	23 March 2022 (Meeting)	Project update on the proposed landfall location and coastal erosion issues.	<p>A joint meeting was held with a focus on coastal erosion at the proposed landfall location and the assessment of coastal processes. The Project's rationale, further details of which are provided in Chapter 3: Consideration of Alternatives (Volume II), for selection of the preferred landfall location at Easington was discussed and it was noted during the discussion that coastal erosion was a factor that was considered during the selection of a preferred landfall location.</p> <p>Subject to suitable design parameters for the buried pipelines as they cross the inter-tidal zone, it was agreed that operational effects on coastal water quality and coastal processes can be scoped out.</p>
Canal and River Trust (CRT)	13 July 2022 (Meeting)	CRT would like to see consideration of construction impacts on the waterspace.	The canals proposed to be crossed by the Proposed Order Limits have been included as a receptor in this Chapter (see Table 17.11). Potential effects on these canals have been considered in Section 17.7 of this Chapter.
		CRT raised issues relating to ecology & biodiversity and landscape.	Responses to these issues are addressed in the corresponding PEIR chapters which are Chapter 7: Ecology and Biodiversity (Volume II) and Chapter 11: Landscape and Visual (Volume II).
Environment Agency	13 July 2022 (Meeting)	Review of scoping opinion comments.	<p>A meeting held to provide an update on the Project design and timelines, and to discuss and provide Project responses to comments raised in the EIA Scoping Opinion. It was agreed that the Project's proposed responses and actions were appropriate.</p> <p>Post meeting, the Environment Agency confirmed its preference for trenchless crossings of main rivers and provided information on planned flood risk management</p>

Consultee	Date and method of engagement	Summary of issues raised	Response
			schemes, welcoming further discussion to ensure no conflict between these and the Project.
Environment Agency and East Riding of Yorkshire County Council	20 July 2022 (Meeting)	Coastal erosion.	<p>A joint follow-up meeting was held with a focus on coastal erosion and Project activities at landfall and in the inter-tidal zone. A Project design update was provided, and it was agreed that:</p> <ul style="list-style-type: none"> <li>• Baseline data to inform the Project’s modelling assessments for the EIA would be shared by East Riding of Yorkshire Council; and</li> <li>• During preparation of the ES, the Project would share further information regarding the selection of a preferred site for the Pump Facility and details of the layout of the Pump Facility site.</li> </ul>
North Lincolnshire Council, East Riding of Yorkshire Council, Lincolnshire County Council and North Yorkshire County Council	27 July 2022 (Meeting)	Review of scoping opinion comments.	A meeting held to provide an update on the Project design and timelines, and to discuss and provide Project responses to comments raised in the EIA Scoping Opinion. It was agreed that the Project’s proposed responses and actions were appropriate.

## 17.4 Assessment methodology and significance criteria

### Study Area

- 17.4.1 The Study Area for the PEIR includes all land within the Proposed Order Limits and in addition a buffer of 500 m. The size of the buffer was selected on the basis of professional experience and is precedent, having been adopted for the EIA of several other projects of a similar nature. The assessment considers predominantly terrestrial waterbodies and will also include the inter-tidal zone up to Mean Low Water Springs (MLWS) notably at the landfall, where the Project interacts with the offshore carbon dioxide transportation and storage infrastructure. The Study Area is illustrated in Figure 17.1 (Volume IV).
- 17.4.2 Whilst this Study Area is deemed appropriate, in bespoke locations, the Study Area may be extended where potential impacts may be more widespread. For example, at crossings of sensitive watercourses reaches of up to 1 km will be assessed.
- 17.4.3 The FRA that will be prepared to inform the EIA and will include a larger Study Area, to ensure any potentially relevant impacts of the Project are considered within a floodplain cell or at the catchment scale, where this is appropriate. The WFD screening assessment that will be prepared to support the EIA will include all WFD waterbodies within the Proposed Order Limits and extending up to one nautical mile from the proposed landfall location.
- 17.4.4 The Study Areas for assessing effects on geology and the groundwater environment are described in Chapter 9: Geology and Hydrogeology (Volume II).

### Baseline data collection

#### Desk study

- 17.4.5 Baseline conditions of the Project were established during a desk study using the following sources:
- Environment Agency Flood Map for Planning (Ref 17.29);
  - Environment Agency long-term flood risk mapping (including flood risk from surface water and reservoirs) (Ref 17.30);
  - Environment Agency Recorded Flood Outlines (Ref 17.31);
  - Environment Agency Main River map (Ref 17.32);
  - Environment Agency Spatial Flood Defences dataset (Ref 17.33);
  - Association of Drainage Authorities IDB map (Ref 17.34);
  - Environment Agency Catchment Data Explorer (Ref 17.35);
  - Humber RBD RBMP (Ref 17.36) and 2021 consultation draft (Ref 17.37);
  - Environment Agency Water Quality Archive (Ref 17.38);
  - DEFRA Magic Map (Ref 17.39);
  - LiDAR data (Ref 17.40);

- Aerial Imagery;
- Historical mapping of watercourses (Ref 17.41);
- Flood Estimation Handbook (FEH) Web Service (Ref 17.42);
- Selby District Level 1 (Ref 17.43) and 2 (Ref 17.44) Strategic Flood Risk Assessment (SFRA), East Riding of Yorkshire Level 1 SFRA (Ref 17.45), North and North East Lincolnshire SFRA (Ref 17.46) and West Lindsey SFRA (Ref 17.47); and
- East Riding Integrated Coastal Zone Management Plan (Ref 17.48).

17.4.6 In addition, data requests have been made to the Environment Agency, North Lincolnshire Council, East Riding of Yorkshire Council, Lincolnshire County Council and North Yorkshire County Council (in their role as LLFAs) and IDBs to provide information on the following to support the assessment:

- Consented discharges surface waters and licensed abstractions from surface waters;
- Deregulated surface water abstractions (private water supplies);
- Information on historical flood events;
- Information on historical shoreline positions and beach level profiles for the vicinity of the Easington landfall; and
- Modelled flood water level and flood extent data for the watercourses within the Study Area.

17.4.7 IDBs include the following: Witham & Humber Drainage Boards, Shire Group, Yorkshire & Humber Drainage Boards; in addition to Lindsey Marsh Drainage Board, Doncaster East IDB, South Holderness IDB and Thorntree IDB.

17.4.8 The Environment Agency have provided information from the following flood models:

- Ancholme Model 2013 & 2021;
- East Halton Beck 2019;
- Northern Area Tidal Model 2010;
- Humber Extreme Water Levels 2020;
- Humber Tributaries – Thorngumbald and Keyingham Drains 2021;
- Burtswick Drain 2015;
- Humber North Bank Tidal Modelling 2012 – 2015;
- Upper Humber Flood Risk Mapping Study 2016;
- Humber Strategy 2020; and
- Coastal Flood Boundaries 2018.

17.4.9 All of the information received has been incorporated into the baseline environment description in Section 17.5. Data from the models provided by the Environment Agency, such as detailed flood maps, information on defences and modelled flood levels, has been used to inform the PEIR whilst more detailed information (model outputs) will be used to inform the FRA where required.

## Site visits and surveys

- 17.4.10 No specific terrestrial Hydrology and Land Drainage surveys have been or will be undertaken to inform this PEIR and the subsequent ES. This is because the baseline water environment can be robustly characterised using published data sources.
- 17.4.11 Proposed post-submission surveys are set out in Section 17.10. Data collected from these surveys will inform the detailed design of the Project.
- 17.4.12 A survey of the shoreline at the Easington landfall has been undertaken (Ref 17.50). Preliminary results from this survey will be used to inform chapters for several disciplines (namely Chapter 7: Ecology and Biodiversity (Volume II)), however a number of findings specific to this chapter are summarised in paragraph 17.5.70. In addition, the assessment in the ES would draw on information collected from surveys undertaken for other disciplines (for example, ecology surveys).

## Impact assessment methodology

- 17.4.13 The adopted assessment methodology is drawn from Part 10 of Volume 11 of the DMRB LA113 (Ref 17.25). Whilst primarily intended for use in assessing the impacts of highways projects on the water environment, the methodology is widely accepted as suitable for assessing the effects of other types of linear infrastructure projects on water environment receptors. The method promotes assessment that is proportionate to the scale and nature of the proposals and that considers the sensitivity of the local water environment to change. The method provides guidance on assigning value (sensitivity) to receptors (for example, watercourses and floodplains) as well as criteria for assigning impact magnitude. The criteria consider the scale/extent of the predicted change and the nature and duration of the impact, and these criteria are reproduced in Tables 1 to 4 in Appendix 17.1 (Volume III).

## Significance criteria

- 17.4.14 The likely significant effects will be assessed with reference to published guidance for assessing the impacts of development on water environment receptors, considering the sensitivity (or value) receptors within the Study Area, and the magnitude of change (impact) likely to be caused by Project activities. The factors are combined to give an overall significance of effect using the matrix set out in Table 4.1, Chapter 4: EIA Methodology (Volume II). The rationale behind the values assigned is provided and Moderate and Major effects are considered to be significant.
- 17.4.15 The assessment has been undertaken based on preliminary project design information. This information is iterative and will be updated for the ES as the design evolves and relevant changes are accounted for in the assessment.

