Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions

Preliminary Environmental Information Report

Volume 1

Chapter 20 - Water Resources and Flood Risk

April 2021

China Resources
Better Life Together

Masdar
A MUBADALA COMPANY

equinor

Title:	
Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions **Preliminary Environmental Information Report** **Chapter 20 Water Resources and Flood Risk**	
Document no.: PB8164-RHD-ZZ-XX-RP-Z-0010	
Date:	Classification
29th April 2021	**Final**
Prepared by:	
Royal HaskoningDHV	
Approved by:	Date:
Jo Rodriguez, Equinor	29th April 2021

Table of Contents

List of Tables

Volume 2

Volume 3

Glossary of Acronyms

BAP	Biodiversity Action Plan
CIA	Cumulative Impact Assessment
CIRIA	Construction Industry Research and Information Association
CMS	Construction Method Statement
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
Defra	Department for the Environment, Food and Rural Affairs
DEP	Dudgeon Extension Project
DMRB	Design Manual for Roads and Bridges
DWPA	Drinking Water Protected Area
EC	European Commission
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
GEP	Good Ecological Potential
GES	Good Ecological Status
GNDP	Greater Norwich Development Partnership
HDD	Horizontal Directional Drilling
IDB	Internal Drainage Board
LDF	Local Development Framework
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
NPS	National Policy Statements
NSIP	Nationally Significant Infrastructure Project
PEIR	Preliminary Environmental Information Report
PPG	Pollution Prevention Guidance

RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SEP	Sheringham Shoal Extension Project
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage System
SWDP	Surface Water and Drainage Plan
WFD	Water Framework Directive

Glossary of Terms

The Applicant	Equinor New Energy Limited
DCO boundary	The area subject to the application for development consent, including all permanent and temporary works for DEP and SEP. The DCO boundary will be subject to updated impact assessment and further development of mitigation proposals to inform the ES.
Dudgeon Offshore Wind Farm Extension site	The Dudgeon Offshore Wind Farm Extension offshore wind farm boundary.
The Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable corridor which would house HDD entry or exit points.
Jointing bays	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water
Onshore cable corridor	The area between the landfall and the onshore substation sites, within which the onshore cable circuits will be installed along with other temporary works for construction.
Onshore substation sites	Parcels of land within onshore substation zones A and B, identified as the most suitable location for development of the onshore substation. Two sites have been identified for further assessment within the PEIR.
Onshore Substation Zone	Parcels of land within the wider onshore substation search area identified as suitable for development of the onshore substation. Two substation zones (A and B) have been identified as having the greatest potential to accommodate the onshore substation.
PEIR boundary	The area subject to survey and preliminary impact assessment to inform the PEIR, including all permanent and temporary works for DEP and SEP. The PEIR boundary will be refined down to the final DCO boundary ahead of the application for development consent.
Study area	Area where potential impacts from the project could occur, as defined for each individual EIA topic.

Sheringham Shoal Offshore Wind Farm Extension site	Sheringham Shoal Offshore Wind Farm Extension offshore wind farm boundary.
The Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure.

20 WATER RESOURCES AND FLOOD RISK

20.1 Introduction

1. This chapter of the Preliminary Environmental Information Report (PEIR) considers the potential impacts of the proposed Dudgeon Offshore Wind Farm Extension Project (DEP) and Sheringham Shoal Offshore Wind Farm Extension Project (SEP) on Water Resources and Flood Risk. The chapter provides an overview of the existing environment for the proposed onshore development area, followed by an assessment of the potential impacts and associated mitigation for the construction, operation, and decommissioning phases of DEP and SEP.

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 Impact Assessment (CIA) are presented in **Section 20.4**.

3. This chapter follows the overall approach set out in **Chapter 6 EIA Methodology**, and considers the potential impacts of DEP and SEP on the hydrology, geomorphology and quality of surface waters and the quality and quantity of groundwaters. It also considers potential changes to flood risk.

4. The assessment should be read in conjunction with following linked chapters:

    - **Chapter 20 Onshore Ground Conditions and Contamination**; and
    - **Chapter 22 Onshore Ecology and Ornithology**.

5. Additional information to support the Water Resources and Flood Risk assessment includes:

    - **Appendix 20.1 Water Framework Directive Compliance Assessment**;
    - **Appendix 20.2 Flood Risk Assessment**; and
    - **Appendix 20.3 Geomorphology Baseline Report**.

20.2 Consultation

6. Consultation with regard to Water Resources and Flood Risk has been undertaken in line with the general process described in **Chapter 6 EIA Methodology**. The key elements to date have included scoping and informal engagement with relevant stakeholders. The feedback received has been considered in preparing the PEIR. **Table 20-1** provides a summary of how the consultation responses received to date have influenced the approach that has been taken.

7. This chapter will be updated following the consultation on the PEIR in order to produce the final assessment that will be submitted with the Development Consent Order (DCO) application. Full details of the consultation process will also be presented in the Consultation Report alongside the DCO application.

Table 20-1: Consultation responses.

Consultee	Date/ Document	Comment	Project Response
Planning Inspectorate	November 2019 – Scoping Opinion Comment 5.2.1	The Scoping Report does not justify the decision to scope out direct disturbance to surface water bodies during operation. However, the Inspectorate considers that given the operational nature of the Proposed Development there are unlikely to be any significant effects from potential direct in this regard disturbance to surface water bodies once construction is complete. The Inspectorate agrees that this matter can be scoped out of the assessment in the Environmental Statement (ES).	Impacts resulting from the temporary disturbance of surface water bodies during construction of the onshore cable corridor and access roads are presented in **Section 20.6.1.1**. The operational infrastructure will not interact with the watercourses and has been scoped out as agreed by the Planning Inspectorate.
Planning Inspectorate	November 2019 – Scoping Opinion Comment 5.2.2	Table 3-4 proposes to scope out transboundary impacts water resources and flood risk, although no justification is provided within the aspect chapter. Nevertheless, given the nature of the Proposed Development in this regard the Inspectorate agrees that significant transboundary effects are unlikely and therefore this matter can be scoped out of the ES.	Further justification for the lack of transboundary impacts is provided in **Section 20.8**.
Planning Inspectorate	November 2019 – Scoping Opinion Comment 5.2.3	Table 3-4 of the Scoping Report scopes in an assessment of increased sediment supply during operation, however this is not considered as a potential impact in Section 3.2.2.2. Despite this inconsistency, the Inspectorate has given consideration to the operational nature of the Proposed Development and does not	The supply of fine sediment during operation is considered alongside other potential contaminants in **Section 20.6.2.1**.

Consultee	Date/ Document	Comment	Project Response
		consider that significant effects are likely to occur and considers this matter does not need to be assessed in the ES.	
Planning Inspectorate	November 2019 – Scoping Opinion Comment 5.2.4	The Inspectorate welcomes the proposal for a Flood Risk Assessment (FRA) and a Water Framework Directive (WFD) Compliance Assessment; these assessments should form an appendix to the ES. The Applicant should make effort to discuss and agree the scope of these assessments with relevant consultation bodies including the Environment Agency (EA), the relevant internal drainage boards and the lead local flood authorities.	A WFD compliance assessment is presented in **Appendix 20.1**, and a Flood Risk Assessment is presented in **Appendix 20.2**.
Planning Inspectorate	November 2019 – Scoping Opinion Comment 5.2.5	The Inspectorate welcomes that changes to surface water runoff and flood risk from construction and operation of the Proposed Development will be assessed. The ES should also assess any likely significant effects resulting from potential flood events to the Proposed Development. The ES should demonstrate that consideration has been given to all potential sources of flooding.	Changes to surface water runoff and flood risk during construction and operation are assessed in **Sections 20.6.1.4** and **20.6.2.2**, respectively. A detailed Flood Risk Assessment, which consider potential flood risks to onshore components of DEP and SEP as well as any changes to flood risk that DEP and SEP may cause is presented in **Appendix 20.2**.

Consultee	Date/ Document	Comment	Project Response
Planning Inspectorate	November 2019 – Scoping Opinion Comment 5.2.6	The Applicant is advised to consider the necessary responsibilities in relation to working over or crossing of main rivers including any permits or licences that may be required (for example Flood Risk Activity Permits under the Environmental Permitting regulations). References to any water resources licensing that may be required should be outlined as part of the ES, particularly where the residual effects reported in the ES are wholly or partly reliant on the grant of such licenses.	The Applicant notes its responsibilities under the Environmental Permitting (England and Wales) Regulations 2010 and associated legislation with regards to activities in or adjacent to Main Rivers, Ordinary Watercourses and their floodplains.
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	The issue of drainage of haul roads and compounds should be an important aspect of the FRA.	Potential flood risk implications of drainage from haul roads is considered in of the Flood Risk Assessment (**Appendix 20.2)**.
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council requested that they are informed as early as possible about the location of Horizontal Directional Drilling (HDD) crossings and any culverting needs so that this can be part of one consent.	The Applicant notes this request, and has provided supporting information as part of the assessment of potential impacts resulting from watercourse crossings (**Section 20.6.1.1**).
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council stated that infill material around the cable could create a pathway for water flows and impact local hydrogeology and hydrology.	Potential impacts on flow pathways are considered in **Sections 20.6.1.4** and **20.6.2.2**.

