NORTH FALLS

Offshore Wind Farm

ENVIRONMENTAL STATEMENT

Chapter 21 Water Resources and Flood Risk

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Glossary of Acronyms

AIS	Automatic Identification System
CEA	Cumulative Effects Assessment
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
DCO	Development Consent Order
Defra	Department for Environment, Food & Rural Affairs
DESNZ	Department for Energy Security and Net Zero
EIA	Environmental Impact Assessment
ES	Environmental Statement
ETG	Expert Topic Group
FRA	Flood Risk Assessment
FWMA	The Flood and Water Management Act
GEP	Good Ecological Potential
GES	Good Ecological Status
GPP	Guidance for Pollution Prevention
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
NFOW	North Falls Offshore Wind Farm
NL	National Landscape
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
NPS	National Policy Statement
OCoCP	Outline Code of Construction Practice
PAH	Polycyclic aromatic hydrocarbons
PBDE	Polybrominated diphenyl ethers
PCB	Polychlorinated biphenyls
PEIR	Preliminary Environmental Information Report
PFOS	Perfluorooctane sulfonate
PFRA	Preliminary Flood Risk Assessment

PPG	Pollution Prevention Guidance
RBD	River Basin District
RBMP	River Basin Management Plan
RNAG	Reasons for Not Achieving Good
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SMP	Soil Management Plan
SPA	Special Protection Area
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
TJB	Transition Joint Bays
UKBAP	UK Biodiversity Action Plan
Five Estuaries	Five Estuaries Offshore Wind Farm
VEOWL	Five Estuaries Offshore Wind Farm Limited
WER	Water Environment Regulations
WFD	Water Framework Directive

Glossary of Terminology

Aquifer	Geological strata that hold water
Coastal catchment	Land which drains directly to the coastal or estuarine waters, rather than through a river water body – not part of a river water body catchment
Geomorphology	The study of landforms and the processes that shape them
Groundwater	Water stored below the ground in rocks or other geological strata
Surface water flooding	Surface water flooding occurs when rainwater does not drain away through normal drainage systems or soak into the ground, but lies on or flows over the ground instead
Main River	Usually larger rivers and streams. The Environment Agency carries out maintenance, improvement or construction work on Main Rivers to manage flood risk
Ordinary Watercourse	Other rivers are called ‘Ordinary Watercourses’. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on Ordinary Watercourses
Onshore project area	The boundary within which all onshore infrastructure required for the Project will be located (i.e. landfall; onshore cable route, accesses, construction compounds; onshore substation and cables to the National Grid substation).
The Applicant	North Falls Offshore Wind Farm Limited (NFOW).
The Project Or ‘North Falls’	North Falls Offshore Wind Farm, including all onshore and offshore infrastructure.
Landfall	The location where the offshore export cables come ashore at Kirby Brook.
Landfall compound	Compound at landfall within which horizontal directional drill (HDD) or other trenchless technique would take place.
Horizontal directional drill (HDD)	Trenchless technique to bring the offshore cables ashore at landfall. The technique will also be the primary trenchless technique used for installation of the onshore export cables at sensitive areas of the onshore cable route.
Onshore cable route	Onshore route within which the onshore export cables and associated infrastructure would be located.
Onshore export cable	The cables which take the electricity from landfall to the onshore substation. These comprise High Voltage Alternative Current (HVAC) cables, buried underground.
Onshore substation	A compound containing electrical equipment required to transform and stabilise electricity generated by the Project so that it can be connected to the National Grid.
Onshore substation construction compound	Area set aside to facilitate construction of the onshore substation. Will be located adjacent to the onshore substation.
Onshore substation works area	Area within which all temporary and permanent works associated within the onshore substation are located, including onshore substation, construction compound, access, landscaping, drainage and earthworks.

21 Water Resources and Flood Risk

21.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the likely significant effects of North Falls offshore wind farm (hereafter 'North Falls' or 'the Project') on water resources and flood risk. The chapter provides an overview of the existing environment for the onshore project area, followed by an assessment of likely significant effects on water resources and flood risk during the construction, operation, and decommissioning phases of the Project.

2. This chapter has been written by Royal HaskoningDHV, with the assessment undertaken with specific reference to the relevant legislation and guidance, of which the primary sources are the National Policy Statements (NPS). Details of these and the methodology used for the Environmental Impact Assessment (EIA) and Cumulative Effects Assessment (CEA) are presented in Section 21.4 and Section 21.7.

3. The assessment should be read in conjunction with following linked chapters (Volume 3.1):
   - ES Chapter 19 Ground Conditions and Contamination (Document Reference: 3.1.21); and
   - ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25).

4. Additional information to support the water resources and flood risk assessment includes:
   - ES Appendix 21.1 Geomorphological Baseline Survey (Document Reference: 3.3.27);
   - ES Appendix 21.2 Water Environment Regulations Compliance Assessment (Document Reference: 3.3.28); and
   - ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29).

21.2 Consultation

5. Consultation regarding water resources and flood risk has been undertaken in line with the general process described in ES Chapter 6 EIA Methodology (Document Reference: 3.1.8). The key elements to date have included scoping and the ongoing technical consultation. The feedback received has been considered in preparing the ES.

6. Table 21.1 provides a summary of how the consultation responses received to date have influenced the approach that has been taken.

7. This chapter has been updated following the consultation on the Preliminary Environmental Information Report (PEIR) in order to produce the final assessment. Full details of the consultation process will also be presented in the Consultation Report as part of the Development Consent Order (DCO) application.

Table 21.1 Consultation responses

Consultee	Date / Document	Comment	Response / where addressed in the ES
Anglian Water	27/07/2021 Scoping Opinion	Anglian Water works with developers including those constructing projects under the 2008 Planning Act to ensure requests for alteration of sewers, wastewater and water supply infrastructure is planned to be undertaken with the minimum of disruption to the Project and customers. The ES should include reference to Anglian Water's existing sewerage infrastructure. Anglian Water recommends the use of Sustainable Drainage Systems (SuDS) for the onshore works. The risk of sewer flooding and any required mitigation within the public sewerage network should form part of a Flood Risk Assessment and Surface Water and Foul Drainage Strategy.	Details of potable and raw water mains and sewerage infrastructure are given in Section 21.5.5. An Outline Operational Drainage Strategy (Document Reference: 7.19) has been developed for the Project, which includes SuDS. Since there are no public sewers in the vicinity of the substation sites (according to the Anglian Water sewer records), it is not possible to make a foul connection to a public sewer. A septic tank is therefore proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage through the Operational Drainage Strategy, based on the outline strategy, secured through DCO Requirement. All potential sources of flooding are assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29).
Anglian Water	12/08/2021 Scoping Opinion	We welcome that Anglian Water will be invited to attend relevant Expert Topic Groups and would suggest this would be the Onshore Water Resources and Flood Risk group. We would expect that the Environmental Statement would include reference to existing sewerage infrastructure managed by Anglian Water and, if necessary, water supply infrastructure near Colchester. Maps of Anglian Water's assets are available to view at the following address: http://www.digdat.co.uk/	Existing water supply and sewerage infrastructure has been outlined in Section 21.5.5. Further consultation with Anglian Water on existing infrastructure will take place through an Expert Topic Group. Since there are no public sewers in the vicinity of the substation sites (according to the Anglian Water sewer records), it is not possible to make a foul connection to a public sewer. A septic tank is therefore proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage.
Anglian Water	12/08/2021 Scoping Opinion	We note that the Scoping Report identifies the potential impacts from construction (para 424 et al.) including excavation activities as well the potential pathways for contamination. At para 491 the Report summaries the position for utilities and that no detailed data has been sought. No reference is made to sewage or water supply data and so we	Existing water supply and sewerage infrastructure has been outlined in Section 21.5.5. A septic tank is proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage.

Consultee	Date / Document	Comment	Response / where addressed in the ES
		would urge the Applicant to consider the impact on utilities early in cable route and design work to minimise impacts and to reduce to a minimum the carbon cost of diversions.	
Anglian Water	12/08/2021 Scoping Opinion	No reference is made to the need for upgraded and additional sewerage infrastructure or water supply for construction or operation. It is recommended that the Environmental statement should include reference to identified impacts on the sewerage network and sewage treatment.	An Outline Operational Drainage Strategy (Document Reference: 7.19) has been developed for the Project, which includes SuDS. Since there are no public sewers in the vicinity of the substation sites (according to Anglian Water's sewer records), it is not possible to make a foul connection to a public sewer. A septic tank is therefore proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage.
Anglian Water	12/08/2021 Scoping Opinion	Anglian Water welcomes the ES identifying that there is a surface water sewer outfall pipe located within the landfall to the north-east of Frinton Golf Course. However, figure 22.6 also identifies a foul sewer from Great Holland to a sewer pumping station Frinton-Holland Road) and further sewers on the edge of Frinton on Sea.	The outfall interacts with a proposed access route into the landfall, rather than the landfall itself. The foul sewer running from Great Holland to the sewer pumping station does not appear to directly interact with the DCO Limits or the Project.
Affinity Water	29/07/2021 Scoping Opinion	Concern will only be at the point of landfall and associated development in terms of connections to existing grid infrastructure; in those instances, Affinity Water will want to ensure there are no potential contamination issues.	North Falls do not anticipate making any connections into existing infrastructure. Since there are no public sewers in the vicinity of the substation sites (according to the Anglian Water sewer records), it is not possible to make a foul connection to a public sewer. A septic tank is therefore proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage.
Environment Agency	16/08/2021 Scoping Opinion	Consider whether EIA should address the potential for saline intrusion with Horizontal Directional Drilling (HDD) at the landfall, and the potential for localised changes to groundwater flow in terms of barriers e.g., excavations proximal to shallow groundwater abstractions.	Although there may be some very localised increases in salinity in the vicinity of the landfall trenchless technique bore, there would not be any consumptive abstraction of groundwater during construction or operation, which would cause a drawdown in the underlying groundwater

Consultee	Date / Document	Comment	Response / where addressed in the ES
		Local wildlife sites and water features surveys will be included in EIA approach.	body. As the landfall is above mean sea level, the head difference would also limit any minor changes in salinity. Potential impacts on groundwater flows are assessed in Section 21.6.1.4 and Section 21.6.2.2. Details of Essex Wildlife Trust nature reserves and other local wildlife sites that could be affected by the Project have been included in Section 21.5.8.
		The onshore aspects of the report should consider flood risk and the requirement for environmental (flood risk activity) permits.	Flood risk and climate change are being considered explicitly within the EIA, through a Flood Risk Assessment (FRA) and in ES Chapter 33 Climate Change (Document Reference: 3.1.35).
		Consideration of local wildlife sites is required, and method, geology and industry good practice associated with potential HDD drilling (bentonite) contamination.	Details of Essex Wildlife Trust nature reserves and other local wildlife sites that could be affected by the Project have been included in Section 21.5.8. Potential monitoring requirement associated with trenchless techniques are discussed in Section 21.7. If construction monitoring is required, details would be formalised in a water quality monitoring protocol which would be secured under the DCO.
Essex County Council	20/08/2021 Scoping Opinion	Drainage strategy to manage surface runoff from larger storm events.	Drainage strategies and flood risk are addressed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29). An Outline Operational Drainage Strategy (Document Reference: 7.19) has been developed in accordance with SuDS principles. It will be submitted as part of the DCO application.
		All information associated with surface water drainage should be included as part of the forthcoming DCO submission. The Project details with reference to surface water drainage and any potential drainage elements are yet to be established and therefore we recommend all information associated with surface water drainage should be included as part of any	

Consultee	Date / Document	Comment	Response / where addressed in the ES
		major planning application and it should be in accordance with SuFRADS Design Guide.	
Planning Inspectorate	26/08/2021 Scoping Opinion	Direct disturbance to surface water bodies to remain scoped out during operation.	Two operational impacts are assessed: supply of contaminants (including fine sediment) and changes to surface and groundwater flows and flood risk.
		Scoping Report focused primarily on inland effects on surface water bodies, with little reference to coastal flooding	All potential sources of flooding are assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29).
		Information should be provided regarding the location, scale, and dimensions of any proposed watercourse crossings / in-stream structures, as well as the nature of any associated construction works (e.g., dewatering, trenching, and trenchless techniques). The ES should consider the potential of such works to negatively impact the ecological status of watercourses under the WER and the results of the WER compliance assessment should be reported in the ES and / or associated technical appendix.	A crossing schedule has been developed for the Project and the impact of the type and number of crossings is assessed in Section 21.6.1.1). A Water Environment Regulations (WER) compliance assessment has been undertaken for the Project (ES Appendix 21.2 Water Environment Regulations Compliance Assessment (Document Reference: 3.3.28)).
		There is potential for indirect effects to below ground heritage assets arising from flood risk and drainage impacts. The ES should set out the method for defining the sensitivity of both heritage and ecological receptors to flood risk and drainage impacts where significant effects are likely to occur.	The sensitivity of heritage receptors is defined in ES Chapter 25 Onshore Archaeology and Cultural Heritage (Document Reference: 3.1.27). There are no known heritage assets / buried archaeology in the onshore search area that could be affected by flood risk and drainage impacts. Water resources and flood risk receptor sensitivity is presented in Table 21.6.
		The ES should present the results of the most recent FRA and should take into account the latest Environment Agency guidance on climate change, including climate change	All potential sources of flooding will be assessed in an FRA that will accompany the ES as part of the DCO application. Consultation with the Environment Agency

Consultee	Date / Document	Comment	Response / where addressed in the ES
		allowances (currently UKCP18). Effort should be made to agree the relevant baseline with the Environment Agency and relevant consultation bodies, including the Lead Local Flood Authority (LLFA) (Essex County Council).	and the LLFA (Essex County Council) will take place through an Expert Topic Group.
		The ES should provide information in relation to the Applicant's proposed drainage strategy, including the details of any proposals to implement Sustainable Drainage Systems (SuDS). The ES should explain how the proposed drainage strategy will interact with any relevant biodiversity and cultural heritage objectives.	An Outline Operational Drainage Strategy (Document Reference: 7.19) has been developed for the Project, which includes SuDS. It will be submitted as part of the DCO application.
		The ES should provide information on existing abstractions and discharges within the baseline and assess the effects of the Proposed Development on any identified abstraction sources or discharges, where significant effects are likely to occur. The ES should also refer to the relevant Strategic Flood Risk Assessment(s) (SFRAs) and LLFA Flood Risk Management Strategies.	Details abstractions and discharges have been added to Section 21.5.4 and assessed in Section 21.6.1.3 and Section 21.6.2.1. Local (SFRA) documents are referred to in Section 21.4.1.
		Paragraph 501 of Section 3.4 (land use) states that permanent infrastructure and hardstanding at the onshore substation, plus the presence of buried cables, has the potential to permanently impact upon land drainage. It states that impacts on drainage are considered further in Section 3.3.3; however, limited further information is provided on this matter. The ES should provide information in relation to the Applicant's proposed drainage strategy, including the details of any proposals to implement Sustainable Drainage Systems (SuDS). The ES should explain how the proposed drainage strategy will interact with any relevant biodiversity and cultural heritage objectives.	The presence of permanent infrastructure has been assessed in Section 21.6.2, and further detail on land drainage is provided in ES Chapter 22 Land Use and Agriculture (Document Reference 3.1.24). An Outline Operational Drainage Strategy (Document Reference: 7.19) has been developed for the Project, which includes SuDS. Impacts on ecology and heritage are assessed in ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25) and ES Chapter 25 Onshore Archaeology and Cultural Heritage (Document Reference: 3.1.27).

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Essex County Council	14/07/2023 PEIR response	Essex County Council as the LLFA have reviewed the consultation documents for the North Falls Wind Farm, further information will be required to cover drainage concerns and drainage elements onsite. It is our wish that the future consultation takes place with more information for specific areas under concern. Essex County Council as LLFA is consulted on the areas that are proposed for underground cable installation and compound construction sites. The LLFA recommends that the drainage proposal for the areas under Essex should comply with SuDS Design Guide, a link to the same being here: suds | Essex Design Guide. The proposal should assess the areas susceptible to surface water flooding and requires appropriate measures to mitigate any adverse impacts during the construction phase and any implication associated with existing drainage interruption / blockage or temporary diversions.	Details of the temporary (construction) and operational drainage strategy is described in detail in the Outline Operational Drainage Strategy (Document Reference: 7.19), which includes SuDS. Details of the drainage strategy are included in the assessment in Section 21.6.1.3, Section 21.6.1.4 and Section 21.6.2. The drainage strategy will be submitted as part of the DCO application.
Essex County Council	14/07/2023 PEIR response	Details should include any temporary works (culverts) to Ordinary Watercourses, drainage channels for the purpose to give access to the Project location. The surface water management during the construction of office, storage compounds. The proposal should enlist the required mitigation to prevent onsite / offsite flooding. Measures taken to prevent any pollutants entering surface water or ground water. Appropriate measures to deal with spills and leakages onsite. Proposal for surface runoff disposal during construction phase and from the built area's (offices, storage compounds) in accordance with SuDS Design Guide.	Section 21.6.1.1 assesses the direct disturbance of surface water bodies, including trenched and temporary crossings (e.g. culverts and bailey bridges). Mitigation measures for all impacts are set out in Section 21.3.3, including measures to manage sediment, pollutants and surface water runoff. Details of the temporary and operational drainage strategy are presented in the Outline Operational Drainage Strategy (Document Reference: 7.19) and summarised (where relevant) in Section 21.6.1.4 and Section 21.6.2.2.
Essex County Council	14/07/2023 PEIR response	Consultation with the LLFA is required to have Section 23 consent for the areas where the Project will have direct or indirect effect on drainage channels, or Ordinary Watercourses	Both projects will discuss a common approach to Section 23 consents and stakeholders will be informed once a decision has been reached.

Consultee	Date / Document	Comment	Response / where addressed in the ES
Anglian Water	13/07/2023 PEIR response	Anglian Water welcomes reference to our Scoping Response in Table 21.1 regarding impacts on our sewer network and that matters relating to the Construction Surface Water and Drainage Plan will be developed as part of the Code of Construction Practice, whilst an Outline Code of Construction Practice will be included as part of the DCO application, Anglian Water requests that we are consulted on the Code of Construction Practice when this is prepared post-DCO consent, particularly if connections are likely to be required to our assets. Anglian Water confirms that we would welcome further engagement through an Expert Topic Group to consider any impacts on our existing infrastructure.	The Outline Operational Drainage Strategy (Document Reference: 7.19) identifies that there are no public sewers in the vicinity of the substation (according to the Anglian Water sewer records), so it will not be possible to make a foul connection to a public sewer. A septic tank is therefore proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage.
Anglian Water	13/07/2023 PEIR response	Surface Water: Anglian Water notes that we may potentially be consulted should a connection to our drainage infrastructure should be required for surface water run-off following construction of the cable corridor and particularly the onshore substation. Anglian Water would request that we are consulted when the Operational Surface Water and Drainage Plan is developed, unless it is demonstrated through the Environmental Statement that surface water drainage will be managed through SuDS or alternative means that do not require a connection to our network.	An Outline Operational Drainage Strategy (Document Reference: 7.19) has been developed for the Project, which includes SuDS to manage runoff from the Project. The strategy identifies that a septic tank would be used at the substation, so it is not anticipated that sewerage connection will be required.
Anglian Water	13/07/2023 PEIR response	Supply of contaminants (construction and operational maintenance phases): It is stated that foul drainage will connect to a mains (public) sewer if a connection is available or collected and disposed of at a facility with capacity within its existing permit. Anglian Water suggests that discussions are undertaken with our pre-development team when reasonably practicable.	The Outline Operational Drainage Strategy (Document Reference: 7.19) identifies that a septic tank would be used at the substation, so it is not anticipated that sewerage connection will be required.
Anglian Water	13/07/2023 PEIR response	Anglian Water notes that the only sewerage mains within the Project area are located within the landfall area of the onshore project area, immediately west of Frinton-on-Sea. However,	The outfall interacts with a proposed access route into the landfall, rather than the landfall itself. The foul sewer running from Great Holland to the sewer pumping station

Consultee	Date / Document	Comment	Response / where addressed in the ES
		the limits of the Project area (Fig 22.6) also include a sewer from Great Holland to the pumping station at Frinton-Holland Road. The proposed route is in proximity to our water recycling catchments at Thorpe-le-Soken (dependent on selected route option) and Kirby Cross. The mitigation for flood risk incurred by the construction of the onshore cable route should therefore ensure that any risks to our wastewater networks are mitigated for – e.g. do not result in increased risk of sewer flooding events.	does not appear to directly interact with the DCO Limits or the Project. The Outline Operational Drainage Strategy (Document Reference: 7.19) identifies that a septic tank would be used at the substation, so it is not anticipated that sewerage connection will be required.
Environment Agency	14/07/2023 PEIR response	Flood Risk Assessment: This table defines the magnitude for a flood risk receptor. The flood risk definitions are rather vague and so open to rather different interpretations of what is considered as "minor, moderate and major" change to flood risk. From a flood risk perspective, we would recommend defining values to an amount of flood risk change as being negligible, minor, moderate or major. You may find Table 3.71 (Estimating the magnitude of an impact on an attribute) from the Design Manual for Roads and Bridges (LA113 Road drainage and the water environment Revision 1, dated March 2020) useful in helping define values to an amount of flood risk change. Dependant on the values defined in Table 21.7 we would need to reassess the suitability of the parameters of Table 21.8 and Table 21.9.	Numerical values for defining changes in flood risk magnitude, presented in the Design Manual for Roads and Bridges, have been added to Table 21.7.
Environment Agency	14/07/2023 PEIR response	Crossing method and impacts on flood risk: Paragraphs 97 to 99 identify that all Main River and most Ordinary Watercourse crossings will be crossed using Trenchless techniques. We would recommend that Trenchless techniques are used for Ordinary Watercourses with associated Fluvial / Tidal Flood Zone 3. If trenched techniques are used on Ordinary Watercourses with associated Fluvial / Tidal Flood Zone 3, the Environment Agency would expect the Flood Risk Assessment to assess the flood risk impacts during construction for the Environment Agency's consideration before or at the	Flood risk from all sources, including trenched crossings during construction, is assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29). The impact of trenched crossings in each water body catchment is assessed in Section 21.6.1.1 and Section 21.6.1.4.

Consultee	Date / Document	Comment	Response / where addressed in the ES
		examination stage of the DCO. The reason for this is that impacts on third parties should be presented to the Examining Authority for consideration to inform their role of assessing the principle of development and the acceptability of associated risks. If the DCO application were made without either a flood risk assessment and / or suitable mitigation for third party properties our position would be objection.	
Environment Agency	14/07/2023 PEIR response	Paragraph 363 of the Flood Risk Assessment regarding flood warning and evacuation must ensure there is an evacuation route in place in the event of Tidal flooding. Currently this paragraph only refers to fluvial and surface water. Paragraph 382 and 383 of the Flood Risk Assessment is in relation to trenched crossings, in which it states that the flood risk impacts of trenched crossings will be assessed at the detailed design stage. We reiterate the points that we have made in the previous paragraph: If trenched techniques are used on Ordinary Watercourses with associated Fluvial / Tidal Flood Zone 3, the Environment Agency would expect the Flood Risk Assessment to assess the flood risk impacts during construction for the Environment Agency's consideration before / during the examination stage of the DCO and not at the detailed design stage.	Updated evacuation measures including for fluvial flood risk are described in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29). Flood risk from all sources, including trenched crossings during construction, is assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29). The impact of trenched crossings in each water body catchment is assessed in Section 21.6.1.1 and Section 21.6.1.4
Environment Agency	14/07/2023 PEIR response	This table identifies water bodies screened in or out of the assessment. Impacts on Hamford Water are screened out. This is justified on the basis that the Main River crossing upstream will be crossed using trenchless crossing techniques. However, we have not been able to identify detailed assessment of the technical suitability of trenchless crossings for each crossing location. It may be that at the detailed design stage there will reasons why trenched techniques should be used. We therefore think it prudent that Hamford Water is scoped in.	The Main River that drains to Hamford Water is now outside of the onshore project area and does not need to be crossed. As a result, impacts on Hamford Water are not expected. An updated screening assessment is included in ES Appendix 21.2 Water Environment Regulations Compliance Assessment (Document Reference: 3.3.28).