## Assumptions and limitations

- 17.4.16 To ensure transparency within the EIA process, the following limitations and assumptions have been identified:
- It is currently assumed that no discharges (other than treated surface water runoff) to surface waters are required for the Project during its operation. It is also assumed that the trenchless crossings and pipeline hydro testing would use water sustainably abstracted from a suitable source(s) in accordance with the limits and conditions of an Environment Agency abstraction licence(s);

- It is assumed that along the majority of the pipelines' route dewatering is not required for the open cut trenches or trenchless crossings, except to remove rainwater and any groundwater seeping into temporary excavations. In localised areas, for example, between Keadby and Drax, where groundwater conditions are such that dewatering is likely, it has been assumed that this activity would be managed in accordance with best practice and any conditions of an environmental permit, with no discharge of untreated water to be made to surface watercourses. Further detail is provided in Chapter 9: Geology and Hydrogeology (Volume II), where effects are assessed;
- The choice of watercourse crossing technique is dependent on several factors, for example, watercourse size, flood risk sensitivity, ecological sensitivity and location. Where the pipelines cross watercourses, it is assumed that the majority of ordinary watercourses would be open cut crossings and that the majority of main rivers would be crossed using trenchless techniques. This is unless an open cut method can be justified based on low flood risk, prevailing ground conditions, ecological sensitivity, location and stakeholder feedback. Where there is uncertainty on crossing technique due to the design still evolving, open cut will be assessed as it is the worst case; and
- Temporary crossings of watercourses would be needed for access. It is assumed bailey type bridges would be used for larger main rivers and temporary culverts would be used for smaller watercourses.

17.4.17 All conclusions and assessments in the PEIR are by their nature preliminary. All assessment work has applied, and continues to apply, a precautionary principle, in that where limited information is available (in terms of the proposals for the Project), a realistic worst-case scenario is assessed.

17.4.18 The key parameters and assumptions will be reviewed based on the final design and, where required, updated or refined. The ES will present the final key parameters and assumptions used within that assessment, particularly drawing attention to any areas that may have evolved from what is presented in this preliminary assessment.

## 17.5 Baseline conditions

### Existing baseline

17.5.1 Baseline information in this section of the Chapter is presented according to the five separate sections of the Proposed Order Limits with regard to watercourses, their water quality and hydromorphology, and flood risk. However, baseline information regarding sites designated for nature conservation interest, existing water interests (abstractions and discharges) and groundwater flood risk is presented upfront.

### Sites Designated for Nature Conservation Interest

17.5.2 As detailed in Chapter 7: Ecology and Biodiversity (Volume II), there are numerous sites designated for nature conservation interest within the Study Area. Where surface waters play a key role in sustaining the designated interest features, these sites are included as Hydrology and Land Drainage receptors. The Project ecologists have identified the sites this applies to, and these are summarised below in Table 17.3. Further detail on these sites is included in Chapter 7 Ecology and Biodiversity (Volume II).

17.5.3 Groundwater Dependent Terrestrial Ecosystems (GWDTEs) are addressed separately in Chapter 9: Geology and Hydrogeology (Volume II).

**Table 17.3: Sites designated for nature conservation interest where surface waters play a key role in sustaining the designated interest features**

Justification	Designated Site
Statutory designated sites situated within the Projects Proposed Order Limits	Dimlington Cliff Site of Specific Scientific Interest (SSSI)
Non-statutory designated sites situated within the Projects Proposed Order Limits	Barnetby Road Verges Local Wildlife Site (LWS); Black Hoe Plantation LWS; Brick Hills LWS; Broom Plantation LWS; Candley Beck, Westrum LWS; Chase Hill Wood LWS; Grasby Bottoms Green Lane LWS; Hatfield Waste Drain LWS; Hedon – Winestead Disused Railway Line LWS; Hodgson's Fields Nature Reserve; Keadby Boundary Drain LWS; New River Ancholme LWS; Oak Hill LWS; Old River Ancholme LWS; Paull Holme Strays Nature Reserve; Pauper's Drain LWS; Stainforth and Keadby Canal Corridor LWS; Sweeting Thorns LWS; Three Rivers LWS; Warping Drain, Derrythorpe LWS; and West Common North Road LWS.
Non-statutory designated sites situated outside the Proposed Order Limits but with hydrological connectivity and/or other potential impact pathway	Abbot's Lodge Grassland LWS; Alder Wood LWS; Ashbyville Lake LWS; Asselby Island LWS; Beaulah Wood LWS; Beckingham Shaw LWS; Black Walk Nook LWS; Brockholes Site of Interest for Nature Conservation (SINC); Brocklesby Park LWS; Burkinshaw's Covert LWS; Butterwick Hale and Common LWS; Dawson City Claypits (Nature Reserve); Donkey Park South LWS; East Marsh LWS; Faraway and Thirty Foot Drains LWS; First Wood North Field LWS; First Wood North LWS; First Wood South LWS; Folly Drain North LWS; Fort Paull Humber Grassland Candidate LWS; Frodingham – Winestead Lane LWS; Greetwell North LWS; Greetwell South LWS; Halton Marsh Clay Pits LWS; Hollym Carrs LWS; Holme Hall Golf Course LWS; Holme Lane Verge LWS; Howsham Barff Wood LWS; Keadby Warping Drain LWS; Keadby Wet Grassland LWS; Keadby Wetland LWS; Kelsey Hill Gravel Pits Historic LWS; Killingholme Haven Pits (Nature Reserve); Low Wood, Barnetby le Wold LWS; Melton Ross Quarry LWS; Messingham Lakes LWS; Messingham Northwest LWS; Messingham Sand Quarry (Nature Reserve); Newland Ings, Newland SINC; Newstead Drain LWS; North Engine Drain, Belton LWS; Out Newton – Skeffling LWS; River Torne LWS; South Cloister Covert LWS; South Engine Drain, Belton LWS; South Soak Drain, Keaby LWS; Station Road Field LWS; Swinster Lane Field LWS; and Thomas Wood LWS.

### Existing Water Interests (Surface Water Abstractions and Discharges)

17.5.4 Data to characterise existing water interests has been collected from the Environment Agency and district councils. The data, which is illustrated in Figure 17.1 (Volume IV), shows that watercourses in the Study Area receive, transport and dilute consented and

informal discharges. The data received from the district councils is discussed in Chapter 9: Geology and Hydrogeology (Volume II).

- 17.5.5 Existing consented discharges to surface water and licensed abstractions from surface water sources have been provided by the Environment Agency (received June 2022) and are summarised in Table 17.4 and Table 17.5 below. Information on groundwater abstractions is included in Chapter 9: Geology and Hydrogeology (Volume II).

**Table 17.4: Existing Consented Surface Water Discharges within the Study Area**

Consent No.	Discharge Type	Receiving Watercourse
ANNNF13085	Wastewater treatment works (WwTW)/Sewage Treatment Works (STW) (water company)	Skitter Beck tributary
AW3NFF878	WTW/Water Collection/Treatment/Supply	Kettleby Beck
AW3NF113	WwTW/STW (water company)	Skitter Beck tributary
AW3NFF200	WwTW/STW (water company)	Scawby Catchwater
ANNNF2373	WwTW/STW (water company)	Scawby Catchwater
3/28/81/1196	Domestic property (single) (including farmhouse)	Cross Drain tributary
T/82/40310/O	Pumping Station on Sewerage Network (water company)	South Field Drain tributary
T/82/45624/R	WwTW/STW (water company)	South Field Drain
S34/G/5/927	Undefined or Other	West Common North Drain tributary
2765(T)	WwTW/STW (water company)	Black Tom Staith tributary
H236	Making of Coke + Refined Petroleum Products	Hedon Haven
WRA7617	Pumping Station on Sewerage Network (water company)	The Humber
WRA7618	WwTW/STW (water company)	The Humber

17.5.6 The Environment Agency have provided data on licensed surface water abstractions located within the Study Area and these are summarised in Table 17.5. The Environment Agency have also provided data on licensed surface water abstractions with abstraction reaches within the Study Area, of which there are 17 with uses reported as spray or trickle irrigation.

**Table 17.5: Existing Licensed Surface Water Abstractions**

Licence No.	Purpose/Use	Source	Licensed Quantity <sup>1</sup> (Megalitres – MI)
AN/029/0009/014	Environmental/Wetland Support	Drain at Halton Marshes	N/A
AN/029/0009/005	Agriculture/Spray irrigation	Drain at Frogmore Farm	90,909
MD/028/0082/020	Industrial	River Trent (tidal)	9,622,067
03/28/83/0257/1	Agriculture/Spray irrigation	North Soak Drain	N/A
2/27/24/195	Agriculture/Spray irrigation	Drax Abbey Fish Pond (tidal)	10,000
03/28/82/0034	Agriculture/Spray irrigation	Rushcarr Lane Drain (point 1)	54,546
03/28/82/0034	Agriculture/Spray irrigation	Rushcarr Lane Drain (point 2)	54,546
03/28/82/0014	Agriculture/Spray irrigation	The Carr Lane Dyke	54,546
03/28/82/0032	Agriculture/Spray irrigation	Rushcarr Lane Drain	45,460
03/28/82/0032	Agriculture/Spray irrigation	Willow Cottage Dyke	45,460

### Groundwater Flood Risk

17.5.7 The Environment Agency have noted that there are artesian groundwater conditions at some locations within the Study Area. Further information will be obtained from SFRAs and from subsequent assessment work to be carried out in relation to geology and hydrogeology which will be reported in the ES, and this data will inform the assessment of flooding from groundwater which will be presented in the FRA. The assessment will consider local groundwater conditions and identify locations at highest risk of groundwater flooding, for example where groundwater in aquifers is artesian, and Project structures or activities could create a potential flow path pathway to the surface.

<sup>1</sup> Maximum annual quantity

The Project would secure suitable design and construction good practice measures to manage these potential effects.

## Section 1 - Drax to Keadby

### Watercourses, their Water Quality and Hydromorphology

- 17.5.8 Within the Section 1 - Drax to Keadby, there are two main rivers (River Aire and River Don (Dutch River)) that would be crossed by the Proposed Order Limits and two main rivers (River Ouse and River Derwent) not within the Proposed Order Limits but within the Study Area. There are also numerous tributaries of these rivers, classified as ordinary watercourses, within the Study Area. The watercourses all drain to the Humber Estuary and those that are crossed by the Proposed Order Limits typically flow in a south-west to north-east direction. Their catchments vary from small, rural catchments to larger catchments covering urban areas such as Leeds, Doncaster, Goole and Thorne. Land use within the majority of the Study Area is rural for the Section 1 - Drax to Keadby.
- 17.5.9 The Study Area is not located within a surface water Drinking Water Protected Area or surface water Drinking Water Safeguard Zone. Information on groundwater Safeguard Zones is included in Chapter 9: Geology and Hydrogeology (Volume II).
- 17.5.10 The main rivers are all included within the Humber RBMP (Ref 17.36). Baseline WFD information for the Study Area is presented in Table 17.6. The watercourses in Section 1 - Drax to Keadby all drain to the Humber Upper transitional WFD waterbody which also covers the reach of the River Don (Dutch River) that is crossed by the Proposed Order Limits.