Consultee	Date/ Document	Comment	Project Response
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council recommended that climate change plus 20% should be used for the FRA and Project's design.	The recommended climate change allowance has been applied in **Section 20.2.6** of the Flood Risk Assessment (**Appendix 20.2**).
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	Norfolk County Council stated that FSR rainfall data is no longer acceptable and only FEH data will be accepted by Norfolk County Council.	FEH data has been used to inform the Flood Risk Assessment (**Appendix 20.2**).
Norfolk County Council	28/05/2020 – Water Resources and Flood Risk Meeting	The operation and maintenance plan will have to be shared with Norfolk County Council.	The Applicant will commit to producing an Operation and Maintenance Plan for the operational development that will be secured through the DCO.

20.3 Scope

20.3.1 Study Area

8. As part of the Anglian River Basin Management Plan (RBMP) developed to comply with the Water Framework Directive (WFD) (discussed in **Section 20.4.1**), 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 on the basis of these surface hydrological catchments. Catchments have been included within the study area if they are crossed by the onshore project area or are hydrologically connected downstream of the project area. Those catchments that are hydrologically connected upstream are not considered due to the lack of any mechanism for an impact to occur at distance upstream. The onshore study area is shown in **Figure 20.1**.

10. When considering the potential impacts to groundwater, the study area is limited to those groundwater bodies that lie directly beneath the project area which are shown in **Figure 20.2**.

20.3.2 Realistic Worst Case Scenario

20.3.2.1 General Approach

11. The final design of DEP and SEP will be confirmed through detailed engineering design studies that will be undertaken post-consent to enable the commencement of construction. 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 potential 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 lesser options will have less impact. Further details are provided in **Chapter 6 EIA Methodology**.
12. The realistic worst case scenarios for the Water Resources and Flood Risk assessment are summarised in **Table 20-2**. These are based on the Project parameters described in **Chapter 5 Project Description**, which provides further details regarding specific activities and their durations.
13. In addition to the design parameters set out in **Table 20-2**, consideration is also given to how DEP and SEP will be built out as described in **Section 20.3.2.2** to **Section 20.3.2.4** below. This accounts for the fact that whilst DEP and SEP are the subject of one DCO application, it is possible that either one or both DEP and SEP will be developed, and if both are developed, that construction may be undertaken either concurrently or sequentially. Therefore, to ensure a thorough assessment, a worst case scenario is set out for each potential construction scenario in **Table 20-2**.

Table 20-2: Realistic Worst Case Scenarios.

Impact	Parameter DEP or SEP in isolation	DEP and SEP concurrently	DEP and SEP sequentially	Notes and Rationale
Construction				
Impacts relating to the landfall	<u>Temporary HDD works</u> • HDD temporary works compound area = 5,750m^2 • Transition joint bay size = 10 x 15m. • Total construction space required = 30,000m^2	<u>Temporary HDD works</u> • HDD temporary works compound area = 5,750m^2 • Transition joint bay size = 15 x 15m. • Total construction space required = 30,000m^2	<u>Temporary HDD works</u> • HDD temporary works compound area = 5,750m^2 for each project (overlapping) • Transition joint bay size = 10 x 15m for each project • Total construction space required for each project = 30,000m^2 (overlapping)	The HDD works should not require any prolonged periods of restrictions or closures to the beach for public access, although it is possible that some work activities will be required to be performed on the beach that may require short periods of restricted access.
	<u>Temporary access</u> • Route from the existing road system	<u>Temporary access</u> • Route from the existing road system	<u>Temporary access</u> • Route from the existing road system	
Impacts relating to the onshore cable corridor	<u>Temporary access</u> • Various from public highway (6m wide) to single tracks (3m wide). • Access haul road dimensions = 60km long by 6m wide.	<u>Temporary access</u> • Various from public highway (6m wide) to single tracks (3m wide). • Access haul road dimensions = 60km long by 6m wide.	<u>Temporary access</u> • Various from public highway (6m wide) to single tracks (3m wide). • Access haul road dimensions = 60km long by 6m wide.	The onshore cable duct will be installed in sections of up to 1km at a time, with a typical construction presence of up to four weeks along each 1km section.

Impact	Parameter DEP or SEP in isolation	DEP and SEP concurrently	DEP and SEP sequentially	Notes and Rationale
	Duration • 24 months in total	Duration • 24 months in total	Duration • 24 months in total	
	Material volumes • Width of top soil storage = 6m • Quantity of material excavated for cable trench = 180,000m^3 of which 36,000m^3 to be disposed of	Material volumes • Width of top soil storage = 6m • Quantity of material excavated for cable trench = 360,000m^3 of which 72,000m^3 to be disposed of	Material volumes • Width of top soil storage = 6m • Quantity of material excavated for cable trench = 360,000m^3 of which 72,000m^3 to be disposed of	
	Construction corridor • Total width = 45m • Jointing bays = 120 (approximately every 500m) buried below ground • Jointing bay dimensions = 12m long by 4m wide by 2m deep within the working corridor • One trench, 1m wide by 1.75m deep.	Construction corridor • Total width = 60m • Approximately 120 jointing bays (one every 500m) buried below ground • Jointing bay dimensions = 12m long by 4m wide by 2m deep within the working corridor. • Two trenches, each 1m wide by 1.75m deep. • Minimum cable burial depth at 1.2m	Construction corridor • Total width = 60m • Approximately 240 jointing bays (one every 500m) buried below ground along each cable trench • Jointing bay dimensions of 12m long by 4m wide by 2m deep within the working corridor. • Two trenches, each 1m wide by 1.75m deep.	

Impact	Parameter DEP or SEP in isolation	DEP and SEP concurrently	DEP and SEP sequentially	Notes and Rationale
	• Minimum cable burial depth at 1.2m		• Minimum cable burial depth at 1.2m	
	Construction compounds • Up to 2 main compounds of 60,000m^2 each • 8 secondary compounds of 2,500m^2 each • HDD compounds = 1,500m^2 - 4,500m^2	Construction compounds • Up to 2 main compounds of 60,000m^2 each • 8 secondary compounds of 2,500m^2 each • HDD compounds = 1,500m^2 - 4,500m^2	Construction compounds • Up to 2 main compounds for each project of 60,000m^2 each • 8 secondary compounds for each project of 2,500m^2 each • HDD compounds = 1,500m^2 - 4,500m^2	
Impacts relating to the onshore substation	Substation footprint • Permanent area = 3.25ha. • Temporary construction area = 1ha • Total construction area = 4.25ha	Substation footprint • Permanent area = 6.0ha • Additional construction area = 1ha • Total construction area = 7.0ha.	Substation footprint • Permanent area = 6.25ha • Additional construction area = 1ha • Total construction area = 7.25ha.	
Operation				
Impacts relating to the onshore cable route	Link boxes • Below ground = 120 (up to 2m x 2m x 1.5m) plus an above ground marker post at each location	Link boxes • Below ground = 120 (up to 2m x 2m x 1.5m) plus an above ground marker post at each location	Link boxes • Below ground = 120 for each project (up to 2m x 2m x 1.5m) plus an above ground marker post at each location	Link boxes are expected to be below ground. Alternatively link boxes may be above ground in cabinets.

Impact	Parameter DEP or SEP in isolation	DEP and SEP concurrently	DEP and SEP sequentially	Notes and Rationale
	• Above ground = 120 (up to 1.5m x 1m x 1.5m)	• Above ground = 120 (up to 1.5m x 1m x 1.5m)	• Above ground = 120 for each project (up to 1.5m x 1m x 1.5m)	
Impacts relating to the onshore substation	Substation footprint • Operational area = 3.25ha	Substation footprint • Operational area = 6.0ha	Substation footprint • Operational area = 6.25ha	
	Substation buildings • Max building height = 15m • Oily water sump to provide secondary containment to oil from transformers in the event of a spillage.	Substation buildings • Max building height = 15m • Oily water sump to provide secondary containment to oil from transformers in the event of a spillage.	Substation buildings • Max building height = 15m • Oily water sump to provide secondary containment to oil from transformers in the event of a spillage.	
	Duration • 36 months in total	Duration • 36 months in total	Duration • 36 months in total for each project	
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 best practice change over time. However, it is likely that the onshore project equipment, including the cable, will be removed, reused or recycled where possible 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.				

20.3.2.2 Construction Scenarios

14. The following principles set out the framework for how DEP and SEP may be constructed:
    - DEP and SEP may be constructed at the same time, or at different times;
    - If built at the same time both Projects could be constructed in four years;
    - If built at different times, either Project could be built first;
    - If built at different times the first Project would require a four-year period of construction including a three year onshore construction period. The second Project would require a three-year period of construction;
    - If built at different times, the duration of the gap between end of onshore construction of the first Project, and the start of onshore construction of the second Project may vary from 0 to 1 year;
    - Assuming maximum construction periods, and taking the above into account, the maximum period over which the construction of both Projects could take place is 7 years; and
    - The earliest construction start date is 2024 and the latest is 2028.
15. In order to determine which construction scenario presents the realistic worst case for each receptor and impact, the assessment considers both maximum duration effects and maximum peak effects, in addition to each project being developed in isolation, drawing out any differences between DEP and SEP.
16. The three construction scenarios considered by the Water Resources and Flood Risk assessment are therefore:
    - Scenario 1: Build DEP or build SEP in isolation;
    - Scenario 2: Build DEP and SEP concurrently – reflecting the maximum peak effects; and
    - Scenario 3: Build one project followed by the other with a gap of up to one year (sequential) – reflecting the maximum duration of effects.
17. Any differences between DEP and SEP, or differences that could result from the manner in which the first and the second project are built (concurrent or sequential and the length of any gap) are identified and discussed where relevant in the impact assessment section of this chapter (**Section 20.6**). For each potential impact only the worst case construction scenario for DEP and SEP is presented, i.e. either concurrent or sequential. The justification for what constitutes the worst case is provided, where necessary, in **Section 20.6**.