Consultee	Date / Document	Comment	Response / where addressed in the ES
Environment Agency	14/07/2023 PEIR response	We are pleased to note the commitment to develop an appropriate bentonite breakout plan in this table and the supporting comments in Section 21.6.1.3.	Mitigating measures associated with bentonite breakout are described in Section 21.3.3.
Environment Agency	14/07/2023 PEIR response	We also note that Chapter 21 Section 21.6.1 is relevant in respect of this subject area. A hydrogeological impact assessment should assist in determining significant effects during construction.	A hydrogeological risk assessment will be undertaken where earthworks / excavations are within 50m (or 250m dependent upon the volume abstracted) of private potable groundwater abstractions and pose a potential risk from either existing or potentially introduced contamination. Further hydrogeological risk assessments will be undertaken where earthworks / excavations are within influencing distance of abstractions whereby they may interrupt flow pathways due to dewatering or other associated activities. The risk assessment, which would be desk-based, follows a tiered approach with more detailed assessments carried out in areas considered to pose a potentially greater risk to groundwater. The hydrogeological risk assessment will meet the requirements of the Environment Agency's Approach to Groundwater Protection 2018 Framework and be completed post consent dependent on further design information. The need for hydrogeological risk assessment will be determined following detailed design based on the final proximity in relation water abstractions. The hydrogeological risk assessment will be secured through DCO Requirement.

Consultee	Date / Document	Comment	Response / where addressed in the ES
Environment Agency	14/07/2023 PEIR response	Any temporary pumps used for over pumping will require screening to prevent the entrainment of eel, lamprey or other fish species. The Eel (England and Wales) Regulations came into force in 2010. Since 1 January 2015, under Part 4, Section 17, it has become an offence not to place an eel screen on any water diversion structure capable of abstracting more than 20 cubic metres in a 24-hour period, unless specifically exempted from the requirement by the Environment Agency. As part of a fish rescue, the fish should be re-located downstream.	Mitigation measures associated with trenched crossings, including the use of pumps, are listed in Section 21.3.3. This includes a fish rescue and use of fish and eel-friendly filters.
Environment Agency	14/07/2023 PEIR response	All three landfall site locations shown in drawing PB9244-RHD-ZZ-LN-DR-GS-0239 would require passing under an existing tidal defence. Jaywick and Holland On Sea defences are currently maintained by the Environment Agency and depending on the micro siting of the proposed Dovercourt location it may also be maintained by the Environment Agency. At the detailed design stage the Applicant must provide evidence / data to prove the design will not affect the stability of the existing defence.	The potential for impact is considered to be low given the depth of the drill (20m). A detailed assessment of drilling below the existing flood defences will be undertaken post-consent (i.e. at detailed design).
Natural England	14/07/2023 PEIR response	Natural England queries if an engineering assessment has been undertaken to ensure that the defences can be drilled under or through without necessitating the lowering of the defences, including the provision of temporary defence mechanisms in the intertidal and / or the shortening of the trenchless techniques as a result of increased depth. Both scenarios could potentially lead to negative environmental implications because The locations of the exit pits terrestrially are paramount to determining no significant impacts to the Site of Special Scientific Interest (SSSI) by ensuring that they are within adjacent arable land and all relevant infrastructure and construction activities remain outside of the notified site.	The potential for impact is considered to be low given the depth of the drill (20m). A detailed assessment of drilling below the existing flood defences will be undertaken post-consent (i.e. at detailed design).

Consultee	Date / Document	Comment	Response / where addressed in the ES
		Any sea defence work has the potential to impact upon the SSSI and wider environment. We recommend that if a trenchless technique risk assessment is not available, then this should be provided alongside the submitted ES and evidence provided to address NE's concerns.	
Little Bromley Parish Council	Consultation response letter	Village Well Water. Many properties in Little Bromley have no mains water connection and are reliant on well water. There is concern on whether the North Falls development will affect the water sources in the village and affect these water supplies. Extension of the water main to these properties would seem to be the only way to guarantee continuity of supply	Potential impacts on surface and groundwater flows, including abstractions, are assessed in Section 21.6.1.3, Section 21.6.1.4, Section 21.6.2.1 and Section 21.6.2.2.
Little Bromley Parish Council	Consultation response letter	Village Drainage. Little Bromley has a very high water table and during wet periods localised flooding and drainage problems can occur. There is concern on whether the North Falls development will affect the village drainage flows and increase the frequency or scale of these events.	Potential impacts on flood risk are assessed in Section 21.6.1.4 and Section 21.6.2.2. Flooding from all sources is assessed in ES Appendix 21.3 FRA (3.3.29).
Zoe Fairley	Consultation response letter	How do you intend to avoid flooding and water drainage issues during construction? How are you assessing and managing risk relating to drainage and well water for residents in Little Bromley?	Potential impacts on surface and groundwater flows, including abstractions, are assessed in Section 21.6.1.3, Section 21.6.1.4, Section 21.6.2.1 and Section 21.6.2.2. Potential impacts on flood risk are assessed in Section 21.6.1.4 and Section 21.6.2.2. Flooding from all sources is assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29).
Environment Agency	29/06/2021 ETG Meeting 1	An initial meeting held with Essex County Council and the Environment Agency to discuss: • The scope of the water resources and Flood Risk assessment;	The sensitivity of surface groundwater resources from trenchless techniques is assessed in Section 21.6. An assessment of the effects of bentonite break-put on qualifying features of the Holland Haven Marshes SSSI

Consultee	Date / Document	Comment	Response / where addressed in the ES
		• Data collection; • Impacts to be assessed and the assessment methodology; and • Proposed DCO documents. It was noted that the Environment Agency receive a lot of applications with respect to trenchless techniques and that the Environment Agency would seek more information around local groundwater abstractions / sensitivity of sites (more needed at coast) when considering risks from trenchless techniques, although as the Project will not be going through chalk the sensitivity may be lower. The Environment Agency noted that some issues have been identified with HDD on other projects, resulting in pollution of estuaries from bentonite which prevented SSSI features from functioning (an example was provided - the Deben - where damage had been observed). Noted that all parties need to work together to address best approach for mitigating HDD risk. The Environment Agency will look at the geology as standard when assessing HDD risk and also ask for a drilling mud pressure monitoring plan (or similar) and mud breakout contingency strategy to manage mud loss incidents should they occur.	is provided in ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25).
Environment Agency, Essex County Council,	19/09/2023 ETG Meeting 2	Consultees were updated on the Project including: watercourse crossings, flood risk, private water supplies, data sources and receptor sensitivity, mitigation measures and co-locating strategy with Five Estuaries Offshore Wind Farm (Five Estuaries). Only two questions were asked, about critical drainage and whether Section 23 consents would be applied for at the DCO consent stage.	It was confirmed in the meeting that no critical drainage areas are crossed by either project. Both projects will discuss a common approach to Section 23 consents and stakeholders will be informed once a decision has been reached.
Essex County Fire and	19/04/24 Targeted consultation	Consideration should be given to the likelihood of longer-term water level increases and the need to mitigate the risks of	Flooding from all sources is assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference:

Consultee	Date / Document	Comment	Response / where addressed in the ES
Rescue Service		flooding and the potential impacts upon new infrastructure developments.	3.3.29). The FRA considers longer term increases through climate change allowances.
Anglian Water	19/04/24 Targeted consultation	There is an underground foul sewer belonging to Anglian Water which is located within this part of the order limits and would interact with an access track for the Project to use during the operation and maintenance period.	Utility providers potentially affected by construction works would be contacted prior to construction works commencing. Methodology for utility crossings would be agreed with asset owners in line with industry good practice. The continuity of utilities during the construction works would be ensured. Prior to construction, the team on the ground would be made aware of the precise locations of existing services. Further details regarding how interactions with utilities are outlined in the Project's Outline Code of Construction Practice (OCoCP) (Document Reference: 7.13), submitted with the DCO application.
		It is our understanding that with regards to connections into Anglian Water networks, as there are no existing assets within the Projects order limits, North Falls will physically not be able to make a connection. There will be a requirement for some form of septic / wastewater storage tank at compound sites that host welfare facilities, which will need emptying and disposing of, but this would be dealt with outside of this consent regime by a third-party contractor.	The Outline Operational Drainage Strategy (Document Reference: 7.19) identifies that a septic tank would be used at the onshore substation, so it is not anticipated that sewerage connection will be required.
		Anglian Water welcomes the PEIR identifying that there is a surface water sewer outfall pipe located within the landfall search area to the north-east of Frinton Golf Course. However, figure 22.6 also identifies a foul sewer from Great Holland to a sewer pumping station (Frinton-Holland road] and further sewers on the edge of Frinton on Sea.	Utility providers potentially affected by construction works would be contacted prior to construction works commencing. Methodology for utility crossings would be agreed with asset owners in line with industry good practice. The continuity of utilities during the construction works would be ensured. Prior to construction, the team on the

Consultee	Date / Document	Comment	Response / where addressed in the ES
			ground would be made aware of the precise locations of existing services. Further details regarding how interactions with utilities are outlined in the Project's OCoCP (Document Reference: 7.13), submitted with the DCO application.
		Anglian Water welcomes reference to our Scoping Response in Table 21.1 regarding impacts on our sewer network and that matters relating to the Construction Surface Water and Drainage Plan will be developed as part of the Code of Construction Practice (CoCP). Whilst an outline CoCP will be included as part of the DCO application, Anglian Water requests that we are consulted on the CoCP when this is prepared post-DCO consent, particularly if connections are likely to be required to our assets. Anglian Water confirms that we would welcome further engagement through an Expert Topic Group to consider any impacts on our existing infrastructure.	A connection to Anglian Water's assets will not be needed. As described in the Outline Operational Drainage Strategy (Document Reference: 7.19), a septic tank would be used at the onshore substation.
		Anglian Water notes that paragraph 155 states that protective provisions and / or side agreements will be agreed with affected utilities as part of the DCO application process and that NFOWF will undertake utility crossings or diversions in accordance with the appropriate industry standards for such crossings. We have provided NFOWF with our template protective provisions and would welcome further discussion on these and other matters raised through the statutory consultation.	Utility providers potentially affected by construction works would be contacted prior to construction works commencing. Methodology for utility crossings would be agreed with asset owners in line with industry good practice. The continuity of utilities during the construction works would be ensured. Prior to construction, the team on the ground would be made aware of the precise locations of existing services. North Falls Offshore Wind Farm (NFOW) will seek to continue discussion with Anglian Water regarding protective provisions within the DCO.

Consultee	Date / Document	Comment	Response / where addressed in the ES
			Further details regarding how interactions with utilities are outlined in the Project's OCoCP (Document Reference: 7.13), submitted with the DCO application.
		Onshore cable corridor(s) for PEIR: Anglian Water notes the broad corridor connecting the landfall search area to the onshore substation zone, which will accommodate any temporary works for both NFOWF and VEOWF, temporary construction compounds and corridor flexibility. In retaining corridor flexibility around Thorpe-le-Soken and adding the temporary construction compounds to the onshore cable corridor; the approach taken avoids direct interfaces with our assets. The closest corridor option to Thorpe-le-Soken is therefore closest to our water recycling network but does not appear to intersect with our below ground wastewater network assets. Should this option be taken forward following the ongoing refinement of options to a final onshore cable route, we would seek to require Protective Provisions specifically to ensure Anglian Water's services are maintained and retained apparatus protected during construction. However, we welcome the acknowledgement in the PEIR that the cable corridor has been broadened to accommodate the necessary stand-off distances requested by utility companies.	Utility providers potentially affected by construction works would be contacted prior to construction works commencing. Methodology for utility crossings would be agreed with asset owners in line with industry good practice. The continuity of utilities during the construction works would be ensured. Prior to construction, the team on the ground would be made aware of the precise locations of existing services. NFOW will seek to continue discussion with Anglian Water regarding protective provisions within the DCO. Further details regarding how interactions with utilities are outlined in the Project's OCoCP (Document Reference: 7.13), submitted with the DCO application.
		Anglian Water notes that this section states that a surface water drainage system would be required for the operational substation. Anglian Water would welcome a design that follows the drainage hierarchy in seeking to manage surface water through sustainable drainage systems, and only seek a connection to a public sewer when all other options are demonstrated to be impracticable. The PEIR states that the full specification for water attenuation and drainage system, plus any foul drainage connection to a public sewer system (if available) would be addressed as part of detailed design post consent. If a connection to a public sewer is therefore a	A connection to Anglian Water's assets will not be needed. Details of the SUDs measures that will be used at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference; 7.19); the Drainage Strategy also identifies that a septic tank would be used at the substation, so it is not anticipated that sewerage connection will be required.

Consultee	Date / Document	Comment	Response / where addressed in the ES
		possibility, Anglian Water would wish to be included as a consultee in the Schedule of Requirements that specifically concern surface water and foul water drainage.	
		Surface Water: Anglian Water notes that we may potentially be consulted should a connection to our drainage infrastructure should be required for surface water run-off following construction of the cable corridor and particularly the onshore substation. Anglian Water would request that we are consulted when the Operational Surface Water and Drainage Plan is developed, unless it is demonstrated through the Environmental Statement that surface water drainage will be managed through SuDS or alternative means that do not require a connection to our network. Supply of contaminants (construction and operational maintenance phases): It is stated that foul drainage will connect to a mains (public) sewer if a connection is available or collected and disposed of at a facility with capacity within its existing permit. Anglian Water suggests that discussions are undertaken with our pre-development team when reasonably practicable."	A connection to Anglian Water's assets will not be needed. As described in the Outline Operational Drainage Strategy (Document Reference: 7.19), a septic tank would be used at the substation. Details of the SUDs measures that will be used at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19).
		Onshore Substation Operational Surface Water Drainage: It is noted that an Outline Operational Drainage Plan will provide details of the proposed surface water drainage design confirming that sufficient storage will be provided to attenuate surface water and discharge at a controlled rate during surface water events following the SuDS hierarchy. Anglian Water would wish to be consulted on the details of the operational drainage at the onshore substation when this is developed in consultation with Essex County Council (as the LLFA) and the Environment Agency; particularly regarding the final proposed approach for discharge of water from the site.	Details of the SUDs measures that will be used at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19).

Consultee	Date / Document	Comment	Response / where addressed in the ES
Little Bromley Parish Council		Little Bromley has a high water table and many properties are on well water and have no sewage. These past months have proved very difficult for residents and farmers with gardens, fields and roads being underwater for weeks. Many properties in Little Bromley have no mains water connection and are reliant on well water. We have concern on whether the NF development will affect the water sources in the village and affect these water supplies. Construction runoff will degrade water quality in nearby waterways. The large-scale reshaping of the land could disrupt drainage patterns and increase erosion issues long-term. The changes to hydrology, topography, vegetation, and viewsheds will be impossible to fully remediate or restore to pre-construction conditions.	Potential impacts on surface and groundwater flows, including abstractions, are assessed in Section 21.6.1.3, Section 21.6.1.4, Section 21.6.2.1 and Section 21.6.2.2. Potential impacts on flood risk are assessed in Section 21.6.1.4 and Section 21.6.2.2. Flooding from all sources is assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29). Potential impacts on water quality form increased sediment supply are assessed in Section 21.6.1.2 and Section 21.6.2.1. Potential impacts on water bodies, including biological, physico-chemical and hydromorphological receptors, are assessed in ES Appendix 21.2 (Water Environment Regulations Compliance Assessment) (Document Reference: 3.3.28).

21.3 Scope

21.3.1 Study area

8. As part of the Anglian River Basin Management Plan (RBMP) (Environment Agency, 2022) developed to comply with the Water Framework Directive Regulations 2017, the Environment Agency has defined river water body catchments based on surface hydrological catchments with an area of greater than 5km^2.

9. The study area for water resources and flood risk has been defined based on these surface hydrological catchments. Catchments have been included within the study area if they are crossed by the onshore project area, or they are hydrologically connected downstream. Catchments that are hydrologically connected upstream are not considered due to the lack of any mechanism for likely effects to propagate upstream. The onshore study area, showing surface water catchments and Main Rivers, is shown in ES Figure 21.1 (Document Reference: 3.2.17).

10. When considering the potential impacts to groundwater, the study area is limited to those groundwater bodies that lie directly beneath the onshore project area, which are shown in ES Figure 21.2 (Document Reference: 3.2.17).

21.3.2 Realistic worst case scenario

11. The final design of the Project will be confirmed through detailed engineering design studies that will be undertaken post-consent. In order to provide a precautionary but robust impact assessment at this stage of the development process, realistic worst case scenarios have been defined in terms of the significant effects that may arise. This approach to EIA, referred to as the Rochdale Envelope, is common practice for developments of this nature, as set out in Planning Inspectorate Advice Note Nine (2018). The Rochdale Envelope for a project outlines the realistic worst case scenario for each individual impact, so that it can be safely assumed that all other scenarios within the design envelope will have less impact. Further details are provided in ES Chapter 6 EIA Methodology (Document Reference: 3.1.8).

12. The realistic worst case scenarios for the likely significant effects scoped into the EIA for the water resources and flood risk assessment are summarised in Table 21.2. These are based on North Falls parameters described in ES Chapter 5 Project Description (Document Reference: 3.1.7), which provides further details regarding specific activities and their durations.

13. The main grid connection options considered in the ES are outlined below:

- Option 1: Onshore electrical connection at a National Grid connection point within the Tendring peninsula of Essex, with a project alone onshore cable route and onshore substation infrastructure;
- Option 2: Onshore electrical connection at a National Grid connection point within the Tendring peninsula of Essex, sharing an onshore cable route and onshore duct installation (but with separate onshore export cables) and co-

locating separate project onshore substation infrastructure with Five Estuaries; or

- Option 3: Offshore electrical connection, supplied by a third party.

14. Grid connection Option 2 is considered the realistic worst case scenario for the water resources and flood risk assessment because the build out requires four sets of cable ducts and associated joint bays to be installed, impacting upon the largest footprint of the three grid connection options.

15. Under Option 2, the Project's onshore infrastructure comprises the following elements:

    - Landfall, where the offshore export cables are brought ashore;
    - Onshore cable route, which includes space for temporary works for the installation of cable ducts and buried onshore export cables, including areas for temporary construction compounds (TCCs), construction and operation and maintenance accesses (including Bentley Road improvement works);
    - Onshore substation, proposed to be located west of Little Bromley;
    - Onshore substation works area, which includes land required for temporary construction, export cables, means of access, drainage, landscaping and environmental mitigation for the onshore substation; and
    - The search area for the East Anglia Connection Node (EACN) (the Project's National Grid connection point), within which will be located the Project's National Grid substation connection works.

16. Collectively, the footprint of the Project's onshore infrastructure is referred to herein as the 'onshore project area' and is shown on ES Figure 5.2 (Document Reference: 3.2.3). The Project's onshore infrastructure outlined above is proposed to be located entirely within the Tendring peninsula of Essex.

Table 21.2 Realistic worst case scenario: effects arising from development of NFOW – Option 2 (Installation of ducts for a second project)

Element of the project infrastructure	Parameter	Notes
Construction		
Impact 1: Direct disturbance of surface water bodies	Trenchless techniques to be used at most watercourse crossings (either Main River or Ordinary Watercourse). Trenched crossings would involve installing temporary dams (composed of sandbags, straw bales and ditching clay, or another suitable technique) upstream and downstream of the crossing point. The trench would then be excavated in the dry area of riverbed between the two dams with the river flow maintained using a temporary pump or flume using fish-friendly filters. Where the cable corridor crosses an open ditch or drain, and access for the haul road is required, an appropriately sized culvert may be installed inside the channel bed to avoid upstream impoundment. This would remain in place for the duration that the haul road is required up to 27 months). **Onshore cable route** • Total onshore cable length: 24km; • Indicative cable route width = 72m (open cut trenching), 90m (trenchless crossings), 130m (complex trenchless crossings) • No. of trenches = 4; • Cable trench dimensions = 3.75 – 1.2 x 2m (tapered top to bottom); • Maximum cable burial depth = 2m; • Minimum cable burial depth (to top of protection tile) = 0.9m; • Minimum target cable burial depth = 1.2m; and • Haul road width = 6m wide road, 10m wide total including verges, drainage and passing places. Trenchless crossings physical parameters:	Direct disturbance of surface water bodies will only occur due if temporary damming and diversion / fluming of Ordinary Watercourses is used where the onshore cable route and haul road crosses them. These parameters represent the worst case scenario of the onshore cable route.

Element of the project infrastructure	Parameter	Notes
	• Maximum width of buried cable = 130m; • Maximum trenchless crossing depth = 20m; • Trenchless technique compound dimensions = 75 x 150m; and • Cable construction compound dimensions (m): Main – 150 x 150m; satellite – 100 x 100m. Durations: • Bentley Road improvement works = 6 - 9 months; • Cable route works = 18 – 27 months; • Cable installation = 12 months; • Major trenchless techniques (each location) = 8 months (of which trenchless techniques = 4 months); and • Minor trenchless techniques crossings = 2 months.	
Impact 2: Increased sediment supply Impact 3: Supply of contaminants to surface and groundwater Impact 4: Changes to surface and groundwater flows and flood risk	**Landfall** • Maximum No. of Transition Joint Bays (TJB) = 2; • Individual TJB dimensions / permanent land take = 4 x 15m; • Maximum indicative HDD spacing onshore = 40m; • Maximum HDD depth = 20m; • Maximum indicative length of HDD = 1.1km; and • HDD temporary works area = 75 x 150m. Duration: • 13 months (of which HDD = 6 months); and • HDD to include 24 hour / 7 days working where required. **Onshore cable route** As for impact 1 and in addition: • HDD compound dimensions = 75 x 150m;	These parameters represent the maximum footprint of disturbance and activities within the onshore project area that could lead to the potential disturbance of sediment, contamination and alteration of surface and groundwater flows and flood risk.

Element of the project infrastructure	Parameter	Notes
	• No. of cable construction compounds: Up to 11; and • Cable construction compound dimensions (m): Main – 150 x 150m; satellite – 100 x 100m. **Onshore substation** • Construction compound footprint = 250 x 150m; • Indicative area of the Automatic Identification System (AIS) substation = 280 x 210m; • Number of buildings = 6; • Foundations: Concrete raft type foundations are assumed however in some circumstances piling may be required. Details of piling to be confirmed once final location and orientation of substation is confirmed; and • Substation construction duration = 21 - 27 months. **National Grid connection works** • All enabling work / platform constructed by National Grid; and • Cable installation works as described above. Equipment may include: • Cable sealing ends, surge arrestors, earth switch, disconnectors, circuit breakers, current transformers, voltage transformers, busbars.	
Operation		
Impact 5: Supply of contaminants to surface and groundwater	**Onshore cable route** Link boxes would require periodic access by technicians for inspection and testing during operation and maintenance. • No. of link boxes = up to 96; and • Link box footprint (per box) = 0.6 x 1 x 1.5m. **Onshore Substation O&M haul road** • 7 months construction period;	These parameters represent the worst case scenario for maintenance requirements. The use of vehicles for maintenance activities is the main potential source of contaminants to surface and groundwater.

Element of the project infrastructure	Parameter	Notes
	• 6m wide (10m at passing places – located every 500 m); and • One temporary watercourse crossing at Ardleigh Road. **Onshore substation** The onshore substation is likely to be unmanned, with no, or at most minimal, welfare facilities on site. • Operational period: 30 years; and • Hazardous materials / substances: transformer oil: filled during construction, only topped up in the event of a leak.	
Impact 6: Changes to surface and groundwater flows and flood risk	**Landfall** • Maximum No. of TJB = 2; • Individual TJB dimensions / permanent landtake = 4 x 15m ; and • HDD indicative depth (m): up to 20m max. **Onshore cable route** • Cable trench dimensions = 3.75 – 1.2 x 2m (tapered top to bottom); • Maximum cable burial depth = 2m; • Minimum cable burial depth (to top of protection tile) = 0.9m; • Minimum target cable burial depth = 1.2m; • Jointing bays = Up to 192 (approximately every 500m) buried below ground; • Joint bay dimensions = 4 x 15m; • No. of link boxes = up to 96; and • Link box footprint (per box) = 0.6 x 1 x 1.5m. **Onshore Substation O&M haul road** • 7 month construction period; and • 6m wide (10m at passing places – located every 500m)	These parameters represent the worst case scenario for impermeable ground and potential sources of disruption to surface and groundwater flows.