**Table 17.6: Summary of WFD Status Data (Cycle 2) 2019**

Main River	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorphological designation
River Aire	Aire from River Calder to River Ouse (GB104027 062760)	Moderate	Moderate	Fail	Heavily modified
River Don (Dutch River)	Humber Upper (GB530402 609203)	Moderate	Moderate	Fail	Heavily modified
River Ouse	Ouse from R Wharfe to Upper Humber (GB104027 064270)	Moderate	Moderate	Fail	Heavily modified

Main River	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorphological designation
River Derwent	Derwent from Elvington Beck to River Ouse (GB104027068311)	Moderate	Moderate	Fail	Heavily modified

- 17.5.11 As Table 17.6 shows, the waterbodies share similar quality characteristics. They all share a Moderate ecological status and are failing with regard to chemical status.
- 17.5.12 Multiple reasons for not achieving good (RNAG) status are reported for these waterbodies with those common to all reported as being mercury and its compounds and polybrominated diphenyl ethers (PBDE). Phosphate from point (sewage discharge) and diffuse (poor agricultural and soil management) sources are RNAGs common to the River Aire and the River Ouse whilst RNAGs related to physical modifications are common to the Rivers Aire, Don and Derwent. The RBMP sets out measures for the waterbodies to help them reach their target status. For the Rivers Ouse and Derwent, their target status is Good by 2027. These measures focus on reducing diffuse water pollution from agriculture and, specifically for the River Derwent, also removing barriers to fish migration, improving in-channel habitat and restoring the River Derwent SSSI to favourable condition. For the Aire and the Humber Upper WFD waterbodies, the Moderate target for 2015 is attributed to disproportionate expense and burdens and technical infeasibility.
- 17.5.13 In addition to the main river WFD waterbodies shown in Table 17.6, the Proposed Order Limits also crosses three WFD waterbodies associated with ordinary watercourses in Section 1 - Drax to Keadby. These WFD waterbodies all have an ecological status of moderate, a chemical status of fail and are all classified as artificial. Agriculture and land management are responsible for the majority of the RNAGs which generally include physical modification and pollutants such as phosphate and ammonia.
- 17.5.14 The Environment Agency also monitors a range of parameters that are indicators of water quality on several watercourses within the Study Area. Available data has been reviewed and indicates that, for most parameters, measured values are within typical ranges for achieving 'High' WFD status. The exception to this on all watercourses reviewed within Section 1 - Drax to Keadby are orthophosphate which is indicative of nutrient enrichment. Some watercourses also exceed the thresholds for ammoniacal nitrogen, dissolved oxygen and conductivity.
- 17.5.15 The Aire and Calder Navigation would be crossed by the Proposed Order Limits in Section 1 - Drax to Keadby.
- 17.5.16 There are five ponds within the Study Area in Section 1 - Drax to Keadby.
- 17.5.17 With regard to their physical form, many of the watercourses in the Study Area have been subject to modifications for the purposes of land drainage and flood defence. All of the main rivers in Table 17.6, have a 'heavily modified' designation. Many of the ordinary watercourses in the Study Area also serve a land drainage function and have a

relatively low hydromorphological diversity, typically having uniform channel profiles and straightened channel forms.

## Flood Risk

- 17.5.18 For this section, according to the Environment Agency Flood Map for Planning, the Proposed Order Limits are located almost entirely within Flood Zone 3 (high risk), equivalent to an annual flood risk from rivers of 1 in 100 (1%) or greater; or an annual flood risk from the sea of 1 in 200 (0.5%) or greater. The exception to this is a small area (less than 5% of the Proposed Order Limits in this section) of higher ground in the vicinity of the Keadby AGI options, which is within Flood Zone 1 (low risk), equivalent to an annual flood risk from rivers and the sea of less than 1 in 1000 (0.1%). The rest of the AGI options in this section are all within Flood Zone 3. Land within Flood Zone 3 in this section is shown to be within an area benefitting from flood defences.
- 17.5.19 Flood defences in this section comprise flood walls and embankments along the River Ouse, Derwent, Aire and Don (Dutch River).
- 17.5.20 The Recorded Flood Outline dataset (Ref 17.31) shows that the following areas within the Study Area have previously flooded, the reported cause of the flooding is noted in brackets for each event:
- January/February 1995 flood event – flood outline restricted to main rivers and land adjacent to and within approximately 40 m of main rivers (overtopping of defences, channel capacity exceeded);
  - Autumn 2000 flood event – flood outline restricted to the River Ouse and land within approximately 30 m of the River Ouse (overtopping of defences);
  - June 2007 flood event (main river) – flood outline restricted to the River Aire and land between the River Aire and Rawcliffe Road, the River Don (Dutch River) and land within 300 m of the River Don (cause unknown);
  - June 2007 flood event (surface water) – flood outline covers several small, isolated areas of land between the River Don (Dutch River) and Drax (surface water);
  - November 2019 – flood extent restricted to within 10 m of the River Don (Dutch River) (channel capacity exceeded);
  - February 2020 flood event, Storm Dennis (main river) – flood outline limited to main rivers and typically land within 10 m of the main rivers (channel capacity exceeded); and
  - February 2020 flood event, Storm Dennis (surface water) – flood outline covers several small, isolated areas of land between the River Aire and Eastoft (local drainage/surface water).
- 17.5.21 The proposed AGIs within Section 1 - Drax to Keadby (Drax AGI Options A-D, Block Valve KP 19.3 and Keadby AGI Options A-C) are not located within the Recorded Flood Outlines.
- 17.5.22 The Risk of Flooding from Surface Water map (Ref 17.30) shows the majority of land at the proposed AGI locations is at very low risk of surface water flooding (annual chance of flooding of less than 0.1%), with very small areas shown to be at low risk of surface water flooding (annual chance of flooding between 0.1% and 1%).

## Section 2 - Keadby to Scunthorpe

### Watercourses, their Water Quality and Hydromorphology

- 17.5.23 Within the Section 2 - Keadby to Scunthorpe, there are eight main rivers, all crossed by the Proposed Order Limits with the exception of Bottesford Beck which is not crossed by the Proposed Order Limits but is within the Study Area. There are also numerous tributaries of these rivers, classified as ordinary watercourses, within the Study Area. The watercourses all drain to the River Trent and subsequently the Humber Estuary. Their catchments vary from small, rural catchments to larger catchments covering urban areas such as Scunthorpe, Gainsborough and Epworth. Land use within the majority of the Study Area is rural for this section with the exception of the portion of the Study Area covering British Steel at Scunthorpe.
- 17.5.24 The Proposed Order Limits are not located within a surface water Drinking Water Protected Area or surface water Drinking Water Safeguard Zone. However, the Study Area is partially within the surface water Drinking Water Protected Area located to the east of Scunthorpe.
- 17.5.25 The main rivers included in the Humber RBMP (Ref 17.36) are the New Idle River and the River Trent. Baseline WFD information for the Study Area is presented in Table 17.7. The watercourses in Section 2 - Keadby to Scunthorpe all drain to the Humber Upper transitional WFD waterbody which also covers the reach of the River Trent that is crossed by the Proposed Order Limits. The Humber Upper waterbody is discussed in the previous section. The Hatfield Waste Drain, New Idle River and South Engine Drain are collectively known as the Three Rivers.

**Table 17.7: Summary of WFD Status Data (Cycle 2) 2019**

Main River	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorphological designation
North Soak Drain	North Soak Drain Catchment (trib of Torne/Thre e Rivers) (GB104028 064350)	Moderate	Moderate	Fail	Artificial
South Soak Drain					
Hatfield Waste Drain	Hatfield Waste Drain Catchment (trib of Torne/Thre e Rivers) (GB104028 064330)	Poor	Poor	Fail	Artificial
New Idle River	Torne/Thre e Rivers from	Moderate	Moderate	Fail	Artificial

Main River	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorphological designation
South Engine Drain	Mother Drain to Trent (GB104028064340)				
River Trent	Humber Upper (GB530402609203)	Moderate	Moderate	Fail	Heavily modified
Bottesford Beck	Bottesford Beck Catchment (trib of Trent) (GB104028064290)	Moderate	Moderate	Fail	Heavily modified
Catchwater Drain					

- 17.5.26 As Table 17.7 shows, the waterbodies share similar quality characteristics. All are failing with regard to chemical status and the majority of the waterbodies have a Moderate ecological status, with the exception of Hatfield Waste Drain which is Poor. Multiple RNAGs are reported for these waterbodies with those common to all reported as being mercury and its compounds and PBDE. Other common RNAGs include physical modification, ammonia (from misconnections, sewage discharge and industry) and phosphate (from transport drainage, sewage discharge and poor agricultural and soil management). The RBMP sets out measures for the waterbodies to help them reach their target status. The Target status for the Three Rivers is Good by 2027. The measures in the Humber RBMP for the New Idle River focus on reducing rural diffuse pollution and urban pollution and making hydromorphological improvements. For the North Soak Drain and Bottesford Beck WFD waterbodies, the Moderate target for 2015 is attributed to disproportionate expense.
- 17.5.27 In addition to the main river WFD waterbodies shown in Table 17.7, the Proposed Order Limits also crosses a WFD waterbody associated with Paupers Drain (WFD waterbody ID: GB104028064300) which is an ordinary watercourse with similar characteristics to the Three Rivers and North Soak Drain waterbodies.
- 17.5.28 The Environment Agency also monitors a range of parameters that are indicators of water quality on several watercourses within the Study Area. Available data has been reviewed and indicates that, for most parameters, measured values are within typical ranges for achieving 'High' WFD status. The exception to this is orthophosphate in some watercourses which is indicative of nutrient enrichment.
- 17.5.29 The Sheffield and South Yorkshire Navigation Stainforth and Keadby Canal would be crossed by the Proposed Order Limits in Section 2 – Keadby to Scunthorpe.
- 17.5.30 There are 19 ponds within the Study Area in this section.