20.3.2.3 Operation Scenarios

18. Operation scenarios are described in detail in **Chapter 5 Project Description**. The assessment considers the following three scenarios:
    - Only DEP in operation;
    - Only SEP in operation; and

- The two projects operating at the same time, with a gap of up to 3 years between each project commencing operation.

19. The operational lifetime of each project is expected to be 35 years.

20.3.2.4 Decommissioning Scenarios

20. Decommissioning scenarios are described in detail in **Chapter 5 Project Description**. Decommissioning arrangements will be agreed through the submission of a Decommissioning Plan prior to construction, however for the purpose of this assessment it is assumed that decommissioning of DEP and SEP could be conducted separately, or at the same time.

20.3.3 Summary of Mitigation Embedded in the Design

21. This section outlines the embedded mitigation relevant to the Water Resources and Flood Risk assessment, which has been incorporated into the design of DEP and SEP (**Table 20-3**). Where other mitigation measures are proposed, these are detailed in the impact assessment (**Section 20.6**).

Table 20-3: Embedded Mitigation Measures

Parameter	Mitigation Measures Embedded into the Design of DEP and SEP
Watercourse crossings	
Cable crossings over watercourses	All Main Rivers (**Figure 20.3**) will be crossed using trenchless techniques such as HDD to avoid direct interaction with these watercourses. The cable entry and exit pits will be at least 9m from the banks of the watercourse, and the cable will be at least 2m below the channel bed.
Temporary access across watercourses	Temporary bridges (Bailey bridges) or similar may be used as options to traverse Main Rivers where direct access is not readily available from both sides. Selection of crossing technique for all Ordinary Watercourses (including IDB drains) will be dependent on local site conditions and may include the use of temporary culverts.
Groundwater quality and abstractions for public water supply	
Cable routing	The cable corridor has been developed to avoid interaction with Groundwater Source Protection Zone 1, and therefore minimise the potential for impact on abstractions for public water supply.

20.4 Impact Assessment Methodology

20.4.1 Policy, Legislation and Guidance

20.4.1.1 National Policy Statements

22. The assessment of potential impacts upon Water Resources and Flood Risk has been made with specific reference to the relevant NPS. These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to DEP and SEP are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2011c).

23. The specific assessment requirements for Water Resources and Flood Risk, as detailed in the NPS, are summarised in **Table 20-4** together with an indication of the section of the PEIR chapter where each is addressed.

Table 20-4: NPS Assessment Requirements.

NPS Requirement	NPS Reference	Section Reference
En-1 NPS for Energy (EN-1)		
'Where the development is subject to EIA [Environmental Impact Assessment] the applicant should ensure that the ES [Environmental Statement] clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the Infrastructure Planning Commission (IPC) consider thoroughly the potential effects of a proposed project.'	Section 5.3	Potential impacts on river channels, which provide physical habitats of importance for ecology, protected species and the conservation of biodiversity, are considered in **Section 20.6**.
'Where a proposed development on land within or outside a Site of Special Scientific Interested (SSSI) is likely to have an adverse effect on a SSSI (either individually or in combination with other developments), development consent should not normally be granted. Where an adverse effect, after mitigation, on the site's notified special interest features is likely, an exception should only be made where the benefits (including need) of the development at this site clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs.'	Section 5.3	DEP and SEP only have the potential to affect a single watercourse designated as a SSSI - the River Wensum. Potential impacts to the River Wensum SSSI are considered in **Section 20.6**.

NPS Requirement	NPS Reference	Section Reference
'Applications for energy projects of 1 hectare or greater in Flood Zone 1 in England or Zone A in Wales and all proposals for energy projects located in Flood Zones 2 and 3 in England or Zones B and C in Wales should be accompanied by a flood risk assessment (FRA). An FRA will also be required where an energy project less than 1 hectare may be subject to sources of flooding other than rivers and the sea (for example surface water), or where the EA, 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.'	Section 5.7	Potential impacts on flood risk are considered in **Section 20.6** and **Appendix 20.2**.
'Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent. 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 discharges and proposed changes to discharges; • existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies); • existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and	Section 5.15	Potential impacts on water quality, the physical characteristics of surface watercourses and the quality and quantity of groundwater are considered in **Section 20.6**. Potential impacts on WFD compliance are considered separately in **Appendix 20.1**.

NPS Requirement	NPS Reference	Section Reference
• any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions.’		

20.4.1.2 Other

24. In addition to the NPS, there are a number of pieces of legislation, policy and guidance applicable to the assessment of Water Resources and Flood Risk. These are described in the sections below. Further detail is provided in **Chapter 3 Policy and Legislative Context**.

20.4.1.2.1 Water Framework Directive (2000/60/EC)

25. The Water Framework Directive (WFD) (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted by the European Commission (EC) in December 2000. It requires Member States of the European Union (EU) to protect and enhance the status of aquatic ecosystems and ensure that deterioration does not occur, especially as a result of new schemes and developments. The WFD applies to all water bodies including rivers, lakes, estuaries, coastal waters and groundwater, and also those that are man-made such as canals. which are managed in the context of River Basin Districts (RBD).

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

26. The WFD is transposed into national law in the UK by means of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 which continue to provide for the implementation of the WFD. 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 RBMPs which describe the current state of the water environment within the RBD and set out the objectives for protecting and improving it.

20.4.1.2.3 The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015

27. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 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.

20.4.1.2.4 National Planning Policy Framework (2018) and supporting guidance

28. The National Planning Policy Framework (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 through the application of the Sequential Test. If, following the Sequential Test, it is not possible for a project to be located in zones with a lower probability of flooding; the Exception Test can be applied if appropriate.

29. The National Planning Practice Guidance (NPPG) on Flood Risk and Coastal Change provides additional guidance on flood risk vulnerability classifications and managing residual risks in support of the NPPF. The NPPG uses the concept of Flood Zones, Vulnerability Classifications and Compatibility to assess the suitability of a specific site for a certain type of development.

20.4.1.2.5 Flood and Water Management Act (2010)

30. 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 Lead Local Flood Authority (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.

20.4.1.2.6 Anglian River Basin District: River Basin Management Plan (2015)

31. 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 WFD. As water resources and land use are closely linked, RBMPs also inform decisions on land-use planning.

32. The second RBMP for the Anglian RBD was finalised by the Department for the Environment, Food and Rural Affairs (Defra) and the Environment Agency in December 2015 and was published in 2016. 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 WFD.

20.4.1.2.7 Preliminary and Strategic Flood Risk Assessments

33. DEP and SEP onshore infrastructure, including the 60km onshore cable corridor and the onshore substation, falls entirely within the jurisdiction of Norfolk County Council, but passes through several local authority districts including North Norfolk District Council, Broadland District Council and South Norfolk District Council.

34. Norfolk County Council produced a Preliminary FRA in July 2011 which provides a high level overview of flooding from local sources in Norfolk. A consortium of District Councils in Norfolk worked together to produce Strategic FRAs as part of the Norfolk Strategic Framework in 2017. North Norfolk District Council and Broadland District Council worked together, and South Norfolk District Council was included in the wider Norwich area, to produce Strategic FRAs providing more detailed information and guidance on flood risk in their respective areas.

20.4.1.2.8 Local Flood Risk Management Strategy

35. The Norfolk Local Flood Risk Management Strategy was produced by Norfolk County Council in 2015 and was informed by the Preliminary FRA. It outlines the aims and objectives of the council in its role as LLFA and establishes a framework of policies to ensure a consistent and strategic approach to flood management amongst all Risk Management Authorities. The Strategy also identifies proactive measures to increase understanding of flood risk and clarifies funding and monitoring activities.

20.4.1.2.9 Local Planning Policy Documents

36. Each Local Authority has produced a planning policy document. **Table 20-5** lists the key policies of each of these which is relevant to Water Resources and Flood Risk.

Table 20-5: Relevant Local Planning Policies

Document	Policy/Guidance	Policy/Guidance Purpose
North Norfolk District Council		
North Norfolk District Council has produced a collection of planning documents to guide development in North Norfolk known as the Local Development Framework (LDF). This includes a Core Strategy and Development Management Policies document (North Norfolk District Council, 2012) alongside a Proposals Map, Site Allocations and Supplementary Documents.	Development Management Policy EN10 – 'Development and Flood Risk'	"The sequential test will be applied rigorously across North Norfolk and most new development should be located in Flood Risk Zone 1. New development in Flood Risk Zones 2 and 3a will be restricted to the following categories: • Water compatible uses; • Minor development (xii); • Changes of use (to an equal or lower risk category in the flood risk vulnerability classification) where there is no operational development (xiii); and • 'Less vulnerable' uses where the sequential test has been passed."
	Strategic Policy	In addition, the adopted Core Strategy includes the following Strategic Policy, relevant for the project: "Renewable energy proposals will be supported and considered in the context of sustainable development and climate

Document	Policy/Guidance	Policy/Guidance Purpose
		change, taking account of the wide environmental, social and economic benefits of renewable energy gain and their contribution to overcoming energy supply problems in parts of the District.”
	Appendix B (North Norfolk Ecological Network) of North Norfolk District Council’s Policy EN 9 on Biodiversity	The policy identifies the Rivers Wensum and Bure, their tributaries and their floodplains as a core area for biodiversity, where protection, enhancement and expansion of the existing resource will be a priority. Chalk river Biodiversity Action Plan (BAP) habitat in the Wensum and Bure is identified as being a particular priority in the county. The policy also sets out four objectives for river habitats: • Produce river restoration plans; • Create habitat ecotones from wet to dry habitat; • Buffer floodplains by encouraging low input agricultural systems or semi-natural habitats; and • Enhance connectivity through creating new wetland linkages and enhancing the matrix (land uses surrounding a wetland).
Joint Core Strategy (JCS) for Broadland, Norwich and South Norfolk		
The Joint Core Strategy DPD for Broadland, Norwich and South Norfolk District Councils was adopted in 2011 and amended in 2014. It was developed with Norfolk County Council as part of the Greater Norwich Development Partnership (GNDP)	Objective 1 of the Spatial Planning Objectives	This Strategy recognises flooding as a key concern, where it states: “New development will generally be guided away from areas with a high probability of flooding. Where new development in such areas is desirable for reasons of sustainability (e.g. in the city centre), flood mitigation will be required and flood protection will be maintained and enhanced.”