Element of the project infrastructure	Parameter	Notes
	• One temporary watercourse crossing at Ardleigh Road. **Onshore substation** • Indicative area of AIS Substation: 280 x 210m (5.88ha); and • Foundations: Concrete raft type foundations are assumed however in some circumstances piling may be required. Details of piling to be confirmed once final location and orientation of substation is confirmed. Worst case for Piling 4 transformer pads with 4 auger piles (total 12) of max 5m depth x 500mm width.	
Decommissioning		
No final decision has yet been made regarding the final decommissioning policy for the onshore project infrastructure including landfall, onshore cable route, 400kV cable route and onshore substation. It is also recognised that legislation and industry good practice change over time. However, it is likely that the onshore project equipment, including the cable, will be removed, reused, or recycled where practicable and the transition bays and cable ducts being left in place. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning, in consultation with the regulator. It is anticipated that for the purposes of a reasonable worst case scenario, the impacts will be no greater than those identified for the construction phase. Assuming that provision is made for methods of removal which reduce further impact to the wider area, it is reasonable to assume that any potential damage upon designated and non-designated heritage assets would have already occurred as part of construction activities. The demolition of buildings and infrastructure can additional impacts e.g. if grubbing out of foundations or remediation of contaminants is required, however these are expected to be in line with the effects assessed for onshore substation construction. Changes to setting may be present as a result of visual and audible impacts associated with decommissioning activities. Changes to the setting of heritage assets are considered to be temporary in duration, occurring in association with the decommissioning phase. As such, the worst case scenario as outlined for the construction phase in relation to temporary changes to the setting of heritage assets is unlikely to be exceeded as a result of decommissioning activities		

21.3.3 Summary of mitigation embedded in the design

17. This section outlines the embedded mitigation relevant to the water resources and flood risk assessment, which has been incorporated into the design of North Falls (Table 21.3). Measures outlined below are detailed in the OCoCP (Document Reference: 7.13) submitted with the DCO application. The OCoCP (Document Reference: 7.13) will form the basis of a final CoCP prepared post-consent, and secured through DCO requirement.

Table 21.3 Embedded mitigation measures

Parameter	Mitigation measures embedded into North Falls design
Watercourse crossings (construction phase)	
Cable crossings beneath watercourses	All Main Rivers (see ES Figure 21.1 (Document Reference: 3.3.27)) will be crossed using trenchless techniques such as HDD to avoid direct interaction with these watercourses. Most Ordinary Watercourses will also be crossed using trenchless techniques. As advised by Natural England during the Evidence Plan Process, an Outline Horizontal Directional Drill Method Statement and Contingency Plan (Document Reference: 7.15) has been submitted with the Project's DCO application. This outline plan sets out the steps will be taken to minimise the risk of effects upon watercourses as a result of a bentonite, an inert clay, 'breakout' during HDD. It details both the measures proposed to reduce the risk of a breakout occurring, and the contingency plans steps to reduce the extent of the breakout and to clean up the spill should it occur. In summary, these steps include: • Pre-drilling ground conditions assessment and hydrofracture modelling to target formations with lower risk of breakout; • Use of drill casing in softer, surface deposits; • Constant fluid monitoring during drilling, so that a breakout can be identified as soon as it occurs; • Provision of appropriate spill management supplies and staff training on breakout management on site; and • Process of containment and spill removal once a spill has been identified. Please refer to the Outline Horizontal Directional Drill Method Statement and Contingency Plan (Document Reference: 7.15) for full details of the measures proposed.
Temporary access across watercourses	Temporary bridges may be used as options to traverse Main Rivers where direct access is not readily available from both sides. Selection of a crossing technique for Ordinary Watercourses not crossed using trenchless techniques will be dependent on local site conditions and may include the use of temporary culverts.

Parameter	Mitigation measures embedded into North Falls design
	If temporary culverts are required, they will be adequately sized to avoid impounding flows (including allowing for increased winter flows as a result of climate change) and the invert set below bed level to allow bedload transport.
Trenched crossings	Where temporary dams are used: • The onshore export cables would typically be a minimum of 3 m below the channel bed (dependent on local geology and geomorphological risks). This would avoid exposure during periods of higher energy flow when the bed could be mobilised. This depth takes into consideration anticipated climate-change related changes in fluvial flows and erosion that will occur over time; • The amount of time that temporary dams or flumes are in place will be kept to a minimum; • Flumes or pumps would be adequately sized to ensure that flows downstream are maintained whilst minimising upstream impoundment; • Scour protection would also be used to protect the river bed downstream of the dam from high energy flow at the outlets of flumes and pumps; • If a diversion channel is required, geotextiles or similar techniques will be used to line the channel and prevent sediment entering the watercourse; • Vegetation would not be removed from the banks unless necessary to undertake the works, in which case removal would be restricted to the smallest practicable footprint; • Channel bed and banks would be sympathetically reinstated (e.g. by replacing re-sectioned banks with more natural profiles that are typical of the natural geomorphology of the watercourse); and • Prior to dewatering the area between the temporary dams, a fish rescue would be undertaken.
Agricultural drainage	The Applicant will appoint a land drainage consultant to develop pre-and post-construction drainage plans. Additionally, land drainage systems will be maintained during construction and land drainage would be reinstated following completion of construction works during the reinstatement phase. An OCoCP (Document Reference: 7.13) is being submitted with the DCO application, which includes outline soil management measures and outline the mitigation measures and industry good practice techniques, which contractors would be obliged to comply with. The DCO contains a requirement to submit a final CoCP and Soil Management Plan (SMP) (which must be in accordance with the OCoCP (Document Reference: 7.13)) prior to commencement of construction.

Parameter	Mitigation measures embedded into North Falls design
Exposed land (construction and operational maintenance phases)	
Sediment supply to watercourses	Construction activities will adhere to industry good practice measures as detailed in the Environment Agency's Pollution Prevention Guidance (PPG) notes (PPG1, PPG5, PPG8 and PPG21). Although the Environment Agency's PPG notes have been revoked in England, they have been updated as Guidance for Pollution Prevention (GPP notes) for use in Scotland and Northern Ireland (NetRegs, 2022). Updates are included in the measures listed below. Construction Industry Research and Information Association (CIRIA) industry good practice (Control of water pollution from construction sites: Guidance for consultants and contractors (C532) (2001)) will also be adhered to. Specific measures will potentially include: • Minimising the amount of time stripped ground and soil stockpiles are exposed; • Only removing vegetation from the area that needs to be exposed in the near future; • Seeding or covering stockpiles; • Using geotextile silt fencing at the toe of the slope, to reduce the movement of silt – this should be installed before soil stripping has begun and vehicles start tracking over the site; • On-site retention of sediment to be maximised by routing all drainage through the site drainage system; • Include measures to intercept sediment runoff at source in the drainage system using suitable filters to remove sediment from water discharged to the surface drainage network; • Plant and wheel washing is carried out in a designated area of hard standing at least 10m from any watercourse or surface water drain, rock outcrop (hard rock at surface) or karstic sinkhole; • Traffic movements would be restricted to minimise surface disturbance; • Divert clean water away from the area of construction work in order to minimise the volume of contaminated water; and • Routing the cable to avoid water resources and flood risk receptors where practicable. In locations where large areas of exposed ground lie adjacent to watercourses, buffer strips of vegetation will be retained where practicable to prevent runoff. Other embedded industry good practice measures include: • Limiting the extent of open excavations along the onshore cable route to short sections of adequate length to carry out excavation and installation and there is no need for tracking

Parameter	Mitigation measures embedded into North Falls design
	over the trench sections at any one time (work fronts); • Temporary works areas (e.g. construction compounds and trenchless crossing areas) within the onshore project area may comprise hardstanding of permeable material, such as gravel aggregate or alternatively matting / timber or similar, underlain by geotextile or another suitable material to a minimum of 50% of the exposed area. This would minimise the area of open ground; and • At the onshore substation temporary swales are proposed along the perimeter of the construction compound to intercept and attenuate runoff (and sediment) before discharge to a temporary attenuation pond via a filter drain / pipe running along the length of the temporary haul road (the temporary ponds will be located in tenpenny Brook's catchment). Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19).
Supply of contaminants (construction and operational maintenance phases)	
Construction activities and operational infrastructure	Specific measures relevant to the prevention of contaminant supply to water bodies will prevent the immediate discharge of contaminated water and sediment from the onshore cable route into the surface drainage network, and include: • Situating concrete and cement mixing and washing areas at least 10m away from the nearest water body. These areas will incorporate settlement and recirculation systems to allow water to be re-used. All washing out of equipment would take place in a contained area and the water collected for disposal off-site; • Storing all fuels, oils, lubricants and other chemicals in impermeable bunds with at least 110% of the stored capacity, with any damaged containers being removed from site. Refuelling would take place in a dedicated impermeable area, using a bunded bowser, located at least 10m away from the nearest water body; • Ensuring that spill kits are available on site at all times as well as sand bags and stop logs for deployment on the outlets from the site drainage system in case of emergency spillages; • Foul drainage (e.g. from construction welfare facilities) will be collected through mains connection to an existing mains sewer (if such a connection is available) or collected in a septic tank located within the DCO order limits and transported off site for disposal at a licensed

Parameter	Mitigation measures embedded into North Falls design
	- facility with appropriate treatment capacity within its existing permit; - Construction drainage will be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. Water filling the trenches would be appropriately treated to ensure no adverse effects on the local watercourses. Existing agricultural drainage would be reinstated to include the replacement of any drains that were damaged during the construction process; - Potential contaminants will be stored under cover to prevent rainwater carrying pollutants away; and - Potential contaminants will be stored in a safe place away from vehicles, to prevent collisions. In addition, buffer strips of vegetation will be retained adjacent to water bodies where practicable, to intercept any contaminated runoff. At the onshore substation it is anticipated that areas of the construction compound, such as refuelling stations and wheel wash areas will require bunding and / or additional proprietary treatment before discharge to the wider drainage network. Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19). During operation of the substation the proposed drainage system and treatment train is to be designed to comply with the water quality design criteria outlined in the CIRIA SuDS manual. Full details of the operational drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19). To protect groundwater bodies, excavation will be shallow, except where trenchless techniques are used below road or rail infrastructure and watercourses, where it may be deeper. At HDD locations ground investigations and a hydrogeological risk assessment meeting the requirements of The Environment Agency's Approach to Groundwater Protection (Environment Agency, 2018), will be undertaken at each major trenchless crossing location.
Changes to surface and groundwater flows and flood risk (construction and operational maintenance phases)	
Surface water runoff	Changes in surface water runoff resulting from the increase in impermeable area following construction of the onshore cable route(s), and particularly the onshore substation, would be attenuated and discharged at a controlled rate, in consultation with the LLFA (Essex County Council) and the Environment Agency. An Outline Operational Drainage Strategy (Document Reference: 7.19) has been

Parameter	Mitigation measures embedded into North Falls design
	developed for the Project, which includes SuDS. Full details of the drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19). • As described above for watercourse crossings, the Applicant will appoint a land drainage consultant to develop pre-and post-construction drainage plans. Land drainage systems will be maintained during construction and land drainage would be reinstated following completion of construction works during the reinstatement phase. An OCoCP (Document Reference: 7.13). including outline soil management measures has been submitted with the DCO and the DCO contains a Requirement to submit a final CoCP and SMP prior to commencement of construction. • Construction drainage would be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. Water filling the trenches would be appropriately treated to ensure no adverse effects on the local watercourses. Existing agricultural drainage would be reinstated to include the replacement of any drains that were damaged during the construction process; • As described for watercourse crossings, temporary culverts will be adequately sized to avoid impounding flows. • At the onshore substation temporary swales are proposed along the perimeter of the construction compound to intercept and attenuate runoff before discharge to a temporary attenuation pond via a filter drain / pipe running along the length of the temporary haul road (the temporary pons will be located in tenpenny Brook's catchment). Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19). • During operation of the substation, the current strategy is to discharge all surface water runoff from impermeable surfaces across the scheme at restricted rates into an unnamed Ordinary Watercourse located to the south of the overall site. Discharge will be at the undeveloped greenfield rate. The substation design includes a permanent attenuation pond and attenuation swale for the access road. Full details of the operational drainage strategy at the onshore substation can be found in the Outline

Parameter	Mitigation measures embedded into North Falls design
	Operational Drainage Strategy (Document Reference:7.19).
Groundwater quality and abstractions for public water supply (construction and operational maintenance phases)	
Cable routing	• The onshore cable route has been developed to avoid interaction with Groundwater Source Protection Zone (SPZ) 1, and therefore minimise the potential for impact on abstractions for public water supply. • Ground investigations and a hydrogeological risk assessment meeting the requirements of The Environment Agency's Approach to Groundwater Protection (Environment Agency, 2018), will be undertaken at each major trench crossing location. • A written scheme dealing with contamination of any land and groundwater will be prepared before construction activities commence.

21.4 Assessment methodology

21.4.1 Legislation, guidance and policy

21.4.1.1 National Policy Statements

18. The assessment of potential impacts upon Water Resources and Flood Risk has been made with specific reference to the relevant legislation and guidance, of which the principal policy documents with respect to the Nationally Significant Infrastructure Projects (NSIPS) are the National Policy Statements (NPS). Those relevant to the Projects are:

- Overarching NPS for Energy (EN-1) (Department for Energy Security and Net Zero (2023);
- National Policy Statement for Renewable Energy Infrastructure (EN-3) (Department for Energy Security and Net Zero (2023); and
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (Department for Energy Security and Net Zero (2023).

19. The specific assessment requirements for Water Resources and Flood Risk, as detailed in the NPS, are summarised in Table 21.4 together with an indication of the section of this chapter where each is addressed.

Table 21.4 NPS assessment requirements

NPS Requirement	NPS Reference	ES Reference
Overarching NPS for Energy (EN-1)		
Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of	EN-1 - Section 5.4, paragraphs 5.4.17 to 5.4.24	Potential impacts on river channels, which provide physical habitats of importance for ecology, protected species and the

NPS Requirement	NPS Reference	ES Reference
principal importance for the conservation of biodiversity, including irreplaceable habitats. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the Secretary of State consider thoroughly the significant effects of a proposed project.		conservation of biodiversity, are considered in Section 21.6.
Development on land within or outside a SSSI, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits (including need) of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of SSSIs. The Secretary of State should use requirements and / or planning obligations to mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site's biodiversity or geological interest.	EN-1 Section 5.4, paragraph 5.4.8 and paragraph 5.4.50	Potential SSSI impacts are considered in Section 21.6.
A site-specific flood risk assessment should be provided for all energy projects in Flood Zones 2 and 3 in England or Zones B and C in Wales. In Flood Zone 1 in England or Zone A in Wales, an assessment should accompany all proposals involving: • Sites of 1 hectare or more; • Land which has been identified by the Environment Agency or National Resources Wales as having critical drainage problems; • Land identified (for example in a local authority strategic flood risk assessment) as being at increased flood risk in future; and • Land that may be subject to other sources of flooding (for example surface water) where the Environment Agency or National Resources Wales LLFA, Internal Drainage Board or other body have indicated that there may be drainage problems. This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account.	EN-1 Section 5.8, paragraphs 5.8.13 to 5.8.23.	Potential impacts on flood risk are considered in Section 21.6.and ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29).
Where the Project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment, and how this might change due to the impact of climate change on rainfall patterns and consequently water availability across the water environment, as part of the ES or equivalent. The ES should in particular describe: • The existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new	EN-1 Section 5.16, paragraphs 5.16.3 – 5.16.7	Potential impacts on water quality, the physical characteristics of surface watercourses and the quality and quantity of groundwater are considered in Section 21.6. Potential impacts on WER compliance are considered separately

NPS Requirement	NPS Reference	ES Reference
discharges and proposed changes to discharges; • Existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Abstraction Licensing Strategies) and also demonstrate how proposals minimise the use of water resources and water consumption in the first instance; • Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; • Any impacts of the proposed project on water bodies or protected areas (including shellfish protected areas) under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 and SPZs around potable groundwater abstractions; • How climate change could impact any of the above in the future; and • Any cumulative effects.		in ES Appendix 21.2 (3.3.28).
NPS for Energy Networks Infrastructure (EN-3)		
Offshore wind farms will not be affected by flooding. However, applicants should demonstrate that any necessary land-side infrastructure (such as cabling and onshore substations) will be appropriately resilient to climate-change induced weather phenomena. Similarly, applicants should particularly set out how the proposal would be resilient to storms.	Paragraph 2.4.8	Changes to surface and groundwater flows and flood risk are assessed in Section 21.6.1.4 and Section 21.6.2.2. Flood risk is assessed in the ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29)).
NPS for Energy Networks Infrastructure (EN-5)		
Section 4.9 of EN-1 sets out the generic considerations that applicants and the Secretary of State should take into account in order to ensure that electricity networks infrastructure is resilient to the effects of climate change. As climate change is likely to increase risks to the resilience of some of this infrastructure, from flooding for example, or in situations where it is located near the coast or an estuary or is underground, applicants should in	EN-5 Section 2.3, paragraphs 2.3.1, 2.3.3	Flooding and the significant effects of climate change are considered in Section 21.6.and an FRA is provided in ES Appendix 21.3 Flood Risk Assessment

NPS Requirement	NPS Reference	ES Reference
particular set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it has been designed to be resilient to: • Flooding, particularly for substations that are vital to the network; and especially in light of changes to groundwater levels resulting from climate change; • The effects of wind and storms on overhead lines; • Higher average temperatures leading to increased transmission losses; • Earth movement or subsidence caused by flooding or drought (for underground cables); and • Coastal erosion – for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations respectively. Section 4.9 of EN-1 advises that the resilience of the project to the effects of climate change must be assessed in the ES accompanying an application. For example, future increased risk of flooding would be covered in any flood risk assessment (see Sections 5.8 in EN-1)		(Document Reference: 3.3.29).

21.4.1.2 Other legislation, policy and guidance

21.4.1.2.1 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

20. The Water Framework Directive (WFD) (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted in 2000. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WER) transposed the WFD into national law in the UK. The WFD Regulations remain in force following the UK's withdrawal from the European Union under the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

21. Under the Regulations, surface waters are designated as water bodies and are set objectives for achieving Good Ecological Status (GES) or Good Ecological Potential (GEP) (in the case of heavily modified water bodies). The Environment Agency is required to produce River Basin Management Plans (RBMPs) which describe the current state of the water environment within the River Basin District (RBD) and set out the objectives for protecting and improving it.

21.4.1.2.2 The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2017

22. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2017 set out the standards and thresholds used to determine the ecological and chemical status of water bodies. These are considered in terms of biological, hydromorphological, physico-chemical and chemical status for surface water bodies, and quantitative and chemical status for groundwater bodies.

21.4.1.2.3 National Planning Policy Framework (2023) and Supporting Guidance

23. The National Planning Policy Framework (NPPF) was updated on 5th September 2023 and sets out the government's planning policies for England and how these are expected to be applied. Within the latest update there were no material changes to the approach identified with regards the assessment of flood risk used in the FRA. The NPPF sets out the UK Government planning policies for England and seeks to ensure that flood risk is considered at all stages of the planning and development process. Its policies aim to avoid inappropriate development in areas at highest risk of flooding, and to direct development away from these areas.

24. NPPF provides clarification that all strategic policies and plans should apply a sequential, risk-based approach to the location of development taking into account all sources of flood risk (e.g. fluvial, coastal, surface water, groundwater, reservoir and sewer flooding). It also provides guidance on how this is to be considered in the context of the location of site-specific development. Further guidance, on the application of the Sequential Test and Exception Test is provided in the supporting Planning Practice Guidance for Flood Risk and Coastal Change (Ministry of Housing, Communities and Local Government, 2021), which was updated on 25th August 2022.

25. In the recent update to the Planning Practice Guidance the guidance was extended to include clarification on the application of the Sequential Test for all sources of flood risk, not only fluvial and coastal / tidal flooding, as well as summarising additional considerations with regard to the presence of flood risk management infrastructure. A supporting FRA to this ES Chapter, included as ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29), has been produced in accordance with the policy and guidance set out in the NPPF and supporting PPG for Flood Risk and Coastal Change.

21.4.1.2.4 Flood and Water Management Act (2010)

26. The Flood and Water Management Act (FWMA) aims to improve the management of flood risk management and water resources by creating clear roles and responsibilities. It gave local authorities the new role of LLFA under which they take on the responsibility of managing flood risk on a local scale from surface water, groundwater and Ordinary Watercourses. The Environment Agency gained a strategic overview role of all flood risk. The FWMA provides opportunities for a comprehensive, risk-based approach on land use planning and flood risk management by local authorities and other key partners.

21.4.1.2.5 Anglian River Basin District: River Basin Management Plan (2022)

27. RBMPs provide a framework for the protection and enhancement of the benefits provided by the water environment in each RBD and are produced in order to implement the Water Environment Regulations. As water resources and land use are closely linked, RBMPs also inform decisions on land-use planning.

28. The third RBMP for the Anglian RBD was finalised by the Department for the Environment, Food and Rural Affairs (Defra) and the Environment Agency in 2022. It provides a baseline classification of the water environment in the Anglian RBD and highlights statutory objectives for protected areas such as waters used for drinking water, bathing, and designated sites. It lays out the actions needed to improve the water environment and achieve the objectives of the WER.

21.4.1.2.6 Essex County Council Preliminary Flood Risk Assessment (PFRA)

29. Essex County Council produced a Preliminary FRA in January 2011 which provides a high level overview of flooding from local sources in Essex. Flood risk data and records of historic flooding were collected from several local and national sources to develop a clear understanding of the flood risk across Essex. Information relating to 1342 flood events, caused by flooding from surface water, groundwater, Ordinary Watercourses, canals and small impounded reservoirs, was collected and analysed to develop a better understanding of flood risk in the area.

21.4.1.2.7 Local Flood Risk Management Strategy

30. Essex Local Flood Risk Management Strategy was produced by Essex County Council in 2018. The strategy sets out the council's aims and actions to reduce the impact of local flooding to communities. Local flooding in Essex as defined in the strategy means the risk of flooding from artificial drainage systems, small watercourses and rainfall-runoff from land.

21.4.2 Data sources

21.4.2.1 Site specific

31. In order to provide site specific and up to date information on which to base the impact assessment, a geomorphological baseline survey was conducted between 22nd and 24th August 2022. The aim of the survey was to characterise the physical characteristics of the watercourses (Main Rivers, Ordinary Watercourses and water bodies) within the onshore project area. The survey included an assessment of channel form, flow conditions, floodplain characteristics, in-channel and riparian vegetation, and any evidence of channel modification. Summary findings are provided in Section 21.5.2 and a detailed report can be found in ES Appendix 21.1 Geomorphology Baseline Survey (Document Reference: 3.3.27).

21.4.2.2 Other available sources

32. The sources of information presented in Table 21.5 were consulted upon to inform the water resources and flood risk assessment.

Table 21.5 Other available data and information sources

Data set	Coverage	Year	Notes
Water body status objectives and classification data	National	Updated May 2022	Environment Agency Catchment Data Explorer (https://environment.data.gov.uk/catchment-planning/)
Water quality data	National	Updated ~every 6 months	Environment Agency Water Quality Data Archive (https://environment.data.gov.uk/water-quality/view/landing)
Aquatic ecology data	National	Undated	Environment Agency Ecology and Fish Data Explorer (https://environment.data.gov.uk/ecology/explorer/)

Data set	Coverage	Year	Notes
Source Protection Zones (SPZs) Aquifer designation mapping Groundwater vulnerability mapping	National	Undated	Defra Magic (https://magic.defra.gov.uk/MagicMap.aspx)
Geological mapping	National	Undated	British Geological Survey (https://www.bgs.ac.uk/map-viewers/geology-of-britain-viewer/)
Licensed abstraction data	National	Abstractions dated individually	Environment Agency (available on request)
Statutory and non-statutory designated sites	National	Undated	Defra Magic (https://magic.defra.gov.uk/MagicMap.aspx)
Flood Map for Planning; Flood risk mapping (rivers and sea, surface water, reservoirs)	National	Undated	Environment Agency (https://flood-map-for-planning.service.gov.uk/; https://check-long-term-flood-risk.service.gov.uk/postcode)

21.4.3 Impact assessment methodology

33. ES Chapter 6 EIA Methodology (Document Reference: 3.1.8) explains the general impact assessment methodology applied to North Falls. The following sections confirm the methods used to assess the likely significant effects on water resources and flood risk. More detailed methodologies specific to the WER compliance assessment can be found in ES Appendix 21.2 Water Environment Regulations Compliance Assessment (Document Reference: 3.3.28).

34. As described in Section 21.3.1, the study area has been defined based on surface hydrological catchments that could potentially interact with the Project. For the purposes of this assessment, each catchment has been defined as a single receptor, containing multiple Main Rivers and Ordinary Watercourses, and assigned a single sensitivity which reflects the most sensitive watercourse within that receptor. For clarity, the sensitivity of each water body is defined once, with a justification, in Table 21.10, and is referred to throughout the impact assessment in Section 21.6.