- 17.5.31 With regard to their physical form, many of the watercourses in the Study Area have been subject to modifications for the purposes of land drainage and flood defence. All of the main rivers in Table 17.7, have a 'heavily modified' or 'artificial' designation. Many of the ordinary watercourses in the Study Area also serve a land drainage function and have a relatively low hydromorphological diversity, typically having uniform channel profiles and straightened channel forms.

### Flood Risk

- 17.5.32 According to the Environment Agency Flood Map for Planning, between the Keadby AGI options and the River Trent, the majority of the Proposed Order Limits and Study Area are located within Flood Zone 3 (high risk). To the east of the River Trent, Flood Zone 3 extends up to approximately 3.3 km from the Trent and Flood Zone 2 (medium risk, equivalent to an annual flood risk from rivers between 1% and 0.1% or from the sea between 0.5% and 0.1%) typically covers up to 1 km of land further east. Continuing east, the majority of the land within the Proposed Order Limits and Study Area is located within Flood Zone 1 (low risk) with a small area of Flood Zone 2 and 3 associated with the Bottesford Beck and Catchwater Drain. The AGI options in this section are shown to be within Flood Zone 1. Land designated as Flood Zone 3 north of the North Soak Drain (west of the Trent) and north of the railway (east of the Trent) is shown to be within an area benefitting from flood defences. The remainder of the Study Area within this section is not shown to benefit from flood defences by the Flood Map for Planning.
- 17.5.33 Flood defences include natural high ground along the North and South Soak Drains and the Three Rivers and embankments along the River Trent and Bottesford Beck downstream of its confluence with the Catchwater Drain. Upstream of this confluence, there is natural high ground along both watercourses.
- 17.5.34 The Recorded Flood Outlines (Ref 17.31) within this section are restricted to the east of the River Trent, between the River Trent itself and the Bottlesford Beck/Catchwater Drain confluence. The majority of the outlines are attributed to the tidal Trent and a flood event in March 1947. The cause is attributed to the channel exceeding its capacity. There are small areas within the outline of the December 2013 flood event which is attributed to the tidal Trent and caused by overtopping of defences. The proposed AGIs within Section 2 Keadby to Scunthorpe (Block Valve KP 46.3 and British Steel AGI Options A and B) are not located within the Recorded Flood Outlines.
- 17.5.35 The surface water flood risk to the Keadby AGI options is reported in the previous section. For the Block Valve KP 46.3 AGI option, the Risk of Flooding from Surface Water map (Ref 17.30) shows ponding of surface water with small areas of land at high risk (annual chance of flooding greater than 3.3%) and medium risk (annual chance of flooding between 1% and 3.3%) of surface water flooding. The British Steel AGI Options A and B are shown to be at very low risk of flooding from surface water.

## **Section 3 - Scunthorpe to Killingholme**

### Watercourses, their Water Quality and Hydromorphology

- 17.5.36 Within the Section 3 - Scunthorpe to Killingholme, there are six main rivers crossed by the Proposed Order Limits. The Skitter Beck/East Halton Beck is crossed twice by the Proposed Order Limits: at NGR TA 11569 13214 it is classified as an ordinary watercourse whereas further downstream, in the vicinity of East Halton, the watercourse is classified as an Environment Agency main river. There are also numerous tributaries of the main rivers, classified as ordinary watercourses, within the Study Area. The

watercourses all drain either directly to the Humber Estuary or to the Humber via other watercourses such as the River Ancholme. Their catchments vary from small, rural catchments to larger catchments covering small urban areas such as Brigg and East Halton. Land use within the majority of the Study Area is rural for this section with the exception of the portion of the Study Area covering British Steel’s Scunthorpe Steelworks and Killingholme Port and Power Station.

17.5.37 The Proposed Order Limits and Study Area are partially located within the surface water Drinking Water Protected Area in the vicinity of Scawby and Brigg but are not located within a surface water Drinking Water Safeguard Zone.

17.5.38 The River Ancholme is included in the Humber RBMP (Ref 17.36). Baseline WFD information for the Study Area is presented in Table 17.8. Within the Proposed Order Limits, at NGR SE 99476 05687, the River Ancholme splits into a straight channel flowing south to north and a more sinuous channel named Old River Ancholme. These are both designated main rivers and are within the same WFD waterbody reported in Table 17.8 for the River Ancholme. The Skegger Beck is a tributary of the Kettleby Beck and is within the Kettleby Beck WFD waterbody.

**Table 17.8: Summary of WFD Status Data (Cycle 2) 2019**

Main River	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorphological designation
River Ancholme	Ancholme from Bishopbridge to the Humber (GB104029067 520)	Moderate	Moderate	Fail	Artificial
Scawby Catchwater					
Kettleby Beck	Kettleby Beck (GB104029067 510)	Moderate	Moderate	Fail	Artificial
Kettleby Beck unnamed tributaries (no. 2) *					
Skegger Beck					
Skitter Beck / East Halton Beck	Skitter Beck / East Halton Beck (GB104029067 655)	Bad	Bad	Fail	Heavily Modified

\* The Kettleby Beck tributary crossed by the Proposed Order Limits is also partially within the Ancholme from Bishopbridge to the Humber WFD waterbody. The other Kettleby Beck tributary is within the Study Area but is not crossed by the Proposed Order Limits and is wholly within the Kettleby Beck WFD waterbody.

17.5.39 As Table 17.8 shows, the waterbodies share similar quality characteristics. All are failing with regard to chemical status and the majority of the waterbodies have a Moderate ecological status, except for the Skitter Beck/East Halton Beck waterbody which has an ecological status of Bad. Multiple RNAGs are reported for these waterbodies, with those common to all including mercury and its compounds and PBDE. Common RNAGs are also reportedly due to poor agricultural and soil management, sewage discharge and

physical modifications. The Skitter Beck/East Halton Beck WFD waterbody has a target status of good for 2027 whereas the Moderate targets for 2015 for the other two WFD waterbodies are attributed to disproportionate expense and burdens and technical infeasibility. The measures included in the RBMP for the River Ancholme focus on tackling the extent of historic river modification, pollution from rural areas and pollution from wastewater discharges.

- 17.5.40 In addition to the main river WFD waterbodies shown in Table 17.8, the Proposed Order Limits crosses two WFD waterbodies associated with ordinary watercourses. These waterbodies have similar characteristics to the Ancholme and Kettleby Beck WFD waterbodies.
- 17.5.41 The Environment Agency also monitors a range of parameters that are indicators of water quality on several watercourses within the Study Area. Available data has been reviewed and indicates that, for most parameters, measured values are within typical ranges for achieving 'High' WFD status. The exception to this is orthophosphate (which is indicative of nutrient enrichment) in the East Halton Beck and Kettleby Beck.
- 17.5.42 There are 12 ponds within the Study Area within this section including several of the ponds at the Messingham Sand Quarries.
- 17.5.43 With regard to their physical form, many of the watercourses in the Study Area have been subject to modifications for the purposes of land drainage and flood defence. All of the main rivers in Table 17.8, have a 'heavily modified' or 'artificial' designation. Many of the ordinary watercourses in the Study Area also serve a land drainage function and have a relatively low hydromorphological diversity, typically having uniform channel profiles and straightened channel forms.

### Flood Risk

- 17.5.44 Within Section 3 - Scunthorpe to Killingholme, there are two broad areas of Flood Zone 2 (medium risk) and Zone 3 (high risk): one associated with the River Ancholme (and its tributaries including the Skegger Beck) and the other associated with the Skitter Beck/East Halton Beck. There is also a small area of Flood Zone 3 associated with the ponds at the Messingham Sand Quarries. The remainder of the Proposed Order Limits and Study Area within Section 3 – Scunthorpe to Killingholme are shown to be in Flood Zone 1 (low risk). The Flood Zone designation of the British Steel AGI options is discussed in the previous section. The Block Valve KP 57.4 Option A AGI is shown to be partially within Flood Zone 3 (high risk) whereas the rest of the AGIs in this section are shown to be within Flood Zone 1 (low risk). Land within this section is not shown to benefit from flood defences by the Flood Map for Planning.
- 17.5.45 The areas benefitting from defences in the Flood Map for Planning benefit in a 1 in 100 (1%) fluvial flood event or 1 in 200 (0.5%) tidal flood event. The Environment Agency Spatial Flood Defences dataset (Ref 17.33) also shows flood defences that provide a lower standard of protection. According to the dataset, flood defences within this section include embankments along the River Ancholme, Scawby Catchwater and Kettleby Beck; and natural high ground along some reaches of the Scawby Catchwater, Kettleby Beck and its tributaries and Skitter Beck/East Halton Beck. There are also flood walls (1 in 150 design standard of protection) and embankments (1 in 20 design standard of protection) along the banks of the Humber estuary.
- 17.5.46 The Recorded Flood Outline dataset (Ref 17.31) shows that the following areas within the Study Area have previously flooded, the reported cause of the flooding is noted in brackets for each event:

- January 1953 – flood extent to the north and north-east of East Halton associated with the Humber and the downstream reach of the East Halton Beck (overtopping of defences);
- April 1981 – flood extent to the south of Brigg associated with the River Ancholme and Kettleby Beck (operational failure/breach of defence);
- December 2013 – flood extent north of East Halton, between East Halton and Goxhill Haven, attributed to a tidal surge (overtopping of defences); and
- November 2019 – flood extents up to 600 m from the River Ancholme and up to 500 m from the Kettleby Beck (overtopping of defences). Additional small flood extent associated with the East Halton Beck (channel capacity exceeded).