20.4.2 Data and Information Sources

20.4.2.1 Site specific surveys

37. In order to provide site specific and up to date information on which to base the impact assessment, a geomorphological site walkover survey was conducted in September 2020 to characterise the physical characteristics of the major watercourses (Main Rivers and WFD water bodies) that would be crossed by the onshore cable corridor and potentially affected by the onshore substation. This included an assessment of flow conditions, channel form, floodplain characteristics and any evidence of channel modification. The survey and its results are discussed in further detail in **Appendix 20.3 Geomorphology**.

20.4.2.2 Other available sources

38. Other sources that have been used to inform the assessment are listed in **Table 20-6**.

Table 20-6: Other available data and information sources

Data set	Spatial coverage	Year	Notes
Environment Agency's Flood Map for Planning	Nationwide	2020	N/A
Environment Agency Product 4 data	Landfall, onshore cable corridor, onshore substation	2020	N/A
Environment Agency Product 8 data	Landfall, onshore cable corridor, onshore substation	2020	N/A
Environment Agency Catchment Data Explorer	Nationwide	2020	WFD River Basin Districts Management Catchments, Operational Catchments and WFD water bodies
IDB Classification of drains within the Norfolk Rivers Internal Drainage District	Landfall, onshore cable corridor, onshore substation	2020	N/A

20.4.3 Impact Assessment Methodology

39. **Chapter 6 EIA Methodology** provides a summary of the general impact assessment methodology applied to DEP and SEP. The following sections confirm the methodology used to assess the potential impacts on Water Resources and Flood Risk. More detailed methodologies specific to the WFD and FRA can be found in **Appendix 20.1** and **Appendix 20.2** respectively.

40. As described in **Section 20.3.2.1**, the study area has been defined on the basis of the surface hydrological catchments that could potentially interact with DEP and SEP. 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 20-13**, and is referred to throughout the impact assessment in **Section 20.6**.

41. In addition, due to the repetition of receptors across each impact, a summary table has been produced for each impact and scenario which sets out the individual receptors and the magnitude of effect and significance both before and after mitigation for each one. These are discussed in the preceding text but are summarised in this way to avoid repetition and ensure clarity and a concise assessment.

20.4.3.1 Definitions

42. For each effect, the assessment identifies receptors sensitive to that effect and implements a systematic approach to understanding the impact pathways and the level of impacts on given receptors. The definitions of sensitivity and magnitude for the purpose of the Water Resources and Flood Risk assessment are provided in **Table 20-7** and **Table 20-8**.

Table 20-7: Definition of sensitivity for a Water Resources and Flood Risk receptor

Sensitivity	Definition
High	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. • Site is within Inner or Outer Source Protection Zones. *Flood risk* • Highly Vulnerable Land Use, as defined by NPPF PPG (Department for Communities and Local Governments (DCLG), 2014). • Land with more than 100 residential properties (after Design Manual for Roads and Bridges (DMRB), 2009).

Sensitivity	Definition
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. • 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. • Site is within a Catchment Source Protection Zone. *Flood risk* • More Vulnerable Land Use, as defined by NPPF PPG (DCLG, 2014). • Land with between 1 and 100 residential properties or more than 10 industrial premises (after DMRB, 2009).
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. • Supports Secondary A or Secondary B Aquifer without abstractions. *Flood risk* • Less Vulnerable Land Use, as defined by NPPF PPG (DCLG, 2014). • Land with 10 or fewer industrial properties (after DMRB, 2009).
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*

Sensitivity	Definition
	• Controlled waters with hydrology that does not support natural variations, geomorphology that does not support natural processes, and water quality that constrains ecological communities. • Aquatic or water-dependent habitats and/or species are tolerant to changes in hydrology, geomorphology or water quality. • Non-productive strata that does not support groundwater resources. *Flood risk* • Water Compatible Land Use, as defined by NPPF PPG (DCLG, 2014). • Land with limited constraints and a low probability of flooding of residential and industrial properties (after DMRB, 2009).

Table 20-8: 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* • 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 WFD surface water body status or prevention of achieving future status objectives. • Deterioration in groundwater levels, flows or quality leading to a deterioration in WFD groundwater body status. *Flood risk* • Permanent or major change to existing flood risk. • 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. • 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.

Magnitude	Definition
	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 WFD elements, without affecting the ability of the surface water to achieve future objectives. • Medium-term deterioration in groundwater levels, flow or quality leading to potential temporary downgrading of WFD status. *Flood risk* • Medium-term or moderate change to existing flood risk. • Possible failure of sequential or exception test (if applicable). • 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. • No change to WFD status. *Flood risk* • Short-term temporary or minor change to existing flood risk. • Localised increase in on-site or off-site flood risk due to increase in impermeable area. • Passing of sequential and exception test.
Negligible	Temporary change, undiscernible over the medium- to long-term, 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*

Magnitude	Definition
	• Intermittent impact on local water quality or availability. • Intermittent or no degradation of a water supply source. • Very slight local changes to habitat that have no observable impact on dependent receptors. *Flood risk* • Intermittent or very minor change to existing flood risk. • Highly localised increase in on-site or off-site flood risk due to increase in impermeable area.

20.4.3.2 Impact Significance

43. In basic terms, the potential significance of an impact is a function of the sensitivity of the receptor and the magnitude of the effect (see **Chapter 6 EIA Methodology** for further details). The determination of significance is guided by the use of an impact significance matrix, as shown in **Table 20-9**. Definitions of each level of significance are provided in **Table 20-10**.

44. Potential impacts identified within the assessment as major or moderate are regarded as significant in terms of the EIA Regulations. Appropriate mitigation has been identified, where possible, in consultation with the regulatory authorities and relevant stakeholders. The aim of mitigation measures is to avoid or reduce the overall impact in order to determine a residual impact upon a given receptor.

Table 20-9: Impact significance matrix

		Negative 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*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

Table 20-10: Definition of impact 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.

Significance	Definition
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 impact, therefore, no change in receptor condition.

20.4.4 Cumulative Impact Assessment Methodology

45. The cumulative impact assessment (CIA) considers other plans, projects and activities that may impact cumulatively with DEP and SEP. As part of this process, the assessment considers which of the residual impacts assessed for DEP and/or SEP on their own have the potential to contribute to a cumulative impact, the data and information available to inform the cumulative assessment and the resulting confidence in any assessment that is undertaken. **Chapter 6 EIA Methodology** provides further details of the general framework and approach to the CIA.

46. For Water Resources and Flood Risk, these activities include the potential crossing of cable routes associated with other offshore wind farms including Norfolk Boreas and Norfolk Vanguard. Activities involving large scale excavation, such as major infrastructure projects, taking place concurrently within, the same surface water catchments as DEP and SEP would also require consideration.

20.4.5 Transboundary Impact Assessment Methodology

47. For Water Resources and Flood Risk, the potential for transboundary effects was scoped out as agreed at scoping stage in the Scoping Report (Equinor, 2019) as the onshore project area is not located adjacent to any international boundaries.

20.4.6 Assumptions and Limitations

48. This assessment is based on a range of publicly available information and data. These are considered to be robust, however there is a level of uncertainty associated with their use in this impact 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 catchment. This is a precautionary approach that ensures value and sensitivity have not been under-assessed within the assessment.

20.5 Existing Environment

20.5.1 Surface Water

20.5.1.1 Surface water drainage

49. As discussed in **Section 20.3.1**, this assessment is considered in terms of the river water body catchments which are defined by the Environment Agency. Receptors are those river water bodies that are crossed, or their catchments that are crossed, by the landfall, onshore cable corridor or onshore substation and those that are downstream. These are grouped within their respective operational catchments, as identified by the Environment Agency, for this assessment due to the distinctive characteristics of each catchment and the water bodies within them.

50. The onshore infrastructure associated with DEP and SEP lies within four surface water catchments (based on the operational catchments defined by the Environment Agency) as described in **Section 20.3.1**:

- The North Norfolk catchment;
- The Bure catchment;
- The Wensum catchment; and
- The Yare catchment.

51. The landfall and northern extent of the onshore cable corridor passes through the eastern section of the North Norfolk surface water operational catchment. This operational catchment encompasses three main chalk rivers, which are an internationally rare habitat, including the River Glaven which is crossed by the onshore cable corridor.