21.4.3.1 Definitions

35. For each potential impact, the assessment identifies receptors within the study area which are sensitive to that impact and implements a systematic approach to understanding the impact pathways and the level of impacts (i.e., magnitude) on given receptors. Definitions of sensitivity and magnitude for the purpose of this assessment are provided in Table 21.6 and Table 21.7.

21.4.3.1.1 Sensitivity

36. For each receptor, the assessment identifies a level of sensitivity (as defined in Table 21.6). This is then used systematically to understand the impact pathways and the level of impacts on given receptors which considers both magnitude (as defined in Table 21.7 and sensitivity of receptor to determine the effects of the Project on each receptor.

37. Timescales in the tables below for impact duration are defined based on the RBMP cycle. Therefore, short-term is less than one year, medium-term is one to six years (i.e., one RBMP cycle) and long-term is greater than six years (i.e., more than one RBMP cycle).

Table 21.6 Definition of sensitivity for a water resources and flood risk receptor

Sensitivity	Definition
High	The receptor has no or very limited capacity to tolerate changes to hydrology, geomorphology, water quality or flood risk and has little potential for substitution. Includes water resources which support human health and / or the economic activity at a regional scale, or receptors with a high vulnerability to flooding. Water resources • Controlled waters with an unmodified, naturally diverse hydrological regime, a naturally diverse geomorphology with no barriers to the operation of natural processes, and good water quality; • Supports habitats or species that are highly sensitive to changes in surface hydrology, geomorphology or water quality; • Supports Principal Aquifer with public water supply abstractions by provision of recharge; and • Site is within Inner or SPZs. Flood risk • Highly Vulnerable Land Use, as defined by Annex 3 of NPPF (Department for Levelling Up, Housing and Communities, 2021); and • Land with more than 100 residential properties (after Standards for Highways, 2020).
Medium	Receptor has limited capacity to tolerate changes to hydrology, geomorphology, water quality or flood risk. Water resources which support human health and / or economic activity at a local scale. Receptors with a high vulnerability to flooding. Water resources • Controlled waters with hydrology that sustains natural variations, geomorphology that sustains natural processes, and water quality that is not contaminated to the extent that habitat quality is constrained;

Sensitivity	Definition
	• Supports or contributes to habitats or species that are sensitive to changes in surface hydrology, geomorphology and / or water quality; • Supports Secondary A or Secondary B Aquifer with water supply abstractions; and • Site is within a Catchment SPZ. Flood risk • More Vulnerable Land Use, as defined by Annex 3 of NPPF (Department for Levelling Up, Housing and Communities, 2021).; and • Land with between 1 and 100 residential properties or more than 10 industrial premises (after Standards for Highways, 2020).
Low	Receptor has moderate capacity to tolerate changes to hydrology, geomorphology and, water quality or flood risk. Water resources that support human health and / or economic activity at a neighbourhood (multiple property) scale. Receptors with a moderate vulnerability to flooding. Water resources • Controlled waters with hydrology that supports limited natural variations, geomorphology that supports limited natural processes, and water quality that may constrain some ecological communities; • Supports or contributes to habitats that are not sensitive to changes in surface hydrology, geomorphology or water quality; and • Supports Secondary A or Secondary B Aquifer without abstractions. Flood risk • Less Vulnerable Land Use, as defined by Annex 3 of NPPF (Department for Levelling Up, Housing and Communities, 2021); and • Land with 10 or fewer industrial properties (after Standards for Highways, 2020).
Negligible	Receptor is generally tolerant of changes to hydrology, geomorphology, water quality or flood risk. Water resource that supports human health and / or economic activity at a single property scale. Receptors with a low vulnerability to flooding. Water resources • Controlled waters with hydrology that does not support natural variations, geomorphology that does not support natural processes, and water quality that constrains ecological communities;

Sensitivity	Definition
	• Aquatic or water-dependent habitats and / or species are tolerant to changes in hydrology, geomorphology or water quality; and • Non-productive strata that does not support groundwater resources. Flood risk • Water Compatible Land Use as defined by Annex 3 of NPPF (Department for Levelling Up, Housing and Communities, 2021); and • Land with limited constraints and a low probability of flooding of residential and industrial properties (after Standards for Highways, 2020).

21.4.3.1.2 Magnitude

38. In addition to the magnitude of impact definitions outlined in Table 21.7, three specific measures of magnitude are used for assessing water resources and flood risk. These specific measures represent industry good practice consistent with other DCOs, such as the Dudgeon Extension and Sheringham Shoal Extension Projects (Equinor, 2022), and have been consulted upon with the North Falls Water Resources and Flood Risk Expert Topic Group as part of the Evidence Plan Process:

- First, for construction impacts related to the direct disturbance of surface water bodies, magnitude of impact is defined in terms of the number of trenched crossings per water body catchment. These thresholds are set out in Table 21.12 alongside assessment of Impact 1: Direct disturbance of surface water bodies;
- Second, for construction impacts related to increased sediment supply, magnitude of impact is defined in terms of the estimated total area of disturbed ground per water body catchment. The area of disturbed ground is also used to assess the magnitude of the supply of contaminants from construction. These thresholds are set out in Table 21.14 alongside assessment of Impact 2: Increased sediment supply; and
- Third, the total area of buried / permanent infrastructure per water body catchment is used to estimate the potential for changes in surface runoff and flood risk due to an increased area of impermeable surfaces. These thresholds are set out in Table 21.19 alongside assessment of Impact 5: Supply of contaminants to surface and groundwater.

Table 21.7 Definition of magnitude for a water resources and flood risk receptor

Magnitude	Definition
High	Permanent / irreversible, or large-scale changes, over the whole receptor affecting usability, risk, or value. Causes fundamental changes to key features of the receptor's character or distinctiveness. Water resources

Magnitude	Definition
	• Permanent changes to geomorphology and / or hydrology that prevent natural processes operating.; • Permanent and / or wide scale effects on water quality or availability; • Permanent loss or long-term degradation of a water supply source resulting in prosecution; • Permanent or wide scale degradation of habitat quality; • Deterioration in surface water body status or prevention of achieving future status objectives; and • Deterioration in groundwater levels, flows or quality leading to a deterioration in groundwater body status. Flood risk • Permanent or major change to existing flood risk – increase in peak flood level (> 100mm); • Reduction in on-site flood risk by raising ground level in conjunction with provision of compensation storage; • Increase in off-site flood risk due to raising ground levels without provision of compensation storage; and • Failure to meet either sequential or exception test (if applicable).
Medium	Partial loss or noticeable change over the majority of the receptor, and / or discernible alteration to key features of the receptor's character or distinctiveness. Moderate permanent or long-term reversible change affecting usability, value, or risk, over the medium- term or local area. Water resources • Medium-term effects on water quality or availability; • Medium-term degradation of a water supply source, possibly resulting in prosecution; • Habitat change over the medium-term; • Potential temporary downgrading in the status of individual water body quality elements, without affecting the ability of the surface water to achieve future objectives; and • Medium-term deterioration in groundwater levels, flow or quality leading to potential temporary downgrading of water body status. Flood risk

Magnitude	Definition
	• Medium-term or moderate change to existing flood risk – increase in peak flood level (> 50mm); • Possible failure of sequential or exception test (if applicable); and • Reduction in off-site flood risk within the local area due to the provision of a managed drainage system.
Low	Discernible temporary change over a minority of the receptor, and / or with minimal effect on usability, risk or value. Also potential discernible alteration to key features of the receptor's character or distinctiveness. Water resources • Short-term or local effects on water quality or availability; • Short-term degradation of a water supply source; • Habitat change over the short-term; and • No change to water body status. Flood risk • Short-term temporary or minor change to existing flood risk – increase in peak flood level (> 10mm); • Localised increase in on-site or off-site flood risk due to increase in impermeable area; and • Passing of sequential and exception test.
Negligible	Temporary change, undiscernible over longer timescales, with no effect on usability, risk or value. Slight, or no, alteration to the characteristics or features of the receptor's character or distinctiveness. Water resources • Temporary impact on local water quality or availability; • Temporary or no degradation of a water supply source; and • Very slight local changes to habitat that have no observable impact on dependent receptors. Flood risk • Temporary or very minor change to existing flood risk – negligible change to peak flood level (≤ +/- 10mm); and • Highly localised increase in on-site or off-site flood risk due to increase in impermeable area.

21.4.3.2 Significance of effect

39. The assessment of significance of an effect is a function of the sensitivity of the receptor and the magnitude of the impact (see ES Chapter 6 EIA Methodology (Document Reference: 3.1.8) for further details). The determination of significance is guided by the use of a significance of effect matrix, as shown in Table 21.8. Definitions of each level of significance are provided in Table 21.9.

40. Should major or moderate effects be identified within the assessment, these would be regarded within this chapter as significant. Should the assessment indicate any likely significant effect, mitigation measures would be identified, where practicable, in consultation with the regulatory authorities and relevant stakeholders. The aim of mitigation measures is to avoid or reduce the overall significance of effect to determine a residual effect upon a given receptor.

Table 21.8 Significance of effect matrix

		Adverse magnitude				Beneficial magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Negligible	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 21.9 Definition of effect significance

Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No effect, therefore no change in receptor condition

41. Where the need for additional mitigation has been identified specifically to reduce or eliminate any predicted likely significant effects, this has been proposed in consultation with the appropriate regulatory authorities and relevant stakeholders. The aim of additional mitigation measures is to avoid or reduce the overall significance of effect to determine a residual effect upon a given receptor. Residual effects are summarised in Table 21.31.

42. In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

21.4.4 Cumulative effects assessment methodology

43. The CEA considers other plans, projects and activities that may interact cumulatively with North Falls. ES Chapter 6 EIA Methodology (Document Reference: 3.1.8) provides further details of the general framework and approach to the CEA.

44. For water resources and flood risk, these activities include the potential crossing of cable routes associated with other offshore wind farms. Concurrent activities involving large scale excavation, such as major infrastructure projects, taking place within the same surface water catchments as the Project would also require consideration.

21.4.5 Transboundary effects assessment methodology

45. The transboundary assessment considers the potential for transboundary effects to occur on water resources and flood risk as a result of North Falls. ES Chapter 6 EIA Methodology (Document Reference: 3.1.8) provides further details of the general framework and approach to the assessment of transboundary effects. For water resources and flood risk, no potential for transboundary effects have been identified and therefore do not need to be considered for this chapter.

21.4.6 Assumptions and limitations

46. This assessment is based on a range of publicly available information and data sources (as listed out in Table 21.5) and is largely desk-based. Although these data sets are considered robust, there is a degree of uncertainty and assumptions associated with their use in this assessment. For example, the known characteristics of the drainage network and attributes and conditions specific to water bodies have been used as a proxy to assign value and sensitivity to the wider catchments and the Ordinary Watercourses within them. This is a precautionary approach that ensures value and sensitivity have not been under-assessed within this assessment.

21.5 Existing environment

21.5.1 Surface water drainage

47. As discussed in Section 21.3.1, this assessment is based on river water body catchments as defined by the Environment Agency. Receptors are those river water bodies (and catchments) that are crossed by the onshore project area, as well as and those that are downstream. Water body catchments are grouped within their respective operational catchments.

48. The onshore infrastructure associated with the Project lies within two operational catchments:

- Colne Essex operational catchment

- o Holland Brook; and
  - o Tenpenny Brook.
- Stour operational catchment
  - o Wrabness Brook; and
  - o Coastal catchment associated with Hamford Water.

21.5.1.1 Holland Brook catchment

49. Holland Brook (Main River) rises near Little Bromley and flows in a south-easterly direction to Holland Haven where it meets the sea. It is a largely rural catchment and is fed by numerous tributaries. These include Tendring Brook, Weeley Brook and Kirby Brook (all Main River).

50. In the lower reaches of the catchment, the Main River flows through Holland Haven Marshes SSSI, which Natural England state is an area of neutral grassland in favourable condition, reclaimed estuarine saltmarsh and freshwater marsh with an extensive ditch system (Natural England, 2022a). The SSSI extends upstream on Holland Brook as far as Hunter's Bridge. The main tributary watercourse in the SSSI is Kirby Brook, which flows west from Frinton-on-Sea into the Holland Brook, close to its mouth.

21.5.1.2 Tenpenny Brook catchment

51. Tenpenny Brook rises south-west of Great Bromley, from where it flows in a southerly direction towards Mill Dam and into Alresford Creek and the Colne Estuary. The brook is Main River from the A120 southwards. The Colne estuary is designated as a SSSI for littoral sediment, inshore sublittoral sediment and neutral grassland (Natural England, 2022b).

21.5.1.3 Wrabness Brook

52. Wrabness Brook, which is an Ordinary Watercourse apart from a short section of Main River close to its confluence with the Stour, rises north of the A120 near Horselycross Street. It then flows in a north easterly direction to join the River Stour at Wrabness Point. The lower course of the brook overlaps with several designated sites. These are: Stour Estuary SSSI, Stour and Orwell Estuaries Special Protection Area (SPA, Stour and Orwell Estuaries Ramsar, Suffolk Coasts Heaths National Landscape (NL) and Wrabness Local Nature Reserve (LNR). The SSSI is nationally important for 13 species of wintering waterfowl and three species on autumn passage. The estuary is also of national importance for coastal saltmarsh, sheltered muddy shores, two scarce marine invertebrates and a scarce vascular plant assemblage (Natural England, 2022c). The SSSI is at mostly (98%) favourable status.

21.5.1.4 Coastal catchment associated with Hamford Water

53. The coastal catchment associated with Hamford Water has an area of ~40km^2. The onshore project area crosses a tributary section of Main River (Beaumont Cut), which rises near Beaumont and flows in a southerly and then easterly direction to join Landermere Creek, which then flows to Hamford Water. The catchment is predominantly rural and the channel flows in a relatively narrow valley before turning east towards Beaumont Bridge, where it occupies a wide and shallow east facing valley. Hamford Water is also designated as an SPA, Special Area of Conservation (SAC), Ramsar site and SSSI (see Section 21.5.8).

21.5.2 Geomorphology

54. The methodology and results of the geomorphological baseline survey undertaken in August 2022 are discussed in detail in ES Appendix 21.1 Geomorphology Baseline Survey (Document Reference: 3.3.27). Summary details of each watercourse within the onshore project area are provided below:

- **Holland Brook headwaters (Abbott's Farm)**. The headwater channel of Holland Brook is ~1 m wide and incised in places with evidence of bank erosion. Flows were mainly ponded / stagnant and there were no visible bedforms. Some sections of the channel had been recently cleared of vegetation, and the channel bed and banks are artificial (concrete culverts) where crossed by farm access tracks. Several concrete and plastic field drains line the banks.
- **Holland Brook lower course**. The lower course of Holland Brook is ~6 m wide the flows are impounded by a large sluice. Flows are sluggish to stagnant with evidence of frothy surficial scum and an unpleasant (sewage) odour at the time of survey. The channel is set within a well-defined riparian corridor characterised by reeds and rushes next to the channel, and scrubby woodland and undergrowth close to the floodplain. The floodplain covers a wide area of Holland Haven Marshes, but water levels are managed. Close to the sluice, banks are artificial (metal sheeting).
- **Holland Brook tributaries**. Near Great Holland Pits Nature Reserve two left bank tributaries (i.e., in the eastern part of the catchment) join Holland Brook. Both watercourses are very similar and comprise an incised channel (~1 m wide) set within a densely vegetated scrubby riparian corridor, which cuts through arable fields. The extent of undergrowth made it difficult to access the channel. Where visible, flows were ponded and sluggish with no evidence of bedforms. Banks are artificial (concrete culverts) where crossed by farm access tracks. These two tributaries are directly connected to the upstream area of Holland Haven Marshes SSSI, near Hunter's Bridge.
- **Kirby Brook**. Kirby Brook drains the eastern area of Holland Brook's wider catchment. It flows around Frinton and then across Holland Haven Marshes, close to the sea wall. The channel is 2 - 3 m wide and the upstream end of the watercourse, near Frinton, has a straight / engineered planform. Across Holland Haven Marshes the channel has a meandering planform. The entire channel length is very densely vegetated with reeds and rushes. Where visible, flows were ponded and there were no bedforms. A low rubble embankment and water level management associated with the sluice on Holland Brook may limit channel-floodplain connectivity.
- **Tendring Brook**. Tendring Brook joins Holland Brook upstream of Weeley. The channel flows in a relatively narrow / confined valley over most of its length and channel planform is typically straight. The channel is incised approximately 1 - 1.5 m below the surrounding floodplain and there appears little opportunity for connectivity. The channel occupies a 10m riparian corridor that is densely overgrown with scrub, making access difficult. Where visible, there was no evidence of flows or bedforms. A substantial concrete farm bridge partially impounds the channel at the upstream end of the reach.

- **Tributary of Bromley Brook**. At the northern limit of the onshore project area, close to the onshore substation work area, a tributary of Bromley Brook flows in a southerly direction. The channel is ~1m wide and has a distinct trapezoidal cross-section, indicative of regular maintenance. Upstream sections of the reach had been cleared of vegetation whilst downstream the channel is dominated by scrubby vegetation. The channel was either dry or characterised by ponded water with no evidence of bedforms. Channel bed and banks are artificial (concrete) where they are formed by culverts and there are permanent irrigation pipes and field drains on the banks.
- **Beaumont Cut (tributary of Hamford Water)**. The tributary section of Main River that flows to Landermere Creek and Hamford Water is incised up to 2m below the surrounding floodplain and the channel area is densely vegetated with grass and scrub. Where visible, flows were ponded, and other areas were dry. There was no visible evidence of bedforms.

21.5.3 Water quality

55. A review of the Environment Agency's Catchment Data Explorer (Environment Agency, 2022) and water quality archive for surface water bodies gives an indication of water quality across the catchments of interest.

56. Water body chemical status has not been assessed in Cycle 3 (2022) by the Environment Agency, so 2019 classifications (Cycle 2) data are described. This is because chemical status is fail for all water bodies in England due to a group of global pollutants (polybrominated diphenyl ethers (PBDEs – a group of brominated flame retardants); mercury; certain polycyclic aromatic hydrocarbons (PAHs) and Perfluorooctane sulfonate (PFOS) – a group of per- and polyfluoroalkyl substances (PFAS)). No feasible technical solution exists to remove these chemicals entirely and that they will take time to naturally drop to required levels – 2040 and 2063 are listed as the objective date for water bodies in the study area.

21.5.3.1 Holland Brook

57. Holland Brook (GB105037077810), which is designated as heavily modified, is at Moderate ecological potential. Significant water quality pressures are shown by a Poor classification for some biological and physico-chemical quality elements (fish, invertebrates (macrophytes sub element and phosphate)). The water body is also classified as Moderate or less for mitigation measures assessment. The latter refers to the ecological potential of heavily modified water bodies, which is determined by an assessment of whether measures are properly in place to mitigate the impacts of any modification on the ecology of the water body. If one or more identified mitigation measures are absent, the water body has been classified as Moderate potential.

58. The water body is at Fail for chemical status due to high levels of priority hazardous substances (mercury and its compounds and PBDEs).

59. The water body's 'reasons for not achieving good' (RNAG) status include diffuse pollution associated with poor livestock, nutrient and soil management, and urban development. There are also issues associated with point source pollution (sewage), physical modifications (barriers and land drainage), as well as saline intrusion and fish stocking.

21.5.3.2 Tenpenny Brook

60. Tenpenny Brook (GB105037041310), which is designated as heavily modified, is at Moderate ecological potential. Significant water quality pressures are shown by a Poor classification for biological quality elements (fish) and a Bad classification for phosphate (physico-chemical quality).

61. The water body is at Fail for chemical status due to high levels of priority hazardous substances (mercury and its compounds and PBDEs).

62. RNAG include point source pollution from sewage and physical modifications (barriers and flood protection structures).

21.5.3.3 Wrabness Brook

63. Wrabness Brook (GB105036040800), which is designated as heavily modified, is at Good ecological potential, although the water body does not support a good hydrological regime.

64. The water body is at Fail for chemical status due to high levels of priority hazardous substances (mercury and its compounds and PBDEs).

65. Although at Good ecological potential, there are water quality issues associated with diffuse pollution (poor livestock and nutrient management), point source pollution (private sewage treatment) and flow (surface water abstraction).

21.5.3.4 Coastal catchment

66. There are no data available to determine water quality of the tributary section of Main River in the onshore coastal catchment. The coastal water body immediately downstream (Hamford Water (GB680503713700)) is at Moderate ecological status due to Moderate classifications for invertebrates (infaunal quality index), phytoplankton and dissolved inorganic nitrogen. The coastal water body is at Fail for chemical status due to high levels of priority hazardous substances (mercury and its compounds and PBDE).

21.5.4 Abstractions and discharges

21.5.4.1 Abstractions

67. There are two licensed abstractions within the onshore project area (Holland Brook catchment) at Lodge Farm, Great Holland, and at Wolves Hall, Tendring. Both are for spray irrigation purposes. The abstraction at Lodge Farm is sourced from groundwater and the abstraction at Wolves Hall is from a surface water source. The annual volume allowed for abstraction at Wolves Hall is 36,300m^3. There are other licenced and private abstractions within 1km of the onshore project area for agricultural and domestic use.

21.5.4.2 Discharges

68. Some low risk water discharge and groundwater activities can be exempt from requiring a permit – most exceptions are for small sewage discharges. Environment Agency data shows there is a single discharge exemption within the onshore project area, near Bentley Road. Exemptions typically relate to limited amounts of sewage effluent discharge from septic tanks. Exemptions also typically state that the septic tanks must not be within 10m of any ditch, pond or watercourse, or within 50m of a borehole.

21.5.5 Utilities

21.5.5.1 Potable water, raw water and sewerage

69. A potable water main follows and crosses the course of the onshore project area between Great Holland in the south and Horsleycross Street in the north. Potable water mains also cross the onshore project area:

- South of Great Holland;
- Between Kirby Cross and Thorpe Cross; and
- North of Abbott's Hall.

70. A potable water main is also located immediately south of the onshore project area south of the onshore substation area.

71. Raw water mains also cross the onshore project area:

- Between Horsley Cross and Horsleycross Street (associated with Horsley Cross WTW).

72. Sewerage mains are located in the landfall area of the onshore project area south of Great Holland and immediately west of Frinton-on-Sea.

21.5.6 Flood risk

21.5.6.1 River and sea flooding

73. A full assessment of flood risk from all sources is provided in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29). A summary is provided below.

74. Land at risk from river and sea flooding in the study area is shown in ES Figure 21.3 (Document Reference: 3.2.17). The majority of the onshore project area is in Flood Zone 1 (land with less than a 0.1% annual probability of river and sea flooding). There are three areas of the onshore project area at higher risk of flooding (Flood Zones 2 and 3):

- In the upper reaches of Holland Brook, immediately west of Abbott's Hall, there is a narrow (30-60 m) 450 m long area of valley floor that is in Flood Zone 3 (land that has a 1% or greater annual probability of river flooding, or a 0.5% or greater probability of flooding from the sea);
- On Tendring Brook, near Tending Green, there is a narrow (20m), 200m long area of valley floor in Flood Zone 3; and
- Associated with Kirby Brook and the lower course of Holland Brook at Holland Haven Marshes, there is a large area of land mostly in Flood Zone 3, with peripheral areas in Flood Zone 2 land that has a 0.1% to 1% annual probability of river flooding, or a 0.1% to 0.5% annual probability of flooding from the sea). This area benefits from the presence of flood defences (sea wall).

21.5.6.2 Surface water flooding

75. High risk (areas with a 3.3% annual probability of flooding) surface water flow paths occur in the same areas as described for river and sea flooding. Across the onshore project area there are other very minor flow paths associated with hillslope hollows. There are several relatively small areas on low to medium surface water flood risk north of Normans Farm in the onshore substation area.

76. The most extensive area of surface water flood risk is around Holland Haven Marshes. Much of this area overlaps with that described for river and sea flooding but there are also numerous flow paths that drain the low ridge above Holland Haven Marshes.

21.5.6.3 Reservoir flooding

77. Floodplain areas of Kirby Brook and Holland Haven Marshes are at risk of reservoir flooding under a dry-day scenario. The area at risk of flooding extends upstream on Holland Brook to the north-west of Tendring. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal level. Reservoir flood risk under a 'wet day' scenario (when river levels are high) covers roughly the same area but only begins north of the B1032 Frinton Road.

21.5.7 Groundwater

78. Bedrock geology that underlies the onshore project area is dominated by the sedimentary Thames Group of clay, silt and sand, classified as unproductive strata.