17.5.47 The proposed AGIs within Section 3 Scunthorpe to Killingholme (Block Valve KP 57.4 Option A, Block Valve KP 57 Option B, Block Valve KP 75.1 Option A, Block Valve KP 75.2 Option B and Killingholme AGI) are not located within the Recorded Flood Outlines.

17.5.48 The surface water flood risk to the British Steel AGI options is reported in the previous section. The Risk of Flooding from Surface Water map (Ref 17.30) shows that there are parts of the proposed Killingholme AGI at high and medium risk of surface water flooding, associated with ponding of surface water. For the rest of the AGI options in this section, the Risk of Flooding from Surface Water map shows very low risk of surface water flooding, with some small areas of low risk.

## **Section 4 – Killingholme to Hedon (Humber Crossing)**

### Watercourses, their Water Quality and Hydromorphology

17.5.49 Within the Section 4 – Killingholme to Hedon, there are three main rivers crossed by the Proposed Order Limits in addition to the crossing of the Humber Estuary. There are also numerous tributaries of these rivers, classified as ordinary watercourses, within the Study Area. The catchments of these watercourses are typically drained by an extensive network of channels and in some cases cover the urban areas of Hedon, Thorngumbald and industrial areas of Saltend. The Humber estuary is approximately 3 km wide at the point it is crossed by the Proposed Order Limits, and it drains a catchment area of over 24,000 km<sup>2</sup>. Land use within the majority of the Study Area is rural for this section with the exception of the portion of the Study Area covering Saltend Chemicals Park and Killingholme Port and Power Station.

17.5.50 The Study Area is not located within a surface water Drinking Water Protected Area or surface water Drinking Water Safeguard Zone.

17.5.51 The watercourses in this section all drain to the Humber Estuary in the reach that is part of the Humber Lower transitional WFD waterbody at the point it is crossed by the Proposed Order Limits. Skitter Beck/East Halton Beck is one of the main rivers within this section crossed by the Proposed Order Limits and baseline information on this watercourse and associated WFD waterbody is included in the previous section. Baseline WFD information for the rest of the WFD waterbodies in the Study Area associated with this section is presented in Table 17.9.

**Table 17.9: Summary of WFD Status Data (Cycle 2) 2019**

Main River/ Estuary	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorp hological designation
Humber Estuary	Humber Lower (GB5304026092 01)	Moderate	Moderate	Fail	Heavily modified
Thorngumbald Drain					
Burstwick Drain	Burstwick Drain from Source to Humber	Moderate	Moderate	Fail	Artificial

- 17.5.52 As Table 17.9 shows, the WFD waterbodies share similar quality characteristics. Both are failing for chemical status and have an ecological status of Moderate. Multiple RNAGs are reported for these waterbodies with those common to both including mercury and its compounds and PBDE. Burstwick Drain also has several RNAGs attributed to poor agricultural and soil management, sewage and septic tank discharges. The Humber Lower WFD transitional waterbody has several RNAGs where the source is under investigation, these include chemical classification elements and invertebrates. Burstwick Drain has a target of Good for 2027 whereas, for the Humber Lower WFD waterbody, the Moderate target for 2015 is attributed to disproportionate expense and burdens and technical infeasibility.
- 17.5.53 In addition to the WFD waterbodies already discussed in this section, the Proposed Order Limits cross two WFD waterbodies associated with ordinary watercourses. These waterbodies have similar characteristics to the waterbodies shown in Table 17.9.
- 17.5.54 The Environment Agency also monitors a range of parameters that are indicators of water quality on several watercourses within the Study Area. Available data has been reviewed and indicates that, for most parameters, measured values are within typical ranges for achieving 'High' WFD status. The exceptions to this are orthophosphate (all watercourses reviewed), conductivity (Burstwick Drain) and copper (Humber estuary).
- 17.5.55 There is one pond within this section.
- 17.5.56 With regard to their physical form, many of the watercourses in the Study Area have been subject to modifications for the purposes of land drainage and flood defence. All of the watercourses in Table 17.9, have a 'heavily modified' or 'artificial' designation. Many of the ordinary watercourses in the Study Area also serve a land drainage function and have a relatively low hydromorphological diversity, typically having uniform channel profiles and straightened channel forms. The hydromorphology of the Humber Estuary in this section is typical of a coastal estuary and it has a high turbidity due to suspended sediment. There are areas of mudflats on the banks of the Humber Estuary within this section of Study Area, including Paull Holme Sands. Further detail on these mudflats is included in Chapter 7: Ecology and Biodiversity (Volume II).

### Flood Risk

- 17.5.57 To the south-west of the Humber, Flood Zone 3 (high risk) typically follows the banks of the Humber and course of the Skitter Beck/East Halton Beck. This area is not shown to

benefit from flood defences by the Flood Map for Planning. To the north-east of the Humber Estuary, the majority of the Proposed Order Limits and Study Area within this section are shown to be within Flood Zone 3 (high risk). The exceptions to this are areas of higher ground which are shown to be within Flood Zone 1 (low risk), located around Dark Lane and between Farbridge Lane and Low Paull Farm. The land shown to be within Flood Zone 3 north-east of the Humber is also shown to be within an area benefiting from defences on the Flood Map for Planning. The Killingholme AGI option is located within Flood Zone 1 (low risk), but the Hedon and Saltend AGI options are all within Flood Zone 3 (high risk).

- 17.5.58 Flood defences in the area to the south-west of the Humber Estuary are discussed in the previous section (Section 3 – Scunthorpe to Killingholme). To the north-east of the Humber Estuary, flood defences include embankments and flood walls along the banks of the Humber; embankments, natural high ground and engineered high ground along Thorngumbald Drain; and embankments and natural high ground along Burstwick Drain.
- 17.5.59 Historic flood events in the area to the south-west of the Humber Estuary are discussed in the previous section (Section 3 – Scunthorpe to Killingholme). For the area to the north-east of the Humber Estuary, the Recorded Flood Outline dataset (Ref 17.31) shows that the following areas within the Study Area have previously flooded, the reported cause of the flooding is noted in brackets for each event:
- February 1953 – flood extents along the north bank of the Humber attributed to tidal flooding (overtopping of defences);
  - January 1969 – small flood extent south-west of Thorngumbald (drainage);
  - June 2007 – parcels of land throughout this area and along the north bank of the Humber (surface water flooding);
  - December 2013 – small flood extent near Paull attributed to tidal flooding (overtopping of defences); and
  - February 2020, Storm Ciara and Storm Dennis – flood extents covering small parcels of land throughout the area with the majority attributed to Storm Ciara rather than Storm Dennis (local drainage/surface water).
- 17.5.60 The Killingholme AGI is not located within the Recorded Flood Outlines. The Recorded Flood Outlines from the February 1953 and Storm Dennis flood events partially cover the Saltend AGI Options A and D. The remainder of the proposed AGIs within Section 4 Killingholme to Hedon (Humber Crossing) (Saltend AGI Options B and C and Hedon AGI Options A and B) are not located within the Recorded Flood Outlines.
- 17.5.61 The surface water flood risk to the Killingholme AGI is reported in the previous section. The Risk of Flooding from Surface Water map (Ref 17.30) shows that the Saltend AGI options are almost entirely at very low risk of surface water flooding, with some very small areas at low risk.

## **Section 5 - Hedon to Easington**

### Watercourses, their Water Quality and Hydromorphology

- 17.5.62 Within Section 5 - Hedon to Easington, there is one main river (the Burstwick Drain) which is crossed twice by the Proposed Order Limits. There are no other main rivers within the Study Area in this section. There are also numerous watercourses within the Study Area classified as ordinary watercourses, including multiple tributaries of the Burstwick Drain. In this section, the majority of watercourses drain to the Humber

Estuary and some drain to the East Yorkshire coast. The catchments of these watercourses are typically drained by an extensive network of channels. Land use within the majority of the Study Area is rural for this section with the exception of the portion of the Study Area covering Saltend Chemicals Park and the gas terminals north of Easington.

17.5.63 The Study Area is not located within a surface water Drinking Water Protected Area or surface water Drinking Water Safeguard Zone.

17.5.64 Baseline data for the Burstwick Drain and its WFD waterbody is presented in the previous section (Section 4 - Killingholme to Hedon (Humber Crossing)). The Study Area is partially located within the Yorkshire South coastal WFD waterbody at the landfall location and several of the watercourses crossed by the Proposed Order Limits are also covered by this WFD waterbody. Baseline data for this waterbody is presented in Table 17.10.

**Table 17.10: Summary of WFD Status Data (Cycle 2) 2019**

Waterbody	WFD Waterbody Name (ID)	Overall Status	Ecological Status	Chemical Status	Hydromorphological designation
East Yorkshire Coast	Yorkshire South (GB640402491000)	Moderate	Moderate	Fail	Heavily modified

17.5.65 The Yorkshire South coastal WFD waterbody shares similar characteristics with the Burstwick South WFD waterbody regarding their fail due to chemical status and Moderate ecological status. The RNAGs common to these WFD waterbodies are mercury and its compounds, PBDE and physical modifications. The Yorkshire South coastal WFD waterbody also has RNAGs relating to other chemical classification elements: tributyltin compounds and benzo(g-h-i)perylene. The Yorkshire South waterbody has a target status of Good for 2027.

17.5.66 In addition to the WFD waterbodies already discussed in this section, the Proposed Order Limits cross three WFD waterbodies associated with ordinary watercourses. This includes the Winstead Drain WFD waterbody and the Sands/Keyingham/ Roos Drain from Source to Humber waterbody. The Winstead Drain is an ordinary watercourse within the Study Area but is designated main river approximately 1.3 km downstream of the Study Area. The Project crosses several tributaries of the Keyingham Drain which are designated as ordinary watercourses, and the Keyingham Drain is designated main river approximately 4.2 km downstream of the Study Area. These waterbodies have similar characteristics to the Burstwick Drain.

17.5.67 The Environment Agency also monitors a range of parameters that are indicators of water quality on several watercourses within the Study Area. Available data has been reviewed and indicates that, for most parameters, measured values are within typical ranges for achieving 'High' WFD status. The exceptions to this are orthophosphate (all watercourses reviewed within the Section 5 – Hedon to Easington section), conductivity (Burstwick Drain) and copper (Humber Estuary).