52. The River Bure itself and the catchments of two of its tributaries within its upper reaches, Scarrow Beck and Mermaid Stream, are intersected by the onshore cable corridor. The River Bure rises at Melton Constable and flows south west through the Broads to meet the sea at Great Yarmouth. Its upper reaches are steeper and suffer from sediment runoff due to historical land management. The lower reaches include a range of wetland features including Hoveton Great Broad and Marshes, Woodbastwick Fens and Marshes, Bure Marshes and Norfolk Broads.

53. The River Wensum and two of its tributaries, the River Tud and Swannington Beck are crossed by the onshore cable corridor, along with a portion of the catchment of Blackwater Drain. The Wensum is designated along much of its length as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) due to its status as an internationally rare chalk river system, including the location of the proposed crossing. It passes through Fakenham and the Pensthorpe Nature Reserve and continues in a broadly south-easterly direction through Norwich to join the River Yare at Whitlingham. The Tud and Blackwater Drain have been identified as significant contributors of phosphate into the River Wensum, causing the SSSI to be in unfavourable condition along much of its length.

54. The River Yare and two of its tributaries, the River Tiffey and the Intwood Stream, are crossed by the onshore cable corridor. The catchments of the Intwood Stream and the River Tas (another tributary of the Yare) also contain the onshore substation area. The River Yare rises south of Dereham and flows east towards Norwich with the River Tiffey being a major tributary. It is joined by the Wensum at Whitlingham and flows into Breydon Water following which it enters the sea at Great Yarmouth. The catchment experiences pressures from agriculture and rural land management and the water industry throughout.

55. There are a number of Ordinary Watercourses within the river water body catchments which will be crossed by the onshore cable corridor. Ordinary Watercourses are all rivers, streams, ditches and drains that are not designated Main Rivers (which are managed by the Environment Agency), instead they are the responsibility of the LLFA or, in the case of selected watercourses within an Internal Drainage District, the appropriate IDB. Several of those water bodies crossed by the onshore cable corridor are maintained and managed by Norfolk Rivers IDB, as shown in **Figure 20.3**. The onshore surface water receptors are listed in **Table 20-11** below in their relevant operational catchments. There are also a number of agricultural drains and unnamed agricultural drainage channels that are too numerous to be listed individually.

Table 20-11: Surface water receptors

Operational catchment	River water body	Other watercourses within river water body catchment
North Norfolk Rivers	Spring Beck (coastal catchment)	N/A
	Glaven	N/A
Bure	Scarrow Beck	N/A
	Bure	Norfolk Rivers IDB Drains: DRN074G3501 DRN073G3601
	Mermaid Stream	N/A
Wensum	Blackwater Drain	N/A
	Swannington Beck	Norfolk Rivers IDB Drains: DRN111G0401 DRN111G0106 DRN111G0107 DRN111G0201 DRN111G0103
	Wensum upstream of Norwich	Norfolk Rivers IDB Drains: DRN111G0101

Operational catchment	River water body	Other watercourses within river water body catchment
		DRN112G0104 DRN112G0103 DRN112G0101
	River Tud	N/A
Yare	Yare upstream of confluence with Tiffey	N/A
	River Tiffey	N/A
	Yare (Tiffey to Wensum)	Norfolk Rivers IDB Drains: DRN065G0601
	Intwood Stream	N/A
	River Tas (Tasburgh to Yare)	N/A

20.5.1.2 Geomorphology

56. The methodology and results of the geomorphological walkover survey undertaken in September 2020 are discussed in further detail in **Appendix 20.3 Geomorphology**. The main characteristics of each watercourse within the study area are described below:

- Spring Beck: A modified stream diverted along an artificial course with a predominately straight uniform channel, characterised by glide flows, with limited geomorphological complexity, floodplain connectivity and in-channel aquatic vegetation. The dominant fluvial process is sediment deposition.
- River Glaven: A chalk river characterised by a uniform, incised channel which is straight, dominated by glide flows, with margins well vegetated, flowing through a low gradient glacial till floodplain and woodland. There is some geomorphological complexity, including an online pond and two-stage channel, although there is limited floodplain connectivity. The dominant fluvial process is sediment deposition.
- River Bure: A chalk river characterised by varied channel morphology and flow types, including glides, runs and pools with good floodplain connectivity. The watercourse contains several ditches in the floodplain and along with a two-stage channel consisting of high and low flow channels within a wider channel belt, provide good geomorphic complexity and habitat diversity. The dominant fluvial processes are sediment transport and deposition.

- Swannington Beck: A stream consisting of a primary and secondary channel, with the primary channel displaying varied morphology, such as anabranches and flow habitats including runs, riffles, glides and pools within a meandering planform that is tree lined with limited floodplain connectivity. The secondary channel is a smaller watercourse, also with limited floodplain connectivity, although similar to the primary channel has well vegetated margins. The dominant fluvial process is sediment deposition, with the beds of both channels also armoured in places.
- River Wensum: A chalk river consisting of a primary and secondary channel, with the primary channel characterised by a straight to sinuous planform which is wide, deep and slow flowing in places and dominated by glide flow habitat, with good marginal vegetation. There is good floodplain connection as evident by small wetlands, back waters and an overall wetted floodplain. The secondary channel is a small, straight, incised, modified watercourse, with good marginal vegetation and floodplain connectivity in places. The dominant fluvial process for both channels is sediment deposition.
- River Tud: A chalk river characterised by a straight to gently sinuous planform, varied flow habitats including glides, runs, pools and riffles with good marginal vegetation. There is good floodplain connectivity, with key channel and floodplain features include small benches, relic channels, drainage ditches, scrapes and wetlands, providing geomorphic complexity and habitat diversity. The dominant fluvial process is sediment deposition, although there is little silt deposition on the bed and margins, despite livestock poaching being prevalent.
- River Yare: Characterised by a straight to sinuous planform which is wide and deep in places and dominated by glide and pool flow types. The watercourse has good marginal vegetation, with good floodplain connection. The floodplain contains small wetland scrapes (or ponds) and backwaters. The dominant fluvial process for both channels is sediment deposition.
- River Tiffey: Characterised by a relatively straight planform which is deep and narrow in places and dominated by glide and pool flow types. The river has good marginal vegetation, with good floodplain connection. The floodplain contains ditches, a small lake (offline pond) and wet woodland. The dominant fluvial process for both channels is sediment deposition.
- Intwood Stream: Consists of two connected watercourses, a main larger western channel and a smaller eastern channel, with the western channel characterised by a straight planform of varied morphology, incised in places, with good floodplain connectivity and varied flow types. The channel has good marginal vegetation, with floodplain features including ditches and ponds. The eastern channel also has varied flow types, good marginal vegetation, although modified in places. The dominant fluvial process for both channels is sediment deposition and transport occurring at a similar degree in response to the varied nature of the flow types.

20.5.1.3 Water quality

57. A review of the Environment Agency's Catchment Data Explorer WFD water quality data for surface water bodies gives an indication of water quality across the catchments. Most water bodies show near natural physico-chemical elements of water quality such as dissolved oxygen, temperature, pH, ammonia and phosphate. Most have suffered from physical modifications for agricultural or operational management purposes (Environment Agency, 2020) affecting hydromorphological regime and fish habitat.

58. Some water bodies show high levels of phosphate, particularly the River Tud, the River Tiffey, Intwood Stream and River Tas, which the Environment Agency attributes variously to diffuse sources of pollution from poor livestock and soil management in the agriculture and rural land management industries and also to point source pollution from waste water treatment works by the water industry (Environment Agency, 2020).

59. The onshore cable corridor passes through a surface water Drinking Water Protected Area (DWPA) (Surface Water) towards its southern extent. DWPAs are designated under the WFD where raw water is extracted from rivers and reservoir and therefore requires additional protection to ensure it is not polluted. Areas are identified that are at risk of deterioration, predominantly due to land use practices that cause pollution of the raw water.

20.5.1.4 Flood risk

60. The PEIR boundary for DEP and SEP is primarily located on rural, agricultural land with a large number of agricultural land drains, IDB-maintained Ordinary Watercourses and other Ordinary Watercourses.

61. The NPPF PPG aims to steer development towards areas at lowest risk of flooding (Flood Zone 1) and away from medium and high flood risk areas (Flood Zones 2 and 3) (**Table 20-12**). Flood Zones are informed by the extent of modelling undertaken by the Environment Agency. All designated Main Rivers, as well as some of the larger Ordinary Watercourses included in the Environment Agency's modelling, are considered within the Flood Zone datasets.

Table 20-12: Summary of Flood Zone Definitions

Flood Zone	Probability of Flooding	Return Periods
1	Low	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
3a	High	Land having a 1 in 100 or greater annual probability of river flooding; or

Flood Zone	Probability of Flooding	Return Periods
		Land having a 1 in 200 or greater annual probability of sea flooding.
3b	High – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

62. The landfall location is largely within Flood Zone 1, with a small part falling within Flood Zones 2 and 3, associated with the beach and coastal areas to the north west of Weybourne and Spring Beck which is a Main River. Flood zones in the landfall area are therefore largely dominated by tidal influences and the risk of flooding from fluvial sources is considered low. Furthermore, the area is not at risk of flooding from sewers, reservoirs, canals or other artificial sources.

63. The onshore cable corridor mainly passes through Flood Zone 1, with some areas of Flood Zones 2 and 3 particularly associated with where it crosses Main Rivers and Ordinary Watercourses. The majority of the area is not at risk from tidal or coastal flooding, fluvial flooding from Main Rivers (with the exception of narrow areas at watercourse crossings), sewers, reservoirs, canals or other artificial sources. There is a low level of flood risk associated with groundwater.