79. Although most of the onshore project area is underlain by unproductive strata, there are areas of low groundwater vulnerability near Thorpe-le-Soken and medium-low vulnerability north of the A120. Groundwater vulnerability maps show the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a single square kilometre.

80. North of Tendring the onshore project area lies within Zone III (total catchment) of a SPZ. SPZs are defined around large and public potable groundwater abstraction sites, and Zone III is defined as the total area needed to support the abstraction or discharge from the protected groundwater source.

81. Superficial deposits of glacial sands and gravels, river terrace deposits and Diamicton till overlay bedrock in this area. These superficial units support mainly Secondary A aquifers (smaller aquifers capable of supporting water supplies at a local scale) south of Tendring, and mainly Secondary B aquifers (lower permeability layers which can store limited amounts of groundwater) north of Tendring.

82. The onshore project area is underlain by a single groundwater body (Essex Gravels (GB40503G000400)). The groundwater body is at Poor overall status, as assessed in 2019. It has Good quantitative status but Poor chemical status. RNAG are related to diffuse pollution (poor livestock and nutrient management).

21.5.8 Designated sites

21.5.8.1 Statutory designations

83. Land immediately north of the sea wall (i.e., Holland Haven Marshes) is designated as a SSSI. Holland Haven Marshes SSSI is a reclaimed estuarine saltmarsh and freshwater marsh with an extensive ditch system (Natural England, 2022a). The site is bisected by Holland Brook and its tributaries, from which an extensive ditch system radiates. The citation for the site states the ditch network represents an outstanding example of a freshwater to brackish water transition intimated by the aquatic plant communities, which include

several nationally and locally scarce species. The site was last assessed in 2012 and all units were in favourable condition. NFOW has undertaken extensive vegetation, invertebrate and bird surveys of the SSSI in 2021 in order to inform the assessments for ES (see ES Chapter 23 Onshore Ecology, (Document Reference: 3.1.25)).

84. At the western end of Holland Haven Marshes, the floodplain of Holland Brook and Kirby Brook are part of Holland Haven LNR) and Holland Haven Country Park, the boundaries of which largely overlap. This floodplain area consists of coastal grassland, marshland, dykes and a large brackish pond around the mouth of the Holland Brook (Tendring District Council, 2021). Water levels are managed so that wildfowl and waders are attracted both to over-winter and to breed.

85. Immediately downstream (~400m) of the onshore project area the tributary section of Main River that rises near Beaumont (see Section 21.5.1) connects to Hamford Water. This area of coast has the following designations:

- Hamford Water SSSI;
- Hamford Water SAC;
- Hamford Water SPA;
- Hamford Water Ramsar;
- Hamford Water National Nature Reserve (NNR); and
- Skipper's Island Nature Reserve (Essex Wildlife Trust).

86. Hamford Water is a large and shallow estuarine basin comprising tidal creeks, intertidal mud and sand flats, saltmarshes, islands, beaches and marsh grasslands. The SPA is of international importance for breeding little terns and wintering dark-bellied brent geese, wildfowl and waders, and of national importance for many other bird species. It also supports communities of coastal plants which are rare or extremely local in Britain. The SSSI condition was last assessed in 2012 as mostly (72%) unfavourable (recovering).

87. The Annex II species that is the primary reason for the SAC designation is the Fisher's estuarine moth (*Gortyna borelii lunata)*. Hamford Water supports most of the Essex population and is the most important UK site for this species.

21.5.8.2 Local wildlife sites

88. Immediately west of Great Holland the onshore project area passes adjacent to Great Holland Pits Nature Reserve. The 16ha reserve occupies a former gravel and old working hold ponds and wet depressions favoured by a range of wildlife.

89. Far Thorpe Green near Thorpe-le-Soken (0.86km from the onshore project area) is a grassland site also supporting several ponds. The ponds are shaded with water mint (*Mentha aquatica*), yellow iris (*Iris pseudacorus*) and bulrush (*Typha latifolia*) growing along the margins.

90. Beaumont Marsh (1.2km from the onshore project area) grassland is the only remnant of grazing marsh in the area. A small pond with sweet-grass (*Glyceria spp*.), soft-rush (*Juncus effusus*) and bulrush (*Typha latifolia*) is located in the western half of the site. Shallow ditches support species such as bulrush, common fleabane (*Pulicaria dysenterica*) and common reed (*Phragmites australis*).

91. Upper Holland Brook comprises grassland, scattered trees, secondary woodland, scrub and reservoir along the upper reaches of the Holland Brook, beyond the SSSI (downstream). Near Hunter's Bridge the site is floodplain grazing marsh – this includes UK Biodiversity Action Plan (UKBAP) priority coastal and floodplain grazing marsh.

92. Cattawade Marshes (3.4km from the onshore project area) are adjacent to the Stour Estuary SSSI. The grazing marshes support open water and fen habitats that are of major importance for the diversity of their breeding bird community, which includes species that have become uncommon throughout lowland Britain because of habitat loss.

93. A full list of local wildlife sites within 5km of the onshore project area can be found in Table 23.12 of ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25).

21.5.9 Receptor sensitivity

94. Catchment receptor sensitivity is described in Table 21.10. Although most catchments have limited geomorphological diversity, high sensitivity catchments relate to designations (e.g., SSSI) which support scarce populations associated with inland ditch networks and coastal environments. Groundwater resources of the Essex Gravels are classed as being medium sensitivity due significant water quality pressures combined with the presence of superficial secondary A aquifers and SPZ 3, which are crossed by the onshore project area.

Table 21.10 Catchment receptor sensitivity

Catchment	Sensitivity	Justification
Holland Brook	High	Holland Brook flows through Holland Haven Marshes SSSI. The SSSI units are classified as neutral grassland habitat that support habitats or species that are highly sensitive to changes in surface hydrology, geomorphology or water quality. The citation states the ditch network represents an outstanding example of a freshwater to brackish water transition intimated by the aquatic plant communities, which include several nationally and locally scarce species. The SSSI extends upstream as far as Hunter's Bridge. Outside the SSSI many of the surveyed watercourses (see ES Appendix 21.1 Geomorphology Baseline Survey (Document Reference: 3.3.27)) have limited geomorphological diversity and appear to be regularly maintained (desilted and vegetation clearance). Water quality is adversely affected by a range of pressures (e.g., diffuse pollution).
Tenpenny Brook	Low	Surveyed watercourses (see ES Appendix 21.1 Geomorphology Baseline Survey (Document Reference: 3.3.27) support limited natural variations, geomorphology that supports limited natural processes, and water quality that may constrain some ecological communities. Tenpenny Brook is designated as heavily modified and water quality is Moderate (moderate ecological potential), Significant water quality pressures are shown by a Poor classification for biological quality elements (fish) and a Bad classification for phosphate (physico-chemical quality). Water quality pressures are related to point source pollution and physical modifications (barriers and flood protection structures).
Wrabness Brook	High	The lower course of Wrabness Brook overlaps with multiple designated sites in the Stour estuary. The Stour Estuary SSSI supports habitats or species that are highly sensitive to changes in surface hydrology, geomorphology or water quality. The is of national importance for coastal saltmarsh, sheltered muddy

Catchment	Sensitivity	Justification
		shores, two scarce marine invertebrates and a scarce vascular plant assemblage. Water quality in the catchment is good (Good ecological potential), although there are issues associated with diffuse and point source pollution and surface water abstraction.
Coastal catchment	High	Surveyed watercourses (see ES Appendix 21.1 Geomorphology Baseline Survey (Document Reference: 3.3.27)) support limited natural variations, geomorphology that supports limited natural processes, and water quality that may constrain some ecological communities. The channel appears to have been maintained in places (desilted) and no bedforms were observed that would support ecohydrological niches. The channel is incised and disconnected from its floodplain. The catchment is classed as high sensitivity because it drains to Hamford Water its designated sites.
Essex gravels	Medium	The groundwater body is at Poor overall status. It has Good quantitative status but Poor chemical status. Water quality is adversely affected by diffuse pollution (poor livestock and nutrient management). The catchment supports Secondary A superficial aquifers, water supply abstractions and SPZ 3.

21.5.10 Future trends in baseline conditions

95. A description of the anticipated changes in future baseline conditions for water resources and flood risk has been carried out and is described within this section.

96. The review of the existing environment in this chapter demonstrates that surface water bodies in the study area support limited areas of high-quality natural habitats. Many of these water bodies have experienced physical modification for land drainage and flood risk management, affecting their geomorphology. Water quality is generally moderate but locally poor across the study area. Watercourses are adversely affected by diffuse pollution from agriculture and point source pollution (sewage). Some water bodies are affected by saline intrusion and surface water abstraction.

97. Ongoing measures to reduce existing pressures on geomorphology and water quality as part of the delivery of the measures to achieve the aims of the Water Environment Regulations are likely to improve its condition over time, therefore a steady improvement in the baseline condition is expected.

98. Climate change is causing more extreme weather. The hydrology of the surface drainage network is expected to change with higher winter flows and lower summer flows with a greater number of storm-related flood flows. This is likely to lead to changes in the hydrology of the river systems with increased geomorphological activity occurring as a result of storm events. Therefore, the drainage network is unlikely to remain stable over time and may revert to more natural river types in future.

99. Groundwater resources face pressure from poor livestock and nutrient management. Ongoing initiatives (Essex County Council, 2024) are in place to reduce pressures on groundwater, including increased regulation of agricultural chemicals, in order to achieve compliance with the WER. This would suggest that groundwater quality and quantity is likely to improve in the future, although this would occur over long timescales.

21.6 Assessment of significance

100. The following sections describe the likely significant effects upon those water resources and flood risk receptors described in Section 21.5 that have the potential to arise because of the impacts associated with the construction, operation, and decommissioning phases of the Project. The assessment follows the methodology set out in Section 21.4.3. The assessments are based on the worst case scenarios set out in Section 21.3.2 and include the incorporation of embedded mitigation set out in Section 21.3.3.

21.6.1 Likely significant effects during construction

21.6.1.1 Impact 1: Direct disturbance of surface water bodies

101. The onshore project area will directly cross the following Main Rivers:

- Holland Brook;
- Kirby Brook and tributary; and
- Tendring Brook.

102. The onshore project area will also directly cross some Ordinary Watercourses (which includes all land drainage channels, drains and ditches) within the catchments listed above. Numbers and types of crossings are given in Table 21.11.

Table 21.11 Watercourse crossings in surface water catchments

Catchment	Sensitivity	Trenchless crossings Main River and Ordinary Watercourses	Trenched crossings Ordinary Watercourses	Haul road only crossings (e.g. culvert or bridge)
Holland Brook	High	10	1	2
Tenpenny Brook	Low	1	1	2
Wrabness Brook	High	0	0	0
Coastal catchment	High	3	1	2

103. Trenchless crossing techniques such as HDD have been embedded in the scheme design for Main Rivers and most Ordinary Watercourses (Table 21.3). As stated in Table 21.2, the onshore export cables would be buried a minimum of 3m below bed level at trenchless crossings. Although ground disturbance will occur at the entry and exit points (which could potentially be located on the floodplain), there would be no direct disturbance to the watercourses crossed using a trenchless technique. Therefore, there is no direct mechanism for impacts to occur to the geomorphology, hydrology and physical habitats of these watercourses. Embedded mitigation (Table 21.3) includes a hydrogeological risk assessment and Horizontal Directional Drilling Method Statement and

Contingency Plan to mitigate risks of the fine grained mixture smothering habitats at the SSSI landfall crossing.

104. A small number of trenchless crossings will also be used on some Ordinary Watercourse crossings within the study area. The crossing techniques proposed at each watercourse crossing at this stage is presented within ES Appendix 5.1 Crossing Schedule (Document Reference: 3.3.2).

105. Trenched crossings of watercourses involve installing temporary dams (composed of sand bags, straw bales and ditching clay, or another suitable technique) upstream and downstream of the crossing point. The cable trench is then excavated in the dry area of riverbed between the two dams with the river flow maintained using a temporary pump or flume.

106. These installation techniques would directly disturb the bed and banks of the watercourse and would result in the direct loss of natural geomorphological features and changes to their associated physical habitat niches. It may also result in increased geomorphological instability due to enhanced scour and increased sediment supply and changes to hydrology. These are temporary impacts that would only occur whilst construction work is in progress, and the bed and banks would be reinstated to their original level, position, planform and profile.

107. In the worst case scenario, where the first project would install ducts for the second project, the second project would not need to retrench at watercourse crossings (cable pull only).

108. In addition to the cable infrastructure itself, it may be necessary to install temporary structures to allow haul road access across watercourses where direct access is not readily available from both sides. These could also be required on watercourses which will be crossed using trenchless techniques. As well as haul road crossings at export cable crossing points, there are a small number of haul road only watercourse crossings in some catchments. These are listed in Table 21.11.

109. Temporary crossings are likely to comprise an appropriately sized culvert installed within the ditch with the haul road being installed over the top of the culvert. The culvert would be installed beneath the channel bed so as to avoid upstream impoundment of water and sediment and would be sized to accommodate reasonable 'worst case' weather volumes and flows. These culverts may remain in place for the duration of the cable duct installation and subsequent cable pull. In the worst case scenario (Table 21.2), where ducts would be installed for the second project, cable pulling would be undertaken separately by the first and second projects. For the worst case it is assumed that any temporary haul road crossings would remain in place for the duration of both cable pulls.

110. At larger crossings, or sensitive rivers, temporary bridges (e.g. Bailey bridges or similar) would be installed to allow continuation of the haul road.

111. Temporary bridges are unlikely to result in significant disturbance to the bed and banks of the channel, with any impacts limited to the footprint of the bridge abutments themselves. However, the installation of temporary culverts across Ordinary Watercourses could potentially directly disturb the bed and banks of the watercourse and result in the direct loss of natural geomorphological features. They could also result in reduced flow and sediment conveyance,

create upstream impoundment and affect the patterns of erosion and sedimentation. These impacts would be reversible once the temporary culverts have been removed and the bed and banks reinstated.

21.6.1.1.1 Magnitude of impact

112. For the purposes of this assessment, magnitude of impact is assumed to be directly proportional to the total number of trenched watercourse crossings within each river water body catchment (Table 21.12). Magnitude of impact is negligible in all catchments (one trenched crossing per catchment) (Table 21.11) except for Wrabness Brook. There are no trenched crossings or potential impacts from temporary crossings in this catchment, and therefore no mechanism for impact.

Table 21.12 Magnitude of impact of trenched watercourse crossings

Magnitude of impact	Number of trenched watercourse crossings
Negligible	1-4
Low	5-9
Medium	10-14
High	>15

21.6.1.1.2 Sensitivity of receptor

113. As described in Table 21.10, receptor sensitivity is high for Holland Brook, Wrabness Brook and the coastal catchment, and low for Tenpenny Brook.

21.6.1.1.3 Significance of effect

114. Taking into account industry good practice embedded mitigation for trenched crossings (Table 21.3), significance of effect for Holland Brook, Wrabness Brook and the coastal catchment is minor adverse, and negligible for Tenpenny Brook (Table 21.13). Although magnitude of impact is negligible for all catchments, significance of effect is minor adverse for Holland Brook and the coastal catchment due to high sensitivity. These effects are not significant in EIA terms.

Table 21.13 Effects associated with the direct disturbance of water bodies resulting from construction of the Project

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Holland Brook	High	One trenched crossing is required in each catchment. Although mitigation (Table 21.3) will not reduce the number of watercourses that would need to be crossed by the onshore cable route, industry good practice mitigation would minimise impacts. Significance of effect is minor adverse for Holland Brook and the coastal catchment due to high sensitivity, and negligible for Tenpenny Brook.	Negligible	Minor adverse
Tenpenny Brook	Low		Negligible	Negligible
Coastal catchment	High		Negligible	Minor adverse
Wrabness Brook	High	There are no watercourse crossings or haul road only crossings in this catchment.	No impact	No effect

21.6.1.2 Impact 2: Increased sediment supply

115. The construction of the landfall, onshore cable route, haul road and onshore substation will involve earthworks, potentially some piling, excavation and the tracking of large construction machinery. This will create areas of bare ground by removing vegetation cover and topsoil, and will increase the potential for soil erosion. This could result in an increase in the supply of fine sediment (e.g., clays, silts and fine sands) to surface water bodies (including land drainage channels) through surface runoff and the erosion of exposed soils.

116. Increased sediment supply can affect the geomorphology of water bodies by increasing the turbidity of the water column and, where energy is sufficiently low, encouraging increased deposition of fine sediment on the bed of the channel. Increased sediment supply could lead to smothering of existing bed habitats, reduce light penetration and reduce dissolved oxygen concentrations. These changes would adversely affect the biota of the water body, including macrophytes, aquatic invertebrates and fish. This has the overall effect of reducing the quality of in-channel habitats.

117. In addition to the potential sources of sediment considered, temporary bridges or culverts may be employed to maintain haul road access across water bodies. These would also provide a mechanism by which sediment could be produced close to the water bodies which they cross.

118. Table 21.14 shows the criteria used to assess the magnitude of impact associated with increased sediment supply resulting from exposed land in a water body catchment.

119. The worst case scenario for increased sediment supply has been estimated from the area of onshore project area in each water body catchment (Table 21.15) – this includes the corridor construction swathe, haul road and all construction compounds and access roads. This figure gives a maximum estimation of the extent of disturbed ground that could be affected by soil erosion.

Table 21.14 Magnitude of impact resulting from exposed land in a water body catchment

Magnitude of impact	Area of exposed ground per catchment during construction
Negligible	<1%
Low	1.00 - 5.99%
Medium	6.00 – 10.00%
High	>10%

21.6.1.2.1 Magnitude of impact

120. Areas of disturbed ground in each catchment are between 0.01 and 2.32km^2, which equates to 0.09 to 2.42% catchment area (Table 21.14). The higher figures of 2.42% for Holland Brook and 2.06% for Tenpenny Brook relate to the relatively large landfall area (Holland Brook), and longest section of onshore export cable corridor (Tenpenny Brook). Most of the large landfall area is covered by the onshore project area is designated as a SSSI, which will be crossed through the landfall HDD and will not be disturbed.

121. Based on the criteria presented in Table 21.14, magnitude of impact is low for all catchments except Wrabness Brook, where it is negligible. As well as the numerical thresholds for determining magnitude of impact (Table 21.14), embedded industry good practice mitigation (Table 21.3) is also considered. Embedded mitigation will reduce the magnitude of impact in the catchments Holland Brook, Tenpenny Brook and the coastal catchment from low to negligible.

Table 21.15 Areas of disturbed ground in each water body catchment

Catchment	Estimated total area of disturbed ground during construction	
	km	%
Holland Brook	2.32	2.42
Tenpenny Brook	0.62	2.06
Wrabness Brook	0.01	0.09
Coastal catchment	0.46	1.16

21.6.1.2.2 Sensitivity of receptor

122. As described in Table 21.10, receptor sensitivity is high for Holland Brook, Wrabness Brook and the coastal catchment, and low for Tenpenny Brook.

21.6.1.2.3 Significance of effect

123. Significance of effect for increased sediment supply associated with disturbed land due to construction activities is assessed in Table 21.16. Taking into account industry good practice embedded mitigation (Table 21.1), significance of effect will be minor adverse in all catchments except Tenpenny Brook, which will negligible. Although magnitude of impact is negligible for all catchments, significance of effect is minor adverse for Holland Brook, Wrabness Brook and the coastal catchment due to high sensitivity. These effects are not significant in EIA terms.

Table 21.16 Effects associated with increased sediment supply resulting from construction of the Project

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Holland Brook	High	Approximately 2.42% of Holland Brook's catchment could be affected by the construction activities in the onshore project area, which could increase sediment supply to the surface drainage network. The area affected is relatively high in this catchment because it has the longest section of onshore cable route, landfall and most of the construction compounds. A small part (0.02km^2) of the onshore substation construction compound would be located in this catchment. One trenched crossing may also be required west of Abbott's Hall, which could increase sediment supply. Sensitivity is high due to the presence of Holland Haven Marshes SSSI, which will be crossed with the landfall HDD. With embedded mitigation in place (Table 21.3), magnitude of impact will be negligible and significance of effect is minor adverse.	Negligible	Minor adverse
Wrabness Brook	High	Approximately 0.09% of Wrabness Brook's catchment would be affected by construction activities in the onshore project area, which could increase sediment supply to the surface drainage network. There are no trenched or temporary crossings in this catchment that could increase sediment supply. Catchment sensitivity is high due to multiple designations in the Stour estuary. With embedded mitigation in place (Table 21.3), magnitude of impact will be negligible, and significance of effect is minor adverse. It should be noted that the onshore project area only just crosses into this catchment (the area of onshore cable route in this catchment is approximately 0.01km^2 (1ha) and the potential for impacts would be very limited to a small area near Horsley Cross.	Negligible	Minor adverse
Coastal catchment	High	Approximately 1.16% of the coastal catchment would be affected by construction activities in the onshore project area, which could increase sediment supply to the surface drainage network. Catchment sensitivity is high due to multiple designations associated with Hamford Water. One trenched crossing and two additional haul road crossings would also be required on watercourses that drains to Hamford Water, which could increase sediment supply. With embedded mitigation in place (Table 21.3), magnitude of impact will be negligible, and significance of effect is minor adverse.	Negligible	Minor adverse
Tenpenny Brook	Low	Approximately 2.06% of Tenpenny Brook's catchment would be affected by the construction in the onshore project area, which could increase sediment supply to the surface drainage network. This relatively high figure compared to the other catchments is due to the relatively large onshore substation area. With embedded mitigation in place (Table 21.3), magnitude of impact and significance of effect are negligible.	Negligible	Negligible

21.6.1.3 Impact 3: Supply of contaminants to surface and groundwaters

124. During construction, there is potential for the accidental release of lubricants, fuels and oils from construction machinery. This can occur because of spillages, leakage from vehicle storage areas and direct release from construction machinery working directly in or adjacent to water bodies, including land drainage channels. Bentonite, which is an inert clay-based material used at the drill head during the installation of trenchless crossings, can breakout during use and cause smothering of habitats, although it is inert and not a chemical pollutant. There is also potential for accidental leakages of construction materials including concrete and inert drilling fluids. These can enter surface waters and connected groundwaters through run-off, especially following rainfall.

125. A significant leakage or spillage has the potential to cause adverse effects to water quality if contaminants enter the surface drainage network and can adversely affect the ecology of the water bodies, in particular fish and invertebrate species (ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25)).

126. Construction activities, including excavations for cable trenching, could result in the remobilisation of contaminants that are already present in the soil. This could include in situ contaminated land and nutrients, such as nitrogen and phosphorus from nitrogen-rich arable soils. Nutrients could also be supplied through accidental discharges of foul water from temporary welfare facilities in construction compounds. The supply of nutrients to surface waters could result in adverse effects on water quality (including, in extreme cases, eutrophication) and aquatic plant, invertebrate and fish communities supported by surface waters. This could be a particular issue in designated habitats supported by Holland Brook (Holland Haven Marshes SSSI).

127. Construction activities such as excavation, piling and underground trenchless crossing techniques which disturb the ground can also introduce contaminants (including nutrients) into underlying groundwater bodies, particularly shallow aquifers. Therefore, these activities could adversely affect the quality of the underlying groundwater and any licensed or unlicensed abstractions associated with it.

21.6.1.3.1 Magnitude of impact

128. The magnitude of impact upon a surface water catchment or body of groundwater is proportional to the maximum area of each water body catchment that would be affected during construction, in which machinery will be used and spills and leaks potentially occur. These areas, and associated magnitudes, are shown in Table 21.15. Based on the criteria presented in Table 21.14, magnitude of impact is low for all catchments except Wrabness Brook, where it is negligible.

129. As well as the numerical thresholds for determining magnitude of impact (Table 21.14), embedded industry good practice mitigation (Table 21.3) is also considered. Embedded mitigation will reduce the magnitude of impact in the catchments of Holland Brook, Tenpenny Brook and the coastal catchment from low to negligible.

21.6.1.3.2 Sensitivity of receptor

130. As described in Table 21.10, receptor sensitivity is high for Holland Brook, Wrabness Brook and the coastal catchment, and low for Tenpenny Brook. Sensitivity is medium for the Essex gravels groundwater body.