17.5.68 There are 15 ponds within the Study Area of this section with several comprised of the PB Lakes at East Yorkshire Fisheries.

17.5.69 All of the waterbodies in this section, have a 'heavily modified' or 'artificial' designation. Many of the ordinary watercourses in the Study Area also serve a land drainage

function and have a relatively low hydromorphological diversity, typically having uniform channel profiles and straightened channel forms.

- 17.5.70 Sampling of the sediments at the Easington landfall in June 2022 (Ref 17.50) included heavy and trace metals, Total Petroleum Hydrocarbons (TPHs) and Poly Aromatic Hydrocarbons (PAHs). Mid and lower shoreline stations exhibited the highest concentrations of contaminants, although this is in part likely to be related to the percentage of fine sediments sampled at these stations. Levels of recorded contaminants were below Cefas Action Level 1, which provide guidance for dredged marine sediments that are to be assessed for at sea disposal (Ref 17.49). Contaminant levels below Action Level 1 are considered to be of no concern. The exception to this was at the northern most sampled transect where elevated levels of Nickel were recorded above Action Level 1 in stations sampled on the mid and lower shore. Levels of metals in the intertidal sediments correspond to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) background reference levels with minor elevations in Arsenic and Copper at two sampled stations. These preliminary findings will be reported on in greater detail and context once all of the analysis has been completed in support of the EIA.
- 17.5.71 The strong prevailing wind and wave regime of the North Sea propagate from the northeast creating a strong littoral sediment transport along the Holderness Coast that rapidly moves intertidal and nearshore sediments southwards, including material entrained into the sea from the rapidly eroding coastline (Ref 17.51). The Dimlington Cliff SSSI at the pipeline landfall is designated of national geological importance (Chapter 9: Geology and Hydrogeology (Volume II)) and is maintained by the levels of continuous exposure to littoral sediment transport and erosion of the cliffs. In the deeper waters offshore material is also moved by tidal currents in a net southward direction. The fine clays and the mud that is eroded from the cliffs in the vicinity of the landfall and along the Holderness coast is put into suspension in the nearshore waters and rapidly moved south and offshore, where a great deal of the material entrained in this transport pathway is eventually accumulated in the Humber Estuary.

## Flood Risk

- 17.5.72 As described in the previous section (Section 4 – Killingholme to Hedon (Humber Crossing)), the majority of land in the vicinity of the Saltend and Hedon AGI options is within Flood Zone 3 (high risk) according to the Flood Map for Planning. In the remainder of this section, there are five further areas shown to be within Flood Zone 3: four of these are associated with watercourses that cross the Proposed Order Limits and one is associated with the East Yorkshire coast at the landfall location. The areas of Flood Zone 3 associated with watercourses are shown to be within an area benefitting from defences according to the Flood Map for Planning but the area along the coast is not. The Block Valve KP 109.6 AGI is within the Flood Zone 3 outline associated with the Halsham Drain which is a tributary of the Keyingham Drain (both classified as ordinary watercourses). The remainder of the Proposed Order Limits and Study Area, including the Easington Pump Facility options, are within Flood Zone 1 (low risk).
- 17.5.73 Flood defences in the vicinity of the Saltend and Hedon AGI options are discussed in the previous section (Section 4 – Killingholme to Hedon (Humber Crossing)). The natural high ground along the Burstwick Drain extends across the Proposed Order Limits and throughout the Study Area. No further flood defences have been identified in the remainder of this section.
- 17.5.74 Historic flood events in the vicinity of the Saltend and Hedon AGI options are discussed in the previous section (Section 4 – Killingholme to Hedon (Humber Crossing)). For the

remainder of this section, there are also parcels of land shown to have been flooded in the June 2007 event and February 2020 Storm Ciara and Storm Dennis events. Events shown in the Recorded Flood Outline dataset (Ref 17.31) further to those reported in the previous section are shown below, the reported cause of the flooding is noted in brackets for each event:

- January 1969 – flood extents within the floodplain of the Winstead Drain which is an ordinary watercourse (channel capacity exceeded);
- January 1982 – approximately 300 m wide flood extent associated with the Keyingham Drain which is an ordinary watercourse (channel capacity exceeded); and
- November 2019 – flood extents adjacent to the Winstead Drain where it crosses the Proposed Order Limits (local drainage/surface water).

17.5.75 As reported in the previous section, some of the Recorded Flood Outlines partially cover two of the Saltend AGI options. However, the Easington Pump Facility options and the Block Valve KP 109.6 AGI are not within the Recorded Flood Outlines.

17.5.76 The surface water flood risk to the Saltend and Hedon AGI options is reported in the previous section. The Risk of Flooding from Surface Water map (Ref 17.30) shows that the majority of land proposed for the Easington Pump Facility options is at very low risk of surface water flooding, with some small areas of high, medium and low risk associated with existing surface water flow paths. The Block Valve KP 109.6 AGI is shown to be at very low risk of surface water flooding.

## Future baseline

17.5.77 Future baseline conditions within the ES will be forecast, drawing on current best practice guidelines (Ref 17.51). Flood risk and drainage within the Study Area are expected to be influenced by climate change through impacts on rainfall intensities and peak river flows. These future conditions will be considered to factor in climate change resilience into the Project drainage design.

17.5.78 For the Environment Agency's management catchments, the Project is located in, peak rainfall intensity is anticipated to increase between 25% (central estimate) and 40% (upper end estimate) in the 40 year design lifetime of the Project. With respect to peak river flows, the assessment will be based on the climate change allowances used for the climate change scenarios in the flood model data provided by the Environment Agency.

17.5.79 It is also anticipated that climate change will cause sea level rise which would affect the coastline and the Humber Estuary. Future baseline conditions with respect to sea level rise will be based on data provided from the Environment Agency from the Coastal Flood Boundary data set and the Humber Extreme Water Levels from the Humber Strategy Modelling study (2020).

17.5.80 The Easington landfall is located on a rapidly eroding coastline, retreating on average at a rate of 1-2 m per year. The underlying geology is of chalk overlain by a glacial till of soft boulder clay that can be rapidly eroded when saturated. It is this material that makes up much of the cliffs above Mean High Water Springs (MHWS). Evidence of recent cliff erosion can be seen in the observations from the intertidal survey at the Easington landfall (Ref 17.50). The rate at which the cliffs are eroding is evidenced in the vicinity of the proposed landfall at Easington within the Dimlington Cliff SSSI as well as further north, where much evidence of the cliffs slumping in sections was observed,

undercutting of the cliffs by wave action, large sections of cliff fall and material from the cliffs scattered on the shoreline throughout the intertidal area.

- 17.5.81 In addition to retreat of the coastline there is also a lowering of the shoreline profile. Modelling of both coastal retreat and the reduction of beach profile will be assessed further in the ES, for the proposed landfall.
- 17.5.82 To the south of the proposed landfall, and immediately to the north of the Easington terminal sea defences the shoreline has a noticeably raised profile due to a degree of accumulation of sediments from littoral transport caused by the terminal sea defences. Coastal erosion here is reduced in comparison with the coastline immediately to the north. The ongoing maintenance of the sea defences at Easington terminal will be considered in the ES.
- 17.5.83 The implementation of future cycles of WFD management plans driving future improvements in the ecological and chemical quality of waterbodies has been considered when assigning value to water environment resources and receptors.
- 17.5.84 Future baseline conditions will consider potential effects of other planned development.

## **17.6 Design development, impact avoidance and embedded mitigation**

- 17.6.1 A key primary mitigation measure is that the Project has sought to avoid sensitive features such as areas at medium and high risk of river flooding (defined by Flood Zones 2 and 3) where practicable when locating the most vulnerable project infrastructure such as AGIs. The Pump Facility would be located in an area at low risk of river and sea flooding (i.e., within Flood Zone 1) and would also be suitably set back from the coast to mitigate the risk of coastal erosion.
- 17.6.2 To provide suitable protection to the carbon dioxide pipeline at the landfall location it would be designed to be below the predicted cliff line and seabed profile throughout its design life.
- 17.6.3 Another key primary mitigation measure is the proposed use of trenchless construction methods for the Humber Estuary and several other main rivers (such as the River Aire, the Dutch River, the North and South Soak Drains, the River Ancholme and the River Trent for example). This would reduce temporary disturbance within the riparian corridor and avoid physical changes to the riverbed and channel and flow regimes, as well as reduce potential water quality effects. At trenchless crossings, the pipelines would be constructed at an agreed distance below bed level and offset from the banks of the watercourses.
- 17.6.4 It is anticipated that a number of watercourses would be crossed using open cut techniques, applying good practice methods to prevent pollution and managing flows. Flume pipes would be used to convey water to create a dry working area and pumped bypasses may be used where required. This would maintain the flow of the watercourses up and downstream of the crossing locations.
- 17.6.5 As part of the ongoing design development process, individual crossing locations would be assessed as being appropriate for open cut or trenchless techniques. Consultations are ongoing with the Environment Agency and LLFAs regarding the methods of watercourse crossings, with these discussions also taking recommendations from the Project ecologists into account.