64. The proposed onshore substation sites are both located in Flood Zone 1 and as such are at low risk of flooding. Both sites are adjacent to or intersected by a surface water overland flow pathway which are identified to be at primarily ‘Low’ risk of flooding, with some localised areas at ‘Medium’ and ‘High’ risk of flooding.

65. **Appendix 20.2 FRA** provides a detailed description of the baseline flood risk of the landfall, onshore cable corridor and onshore substation search area.

20.5.2 Groundwater

20.5.2.1 Groundwater bodies

66. The onshore study area is underlain by two groundwater bodies as shown in **Figure 20.2**:

- North Norfolk Chalk; and
- Broadland Rivers Chalk and Crag.

67. Both aquifers are designated as Principal Aquifers by the Environment Agency meaning they usually provide a high level of water storage. The superficial deposits underlying the project area comprise areas of glacial sand and gravel, till and crag group sand and gravel (British Geological Survey, 2020). These are classified by the Environment Agency as predominantly Secondary A (permeable layers capable of supporting water supplies at a local scale) or Secondary Undifferentiated (not possible to assign either A or B categories due to often variable characteristics of rock type) with small areas of Secondary B (predominantly lower permeability with limited ability to store or yield groundwater).

68. The Environment Agency's groundwater vulnerability maps indicate that the onshore project area is predominantly located within an area of medium-high groundwater vulnerability with some areas of medium vulnerability and areas of soluble rock risk.

69. The WFD defines groundwater bodies as distinct volumes of groundwater within an aquifer, or aquifers, with a coherent flow unit including recharge and discharge areas and little flow across boundaries between distinct bodies. Groundwater bodies must be designated as drinking water protected areas based on their use for human consumption under the WFD.

70. In addition to the Principal Aquifer underlying the project area, there are also Groundwater Source Protection Zones (SPZs) (**Figure 20.4**). These zones show the risk of contamination from any activities that might cause pollution in the area, with a lesser distance causing greater risk. There are therefore three main zones, the inner zone (Zone 1), the outer zone (Zone 2) and the total catchment (Zone 3). Through the site selection process, Zones 1 and 2 have been avoided by the onshore cable corridor and substation, although the majority of the onshore cable corridor passes through Zone 3.

20.5.3 Abstractions

71. Data held by the Environment Agency (provided in September 2020) demonstrates that there are 172 abstractions within the PEIR boundary. These are comprised of:

- 28 licensed groundwater abstractions and 11 licensed surface water abstractions. These are largely associated with agricultural uses for spray irrigation, although several abstraction points are also used for general farming and domestic uses.
- 39 deregulated (i.e. smaller capacity) groundwater extractions, which are predominantly used to provide a water supply for general agriculture.
- 94 groundwater abstractions that are used to provide a private domestic water supply (i.e. through wells or boreholes).

20.5.4 Designated Sites

72. The River Wensum is designated as both a SAC and SSSI across its entire length. The SSSI was designated as an example of an enriched calcareous lowland river. In its upper reaches, the Wensum shows chalk stream characteristics which is an internationally rare habitat, recognised for protection under the UK Biodiversity Action Plan. It supports a diverse community of plant, invertebrates and other aquatic species across upper and lower reaches, including reed bed habitats and seasonally inundated flood plain. However, the SSSI is in unfavourable condition across much of its length.

73. The SAC was designated to protect the European Habitats Directive Annex I habitat: watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. It is also home to an eastern example of white-clawed crayfish *Austropotamobius pallipes* populations in England. The river is also home to Annex II species Desmoulin's whorl snail *Vertigo moulinsiana*, brook lamprey *Lampetra planeri* and bullhead *Cottus gobio* which are qualifying features of the site.

74. More detail relating to designated sites can be found in **Chapter 22 Onshore Ecology and Ornithology**.

20.5.5 Sensitivity of Receptors

75. As described in **Section 20.5.1**, there are three main surface water drainage catchments in the study area. Each of these is sub-divided into river water body catchments by the Environment Agency which contain further ordinary watercourses. Therefore, the sensitivity of each of the receptors has been set at river water body catchment level and applied to all water bodies within the catchment. Any parts of the surface drainage network that are not included in Ordnance Survey datasets are therefore considered to part of the nearest downstream water body.

76. The sensitivity of each surface water receptors has been defined in **Table 20-13** below and is based on the geomorphological, hydrological and water quality characteristics described in **Section 20.5.1**. The sensitivity of the groundwater bodies underlying the study area have been defined on the basis of recorded water quality and the use of the water bodies and are also defined in **Table 20-13**.

Table 20-13: Sensitivity of receptors

Receptor	Sensitivity	Justification
North Norfolk Rivers		
Spring Beck	Low	Extensively modified watercourse with resectioned banks and limited flow diversity.
Glaven	Medium	This unmodified water body is a chalk stream which is an internationally rare habitat and is sensitive to change. It sustains physico-chemical conditions, including dissolved oxygen and pH, close to its natural state, but runoff from agricultural fields has led to a reduction in macrophytes and phytobenthos.
Coastal catchment	Low	A few minor drains and streams within this catchment which drain into the sea, although none within the landfall area.
River Bure		
Scarrow Beck	Medium	Heavily modified channel which does not support a good hydrological regime; however, water quality is generally good.
River Bure	Medium	Modified channels with evidence of natural geomorphological recovery which support habitats for brown trout, brook lamprey and water voles. Supports National Nature Reserves in lower reaches including Hoveton Great Broad and Marshes.

Receptor	Sensitivity	Justification
Mermaid Stream	Medium	Modified channel which supports habitats for brown trout, brook lamprey and water voles.
River Wensum		
Blackwater Drain	High	Predominantly natural meandering channel with good geomorphological diversity which supports habitats for brown trout and potentially for water voles.
Swannington Beck	High	Heavily modified water body with limited hydrological connectivity for fish due to barriers in place for flood and land management. Water quality is generally good and supports varied geomorphology and ecology. Nearby drains (IDB drains DRN111G0103 and DRN111G0101) also have high ecological value; providing habitat for otters, a good population of water voles, bullhead and brook lamprey.
River Wensum	High	Gently meandering chalk river with uniform flows and extensive deposition over coarse substrates. Although heavily modified with a hydrological regime impacted by groundwater extraction, its water quality is generally near to natural conditions. The river is designated as a SAC and SSSI along its length and it and its tributaries support habitat for European eels, brown trout, bullhead, brook lamprey and water voles.
River Tud	High	Heavily modified chalk river which is a tributary of the River Wensum and therefore supports an internationally rare and designated habitat. Supports habitat for fish species including brown trout and bullhead. Suffers from elevated levels of phosphate due to agricultural runoff.
River Yare		
River Yare	Medium	Largely natural channel with some geomorphological diversity. Groundwater abstraction affects the flow, and although it supports habitat for fish and invertebrate species, physical modifications for land drainage have affected this.

Receptor	Sensitivity	Justification
River Tiffey	Medium	Relatively straight channel with good marginal vegetation communities.
Intwood Stream	Low	Straightened watercourse showing evidence of natural recovery, although affected by livestock trampling, sewage discharges and diffuse source pollution.
River Tas	Medium	Gently meandering river with low dissolved oxygen concentrations.
Groundwater		
North Norfolk Chalk	High	Both are designated as Principal Aquifers and support public water supplies. They contain a number of groundwater SPZs, and a mix of areas of medium-high to medium groundwater vulnerability.
Broadland Rivers Chalk and Crag	High	

20.5.6 Climate Change and Natural Trends

77. The review of the existing environment presented in the sections above demonstrate that the surface water bodies in the study area support large areas of high-quality natural habitats. However, many of these water bodies have experienced physical modification for land drainage and flood risk management, affecting their geomorphology. Water quality is generally good across the study area, but several watercourses are adversely affected by phosphate fertiliser runoff and sewage effluent release leading to elevated levels of phosphate and other contaminants.

78. Ongoing measures to reduce existing pressures on geomorphology and water quality as part of the implementation of the WFD and restoration of the Wensum are likely to improve its condition over time, therefore a steady improvement in the baseline condition is expected.

79. Climate change is causing wetter winters and drier summers with an increase in the likelihood of convectional rain storms. 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.

80. Groundwater bodies face pressures from intensive land use and highly permeable soils. Ongoing initiatives are in place to reduce pressures on groundwater, including increased regulation of agricultural chemicals, in order to achieve compliance with the WFD. This would suggest that groundwater quality and quantity is likely to improve in the future, although this would occur over long timescales.

81. Details relating to climate change and natural trends in designated sites can be found in **Chapter 22 Onshore Ecology and Ornithology**.

20.6 Potential Impacts

20.6.1 Potential Impacts during Construction

20.6.1.1 Impact 1: Direct disturbance of surface water bodies

82. The proposed onshore cable infrastructure and associated temporary haul road will directly cross the following Main Rivers (**Figure 20.5**):

- The River Glaven;
- The River Bure;
- Swannington Beck;
- The River Wensum (upstream of Norwich);
- The River Tud;
- The River Yare;
- The River Tiffey; and
- The Intwood Stream.

83. The proposed onshore cable infrastructure and associated temporary haul road will also directly cross some Ordinary Watercourses (including IDB-maintained drains) within the catchments listed above. Numbers and types of crossings are given in **Table 20-15**.