21.6.1.3.3 Significance of effect

131. Significance of effect for the supply of contaminants to surface and groundwaters associated with disturbed land due to construction activities is assessed in Table 21.17. Taking into account industry good practice embedded mitigation (Table 21.3), significance of effect will be minor adverse in all surface water catchments except for Tenpenny Brook, which will negligible. Significance of effect will also be minor adverse in the Essex Gravels groundwater catchment. Although magnitude of impact is negligible for all catchments, significance of effect is minor adverse for Holland Brook, Wrabness Brook, the coastal catchment and Essex Gravels due to high sensitivity. These effects are not significant in EIA terms.

Table 21.17 Effects associated with the supply of contaminants to surface and groundwaters resulting from construction of the Project

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Holland Brook	High	Approximately 2.42% of Holland Brook's catchment could be affected by the construction activities in the onshore project area, which could supply contaminants to surface and groundwaters. The area affected is higher is this catchment because it has the longest section of cable corridor, landfall, and most of the construction compounds. Holland Brook's catchment would also be occupied by a small area (0.02km^2) of the onshore substation construction compound. One trenched crossing may also be required west of Abbott's Hall, which could introduce contaminants to the watercourse. It is anticipated that areas of the onshore substation construction compound, such as refuelling stations and wheel wash areas, will require bunding and / or additional proprietary treatment before discharge to the wider drainage network. The management of water quality from the temporary construction compound will be finalised upon confirmation of layout drawings which will enable the identification and categorisation of high-risk areas. Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19) (Mott MacDonald, 2023). Embedded mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. With embedded mitigation in place (Table 21.3), magnitude of impact will be negligible and significance of effect minor adverse due to high sensitivity.	Negligible	Minor adverse
Wrabness Brook	High	Approximately 0.09% of Wrabness Brook's catchment would be affected by construction of the onshore project area, which could increase the risk of an accidental release of contaminants to surface and groundwaters. There are no trenched or temporary crossings in this catchment that could increase the risk of an accidental release within or close to a watercourse. Embedded mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. With embedded mitigation in place (Table 21.3), magnitude of impact will be negligible and significance of effect minor adverse due to high sensitivity. It should be noted that the onshore project area only just crosses into this catchment (the area of onshore cable route in this catchment is approximately 0.01km^2 (1ha) and the potential for impacts would be very limited to a small area near Horsley Cross.	Negligible	Minor adverse

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Coastal catchment	High	Approximately 1.16% of the coastal catchment would be affected by construction activities in the onshore project area, which could increase the risk of an accidental release of contaminants to surface and groundwaters. One trenched crossing and two additional haul road crossings would also be required on watercourses that drains to Hamford Water, which could supply contaminants to Hamford Water through accidental spills or leaks. Embedded mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. With embedded mitigation in place (Table 21.3), magnitude of impact will be negligible and significance of effect minor adverse due to high sensitivity.	Negligible	Minor adverse
Tenpenny Brook	Low	Approximately 2.06% of Tenpenny Brook's catchment would be affected by construction activities in the onshore project area, which could increase the supply of contaminants to surface and groundwaters. This relatively high figure compared to the other catchments is due to the relatively large onshore substation area. Most of the onshore substation construction compound is located in this catchment. The management of water quality from the temporary construction compound will be finalised upon confirmation of layout drawings which will enable the identification and categorisation of high-risk areas. It is anticipated that areas of the construction compound, such as refuelling stations and wheel wash areas will require bunding and / or additional proprietary treatment before discharge to the wider drainage network. Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19) (Mott MacDonald, 2023). Embedded mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. With embedded mitigation in place (Table 21.3), magnitude of impact and significance of effect are negligible.	Negligible	Negligible
Essex gravels	Medium	A very small proportion of the groundwater body (0.16%) would be directly affected by construction activities in the onshore project area. Across the entire groundwater catchment (1274.6km^2), these activities are considered very unlikely to lead to significant changes in groundwater flows. Trenches for the onshore export cables will be generally shallow and ground investigations will be undertaken at deeper trenchless crossings. Inert drilling fluids and inert cable ducting will be used. Embedded mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. With embedded mitigation in place to limit groundwater impacts (Table 21.3), magnitude of impact is negligible, and significance of effect is minor adverse.	Negligible	Minor adverse

21.6.1.4 *Impact 4: Changes to surface and groundwater flows and flood risk*

132. Initial site preparation activities and construction works would alter surface drainage patterns and surface flows by changing the distribution of surface drainage within the onshore project area. Infiltration would be reduced, and surface runoff increased, by a reduction in the proportion of impermeable surfaces in a drainage catchment caused by the compaction of soil by construction vehicles and the development of surface infrastructure. This is directly related to the area of construction and can alter site runoff characteristics; the greater the area of construction, the greater the potential impact on surface and groundwater flows (including land drainage channels).

133. Temporary changes to surface flows because of trenched crossings of Ordinary Watercourses may also occur, particularly if the capacity of any pumps or flumes are exceeded. Local dewatering of trenches and excavations may also be needed, and discharge of this water may increase flows downstream. Any changes in surface flows can alter and / or increase flood risk in the proposed onshore project area.

134. Subsurface flow patterns can be altered because of changes to infiltration rates, surface flows and the installation of impermeable subsurface infrastructure. Therefore, the construction of the onshore infrastructure associated with the Project has the potential to generate increased surface water flows. This could result in increased discharge within watercourses and associated bed and bank scour, as well as in-wash of increased volumes of fine sediment related to the additional surface runoff. This could adversely affect hydrology and geomorphology of the surface drainage network.

135. Note that the flood risk from all sources is assessed in ES Appendix 21.3 Flood Risk Assessment (Document Reference: 3.3.29) that will accompany the ES.

21.6.1.4.1 Magnitude of impact

136. The magnitude of the potential impact upon a surface water catchment or body of groundwater is proportional to the maximum area of each water body catchment that would be affected during construction, as calculated in Section 21.6.1.2.1. The larger the area, the more potential there is for changes in land use and soil properties (e.g. infiltration rates), which could affect surface and groundwater flows. Based on the criteria presented in Table 21.14 and calculations in Table 21.15, magnitude of impact is low for all catchments except Wrabness Brook, where it is negligible.

137. As well as the numerical thresholds for determining magnitude of impact (Table 21.14), embedded industry good practice mitigation (Table 21.3) is also considered. Embedded mitigation will reduce the magnitude of impact in the catchments of Holland Brook, Tenpenny Brook and the coastal catchment from low to negligible.

21.6.1.4.2 Sensitivity of receptor

138. As described in Table 21.10, receptor sensitivity is high for Holland Brook, Wrabness Brook and the coastal catchment, and low for Tenpenny Brook.

21.6.1.4.3 Significance of effect

Significance of effect for changes to surface and groundwater flows and flood risk due to construction activities are assessed in Table 21.18.Taking into account industry good practice embedded mitigation (Table 21.3), significance of effect will be minor adverse in all surface water catchments except for Tenpenny Brook, which will negligible. Significance of effect will also be minor adverse in the Essex Gravels groundwater catchment. Although magnitude of impact is negligible for all catchments, significance of effect is minor adverse for Holland Brook, Wrabness Brook and the coastal catchment due to high sensitivity These effects are not significant in EIA terms.

Table 21.18 Effects associated with changes to surface and groundwater flows and flood risk resulting from construction of the Project

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Holland Brook	High	Approximately 2.42% of Holland Brook's catchment would be directly affected by construction activities, which could alter land use, soil properties, surface and subsurface flows and flood risk. Only one trenched crossing is required in the catchment, which means increased flood risk, due to the exceedance or failure of pumps used during trenching, is unlikely. Water from trenches and excavations may need to be discharged to nearby watercourses during construction, but any effects would be localised, short-term and temporary. Discharges of trench water are considered unlikely to affect surface water supplies for riparian owners who use surface water for agricultural purposes (e.g., spray irrigation) in the catchment. A small part (0.02km^2) of the onshore substation construction compound would be located in this catchment. Temporary swales are proposed along the perimeter of the construction compound to intercept and attenuate runoff before discharge to a temporary attenuation pond via a filter drain / pipe running along the length of the temporary haul road (the temporary ponds will be located in tenpenny Brook's catchment). Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19) (Mott MacDonald, 2023). At a catchment scale, construction activities are considered very unlikely to lead to significant changes in surface water drainage, groundwater flows or flood risk. With embedded mitigation in place (Table 21.3), including the drainage strategy at the onshore substation, magnitude of impact will be negligible, and significance of effect is minor adverse due to high sensitivity.	Negligible	Minor adverse
Wrabness Brook	High	Only a very small proportion of the catchment (0.01km^2; 0.09%) would be directly affected by construction activities and there are no trenched crossing that could increase flood risk through the exceedance or failure of pumps used during trenching. Water from trenches and excavations may need to be discharged to nearby watercourses during construction, but any effects would be localised, short-term and temporary. The closest abstraction for spray irrigation and domestic use are over 200m away from the onshore project area and given the very small scale of potential construction in this catchment, impacts on agricultural use are not expected. At a catchment scale, construction activities are considered very unlikely to lead to significant changes in surface water drainage, groundwater flows or flood risk. Embedded mitigation would minimise the impact of any changes to surface and groundwater flows. With mitigation in place (Table 21.3), magnitude of impact will be negligible, and significance of effect is minor adverse due to high sensitivity.	Negligible	Minor adverse
Tenpenny Brook	Low	Approximately 2.06% of Tenpenny Brook's catchment would be affected by the construction in the onshore project area, which could alter land use, soil properties, surface and subsurface flows and flood risk. Only one trenched crossing is required in the catchment, which means increased flood risk, due to the exceedance or	Negligible	Negligible

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
		failure of pumps used during trenching, is unlikely. Water from trenches and excavations may need to be discharged to nearby watercourses during construction, but any effects would be localised, short-term and temporary. Discharges of trench water are considered unlikely to affect surface water supplies for riparian owners who use surface water for agricultural purposes (e.g. spray irrigation) in the catchment. This catchment includes the onshore substation. Temporary swales are proposed along the perimeter of the construction compound to intercept and attenuate runoff before discharge to a temporary attenuation pond via a filter drain / pipe running along the length of the temporary haul road. Full details of the construction drainage strategy at the onshore substation can be found in the Outline Operational Drainage Strategy (Document Reference: 7.19) (Mott MacDonald, 2023). With mitigation measures embedded into the design of the onshore substation, (Table 21.3), magnitude of impact and significance of effect are negligible.		
Coastal catchment	High	Approximately 1.16% of the coastal catchment would be affected by construction activities in the onshore project area, which could alter land use, soil properties, surface and subsurface flows and flood risk. Only one trenched crossing is required in the catchment, which means increased flood risk, due to the exceedance or failure of pumps used during trenching, is unlikely. Water from trenches and excavations may need to be discharged to nearby watercourses during construction, but any effects would be localised, short-term and temporary. Discharges of trench water are considered unlikely to affect surface water supplies for riparian owners who use surface water for agricultural purposes (e.g. spray irrigation) in the catchment. At a catchment scale, construction activities are considered very unlikely to lead to significant changes in surface water drainage, groundwater flows or flood risk. Embedded mitigation would minimise the impact of any changes to surface and groundwater flows. With mitigation in place (Table 21.3), magnitude of impact will be negligible and significance of effect is minor adverse due to high sensitivity.	Negligible	Minor adverse
Essex Gravels	Medium	A very small proportion of the groundwater body (0.16%) would be directly affected by construction activities in the onshore project area. The groundwater body is discontinuous across the study area – large areas of the onshore project area do not interact with the groundwater body, especially to the south of the Tendring Heath / Tendring Green area. North of this area the majority of onshore project area is underlain by the groundwater body. Although there could be potential impacts on groundwater from dewatering of trenches and excavations, any effects would be localised, short-term and temporary. Trenching would be shallow (<2m) and any dewatering would be unlikely to significantly alter the movement or level of groundwater in the wider groundwater body, or affect gross patterns of groundwater flow which supply small-scale private abstractions. Given the temporary nature of any dewatering and likely slow response time of the groundwater body, impacts on domestic groundwater supplies within 1km of the onshore project area are not anticipated. Across the entire groundwater catchment (1274.6km^2), these activities would not lead to significant changes in groundwater	Negligible	Minor adverse

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
		flows or flood risk. With embedded mitigation in place to limit groundwater impacts (Table 21.3), magnitude of impact is negligible, and significance of effect is minor adverse due to medium sensitivity.		

21.6.2 Likely significant effects during operation

139. During operation, it is expected that there will be no further requirement for land to be disturbed or excavated, except in the event that onshore cables require repair or maintenance or the onshore substation access works needing to be reinstated. However, these activities would not extend beyond the construction footprint assessed above, and for the former would be relatively rare and localised in occurrence. For the latter, the haul road required to access the onshore substation, required in the unlikely event of transformer failure, would potentially be in place for up to seven months, but its location would be over land already disturbed during construction. As such, direct and indirect physical impacts on water resources and flood risk receptors during operation have been scoped out of further assessment, as impacts would have already occurred during the construction phase.

140. Once constructed, there is the potential for effects arising from operation of the Project in the context of water resources and flood risk receptors. Operational affects may occur due to:

- Unplanned maintenance activities at the TJBs, along the onshore cable route and at the onshore substation. The onshore export cables are designed to avoid maintenance throughout their operational life. Unplanned maintenance associated with the onshore cable may involve the repair of onshore cable faults. This is extremely rare (indicatively one to two events per lifetime). Inspection of the onshore export cable can be undertaken at the link boxes and will not require excavation or other disruptive works;
- Operation of the onshore substation (i.e. effects on surface water runoff and foul waters); and
- Reinstatement of the haul road connecting Bentley Road to Ardleigh Road to service Abnormal Indivisible Load (AIL) movements to the onshore substation in the unlikely event of transformer failure during the Project's lifetime. Reinstatement would require construction activity for a further seven months involving Heavy Goods Vehicle (HGV) and plant movements, followed by removal of the haul road in this area. This construction activity would be within the impact envelope assessed during construction.

141. Those impacts that may occur are detailed below.

21.6.2.1 Impact 5: Supply of contaminants to surface and groundwater

142. Access to the onshore export cables would be required to conduct emergency repairs, if necessary, and occasional non-intrusive maintenance visits. In the event of a cable failure the affected section of cable would be pulled out of the duct and replaced. To do this the joint bays, which are below ground at either end of a section of cable, would be excavated to get access to those bays and then backfilled after the works are complete.

143. These activities could lead to an increased supply of fine sediment, fuels, oils and lubricants from the road network and other impermeable surfaces, which could affect water quality and geomorphology of water bodies in the surface water drainage network (including land drainage channels). This in turn could consequently impact upon aquatic ecology, groundwater and the use of water resources for licensed and unlicensed abstractions.

144. Reinstatement and removal of the haul road between Bentley Road and Ardleigh would create ground disturbance, which could lead to a localised increase in sediment supply to watercourses. One temporary watercourse crossing would be required for the haul road at Ardleigh Road, which could disturb sediments and increase sediment supply. Machinery used during construction of the haul road and use of the haul road by AILs could result in accidental spills or leaks of contaminants to watercourses and connected groundwaters.

145. There are no public sewers in the vicinity of the substation site and therefore it is not possible to make a foul connection to a public sewer. A septic tank is therefore proposed for the substation site. The size of the septic tank will be confirmed during the post-DCO design stage. Although increased loadings of nutrients could occur from the sewage treatment, the substation will be staffed intermittently, meaning significant discharges are not expected.

21.6.2.1.1 Magnitude of impact

146. The area of installed infrastructure (above ground or buried) can be used as a proxy to indicate the extent of required maintenance activities in each catchment. The area of permanent infrastructure has been estimated based on the area of the onshore cable trenches (including joint bays and link boxes) the onshore substation and permanent land take required for transition joint bays (Table 21.19). The magnitude of impact in all catchment receptors is anticipated to be negligible due to the very small proportion (0.0016% to 0.32%) of each catchment containing operational above or below ground infrastructure.

147. Reinstatement and removal of the haul road during operation would result in disturbance of approximately 0.013km^2 of Tenpenny Brook's catchment (0.04% of the catchment area) and 0.010km^2 of Holland Brook's catchment (0.03% of the catchment area). These very small areas of disturbance would result in negligible impacts.

Table 21.19 Maximum area of permanent development in each water body catchment

Catchment	Estimated total area permanent development	
	km^2	%
Holland Brook	0.198	0.21
Tenpenny Brook	0.096	0.32
Wrabness Brook	0.007	0.06
Coastal catchment	0.060	0.15
Essex gravels	0.201	0.016

21.6.2.1.2 Sensitivity of receptor

148. As described in Table 21.10, receptor sensitivity is high for Holland Brook, Wrabness Brook and the coastal catchment, and low for Tenpenny Brook.

21.6.2.1.3 Significance of effect

149. Significance of effect for the supply of contaminants to surface and groundwater due to operation and maintenance activities is assessed Table 21.20. Given the very small area of permanent infrastructure that would be installed in each catchment, and the small area affected by reinstatement and removal of the haul road, any operation and maintenance activities are likely to be infrequent

and highly localised in nature. It is unlikely that operational activities will generate large volumes of contaminants that could have a discernible impact on water quality receptors.

150. Significance of effect will be minor adverse in all surface water catchments except for Tenpenny Brook, where it will be negligible. Significance of effect will also be minor adverse in the Essex Gravels groundwater catchment. Minor adverse effects are due to high and medium sensitivity in combination with negligible impacts. These effects are not significant in EIA terms.

Table 21.20 Effects associated with the supply of contaminants to surface and groundwater resulting from operation of the Project

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Holland Brook	High	Holland Brook's catchment contains the largest area of permanent infrastructure associated with the Project (0.198km^2), although this forms a very small proportion of the overall catchment (0.21%). The catchment will be occupied by the landfall transition joints bays and the longest section of onshore export cables. A very small area of Holland Brook's catchment (~100m^2) would be occupied by part of the onshore substation. Drainage for the substation will discharge to a minor watercourse in Tenpenny Brook's catchment. Given the very small footprint of the substation in the catchment, impacts are considered very unlikely. Although some routine maintenance would be required throughout the operational life of the Project, standard industry good practice mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. Standard industry good practice measures would also be used to reduce the risk of accidental spills or leaks and sediment generation that could result from reinstatement and removal of the haul road. The localised, small-scale and infrequent nature of any maintenance activities means that impacts on surface and ground water sources used for agriculture and domestic use are unlikely. Magnitude of impact is negligible and significance off effect is minor adverse due to high sensitivity.	Negligible	Minor adverse
Wrabness Brook	High	Only a very small area of the catchment could contain permanent infrastructure (60m^2; 0.06%). If the final position of the onshore export cables is towards the centre of west / south-west of the onshore cable route, there may not be any permanent infrastructure in this catchment. In a worst case there could be some routine maintenance required throughout the operational life of the Project. Industry good practice mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. The localised, small-scale and infrequent nature of any maintenance activities means that impacts on surface and ground water sources used for agriculture and domestic use are unlikely. Magnitude of impact is negligible and significance off effect is minor adverse due to high sensitivity.	Negligible	Minor adverse
Tenpenny Brook	Low	Although the area of permanent infrastructure in the catchment is very small (0.096km^2; 0.32%), this includes the onshore substation. The substation will have minimal staffing and a septic tank is proposed for foul drainage as there is no mains sewer connection available. The size of the septic tank will be confirmed during the post-DCO design stage. The proposed drainage system and treatment train at the onshore substation is to be designed to comply with the water quality design criteria outlined in the CIRIA SuDS manual. The treatment train proposed	Negligible	Negligible

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
		includes swales / filter drains and an attenuation pond. All transformers at the substation will have a totally sealed bund with a sump which has a water control unit to pump any water out. Rainfall captured within the transformer's bund area will be intercepted by an oil discriminating pump connected to an oil separator tank or passed through a filter unit which will discharge separated water into the site surface water drainage system. Further details of mitigation measures embedded into the design of the onshore substation are provided in Outline Operational Drainage Strategy (Document Reference: 7.19). Although some routine maintenance would be required throughout the operational life of the Project, standard industry good practice mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. Standard industry good practice measures would also be used to reduce the risk of accidental spills or leaks and sediment generation that could result from reinstatement and removal of the haul road. The localised, small-scale and infrequent nature of any maintenance activities means that impacts on surface and ground water sources used for agriculture and domestic use are unlikely. Magnitude of impact and significance are negligible.		
Coastal catchment	High	This catchment will be occupied by the onshore export cables, joint bays and earth boxes. Only a very small area of the catchment will contain permanent infrastructure (0.06km^2; 0.15%). Although some routine maintenance would be required throughout the operational life of the Project, standard industry good practice mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. The localised, small-scale and infrequent nature of any maintenance activities means that impacts on surface and ground water sources used for agriculture and domestic use are unlikely. Magnitude of impact is negligible and significance off effect is minor adverse due to high sensitivity.	Negligible	Minor adverse
Essex gravels	Medium	The groundwater body is extensive, covering 1274.6km^2, and permanent infrastructure would only occupy 0.201km^2 (0.016% of the catchment). The groundwater body is discontinuous across the study area – large areas of the onshore project area do not interact with the groundwater body, especially to the south of the Tendring Heath / Tendring Green area. North of this area the majority of onshore project area is underlain by the groundwater body. Inert solid plastic insulated cables will be used in place of oil insulated cables, removing the potential for fluid leakage into groundwater. The onshore substation will be minimally staffed, and foul waters will be treated using a septic tank. As described for Tenpenny Brook's catchment, the proposed drainage system and treatment train at the onshore substation is to be designed to comply with the water quality design criteria outlined in the CIRIA SuDS manual.	Negligible	Minor adverse

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
		Although some routine maintenance would be required throughout the operational life of the Project, standard industry good practice mitigation measures will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event. Standard industry good practice measures would also be used to reduce the risk of accidental spills or leaks and sediment generation that could result from reinstatement and removal of the haul road. The localised, small-scale and infrequent nature of any maintenance activities means that impacts on surface water and connected groundwater sources used for agriculture and domestic use are unlikely. Magnitude of impact is negligible and significance off effect is minor adverse due to medium sensitivity.		

21.6.2.2 *Impact 6: Changes to surface and groundwater flows and flood risk*

151. Permanent above ground infrastructure, including the onshore substation and any new permanent access tracks (including the increased area of impermeable ground associated with widening works at Bentley Road), would result in permanent changes to land use. Permeable surface treatments will be used where practicable at the onshore substation.

152. The presence of the buried cable ducting along the onshore cable route may affect subsurface flow corridors as it will introduce an impermeable barrier which could alter subsurface flow patterns; forcing water to move upwards towards the surface, or downwards away from the surface. Buried cable ducting may also impact upon the level of recharge and distribution of groundwater within the aquifers underlying the onshore project area.

153. Reinstatement and removal of the of the haul road between Bentley Road and Ardleigh would create ground disturbance, which could alter soil conditions (e.g. infiltration rate) and create preferential flow paths for surface runoff. One temporary watercourse crossing would be required for the haul road at Ardleigh Road, which could locally affect flows.

154. An increase in the impermeable area in a catchment would result in a reduced rate of infiltration and therefore a potential increase in surface runoff to watercourses, including land drainage channels, thereby increasing flood risk. Changes in surface water runoff and subsurface flows could be sufficient to affect the hydrology of the surface water system by increasing surface water volumes and may result in permanent changes to geomorphology by increasing rates of bed and bank erosion, thereby encouraging geomorphological adjustment. Geomorphological changes may also impact upon in-channel habitat conditions for aquatic organisms. Effects on local geomorphology and in-channel habitats could potentially be locally significant if drainage from a large area is discharged at a discrete location within the existing surface drainage network.

155. Furthermore, the ground disturbance during installation of the cable trench is likely to change the transmissivity of the ground which overlays the cable infrastructure after reinstatement and may therefore become a preferential corridor for subsurface water flow.

156. Changes to the proportion of groundwater contained in surface waters could potentially alter water chemistry and impact upon the quality of water-dependent habitats.

21.6.2.2.1 Magnitude of impact

157. The scale of potential impact upon a sub-catchment is proportional to the area of permanent infrastructure in each catchment during operation. This has been estimated based on the area of the onshore cables, onshore substation and permanent access roads within each catchment (Table 21.19). The magnitude of impact in all catchment receptors is anticipated to be negligible due to the very small proportion (less than 1%) of the catchment containing operational above or below ground infrastructure.

158. Reinstatement and removal of the haul road during operation would result in disturbance of approximately 0.013km^2 of Tenpenny Brook's catchment (0.04% of the catchment area) and 0.010km^2 of Holland Brook's catchment (0.03% of

the catchment area). These very small areas of disturbance would result in negligible impacts.