- 17.6.6 Where the pipelines are routed below flood defences, these defences would be suitably designed or protected to withstand loading from above (due to maintenance or operational activities), as required by the Environment Agency.
- 17.6.7 The Humber Estuary would be crossed using a concrete lined tunnel, under the Humber with a minimum diameter of around 3 m and a maximum diameter of 6 m (to be confirmed through the design process). The tunnel would be constructed by using a Tunnel Boring Machine (TBM) which would be launched from a drive shaft potentially located on the Goxhill side (right bank) of the Humber. This crossing method would reduce disturbance within the inter-tidal zone and avoid physical changes to the riverbed and channel.
- A suite of tertiary measures is also relevant to the Hydrology and Land Drainage assessment. These include securing consents for qualifying works, as well as the good practice measures (for example management of silted surface water runoff, undertaking refuelling in designated areas located away from watercourses) adopted during construction to avoid pollution, manage land drainage, mitigate flood risk and reduce temporary impacts on coastal processes and water quality in the intertidal zone. These measures will be documented in a Construction Environment Management Plan (CEMP), which will include a Surface Water Management Plan. An outline CEMP will be submitted with the ES. With reference to the decommissioning works, a similar Environmental Management Plan would also be produced, and the works would have to comply with any licenses and permits that may be required at the time.
- 17.6.8 Temporary watercourse crossings may be required for access during construction. The watercourse crossing design would follow the good practice measures which will be set out within the CEMP. In addition, the construction accesses would be designed in accordance with any conditions set out within the consents and permits for them from the relevant authorities (the Environment Agency for main rivers, and the LLFA/IDBs for ordinary watercourses).
- 17.6.9 AGIs constructed on greenfield land have the potential to induce changes in existing rainfall infiltration and runoff patterns. The AGIs would incorporate drainage systems to appropriately manage surface water runoff from the sites during construction. Over their operational lifetime of these assets, drainage would also be managed as required. Measures would be selected on a case-by-case basis to suit, for example, local ground conditions, AGI size and the nature of land cover required. These measures will be outlined in the CEMP and in the FRA that will be prepared to support the ES.

## 17.7 Preliminary assessment of potential impacts

- 17.7.1 This Section details the preliminary assessment of potential impacts for the Project during the construction, operation and decommissioning phases.

### Construction

- 17.7.2 The potential impacts for Hydrology and Land Drainage associated with the construction phase are provided in Table 17.11.
- 17.7.3 Good practice measures within the CEMP would reduce the risk of pollution of the water environment during construction by removing the pathways between sources and receptors for most working areas. However, potential for construction work to cause localised and temporary pollution effects would remain.

17.7.4 No impacts on the canals crossed by the pipelines (Aire and Calder Navigation & Stainforth and Keadby Canal) are predicted given that they would be crossed using trenchless techniques. At these crossings, the pipelines would be constructed at an agreed distance below the canal and be offset from the banks.

**Table 17.11: Construction phase –preliminary assessment of potential impacts**

Resource/receptor and attribute	Sensitivity of resource/receptor	Description of potential impact/change
All watercourses crossed by the pipelines or for access using open cut techniques and culverts: hydromorphology	Low – watercourses are generally classified as artificial or heavily modified designations and exhibit limited morphological diversity	Where open cut crossing methods are proposed, an impact pathway may be created, with potential for temporary physical disturbance and changes to channel planform and temporary changes to watercourse flow regimes. Impacts would range in duration, but flumes and culvert crossings may be in place in some locations for several months.
Coastal waters: water quality	Very High/High – has a WFD classification shown in an RBMP	Temporary impacts at watercourse crossings for the pipelines and for access, and at the landfall and other construction works sites, for example, arising from generation of silted runoff and associated with overpumping and dewatering activities (dewatering effects assessed in Chapter 9: Geology and Hydrogeology (Volume II)). There is also limited potential for break out of drilling muds at trenchless crossings.
Main rivers: water quality	Very High/High – have WFD classifications included in a RBMP, with Q95 flows ranging from > 1 m <sup>3</sup> /s to < 1 m <sup>3</sup> /s	
Ordinary watercourses: water quality	High/Medium – watercourses not having a WFD classification shown in an RBMP and generally with Q95 flows of >0.001 m <sup>3</sup> /s	
Ponds: water quality	Medium – waterbodies not having a WFD classification shown in an RBMP	The impacts would be greatest on receptors crossed by the Project and/or located immediately adjacent to construction work sites.
Main rivers: flood flow storage and conveyance	Very High/High – project classification of Essential infrastructure	Parts of the construction working width and some temporary construction compounds/laydown areas would be located within Flood Zone 3. Furthermore, several AGIs would be constructed within Flood Zone 3. This could result in changes in floodplain
Ordinary watercourses with mapped areas of Flood Zone 2/3: flood flow storage and conveyance	Medium – watercourses of value for this attribute at the local scale	

Resource/receptor and attribute	Sensitivity of resource/receptor	Description of potential impact/change
		storage or flow routes, and consequently changes to baseline fluvial flood risk.
People and existing development within the floodplain: flood risk	High – existing highly and more vulnerable development within the Study Area	Potential flood risk impacts on people and existing development/infrastructure within the floodplain. This is due to works, for example soil storage, that could cause changes to baseline fluvial flood risk as a consequence of temporary loss of floodplain storage or disruption to flow conveyance.
Existing or proposed flood risk management infrastructure	High – infrastructure providing reduced flood risk to existing highly and more vulnerable development within the Study Area	<p>There is potential for impacts on the structural integrity of flood defences during construction of the pipelines beneath them, due to settlement or vibration from trenchless construction techniques. Key locations include at the crossing of the Humber Estuary, the River Trent, the Dutch River and the New River Ancholme, these are illustrated in Figure 17.1 (Volume IV).</p> <p>Construction works could conflict with planned flood risk management projects and capital works.</p>
Land drainage regime (ditches, pipe drains etc): flow storage and conveyance	Medium – receptors are of value for this attribute at the local scale	The existing land drainage regime could be impacted directly by construction activities causing severance of drainage routes or by damage caused to the soil structure. Several AGIs would be constructed on greenfield land, so changes to existing rainfall infiltration and runoff patterns would be induced. Temporary increases in impermeable land cover (e.g., construction compounds) could

Resource/receptor and attribute	Sensitivity of resource/receptor	Description of potential impact/change
		cause localised changes to the land drainage regime, resulting in ponding of water or waterlogging of soils. Areas with a sloping topography where topsoil has been stripped would be particularly vulnerable to these changes.
Sites designated for nature conservation interest where surface water plays a key role: water quality, flow and level	High to Medium – depending on designation at national or regional/local scale	Impacts on sites designated for nature conservation interest due to potential temporary impacts on water quality, flow and water levels caused by construction works. Construction activities that could be impactful include generation of silted or otherwise polluted runoff and temporary changes to flow regime of supporting watercourses caused by crossings.
Watercourses – water resource availability	High to Medium – depending on water availability status and number of existing abstractions that are supported.	Potential impacts on water availability in watercourses that are selected to support abstraction to supply water for use in hydrostatic pressure testing of the pipelines and for trenchless crossing construction.

## Operation

- 17.7.5 The potential impacts for Hydrology and Land Drainage associated with the operational phase are provided in Table 17.12.
- 17.7.6 Due to active coastal erosion in the vicinity of the Easington landfall the buried pipelines have the potential to become exposed during the operational lifetime of the Project. The Project design will ensure a suitable burial depth and appropriate measures are in place to prevent this potential future effect. If defensive measures are required for the pipeline landfall, then the impacts that these, and any operational maintenance, may have on the coastal processes within the inter-tidal zone will be considered within the ES.
- 17.7.7 As indicated in Table 17.12, operational activities are such that potential impacts during operation are limited to effects on land drainage and surface water flood risk at AGIs and increases in tidal and/or fluvial flood risk, where these sites are in the floodplain. The impact on tidal and/or fluvial flood risk will be fully assessed in ES, which will be informed by the findings of the supporting FRA.

**Table 17.12: Operational phase - preliminary assessment of potential impacts**

Resource/receptor	Sensitivity of resource/receptor	Description of potential impact/change
Main rivers: flood flow storage and conveyance	Very High	Given the extensive nature of the floodplain in several locations within the Proposed Order Limits (e.g., in the vicinity of Drax), locating proposed AGIs in the floodplain could not be completely avoided. Some AGIs would be located in Flood Zone 3 which could result in changes in floodplain storage or flow routes, and consequently changes to baseline fluvial flood risk.
People and existing development within the floodplain: flood risk	High	<p>Potential flood risk impacts on people and existing development/infrastructure within the floodplain due to location of AGIs in Flood Zone 3.</p> <p>Impact likely to be minor given the small footprint of the AGIs relative to the extensive floodplains, especially in Section 1 - Drax to Keadby and Section 2 - Keadby to Scunthorpe, however, a full assessment will be presented in the FRA that will be produced to support the ES.</p>
Land drainage regime (ditches, pipe drains etc): flood flow storage and conveyance	Medium	<p>Permanent increases in impermeable area due to the AGIs could result in increased surface water runoff, increased surface water flood risk and changes to the existing land drainage regime.</p> <p>Surface water runoff from the AGIs would be drained using appropriate SuDS techniques to meet the discharge requirements of the LLFAs/IDBs as applicable.</p>

NB: Impacts on existing surface water abstractions and discharges have been scoped out of the assessment for all phases (as agreed at scoping, see Table 17.1) so have not been assigned a sensitivity.

## Decommissioning

- 17.7.8 The pipelines would have an operational life of at least 40 years. When the pipelines reach the end of their life, they would be decommissioned safely under a separate consent. Decommissioning would consider all the relevant environmental legislation and technology available at the time. Any necessary licences and permits would be acquired.
- 17.7.9 Decommissioning involves the pipelines being left in-situ, with measures put in place to prevent subsidence of the pipelines when they are no longer operational. The AGIs would be dismantled, all equipment would be removed, and the land returned to agricultural or other appropriate uses.
- 17.7.10 Potential impacts during the decommissioning phase are therefore limited to the decommissioning works themselves. Impacts from decommissioning works are likely to be similar to the general construction works referred to in previous sections covering the construction phase, for example, with the potential for localised effects on water quality and the land drainage regime, although the effects of decommissioning works on hydrology and land drainage receptors are anticipated to be localised at the AGI locations. Mitigation and enhancement measures

## 17.8 Mitigation and enhancement measures

- 17.8.1 This Section sets out the preliminary avoidance, mitigation and compensation measures which are likely to be required to address the potential impacts as assessed in Section 17.7.