84. Trenchless crossing techniques such as HDD have been embedded in the scheme design for Main Rivers (**Section 20.3.3**). The cable would be installed at least 2m below the bed of the watercourse and, although ground disturbance will occur at the HDD 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.

85. Trenched crossings would be carried out on the majority of the Ordinary Watercourses (including some IDB-maintained watercourses, depending upon their width, depth and environmental sensitivity) which intersect with the study area. This method has the potential to directly alter the geomorphology, hydrology and physical habitat value of the watercourses. 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 river bed between the two dams with the river flow maintained using a temporary pump or flume.

86. This installation technique would directly disturb the bed and banks of the watercourse and could result in the direct loss of natural geomorphological features and their associated physical habitat niches. It may also result in increased geomorphological instability due to enhanced scour and increased sediment supply. These are, however, temporary impacts provided the bed and banks are reinstated to their original level, position, planform and profile.

87. In addition to the cable infrastructure itself, it may also be necessary to install temporary structures to allow access across watercourses where direct access is not readily available from both sides. As described in **Section 20.3.2**, this will comprise temporary bridges (such as Bailey bridges) at Main Rivers. Depending on local site conditions, Ordinary Watercourses likely to be crossed using temporary culverts.

88. 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 affecting the patterns of erosion and sedimentation. These impacts would be reversible once the temporary culverts have been removed and the bed and banks reinstated.

89. For the purposes of this assessment, the magnitude of effect is assumed to be directly proportional to the total number of trenched watercourse crossings within each river water body catchment as given in **Table 20-14**. For example, 10-14 trenched crossings of ordinary watercourses within a catchment, in the absence of mitigation, would result in habitat changes which equate to a medium magnitude of effect (**Table 20-8**).

Table 20-14: Magnitude of effect resulting from watercourse crossings

Magnitude of effect	Number of trenched crossings per catchment
Negligible	1-4
Low	5-9
Medium	10-14
High	≥15

90. The water body crossings over the course of the cable corridor within each catchment are listed in **Table 20-15**.

Table 20-15: Water body crossings in surface water catchments

Catchment	River water body catchment	Sensitivity	Main River crossings (HDD)	Ordinary Watercourse crossings (trenched)	
				IDB Drains	Other Ordinary Watercourses
North Norfolk Rivers	Spring Beck	Low	0	0	1
	River Glaven	Medium	0	0	0
	Coastal catchment	Low	0	0	0

Catchment	River water body catchment	Sensitivity	Main River crossings (HDD)	Ordinary Watercourse crossings (trenched)	
				IDB Drains	Other Ordinary Watercourses
River Bure	Scarrow Beck	Medium	0	0	0
	River Bure	Medium	1	0	2
	Mermaid Stream	Medium	0	0	0
River Wensum	Blackwater Drain	High	0	0	0
	Swannington Beck	High	1	0	3
	River Wensum	High	1	1	2
	River Tud	High	1	0	0
River Yare	River Yare	Medium	1	0	3
	River Tiffey	Medium	1	0	3
	Intwood Stream	Medium	1	0	3
	River Tas	Medium	0	0	0

20.6.1.1.1 Magnitude of effect – DEP or SEP in Isolation

91. If either DEP or SEP is built in isolation, a single cable corridor will be required of one metre width within a working construction corridor of 45m (100m where HDD is taking place). Trenched crossings of ordinary watercourses crossed by the cable corridor and onshore substation area will lead to short-term degradation of habitats within those water bodies due to direct disturbance of the banks and bed, and therefore may impact on the health of the wider catchment. However, this will be very localised and, with reinstatement, temporary. The magnitude of effect is negligible across all water bodies and is discussed in **Table 20-16**, taking into account the number of potential trenched crossings (**Table 20-15**).

20.6.1.1.2 Magnitude of effect – DEP and SEP Together

92. The construction of DEP and SEP both concurrently and sequentially are considered to have a similar magnitude of effect as changes are temporary and reversible. Trenched crossings of ordinary watercourses along the cable corridor could potentially result in short-term degradation of habitats within those water bodies due to direct disturbance of the banks and bed, and therefore may impact on the condition of the wider catchment.

93. However, concurrent construction could have a marginally greater effect due to the requirement for either a wider trench, or two trenches for the cable corridor, within a construction corridor of 60m width. This will lead to a greater area of disturbance within each watercourse in which the trenched crossing technique is used at any one time. In addition, where trenched crossings are used, the temporary dams and flume or pumps would be in place for a greater period of time continuously. In the sequential scenario, there may be a gap of up to four years between the completion of one Project and the start of the next, and it is assumed that complete reinstatement will occur in between, allowing recovery of the water body.

94. However, because all watercourses will be reinstated to their former state following construction, there is little difference in magnitude of impact for the purposes of this assessment between each scenario. The magnitude of effect is negligible in all water body catchments and is discussed in **Table 20-17**, taking into account the number of trenched crossings in each catchment (**Table 20-15**).

20.6.1.1.3 Impact Significance – DEP or SEP in Isolation

95. The significance of the impact on each watercourse resulting from direct disturbance due to the construction of DEP or SEP in isolation is given in **Table 20-16** below. Prior to mitigation, direct disturbance to all watercourses is considered to be minor adverse.

20.6.1.1.4 Impact Significance – DEP and SEP Together

96. The significance of the impact on each watercourse resulting from direct disturbance due to the construction of DEP and SEP concurrently is given in **Table 20-17** below and, prior to mitigation, are all minor adverse.

20.6.1.1.5 Mitigation

97. HDD has been embedded into the scheme design for Main Rivers and there is no mechanism for direct impacts to occur to the geomorphology, hydrology and physical habitat of the watercourses. Therefore, no further mitigation is proposed at HDD locations.

98. Where temporary dams are required during the trenched crossing process (as described in **Section 20.6.1.1**) the amount of time that these are in place will be kept to a minimum. Prior to dewatering the area between the temporary dams, a fish rescue would be undertaken. 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.

99. The cable ducts would typically be installed two metres below the bed of the water body (dependent on local geology and geomorphological risks) to 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. In addition, 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.

20.6.1.1.6 Residual Impacts – DEP or SEP in Isolation

100. Following the implementation of the additional mitigation measures, the impacts to the ordinary water bodies in which trenched crossings are proposed will be reduced. The resulting magnitude of effect and impact significance to river water body catchments due to the construction of DEP or SEP in isolation are given in **Table 20-16** below.

101. The mitigation measures outlined in **Section 20.6.1.1.5** will not reduce the number of watercourses that would need to be crossed by the proposed cable corridor. However, the level of interaction with Main Rivers will be minimised through the use of HDD and the omission of culverts for haul road crossings. In some sensitive locations where a temporary bridge would not be appropriate, the haul road would effectively stop and would re-start on the opposite side of the river. These measures will reduce the magnitude of impact from medium to low, thereby reducing the significance of the impact to **minor** adverse (unless the pre-mitigation impact was of negligible magnitude, in which case it would remain **negligible**).

20.6.1.1.7 Residual Impacts – DEP and SEP Together

102. The mitigation measures outlined in **Section 20.6.1.1.5** will not reduce the number of watercourses that would need to be crossed by the proposed cable corridor. However, the level of interaction with Main Rivers and IDB drains would be minimised through the use of HDD and the omission of culverts for haul road crossings. These measures will reduce the magnitude of effect from medium to low thereby reducing the significance of the impact to **minor** adverse (unless the pre-mitigation impact was of negligible magnitude, in which case it would remain **negligible**).

20.6.1.1.8 Summary – DEP or SEP in Isolation

Table 20-16: Impacts resulting from direct disturbance of water bodies during the construction of DEP or SEP in Isolation

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Coastal catchment	Low	No trenched watercourse crossings are required in these catchments; therefore, no impacts are anticipated from direct disturbance.	No impact	N/A	No impact	N/A
	River Glaven	Medium		No impact	N/A	No impact	N/A
	Spring Beck	Low	Although one ordinary watercourse will undergo trenched crossing in the Spring Beck catchment, it is a small drainage ditch. Direct disturbance is temporary and the water body will be reinstated to its former condition.	Negligible	Minor adverse	Negligible	Minor adverse
River Bure	Scarrow Beck	Medium		No impact	No impact	N/A	N/A

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Bure	Medium	No crossings of ordinary watercourses are due to take place in either Scarrow Beck or Mermaid Stream, therefore no impact is anticipated in these catchments. The crossing of two ordinary watercourses in the catchment of the River Bure itself are located approximately 4.5km apart and, as each will be reinstated to their former condition, the overall magnitude across the catchment is considered to be low.	Low	Minor adverse	Low	Minor adverse
	Mermaid Stream	Medium		No impact	No impact	N/A	N/A

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
River Wensum	Blackwater Drain	High	There are no crossings of watercourses within the Blackwater Drain catchment, therefore no impact is anticipated.	No impact	No impact	N/A	N/A
	Swannington Beck	High	Only three crossings of ordinary watercourses are expected to be required, therefore the impact associated with these crossings is expected to be negligible, and all will be reinstated following construction.	Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	The magnitude of impact associated with two water body crossings in the catchment of the Wensum is considered to be Negligible. These are adjacent to each other within the catchment, but will be reinstated following trenching and will therefore cause only temporary disturbance.	Negligible	Minor adverse	Negligible	Minor adverse
	River Tud	High	No trenched or open cut crossings of ordinary watercourses are required in the catchment of the River Tud, therefore no impact is anticipated in this catchment.	No impact	N/A	No impact	N/A
River Yare	River Yare	Medium	Three ordinary watercourse crossings are required in the River Yare,	Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tiffey	Medium	River Tiffey and Intwood Stream catchments which will lead to a negligible magnitude of impact across the catchment as only a small proportion of water bodies will be affected. No trenched crossings are required in the River Tas catchment, therefore no impact is anticipated.	Negligible	Minor adverse	Negligible	Minor adverse
	Intwood Stream	Low		Low	Minor adverse	Negligible	Minor adverse
	River Tas	Medium		No impact	N/A	No impact	N/A