21.6.2.2.2 Sensitivity of receptor

159. As described in Table 21.10, receptor sensitivity is high for Holland Brook and Wrabness Brook and low for Tenpenny Brook and the coastal catchment. Sensitivity is medium for the Essex Gravels groundwater body.

21.6.2.2.3 Significance of effect

160. Significance of effect in each water body catchment is assessed in Table 21.21. Given the very small area of permanent infrastructure that would be installed in each catchment, and the small area affected by reinstatement and removal of the haul road, impacts on surface and groundwater flows and flood risk are considered unlikely. Potential impacts from increased runoff at the onshore substation will be adequately mitigated by measures secured in the Outline Operational Drainage Strategy (Document Reference: 7.19).

161. As a result of the reasons in paragraph 162, the significance of effects will be minor adverse in all surface water catchments except for Tenpenny Brook, where it will be negligible. Significance of effect will also be minor adverse in the Essex Gravels groundwater catchment. Minor adverse effects are due to high and medium sensitivity in combination with negligible impacts. These effects are not significant in EIA terms.

Table 21.21 Effects associated with changes to surface and groundwater flows and flood risk resulting from operation of the Project

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Tenpenny Brook	Low	The onshore substation is located in the catchment of Tenpenny Brook. Full details of the drainage strategy for the onshore substation are provided in the Outline Operational Drainage Strategy (Document Reference: 7.19). Infiltration rates at the site are currently unknown and disposal of flows via infiltration has therefore been assumed inappropriate at this stage. The current strategy is to discharge all surface water runoff from impermeable surfaces across the scheme at restricted rates into an Ordinary Watercourse located to the south of the overall site. Discharge will be at the undeveloped greenfield rate. This strategy is subject to change at detailed design upon completion of the ground investigation soakaway testing. The substation will also have an attenuation pond to accommodate runoff from the site (1608m^3 capacity), and an attenuation swale to accommodate runoff from the permanent access road (484m^3). Given the control measures embedded in the design of the onshore substation, impacts on surface and groundwater flows are not anticipated. Magnitude of impact and significance of effect will be negligible. Reinstatement and removal of the haul road would affect a very small area of the catchment (0.04%) and would only affect flows in a highly localised area. Any effects would be negligible.	Negligible	Negligible
Holland Brook	High	As a result of the very limited spatial extent of permanent development at the landfall and along the cable corridor (0.06 to 0.21% catchment area), impacts on surface and groundwater flows and flood risk are considered unlikely. The small scale of permanent infrastructure in these catchments will not significantly alter the movement or level of surface water or connected groundwaters which supply abstractions. A very small area of Holland Brook's catchment (~100m^2) would be occupied by part of the onshore substation. Drainage for the substation will discharge to a minor watercourse in Tenpenny Brook's catchment. Given the very small footprint of the substation in the catchment, impacts are considered very unlikely Reinstatement and removal of the haul road would affect a very small area of the catchment (0.03%) and would only affect flows in a highly localised area. Any effects would be negligible. Magnitude of impact will be negligible in all catchments. Due to high sensitivity, significance of effect will be minor adverse in these catchments.	Negligible	Minor adverse
Wrabness Brook	High		Negligible	Minor adverse
Coastal catchment	High		Negligible	Minor adverse

Catchment	Sensitivity	Assessment	Magnitude of impact	Significance of effect
Essex Gravels	Medium	In the context of the groundwater catchment (1274.6km^2), the small scale of permanent infrastructure in the catchment (0.016%) and limited scale of reinstatement and removal of the haul road, the movement or level of groundwater or gross patterns of groundwater flow will not be significantly affected. As a result, impacts on flood risk from groundwater or connected surface waters, and impacts on groundwater sources which supply licenced and private abstractions are not anticipated.	Negligible	Minor adverse

21.6.3 Likely significant effects during decommissioning

162. No decision has yet been made regarding the final decommissioning policies for the Project as it is recognised that industry good practice, rules and legislation change over time. The detail and scope of decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator with a decommissioning plan provided.

163. However, it is considered likely that the proposed onshore substation would be removed, and materials will be reused or recycled and that the onshore cables would also be removed and recycled, with the transition bays and cable ducts (where used) left in situ. For the purposes of a worst case scenario, it is considered that impacts associated with the decommissioning phase would be no greater than those identified for the construction phase (Section 21.6.1) with similar mitigation in place.

21.7 Cumulative effects

21.7.1 Identification of potential cumulative effects

164. The first step in the CEA process is the identification of which residual effects assessed for North Falls on their own have the potential for a cumulative effect with other plans, projects and activities. This information is set out in Table 21.22. Only significant effects assessed in Section 21.6 as negligible adverse or above are included in the CEA (i.e., those assessed as 'no impact' are not taken forward as there is no potential for them to contribute to a cumulative impact).

Table 21.22 Potential cumulative effects

Impact	Potential for cumulative effect	Rationale
Construction		
Direct disturbance of surface water bodies	Yes	Impacts to surface water bodies could act cumulatively with other projects if these cause direct disturbance to the same water bodies, particularly if there is a temporal or spatial overlap.
Increased sediment supply	Yes	Other projects being constructed within the same catchments as the onshore project area may also cause an increase in sediment supply to the surface water drainage system, which could act cumulatively.
Supply of contaminants to surface and groundwaters	Yes	Other projects being constructed within the same catchments as the onshore project area may act cumulatively to reduce surface and groundwater quality if they cause a supply of contaminants to be released into the surface water drainage system.
Changes to surface and groundwater flows and flood risk	Yes	Other projects being constructed within the same catchments as the onshore project area could also cause changes in surface flow patterns, compaction and

Impact	Potential for cumulative effect	Rationale
		an increase in impermeable area. This could act cumulatively to cause further changes to surface water runoff and flood risk.
Operation		
Supply of contaminants to surface and groundwaters	Yes	All new developments are likely to have operational or maintenance requirements which may require regular access by machinery. This will increase the likelihood of contaminants and fine sediment being released and acting cumulatively. However, operational activities associated with the Project will be largely confined to the onshore substation site (as routine cable maintenance will be non-intrusive) and as such could only result in cumulative impacts in the catchments which contain the onshore substation (Holland Brook and Tenpenny Brook).
Changes to surface and groundwater flows and flood risk	Yes	As a result of the limited spatial extent of permanent impermeable ground in the onshore project area, the effect is considered to be limited and highly localised and therefore unlikely to act cumulatively with other projects. However, the greater area of impermeable ground at the substation could result in cumulative impacts with other projects in the same catchments (Holland Brook, Tenpenny Brook).
Decommissioning		
Decommissioning strategies have not yet been finalised; however, the cumulative impacts are expected to be the same as those of the initial construction phase.		

21.7.2 North Falls, Five Estuaries and other projects

165. The second step in the cumulative assessment is the identification of the other plans, projects and activities that may result in cumulative effects for inclusion in the CEA (described as 'project screening'). This information is set out in Table 21.23 below, together with a consideration of the relevant details of each, including current status (e.g. under construction), planned construction period, closest distance to North Falls, status of available data and rationale for including or excluding from the assessment.

166. The Project screening has been informed by the development of a CEA project list which forms an exhaustive list of plans, projects and activities within the study area relevant to North Falls. The list has been appraised, based on the confidence in being able to undertake an assessment from the information and data available, enabling individual plans, projects and activities to be screened in or out.

Table 21.23 Summary of projects considered for the CEA in relation to water resources and flood risk (project screening)

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
National Infrastructure Planning						
Five Estuaries Offshore Wind Farm EN010115	Pre-application	2028 - 2030	Five Estuaries project area directly overlaps with North Falls onshore project area.	High	Yes	The onshore project area for Five Estuaries covers largely the same area as North Falls. There is also a possibility that both projects could be constructed at around the same time, therefore, cumulative effects may occur.
Norwich to Tilbury EN020027	Pre-application	2027 - 2031	Scoping area directly overlaps with North Falls onshore project area.	Low	Yes	The proposed substation area for Norwich to Tilbury is in close proximity to the North Falls proposed substation zone. Therefore, cumulative impacts could occur.
East Anglia TWO Offshore Windfarm EN010078	Approved (DCO Issued 2022)	Mid 2020s	47	High	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (47km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Bradwell B new nuclear power station EN010111	Pre-application	Predicted 9 – 12 years	21	High	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (21km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Ipswich Rail Chord TR040002	Approved (DCO	Built	17	High	No	Ipswich Rail Chord has already concluded construction and will therefore not contribute to cumulative effects during North Falls construction or decommissioning periods. The development is not in

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
	issued 2012)					a catchment crossed by the onshore project area, so there is no mechanism for operational cumulative effects.
Sizewell C Project EN010012	Approved (DCO issued 2022)	2022 – 2034	49	High	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (49km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Nautilus Interconnector EN020023	Pre-application	Information unavailable	44	Medium	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (44km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Lake Lothing Third Crossing TR010023	Approved (DCO issued 2020)	Over 2 years	76	High	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (76km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Richborough Connection Project EN020017	Approved (DCO issued 2017)	Built	55	High	No	This project has already been built and is therefore now part of the existing baseline.
Manston Airport TR02002	Information unavailable	Information unavailable	53	N/A	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (53km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Kentish Flats Extension EN010036	Approved (DCO issued 2013)	Built	46	High	No	This project has already been built and is therefore now part of the existing baseline.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
Sea Link EN020026	Pre-application	Information unavailable	20	N/A	No	The onshore infrastructure for this project is not in close proximity to the onshore project area. (44km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.,
Galloper Offshore Windfarm EN010003	Approved	Built	15	High	No	This project has already been built and any onshore infrastructure is now part of the baseline.
A12 Chelmsford to A120 widening scheme TR010060	Pre-examination	Information unavailable	27	Medium	No	The onshore infrastructure for this project is not in close proximity to the onshore project area. (27km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.,
Rivenhall IWMF and Energy Centre EN010138	Pre-application	Information unavailable	27	Medium	No	The onshore infrastructure for this project is not in close proximity to the onshore project area (27km away) and is located in different surface water catchment. Cumulative effects on water resources and flood risk are unlikely.
Essex County Council						
Elmstead Hall, Elmstead, Colchester, Essex ESS/24/15/TEN	Approved	Information unavailable.	5	N/A	No	Construction of an irrigation reservoir. Only a small area (0.03km^2) of this development is located in the catchment of Tenpenny Brook (5km away from NFOW). The Project has been under construction for a number of years and planning decision includes conditions of groundwater monitoring, drainage and contamination. A Construction Environmental Management Plan is in place for this project. Given the distance from NFOW and small scale of work, cumulative effects on water resources and flood risk are not anticipated

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
St. George's Infant School and Nursery, Barrington Road, Colchester, Essex, CO2 7RW CC/COL/71/22	Approved	Information unavailable	9	N/A	No	The project is located 9km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Wilson Marriage Centre, Barrack Street, Colchester, Essex, CO1 2LR CC/COL/85/22	Approved	Information unavailable	9	N/A	No	The project is located 9km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Wivenhoe Quarry Alresford Road, Wivenhoe, Essex, CO7 9JU ESS/80/20/TEN /42/2	Report being prepared	Information unavailable	7	N/A	No	The project is located 7km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Elmstead Hall, Elmstead, Colchester,	Approved	Information unavailable.	5	N/A	No	See previous comment on construction of the irrigation reservoir at Elmstead Hall.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
Essex, CO7 7AT ESS/24/15/TEN/55/1/NMA						
Elmstead Hall, Elmstead, Colchester, Essex, CO7 7AT https://planning.essex.gov.uk/Planning/Display/ESS/24/15/TEN ESS/24/15/TEN/2/1/NMA	Approved	Information unavailable.	5	N/A	No	
Old Heath County Primary School, Old Heath Road, Colchester, Essex, CO2 8DD CC/COL/50/22	Approved	Information unavailable.	8	N/A	No	The project is located 8km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Crown Quarry (Wick Farm), Old Ipswich Road, Ardleigh, CO7 7QR	Approved	Information unavailable.	6	N/A	No	The project is located 6km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
ESS/57/04/TEN LA4						
Wivenhoe Quarry, Alresford Road Wivenhoe, Essex CO7 9JU ESS/80/20/TEN /42/2	Approved	Information unavailable.	7	N/A	No	The project is located 7km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Martell's Quarry, Slough Lane, Ardleigh, Essex, CO7 7RU ESS/42/22/TEN	Out for consultation	Information unavailable	3	N/A	No	The project is located 3km away from NFOW and only 0.01km^2 of the development is in Tenpenny Brook's catchment. Cumulative effects are considered unlikely.
Land at: Elmstead Hall, Elmstead, Colchester, Essex ESS/105/21/TEN	Approved	Information unavailable.	5	N/A	No	See previous comment on construction of the irrigation reservoir at Elmstead Hall.
Land at Martells Quarry, Slough Lane, Ardleigh, Essex, CO7 7RU	Approved	Information unavailable.	3	N/A	No	The project is located 3km away from NFOW and only 0.01km^2 of the development is in Tenpenny Brook's catchment. Cumulative effects are considered unlikely due to the very small scale of work in the catchment.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
ESS/39/22/TEN						
Land to the south of Colchester Main Road, Alresford, Colchester, CO7 8DB ESS/17/18/TEN ?NMA2	Report being prepared	Information unavailable	6	N/A	No	The project is located 6km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Land at: Martells Quarry, Slough Lane, Ardleigh, Essex, CO7 7RU ESS/39/22/TEN /NMA/1	Approved	Information unavailable	3	N/A	No	The project is located 3km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Tendring Education Centre, Jaywick Lane, Clacton on Sea, Essex, CO16 8BE CC/TEN/40/21/ 3/1	Approved	Information unavailable.	6	N/A	No	The project is located 6km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
Tendring Education Centre, Jaywick Lane, Clacton on Sea, Essex, CO16 8BE CC/TEN/40/21/4/1	Approved	Information unavailable.	6	N/A	No	The project is located 6km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Land At Martells's Quarry, Slough Lane, Ardleigh, Essex CO7 7RU ESS/39/22/TEN	Approved	Information unavailable.	3	N/A	No	The project is located 3km away from NFOW and only 0.01km^2 of the development is in Tenpenny Brook's catchment. Cumulative effects are considered unlikely due to the very small scale of work in the catchment.
Land At Martells's Quarry, Slough Lane, Ardleigh, Essex CO7 7RU ESS/39/22/TEN/NMA/1	Approved	Information unavailable.	3	N/A	No	The project is located 3km away from NFOW and only 0.01km^2 of the development is in Tenpenny Brook's catchment. Cumulative effects are considered unlikely due to the very small scale of work in the catchment.
Crown Quarry (Ardleigh Reservoir Extension),	Approved	Information unavailable.	3	N/A	No	The project is located 3km away from NFOW and not in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
Wick Farm, Old Ipswich Road, Tendring, Colchester, CO7 7QR ESS/57/04/TEN LA4						
Elmstead Hall, Elmstead, Colchester, Essex ESS/24/15/TEN	Approved	Information unavailable.	6	N/A	No	See previous comment on construction of the irrigation reservoir at Elmstead Hall.
Ardleigh Waste Transfer Station, A120, Ardleigh, Colchester, CO7 7SL ESS/04/17/TEN	Approved	Information unavailable.	5	N/A	No	The project is located 5km away from NFOW and only 0.01km^2 of the development is located in the catchment of Tenpenny Brook. Cumulative effects on water resources and flood risk are not expected due to the very small scale of work in the catchment.
35 Roach Vale, Colchester, CO4 3YN CC/COL/07/22	Approved	Information unavailable.	4	N/A	No	The project is located 4km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Boxted Bridge, Boxted, Essex, CO4 5TB CC/COL/106/21	Report being prepared	Information unavailable	9	N/A	No	The project is located 9km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
Elmstead Hall, Elmstead, Colchester, Essex ESS/24/15/TEN	Approved	Information unavailable.	6	N/A	No	See previous comment on construction of the irrigation reservoir at Elmstead Hall.
Lufkins Farm, Great Bentley Road, Frating CO7 7HN ESS/99/21/TEN/SO	EIA not required	Information unavailable.	6	N/A	No	The project is located 6km away from NFOW and in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Lufkins Farm, Great Bentley Road, Frating CO7 7HN ESS/99/21/TEN	Resolution made / awaiting legal agreement	Information unavailable.	6	N/A	No	The project is 6km away from NFOW and located in a catchment that will not be crossed by NFOW. No mechanism for cumulative effects on water resources and flood risk.
Elmstead Hall, Elmstead, Colchester ESS/24/15/TEN	Approved	Information unavailable.	5	N/A	No	See previous comment on construction of the irrigation reservoir at Elmstead Hall.
Elmstead Hall, Elmstead, Colchester, CO7 7EX ESS/24/15/TEN	Approved	Information unavailable.	5	N/A	No	

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
Tendring District Council						
Land Between the A120 and A133, To The East of Colchester and of Elmstead Market 21/01502/CMTR	Awaiting decision	Information unavailable.	3	N/A	No	The majority of this road improvement scheme is in a catchment that will not be crossed by NFOW. Only a very small section crosses into the catchment of Tenpenny Brook. Given the distance from NFOW and small scale of work in the catchment, cumulative effects on water resources and flood risk are not expected.
Hamilton Lodge Parsons Hill Great Bromley Colchester Essex CO7 7JB 20/00547/OUT	Approval-outline	Information unavailable.	2	N/A	No	A development of 67 dwellings in the catchment of Tenpenny Brook. The development is 2km away from NFOW and the planning decision letter states that no works except demolition shall takes place until a detailed surface water drainage scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro geological context of the development, has been submitted to and approved in writing by the local planning authority. Therefore cumulative effects on water resources and flood risk are not expected.
Land adjacent to Lawford Grid Substation Ardleigh Road Little Bromley Essex CO11 2QB 21/02070/FUL	Approved	Information unavailable.	0.3	N/A	No	Construction and operation of a 50MW Battery Energy Storage System in the catchment of Tenpenny Brook. Sustainable drainage measures including a swale and attenuation basin are proposed to ensure no increased risk of flooding and appropriate pollution control measures are incorporated into the drainage scheme. The LLFA has not raised any objections subject to a detailed surface water drainage scheme being secured through a planning condition. The development is small (1.15ha) and with drainage mitigation in place

Project	Status	Construction period	Closest distance from the onshore project area (km)	Confidence in data	Included in the CEA (Y/N)	Rationale
						cumulative effects on water resources and flood risk are not expected.

21.7.3 Assessment of cumulative effects

167. Five Estuaries is also in its application phase, having submitted a DCO to the Planning Inspectorate for the project on 22 April 2024. Although subject to a separate DCO, Five Estuaries shares the same landfall location and onshore cable route (including Bentley Road widening works) as North Falls, with the two projects also having co-located onshore substations within the same onshore substation works area. The two projects also have the same national grid connection point.

168. Five Estuaries Offshore Wind Farm Limited (VEOWL) and NFOW have sought to collaborate and coordinate where practicable, which has led to collaborative design of the projects' onshore infrastructure, and also to sharing of detailed project design information onshore. As a result, a detailed CEA for effects arising from the development of the Five Estuaries can be undertaken. The CEA section of this chapter is therefore split into two sections:

- The first describing a detailed CEA covering effects predicted to arise from development of Five Estuaries and North Falls;
- The second, detailing effects predicted to arise from the development of Five Estuaries, North Falls and other projects.

169. The latter section will be based on the project information available for each scheme in the public domain, and by definition is therefore less detailed than the Five Estuaries and North Falls CEA section.

170. Full details on the approach to CEA used within this chapter are set out in ES Chapter 6 EIA Methodology (Document Reference: 3.1.8).

21.7.3.1 Five Estuaries Offshore Wind Farm

21.7.3.1.1 Realistic worst case scenario

171. Using the design information provided by Five Estuaries and checked / updated against the submission of the Five Estuaries ES, a realistic worst case cumulative scenario has been developed for the purpose of this chapter.

172. This considers three potential cumulative build-out scenarios as outlined in ES Chapter 5 Project Description (Document Reference: 3.1.7):

- **Scenario 1:** North Falls 'Option 2' build out is progressed, and Five Estuaries Offshore Wind Limited (VEOWL) undertakes landfall, onshore substation construction and cable pull which overlaps with North Falls equivalent works. In this scenario, onshore cable route associated works, including temporary construction compounds, accesses and haul road, all remain in place and are used by the second project during its construction;
- **Scenario 2:** North Falls 'Option 1 build out is progressed, and VEOWL undertakes landfall, onshore substation and onshore cable route construction and cable pull, all of which does not overlap with North Falls' equivalent works. There would be a gap of between 1 and 3 years between each Projects' construction. In this scenario, onshore cable route associated works, including temporary construction compounds, accesses and haul road, all remain in place and are used by the second project during its construction; or

- **Scenario 3:** North Falls ‘Option 1’ build out is progressed, and VEOWL undertakes a separate landfall, onshore substation and onshore cable route construction and cable pull with a multi-year (i.e. >3 year) gap between the two construction activities. In this scenario, there is no reuse in onshore temporary works between the two projects, and all onshore cable route associated works are rebuilt and reinstated in full by the second project.

173. Full details on the build out scenarios considered within this assessment are detailed in ES Chapter 5 Project Description (Document Reference: 3.1.7) and ES Chapter 6 EIA Methodology (Document Reference: 3.1.8).

174. For water resources and flood risk, Scenario 3 is considered the worst case cumulative scenario, as it involves no reuse of temporary works and involves the maximum potential duration that land is taken out of use for temporary works. The realistic worst case scenario parameters for likely cumulative effects scoped into the EIA for the land use and agriculture assessment under Scenario 3 are summarised in Table 21.24. These are based on project parameters for North Falls and Five Estuaries.

Table 21.24 Realistic worst case scenario of cumulative effects arising from development of North Falls and Five Estuaries Offshore Wind Farm – (Scenario 3 North Falls 'Option 1' build out is progressed).

Potential impact	Parameter	Notes
Construction		
Impacts relating to the landfall	Landfall HDD (temporary works) physical parameters: • Maximum No. of TJB = 4; • Individual TJB dimensions / permanent landtake = 4 x 15m; • Maximum indicative HDD spacing onshore = 40m; • Maximum HDD depth = 20m; • Maximum indicative length of HDD = 1.1km; • HDD temporary works area = 150 x 300m; and • Drill exit location = the landfall HDD exit being in the subtidal zone c. 1.5km from MLWS.	Duration includes compound establishment, HDD, transition bays, and reinstatement.
	Duration: • 13 months (of which HDD = 6 months) + 13 months (of which HDD = 6 months); and • HDD to include 24 hour / 7 days working where required.	
Impacts relating to the onshore cable route	Cable route construction physical parameters: • Route length = up to 24km; • Jointing bays = Up to 192 (approximately every 500m) buried below ground;	Overall duration includes establishing / reinstating temporary construction compounds (TCCs) and haul roads, cable installation (trench excavation, duct installation, cable jointing), HDD (includes compound establishment, HDD, and reinstatement).

Potential impact	Parameter	Notes
	• Joint bay dimensions = 4 x 15m; • Maximum cable burial depth = 2m; • Minimum cable burial depth (to top of protection tile) = 0.9m; • Minimum target cable burial depth = 1.2m; • Indicative cable route width = 80m (open cut trenching), 90m (trenchless crossings), 65m + 130m (complex trenchless crossings); • Cable construction compound dimensions = 150 x 150m (main) to 100 x 100m (satellite); • No. of trenches = 4; • Cable trench dimensions = 3.75 – 1.2 x 2m (tapered top to bottom); • Haul road width = 6m wide road, 10m wide total including verges, drainage and passing places; and • Haul road spacing at passing places = 500m.	
	Trenchless crossings physical parameters: • Maximum width of buried cable = 130m; • Maximum trenchless crossing depth = 20m; and • HDD compound dimensions = 75 x 150m.	