## Construction

- 17.8.2 A suite of secondary measures are relevant to the Hydrology and Land Drainage assessment for the construction phase and these are outlined below.
- 17.8.3 In several locations the pipelines would be routed under flood defence infrastructure. To ensure no detrimental impact on these defences and their ability to function, monitoring of the structures is proposed at key locations to establish a pre-construction baseline and during construction to ensure no changes in their level and structural integrity. As part of the ongoing engagement with the Environment Agency, discussions will be held to agree key monitoring locations and a suitable monitoring regime (including the overall period that the monitoring will take place). Engagement with the Environment Agency is also ongoing with reference to potential conflicts between the construction works and planned flood risk management projects and capital works: for example, capital projects near East Halton/Skitter Beck to improve defences in the vicinity of the Proposed Order Limits on the south bank of the Humber. Once finalised, the exact location of the proposed pipelines and construction areas will be provided to the Environment Agency, with intended timings, to ensure that the schemes can co-exist.
- 17.8.4 Some AGIs, parts of the construction working width and multiple temporary construction compounds would be located in the floodplain (Flood Zone 3). It is proposed that the Main Works Contractor (and others) would sign up to the Environment Agency's Floodline service whilst works within the floodplain are being undertaken. A Flood Risk Action Plan would be established containing appropriate evacuation procedures to be followed upon receipt of a flood warning. Further information on the Action Plan would be included in the CEMP, an outline of which will be submitted with the ES.

- 17.8.5 Where additional mitigation of flood risk may be required, such as where drive pits for trenchless crossings are located in the floodplain (Flood Zone 3), suitable protection would be provided. Specific measures (such as raised earth bunds for example) would be determined as an outcome of the FRA that will be prepared in support of the ES and recorded within the Register of Commitments.
- 17.8.6 Where open cut crossings of main rivers are proposed, reinstatement works would be carried out to mitigate potential impacts on the conveyance, flow and hydromorphology of the watercourses, as well as mitigating detrimental impacts on the habitats they support. A pre-construction survey would be undertaken to map the profile of the existing bed, banks and channel gradient to inform the reinstatement works. The survey would also identify the location of any in-channel features such as riffles and pools although it is noted that for the majority of watercourses crossed by open cut techniques morphological diversity is likely to be low.
- 17.8.7 Once the pipelines are installed, the bank and channel profile and gradient would be reinstated to existing or enhanced conditions. The riverbed material would be replaced within the channel and opportunities to encourage flow regime diversity would be considered. Further detail on ecological mitigation and enhancement is included in Chapter 7: Ecology and Biodiversity (Volume II). A geomorphologist would review the method statement for the open cut watercourse crossings, which would be included in the CEMP, and would also confirm that the channels have been suitably reinstated.
- 17.8.8 Canals crossed by the proposed pipelines (Aire and Calder Navigation & Stainforth and Keadby Canal) would be crossed using trenchless techniques.
- 17.8.9 The location and condition of existing land drainage infrastructure would be established during pre-construction surveys and a record would be compiled. Where necessary, and subject to agreement with the landowner/occupier, new field drains would be installed to:
- Enable the landowner/occupier's current drainage system to continue working throughout the period of pipeline construction;
  - Help prevent damage to the soil structure;
  - Aid recovery from construction activity; and
  - Ensure the site work areas are kept as dry as practically possible.
- 17.8.10 The design of these drainage schemes would be agreed between the Applicant, the Main Works Contractor and the landowners/occupiers. A specialist drainage contractor in most instances would carry out the work. Permanent records of the land drainage locations would be produced.
- 17.8.11 If abstraction from a surface water source is required to supply water for trenchless crossing methods and for hydrostatic pressure testing of the pipelines, abstraction would be governed by the terms of Environment Agency Abstraction Licences. Licences would be expected to set 'hands off' flow limits, and potentially temporal restrictions, based on water availability and environmental sensitivity. Adhering to these conditions would protect surface water resources. This will be fully assessed within the ES.

## Operation

- 17.8.12 With regard to secondary measures, a commitment would be made, and secured through the DCO, to mitigate potential flood risk impacts associated with building AGIs in the floodplain.
- 17.8.13 The footprint of the AGIs would be very small compared to the expansive nature of the floodplains they would be located within. Given this, impacts on third party flood risk are expected to be very limited. This will be confirmed through the FRA that will be produced to support the ES.
- 17.8.14 Flood risk impacts on the AGIs themselves would be mitigated using a flood resilient design.

## Decommissioning

- 17.8.15 No secondary mitigation measures specific to the decommissioning of the Project have been identified as necessary at this stage.

## 17.9 Summary of the preliminary assessment of potential significant effects

17.9.1 Table 17.13 below summarises the preliminary assessment of potential significant effects associated with the Project.

**Table 17.13: Summary of the preliminary assessment of potential significant effects**

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of potential impact/change	Mitigation	Potential significant effects
All watercourses with open cut crossings or culverts for access: hydromorphology	Construction	Low	Temporary physical disturbance and temporary changes to watercourse flow regimes.	Maintain downstream flow and reinstate to original or better condition.	Not Significant
Coastal waters: water quality	Construction	Very High/High	Temporary effects at watercourse crossings and construction works sites, for example, due to the generation of silted runoff and associated with overpumping and dewatering activities. There is also limited potential for break out of drilling muds at trenchless crossings.	Mitigation included in the CEMP, following best practice.	Not Significant
Main rivers: water quality		Very High/High			
Ordinary watercourses: water quality		High/Medium			
Ponds: water quality		Medium			
Main rivers: flood flow storage and conveyance	Construction	Very High/High	Fluvial flood risk impacts to project construction work sites.	Additional mitigation of flood risk would be provided where required (e.g., at drive pits for trenchless crossings). Flood	Not Significant

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of potential impact/change	Mitigation	Potential significant effects
				Action Plan and flood resilient design for AGI and work sites.	
Ordinary watercourses with mapped areas of Flood Zone 2/3: flood flow storage and conveyance		Medium		Flood Action Plan and flood resilient design for AGI and work sites.	Not Significant
People and existing development within the floodplain: flood risk	Construction	High	Temporary increase in flood risk due to loss of floodplain storage or disruption of flood flows	Management of temporary effects, e.g., soil storage to prevent formation of continuous barriers to floodplain flows.	Not Significant
Existing or proposed flood risk management infrastructure	Construction	High	Impacts on structural integrity of flood defences. Conflicts with planned flood risk management projects and capital works.	Following best practice, monitoring of defences at key locations during construction works. Sharing of information with Environment Agency to ensure schemes would not affect each other.	Not Significant
Land drainage regime: flood flow storage and conveyance	Construction	Medium	The existing land drainage regime could be impacted through construction works, damage to soil structure	Land drainage reinstated following completion of construction works and new land drains	Not Significant

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of potential impact/change	Mitigation	Potential significant effects
			and construction of AGIs on greenfield land.	installed where required. AGI sites would have suitable drainage provision during construction works, to be detailed in the CEMP.	
Watercourses – water resource availability	Construction	High to Medium	Water abstraction to support pipeline hydrostatic pressure testing and trenchless construction methods	Abstraction in accordance with the conditions of Environment Agency Abstraction Licence, including adherence to ‘hands off’ flow limits to protect water resource availability.	Not Significant
Main rivers: flood flow storage and conveyance	Operation	Very High	Fluvial flood risk impacts on AGIs in Flood Zone 3.	Flood resilient design.	Not Significant
People and existing development within the floodplain: flood risk	Operation	High	Increase in flood risk due to loss of floodplain storage or disruption of flood flows where AGI are constructed in Flood Zone 3.	Floodplain compensation storage provision where necessary.	Not Significant
Land drainage regime: flood flow	Operation	Medium	Permanent increases in impermeable area due	SuDS.	Not Significant

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of potential impact/change	Mitigation	Potential significant effects
storage and conveyance			to the AGIs could result in increased surface water runoff, increased surface water flood risk and changes to the existing land drainage regime.		
Watercourses with culverts for access to decommissioned AGIs: hydromorphology	Decommissioning	Low	Localised, temporary physical disturbance and temporary changes to watercourse flow regimes.	Maintain downstream flow and reinstate to original or better condition.	Not Significant
Main rivers: water quality	Decommissioning	Very High/High	Temporary effects at watercourse crossings and works sites, for example, due to the generation of silted runoff.	Mitigation included in the Environmental Management Plan that would be produced for the decommissioning works, following best practice.	Not Significant
Ordinary watercourses and other waterbodies: water quality		High/Medium			
Decommissioning activities within Flood Zones 2 and 3	Decommissioning	Very High/Medium	Fluvial flood risk impacts to decommissioning work sites.	Flood Action Plan.	Not Significant
Land drainage regime: flood flow storage and conveyance	Decommissioning	Medium	The land drainage regime could be impacted through decommissioning works	Land to be returned to previous uses.	Not Significant

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of potential impact/change	Mitigation	Potential significant effects
			and damage to soil structure.		

## 17.10 Next steps

### Engagement

- 17.10.1 Due to the iterative design process, stakeholder engagement will continue after the statutory consultation period. Further engagement will be undertaken with the IDBs specifically and discussions will continue with the Environment Agency and LLFAs regarding watercourse crossings.
- 17.10.2 Targeted consultations will be held with the Environment Agency focussed on flood risk. It is planned that these discussions will facilitate agreement on the flood data to be used in the FRA. Any specific requirements arising from these consultations, regarding the assessment to be undertaken, will be addressed in the FRA which will inform the ES.

### Surveys

- 17.10.3 No surveys for Hydrology and Land Drainage are intended between now and the ES submission. This is because the baseline water environment can be robustly characterised using published data sources. Detailed analysis of the findings of the landfall survey will inform the full assessment undertaken for the ES.
- 17.10.4 Post-submission, the following surveys would be undertaken prior to commencement of construction works:
- Flood defence pre-construction surveys; and
  - Land drainage surveys.

### Assessment

- 17.10.5 The next steps are developing the FRA and WFD screening assessment. The findings of these will inform the full assessment undertaken for the ES.
- 17.10.6 The assessment undertaken in the ES will take into account any design changes (e.g., as a result of stakeholder engagement or development of the design) since completion of the PEIR.

## 17.11 References

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