Potential impact	Parameter	Notes
	Durations: • Bentley Road widening = 6 - 9 months; • Cable route works = 18 – 27 months (per project, i.e. up to 57 months); • Cable installation = 12 months (per project, i.e. up to 24 months); • Major HDD (each location) = 8 months (of which HDD = 4 months) (per project); • Minor HDD crossings = 2 months (per project); and • Major HDD crossings to include 24 hour / 7 days working where required.	
Impacts relating to the onshore substation and unlicensed works	Onshore substation (temporary works) physical parameters: • Indicative area of the substations = 280 x 210m (project 1) + 280 x 210m (project 2); and • Construction compound footprint = 250 x 150m (project 1) + 250 x 150m (project 2). National grid connection works physical parameters (for two projects): • All enabling worth / platform constructed by national grid; • Cable installation works as described above; and • Equipment may include: ○ cable sealing ends, surge arrestors, earth switch, disconnectors, circuit	

Potential impact	Parameter	Notes
	breakers, current transformers, voltage transformers, busbars.	
	Durations: • Onshore substation construction duration = 21 - 27 months (per project, i.e. up to 57 months).	
Operation		
Impacts relating to the onshore cable route	Cable corridors operational physical parameters: • No. of link boxes = up to 196; • Link box footprint (per box) = 0.6 x 1 x 1.5m; and • Cross-sectional area of buried cement-bound sand = $0.6m^2$.	
Decommissioning		
No final decision has yet been made regarding the final decommissioning policy for the onshore project infrastructure including landfall, onshore cable route and onshore substation. It is also recognised that legislation and industry good practice change over time. However, it is likely that the onshore project equipment, including the cable, will be removed, reused, or recycled where practicable and the transition bays and cable ducts being left in place. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator. It is anticipated that for the purposes of a worst case scenario, the impacts will be no greater than those identified for the construction phase.		

21.7.3.1.2 During construction

Impact 1: Direct disturbance of surface water bodies

175. If North Falls and Five Estuaries are built independently, the same watercourses would need to be trenched in each catchment for each project. These crossings are located in the coastal catchment (WX-15) and as a worst case all options have been retained for WX-24 and WX-26 in Tenpenny Brook's catchment (trenching is assumed). As there would be the same number of trenched crossings for both projects, cumulative effects during construction are not predicted over and above the effects of North Falls (negligible to minor adverse). Although there would be localised disturbance of the bed and banks at each trenched crossing and temporary haul road crossing, both projects will adopt mitigation measures to reduce any effects.

176. With mitigation measures in place, direct and indirect physical cumulative effects during construction are anticipated to not be significant in EIA terms.

Impact 2: Increased sediment supply

177. The worst case assessment for North Falls is based on the area of the onshore project area in each water body catchment (which is shared with Five Estuaries). In the catchment of Tenpenny Brook, the worst case scenario for North Falls is based on the potential for temporary works to take place across the whole of the onshore substation works area, which includes the area of construction associated with Five Estuaries. This means the magnitude of impact and significance of effect for scenario 3 (independent build) would be the same as for North Falls (negligible and minor adverse).

178. Both projects will adopt mitigation measures to reduce any effects from disturbed ground, which could increase sediment supply to watercourses. This means that significant direct or indirect cumulative effects during construction are not predicted over and above the effects of North Falls.

179. With mitigation measures in place, direct and indirect physical cumulative effects during construction are anticipated to not be significant in EIA terms.

Impact 3: Supply of contaminants to surface and groundwaters

180. As described for Impact 2, the worst case assessment for North Falls is based on the area of the onshore project area in each water body catchment (which is shared with Five Estuaries). Magnitude of impact for scenario 3 (independent build) would be the same as for North Falls (negligible and minor adverse).

181. Both projects will adopt mitigation measures to reduce any effects from disturbed ground, which could increase sediment supply to watercourses. This means that significant direct or indirect cumulative effects during construction are not predicted over and above the effects of North Falls.

182. With these mitigation measures in place, direct and indirect physical cumulative effects during construction are anticipated to not be significant in EIA terms.

Impact 4: Changes to surface water and groundwater flows and flood risk

183. As described for Impact 2, the worst case assessment for North Falls is based on the area of the onshore project area in each water body catchment (which is

shared with Five Estuaries). Magnitude of impact for scenario 3 (independent build) would be the same as for North Falls (negligible and minor adverse).

184. Both projects will adopt mitigation measures to reduce any effects from disturbed ground, which could increase sediment supply to watercourses. This means that significant direct or indirect cumulative effects during construction are not predicted over and above the effects of North Falls.

185. With these mitigation measures in place, direct and indirect physical cumulative effects during construction are anticipated to not be significant in EIA terms.

21.7.3.1.3 During operation

Impact 5: Supply of contaminants to surface and groundwater

186. The assessment for North Falls is based on the area of installed infrastructure (above ground or buried), which can be used as a proxy to indicate the extent of required maintenance activities in each catchment. Unplanned maintenance (repair) work would be highly localised and infrequent, and reinstatement and removal of the haul road would only affect very small areas of the catchments of Tenpenny Brook and Holland Brook. Industry good practice mitigation would minimise the risk of an accidental spill or leak and limit the potential for sediment generation.

187. Extra foul waters from the additional substation will be treated in the same septic tank as described for North Falls. As the substations will be minimally staffed this is unlikely to cause impacts on in the wider catchment. The size of the septic tank will be confirmed during the post-DCO design stage.

188. As described for North Falls the proposed drainage system for the co-located substations is based on a treatment train to be designed to comply with the water quality design criteria outlined in the CIRIA SuDS manual. The treatment train proposed includes swales / filter drains and an attenuation pond. All transformers at the substation will have a totally sealed bund with a sump which has a water control unit to pump any water out.

189. In addition, rainfall captured within the transformer’s bund area will be intercepted by an oil discriminating pump connected to an oil separator tank or passed through filter unit which will discharge separated water into the site surface water drainage system.

190. Due to the treatment of foul waters and operational mitigation measures described in the Outline Operational Drainage Strategy (Document Reference: 7.19), additional impacts are not expected.

Impact 6: Changes to surface and groundwater flows and flood risk

191. The additional substation that would be constructed in the catchment of Tenpenny Brook would add an extra 0.06km2. This would increase the area of permanent infrastructure in the catchment from 0.32% to 0.51%. Mitigation for extra runoff from the additional substation is described in the Outline Operational Drainage Strategy (Document Reference: 7.19). An additional permanent attenuation pond would be constructed for Project 2. As described for North Falls, runoff from the attenuation ponds would outfall to the Ordinary Watercourse to the south of the substation. A shared attenuation swale is also proposed to accommodate runoff from the permanent access.

192. Due to the mitigation measures described in the Outline Operational Drainage Strategy (Document Reference: 7.19), additional impacts on surface and groundwater flows at the substation are not expected.

193. In addition, unplanned maintenance (repair) work would be highly localised and infrequent, and reinstatement and removal of the haul road would only affect very small areas of the catchments of Tenpenny Brook and Holland Brook. Additional impacts on surface and groundwater flows are not expected.

21.7.3.1.4 During decommissioning

194. No final decision has yet been made regarding the final decommissioning policy for the onshore project infrastructure including landfall, onshore cable route and onshore substation. It is also recognised that legislation and industry good practice change over time. However, it is likely that the onshore project equipment, including the cable, will be removed, reused, or recycled where practicable and the transition bays and cable ducts being left in place. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator. It is anticipated that for the purposes of a worst case scenario, the impacts will be no greater than those identified for the construction phase.

21.7.3.1.5 Summary

195. Table 21.25 below provides a summary of the potential significant cumulative effects identified during the water resource and flood risk CEA in relation to Five Estuaries Offshore Wind Farm.

Table 21.25 Summary of cumulative effects in relation to Five Estuaries Offshore Wind Farm

Potential impact	Cumulative effect	Additional mitigation
Construction		
Direct disturbance of surface water bodies	No effect to Minor adverse (No change from North Falls alone assessment).	N/A
Increased sediment supply	Negligible to minor adverse (No change from North Falls alone assessment).	N/A
Supply of contaminants to surface and groundwater	Negligible to minor adverse (No change from North Falls alone assessment).	N/A
Changes to surface water and groundwater flows and flood risk	Negligible to minor adverse (No change from North Falls alone assessment).	N/A
Operation		
Supply of contaminants to surface and groundwater	As per section 21.6.2.1	N/A

Potential impact	Cumulative effect	Additional mitigation
Changes to surface and groundwater flows and flood risk	As per section 21.6.2.1	N/A

21.7.3.2 Other projects

196. Based on the project screening in Table 21.23, in addition to Five Estuaries, one of the other listed projects will be included in the CEA for further assessment: Norwich to Tilbury. This section provides the conclusions of the CEA for North Falls, Five Estuaries and Norwich to Tilbury.

21.7.3.2.1 During construction

197. Cumulative effects from Five Estuaries and other projects during construction are shown in Table 21.26.

Table 21.26 Cumulative effects from Five Estuaries and other projects during construction

Project	Impact 1: Direct disturbance of surface water bodies	Impact 2: Increased sediment supply	Impact 3: Supply of contaminants to surface and groundwater	Impact 4: Changes to surface water and groundwater flows and flood risk
Five Estuaries	There would be the same number of trenched crossings for both projects. Cumulative effects during construction are not predicted over and above the effects of North Falls (negligible to minor adverse). Although there would be localised disturbance of the bed and banks at each trenched crossing and temporary haul road crossing, both projects will adopt mitigation measures to reduce any effects. Cumulative effects are not expected	Although the extent of potentially disturbed ground would not exceed that of North Falls, ground could be disturbed over a longer duration. However, mitigation measures to manage soil and limit erosion would be in place which means that cumulative effects greater than assessed for North Falls are not expected.	Although the extent of potentially disturbed ground where construction machinery could be used and potential contaminants stored would not exceed North Falls, ground could be disturbed, and contaminants supplied over a longer duration. However, mitigation measures to prevent accidental spills and leaks of fuels, oils and lubricants and ensure their safe storage would be in place. This means that cumulative effects greater than assessed for North Falls are not expected.	Although the extent of potentially disturbed ground where land use and soil conditions could be altered and affect surface and groundwater flows would not exceed North Falls, land use and soil properties could be altered over a longer duration. However, mitigation measures to manage surface runoff at the onshore substation would be in place. This means that cumulative effects greater than assessed for North Falls are not expected.
Norwich to Tilbury	A new onshore substation is proposed to be built as part of Norwich to Tilbury, close to the North Falls onshore substation area. Only one trenched crossing is required in Tenpenny Brook for North Falls. New crossings of watercourses would be required for temporary access for Norwich to Tilbury (National Grid, 2024). All watercourse crossing designs for Norwich to Tilbury would follow the standard practice measures set out in Appendix 4.1: Draft Outline CoCP in Volume 3.3	The new Norwich to Tilbury substation will be located in Tenpenny Brook's catchment. The area of disturbed ground associated with construction of the national grid substation would increase by 0.41km^2. This means that 3.42% of the catchment could be disturbed, as opposed to 2.06% for North Falls. Based on the thresholds in Table 21.13, magnitude of impact and significance of	There is a risk of pollution from construction traffic using these temporary access routes, and from construction at the substation (National Grid, 2024). Standard practice measures within the Norwich to Tilbury Draft Outline CoCP would reduce potential negative effects of the temporary watercourse crossings such that effects on watercourses are anticipated to be not significant (National Grid, 2024).	The national grid substation and access route to the substation are in Flood Zone 1. The Norwich to Tilbury FRA will outline the proposed mitigation measures / commitments to ensure no detrimental effects on flood risk from rivers and the sea or the functioning of flood defences. Implementation of these would reduce potential negative effects on the flood storage and floodplain flow attributes of watercourses in the study area. Considering the nature and footprint of the Project

Project	Impact 1: Direct disturbance of surface water bodies	Impact 2: Increased sediment supply	Impact 3: Supply of contaminants to surface and groundwater	Impact 4: Changes to surface water and groundwater flows and flood risk
	of the Norwich to Tilbury PEI report (National Grid, 2024). Standard practice measures within the Norwich to Tilbury Draft Outline CoCP would reduce potential negative effects of the temporary watercourse crossings such that effects on watercourses are anticipated to be not significant (National Grid, 2024). Cumulative effects are not anticipated to be significant in EIA terms.	effect would remain negligible and minor adverse. Although construction of Norwich to Tilbury could cause localised soil disturbance associated with temporary access and at the onshore substation, the protocols described in Appendix 4.1: Draft Outline CoCP in Volume 3.3 of the Norwich to Tilbury PEI report would manage worksite runoff and reduce the potential for pollution via this pathway (National Grid, 2024). Material storage areas would be located outside of the fluvial floodplain where practicable. The standard practice measures within Appendix 4.1: Draft Outline CoCP in Volume 3.3 would reduce negative effects associated with pollution risks such that no significant effects are anticipated (National Grid, 2024). Cumulative effects are not anticipated to be significant in EIA terms.	Cumulative effects are not anticipated to be significant in EIA terms.	and using professional judgement, the effect is anticipated to be not significant (National Grid, 2024. Cumulative effects are not anticipated to be significant in EIA terms.

21.7.3.2.2 During operation

198. Overall cumulative effects predicted to arise from the development of North Falls, Five Estuaries and other projects during operation are shown in Table 21.27.

Table 21.27 Cumulative effects from Five Estuaries and other projects during operation.

Project	Impact 5: Supply of contaminants to surface and groundwater	Impact 6; Changes to surface and groundwater flows and flood risk
Five Estuaries	Due to the treatment of foul waters and operational mitigation measures described in the Outline Operational Drainage Strategy (Document Reference: 7.19), cumulative impacts are not expected.	Due to the mitigation measures described in the Outline Operational Drainage Strategy (Document Reference: 7.19), cumulative impacts on surface and groundwater flows at the substation are not expected.
Norwich to Tilbury	Surface water runoff from substation and any permanent access roads would be drained using appropriate SuDS techniques to meet with LLFA discharge requirements. (National Grid, 2024). Once the overhead line construction is complete and underground cables have been installed, land and any associated land drainage would be reinstated, and all temporary watercourse crossings would be removed (National Grid, 2024). The national grid substation would be unmanned during operation. Routine site visits would be required to visually inspect condition of equipment, structures and buildings for signs of damage or wear. The routine maintenance would be carried out in line with maintenance policies and procedures. The change to the land drainage regime and impacts on foul water are assessed to be neutral and effects would be not significant (National Grid, 2024). Cumulative effects are not anticipated to be significant in EIA terms.	Surface water runoff from the Norwich to Tilbury substation and any permanent access roads would be drained using appropriate SuDS techniques to meet with LLFA discharge requirements National Grid, 2024). The Norwich to Tilbury FRA will outline the proposed mitigation measures / commitments to ensure the Project is safe from flooding over its lifetime and that there are no detrimental effects on flood risk from rivers and the sea because of these interactions. Significant effects on baseline groundwater flood risk are anticipated to be neutral and not significant (National Grid, 2024). The change to the land drainage regime is assessed to be neutral and effects would be not significant (National Grid, 2024). Cumulative effects are not anticipated to be significant in EIA terms.

21.7.3.2.3 During decommissioning

199. Decommissioning strategies have not yet been finalised for North Falls, Five Estuaries or Norwich to Tilbury; however, the cumulative effects are not expected to be significant in EIA terms given the initial construction phase effects were assessed as minor adverse to negligible.

21.8 Transboundary effects

200. There are no transboundary effects with regards to water resources and flood risk as the onshore project area would not be sited in proximity to any international boundaries. Transboundary effects are therefore scoped out of this assessment and are not considered further.

21.9 Interactions

201. Water receptors (including surface waters and groundwater) are intrinsically linked to:

- Ground conditions, which influence the quality of groundwater, how it moves through subsurface strata, and how it interacts with surface waters; and
- Ecology, which is to some extent controlled by the availability of habitat niches, and therefore the hydrology, geomorphology and chemical quality of surface waters and the distribution and quality of groundwater.

202. A summary of the potential inter-relationships between water resources, ground conditions and terrestrial ecology is provided in Table 21.28.

Table 21.28 Water resources and flood risk interactions

Topic and description	Related ES chapter (Volume 3.1)	Where addressed in this ES chapter	Rationale
Construction			
Impact 1: Direct disturbance of surface water bodies Impact 2: Increased sediment supply Impact 3: Supply of contaminants to surface and groundwaters Impact 4: Changes to surface and groundwater flows and flood risk	ES Chapter 19 Ground Conditions and Contamination (Document Reference: 3.1.21)	Section 21.6.1.1 Section 21.6.1.2 Section 21.6.1.3 Section 21.6.1.4	Potential changes to ground conditions (including chemical quality and physical properties such as transmissivity) during construction could affect the quality and quantity of groundwater and hydrologically connected surface water receptors.
Impact 1: Direct disturbance of surface water bodies Impact 2: Increased sediment supply Impact 3: Supply of contaminants to surface and groundwaters Impact 4: Changes to surface and groundwater flows and flood risk	ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25)	Section 21.6.1.1 Section 21.6.1.2 Section 21.6.1.3 Section 21.6.1.4	Potential changes to the hydrology, geomorphology and water quality of Holland Haven Marshes SSSI during construction could impact upon water-dependent biological communities (including the designated interest features).
Operation			
Impact 5: Supply of contaminants to surface and groundwater	ES Chapter 19 Ground Conditions and Contamination (Document Reference: 3.1.21)	Section 21.6.2.1 Section 21.6.2.2	Potential changes to ground conditions (including chemical quality and transmissivity) during operation could affect the quality and quantity of groundwater and hydrologically-connected surface water receptors.
Impact 6: Changes to surface and groundwater flows and flood risk	ES Chapter 23 Onshore Ecology (Document Reference: 3.1.25)	Section 21.6.2.1 Section 21.6.2.2	Potential changes to the hydrology, geomorphology and water quality of Holland Haven Marshes SSSI during construction could impact upon

Topic and description	Related ES chapter (Volume 3.1)	Where addressed in this ES chapter	Rationale
			water-dependent biological communities (including the designated interest features).
Decommissioning			
Impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.			

21.10 Inter-relationships

203. The effects identified and assessed in this chapter have the potential to interrelate with each other. The areas of potential inter-relationships between effects are presented in Table 21.29. This provides a screening tool for which effects have the potential to interrelate.

204. Table 21.30 provides an assessment for each receptor (or receptor group) as related to these effects. Within Table 21.30 the effects are assessed relative to each development phase (i.e., construction, operation, or decommissioning) to see if (for example) multiple construction effects affecting the same receptor could increase the significance of effect upon that receptor. Following this, a lifetime assessment is undertaken which considers the potential for effects to affect receptors across all development phases.

Table 21.29 Inter-relationships between impacts - screening

Topic and description				
Construction				
	Impact 1: Direct disturbance of surface water bodies	Impact 2: Increased sediment supply	Impact 3: Supply of contaminants to surface and groundwater	Impact 4: Changes to surface and groundwater flows and flood risk
Impact 1: Direct disturbance of surface water bodies	-	Yes	Yes	Yes
Impact 2: Increased sediment supply	Yes	-	Yes	Yes
Impact 3: Supply of contaminants to surface and groundwater	Yes	Yes	-	No
Impact 4: Changes to surface and groundwater flows and flood risk	Yes	Yes	No	-

Topic and description		
Operation		
	Impact 1: Supply of contaminants to surface and groundwater	Impact 2: Changes to surface and groundwater flows and flood risk
Impact 1: Supply of contaminants to surface and groundwater	-	No
Impact 2: Changes to surface and groundwater flows and flood risk	No	-

Table 21.30 Inter-relationship between impacts – phase and lifetime assessment

Receptor	Highest level of significance			Phase assessment	Lifetime assessment
	Construction	Operation	Decommissioning		
Surface watercourses	Minor adverse	Minor adverse	Minor adverse	No greater than individually assessed impact. The proposed mitigation will minimise the potential for the direct disturbance of watercourses, the direct (from in-channel works) and indirect (from activities in the vicinity of the channel) supply of fine sediment and contaminants, and changes to surface hydrology and flow patterns during the construction phase. There would be no direct disturbance during operation, and further measures would be in place to prevent the supply of contaminants or changes to flow patterns during operation. It is therefore considered there would be no pathway for interaction to exacerbate the potential impacts associated with these activities during or between any of the Project phases.	No greater than individually assessed impact. The greatest magnitude of effect would occur during the construction of trenched watercourse crossings. Once this disturbance impact has ceased all further impact during construction and operation will be small scale, highly localised and episodic. It is therefore considered that over the Project lifetime these impacts would not combine to increase the significance level of any impacts identified in this assessment.
Groundwater	Minor adverse	Minor adverse	Minor adverse	No greater than individually assessed impact. The proposed mitigation will minimise the potential for the introduction of contaminants to groundwater during construction. The inert nature of the cables will prevent contamination during operation. Furthermore, the small scale and relative shallowness of the permanent infrastructure means that impacts on groundwater flows during operation are minimal. It is therefore considered there would be no pathway for interaction to exacerbate the potential impacts associated	The greatest magnitude of effect will occur as a result of subsurface excavations during the construction phase. Once this disturbance impact has ceased, any further impact would be small scale, highly localised and episodic. It is therefore considered that over the Project lifetime these impacts would not combine to increase the significance level of any impacts identified in this assessment.

Receptor	Highest level of significance			Phase assessment	Lifetime assessment
	Construction	Operation	Decommissioning		
				with these activities during or between any of the Project phases.	

21.11 Summary

205. This chapter has provided a characterisation of the existing environment for water resources and flood risk based on both existing data (e.g., national flood risk and WER classification datasets) and site-specific survey data (e.g., a geomorphological baseline survey).

206. The assessment has established that surface and groundwater receptors could be affected because of direct disturbance, the supply of fine sediment and contaminants, and changes to flow patterns and flood risk during the construction and decommissioning phases. The significance of effect on receptors during these phases is negligible or minor adverse. It is not anticipated that effects are likely to be significant in EIA terms.

207. The assessment has also established that surface and groundwater receptors could be affected by the supply of contaminants and changes to flow patterns during the operational phase. However, given the passive or sporadic nature of operational activities, the resulting effects will be negligible or minor adverse. It is not anticipated that effects are likely to be significant in EIA terms.

208. Cumulative effects are not anticipated in associated with the construction of operation of Five Estuaries, or any other projects.

209. A summary of the results of this assessment is provided in Table 21.31 and Table 21.32. This summarises the worst case scenario for all receptors and effects, as determined in Section 21.6.

Table 21.31 Summary of potential likely significant effects on water resources and flood risk

Potential impact	Receptor	Sensitivity	Magnitude of impact	Embedded mitigation	Significance of effect
Construction					
Impact 1: Direct disturbance of surface water bodies	Surface water bodies	Up to high	Up to negligible	Detailed in Table 21.3	Minor adverse, not significant
Impact 2: Increased sediment supply	Surface water bodies	Up to high	Up to negligible		Minor adverse, not significant
Impact 3: Supply of contaminants to surface and groundwater	Surface water and groundwater bodies	Up to high	Up to negligible		Minor adverse, not significant
Impact 4: Changes to surface and groundwater flows and flood risk	Surface water and groundwater bodies	Up to high	Up to negligible		Minor adverse, not significant
Operation					
Impact 1: Supply of contaminants to surface and groundwater	Surface water and groundwater bodies	Up to high	Negligible	Detailed in Table 21.3	Minor adverse, not significant
Impact 2: Changes to surface and groundwater flows and flood risk	Surface water and groundwater bodies	Up to high	Negligible		Minor adverse, not significant
Decommissioning					
No decision has yet been made regarding the final decommissioning policies for the Project as it is recognised that industry good practice, rules and legislation change over time. The detail and scope of decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator with decommissioning plan provided.					

Potential impact	Receptor	Sensitivity	Magnitude of impact	Embedded mitigation	Significance of effect
However, it is considered likely that the proposed onshore substation would be removed and will be reused or recycled and that the onshore cables would also be removed and recycled, with the transition bays and cable ducts (where used) left in situ. For the purposes of a worst case scenario, it is considered that magnitude of impact and effects associated with decommissioning would be no greater than those identified for the construction phase.					

Table 21.32 Summary of potential cumulative effects on Water Resources and Flood Risk

Potential impact	Cumulative effect	Additional mitigation
Construction		
Impact 1: Direct disturbance of surface water bodies	Cumulative effects are not expected	N/A
Impact 2: Increased sediment supply	Cumulative effects are not expected	N/A
Impact 3: Supply of contaminants to surface and groundwater	Cumulative effects are not expected	N/A
Impact 4: Changes to surface and groundwater flows and flood risk	Cumulative effects are not expected	N/A
Operation		
Impact 1: Supply of contaminants to surface and groundwater	Cumulative effects are not expected	N/A
Impact 2: Changes to surface and groundwater flows and flood risk	Cumulative effects are not expected	N/A
Decommissioning		
Decommissioning strategies have not yet been finalised for North Falls, Five Estuaries or Norwich to Tilbury; however, the cumulative effects are expected to be the same as those of the initial construction phase.		

21.12 References

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HARNESSING THE POWER OF NORTH SEA WIND

North Falls Offshore Wind Farm Limited

A joint venture company owned equally by SSE Renewables and RWE.

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