20.6.1.1.9 Summary – DEP and SEP Concurrently

Table 20-17: Impacts resulting from direct disturbance of water bodies during the construction of DEP and SEP Concurrently

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Coastal catchment	Low	No trenched watercourse crossings are required in these catchments; therefore, no impacts are anticipated from direct disturbance.	No impact	N/A	No impact	N/A
	River Glaven	Medium		No impact	N/A	No impact	N/A
	Spring Beck	Low	Although one ordinary watercourse will undergo trenched crossing in the Spring Beck catchment, it is a small drainage ditch. Direct disturbance is temporary and the water body will be reinstated to its former condition.	Negligible	Minor adverse	Negligible	Minor adverse
River Bure	Scarrow Beck	Medium		No impact	No impact	N/A	N/A
	River Bure	Medium		Low	Minor adverse	Low	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Mermaid Stream	Medium	No crossings of ordinary watercourses are due to take place in either Scarrow Beck or Mermaid Stream, therefore no impact is anticipated in these catchments. The crossing of two ordinary watercourses in the catchment of the River Bure itself are located approximately 4.5km apart and, as each will be reinstated to their former condition, the overall magnitude across the catchment is considered to be low.	No impact	No impact	N/A	N/A
River Wensum	Blackwater Drain	High	There are no crossings of watercourses within the Blackwater Drain catchment, therefore no impact is anticipated.	No impact	No impact	N/A	N/A
	Swannington Beck	High	Only four crossings of ordinary watercourses are	Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	The magnitude of impact associated with two water body crossings in the catchment of the Wensum is considered to be Negligible. These are adjacent to each other within the catchment, but will be reinstated following trenching and will therefore cause only temporary disturbance.	Negligible	Minor adverse	Negligible	Minor adverse
	River Tud	High	No trenched or open cut crossings of ordinary watercourses are required in the catchment of the River Tud, therefore no impact is anticipated in this catchment.	No impact	N/A	No impact	N/A
River Yare	River Yare	Medium	Three ordinary watercourse crossings are required in the River Yare,	Negligible	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium		Negligible	Minor adverse	Negligible	Minor adverse
	Intwood Stream	Low		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tas	Medium	River Tiffey and Intwood Stream catchments which will lead to a negligible magnitude of impact across the catchment as only a small proportion of water bodies will be affected. No trenched crossings are required in the River Tas catchment, therefore no impact is anticipated.	No impact	N/A	No impact	N/A

20.6.1.2 Impact 2: Increased sediment supply

103. The construction of the landfall, onshore cable corridor and onshore substation will involve earthworks, 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 the erosion of soil particulates. This could result in an increase in the supply of fine sediment (e.g. clays, silts and fine sands) to surface water bodies through surface runoff and the erosion of exposed soils.

104. 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. Further sediment loads could therefore smother existing bed habitats, reduce light penetration and reduce dissolved oxygen concentration, adversely affecting 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.

105. The magnitude of the potential impact on each river water body is proportional to the area of each catchment that would be disturbed during construction. At this stage, the PEIR boundary is being used as the basis for assessment as this represents the theoretical worst case for ground disturbance, accounting for variations in the cable corridor, haul roads, construction compounds, HDD entry and exit pits and all other construction-stage activities. This worst case approximation of the area of disturbance in each catchment which will be revised downwards at the ES stage when more information on the location of each construction component is available.

106. Therefore, at present there is no difference between the area of land affected between each scenario and although it is clear that scenarios involving both DEP and SEP will require greater land take, this will be included in the assessment at ES following refinement of the design.

107. The site selection process for construction compounds is currently ongoing, with areas of existing surface infrastructure being investigated to minimise the requirement for initial site establishment works. The compounds and associated access arrangements are not therefore included in the calculations of potential disturbance in each catchment. The land take calculations for PEIR will therefore be based on the area of the PEIR boundary within each catchment.

108. The results of the calculations of the area of disturbed ground in each water body receptor are shown in **Table 20-18**.

Table 20-18: Estimated maximum area of disturbed ground in each water receptor

Catchment	River water body catchment	Estimated total area of disturbed ground during construction	
		km^2	% of total catchment
North Norfolk Rivers	River Glaven	0.89	1.16
	Spring Beck	0.65	19.5%
River Bure	Scarrow Beck	0.52	0.81

Catchment	River water body catchment	Estimated total area of disturbed ground during construction	
		km^2	% of total catchment
	River Bure	1.95	1.97
	Mermaid Stream	0.28	1.33
River Wensum	Blackwater Drain	0.69	1.07
	Swannington Beck	1.49	5.14
	River Wensum	1.30	0.69
	River Tud	0.66	0.94
River Yare	River Yare	1.02	1.29
	River Tiffey	0.85	3.12
	Intwood Stream	1.33	4.62
	River Tas	1.28	2.13

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

110. The worst case for both scenarios is that a theoretical maximum of 12.96km^2 of land could be exposed during construction. For the purposes of this assessment, the magnitude of effect is assumed to be directly proportional to the area of exposed land in each water body catchment as shown in **Table 20-19**. Although this provides a high-level proxy for the magnitude of effect, this is also dependent on the proximity of the exposed ground to the main water body. If the magnitude of effect differs from that given in **Table 20-19** it is stated and explained in **Table 20-20** and **Table 20-21**.

Table 20-19: Magnitude of effect resulting from exposed land in a water body catchment

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

20.6.1.2.1 Magnitude of effect - DEP or SEP in Isolation

111. If either DEP or SEP is built in isolation, the overall area of exposed land will be approximately 2.85km^2. The magnitude of effect associated with the exposed area in each river catchment is discussed in **Table 20-20** and range from a negligible magnitude of effect in the Scarrow Beck and Mermaid Stream, due to the small area of each catchment affected, to medium in the River Tud and River Wensum where there is a greater potential for sediment to enter the Main River.

20.6.1.2.2 Magnitude of effect – DEP and SEP Together

112. If both DEP and SEP are built together, it is considered that the concurrent construction scenario would have a greater potential for impact than sequential. A greater area of land would be exposed at any one time, under the concurrent scenario, than under the sequential scenario in which the works area will be reinstated prior to the construction of the second Project.

113. The magnitude of effect associated with the exposed area in each river catchment are discussed in **Table 20-21**, however due to the currently similarities in the areas of each catchment proposed to be affected, the magnitude of effect is considered to be the same for each scenario as discussed in **Section 20.6.1.2.1**.

20.6.1.2.3 Impact Significance – DEP and SEP in Isolation

114. Prior to mitigation, impacts are considered to be of minor adverse significance in all surface water bodies except for the Swannington Beck and Blackwater Drain where their high sensitivity has the potential to combine with a low magnitude of effect, representing impacts of moderate adverse significance. The significance of the impact on each water body resulting from increased sediment supply due to the construction of DEP or SEP in isolation is given in **Table 20-20**.

20.6.1.2.4 Impact Significance – DEP and SEP Together

115. Prior to mitigation, impacts are considered to be of minor adverse significance in all surface water bodies except for the Swannington Beck and Blackwater Drain where their high sensitivity has the potential to combine with a low magnitude of effect, representing impacts of moderate adverse significance. The significance of the impact on each water body resulting from increased sediment supply due to the construction of DEP and SEP together is given in **Table 20-21** below.

20.6.1.2.5 Mitigation

116. In order to manage the supply of sediment into water bodies in each catchment, sediment management measures would be implemented. These include:

- Limiting extent of open excavations along the onshore cable route to short sections at any one time (work fronts). Topsoil would be stripped from the entire width of the onshore cable corridor for the length of the work front, then stored and capped to minimise erosion from wind and rain.

- Temporary works areas (e.g. construction compounds and trenchless crossing areas) within the onshore development 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.
- Construction activities will adhere to industry good practice measures as detailed in the Environment Agency's Pollution Prevention Guidance (PPG) notes (including PPG1, PPG5, PPG8 and PPG21) (although these have been revoked, they provide a useful guide for best practice measures) and Construction Industry Research and Information Association (CIRIA)'s 'Control of water pollution from construction sites: Guidance for consultants and contractors (C532)' (2001). Specific measures within the CMS will include:
  - Minimising of subsoil exposure and retention of strips of undisturbed vegetation on the edge of the working area where possible;
  - On-site retention of sediment to be maximised by routing all drainage through the site drainage system;
  - Including 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;
  - Cleaning of the wheels of vehicles leaving site to prevent the accumulation of soil and sediment on road surfaces. Traffic movements would be restricted to minimise surface disturbance; and
  - Routing the cable to avoid water resources and flood risk receptors where possible.
- In locations where large areas of exposed ground lie adjacent to watercourses, buffer strips of vegetation will be retained where possible to prevent runoff.

20.6.1.2.6 Residual Impacts - DEP or SEP in Isolation

117. Following the implementation of mitigation measures, the magnitude of impacts to water bodies would be reduced to negligible across all receptors. The residual impact significance to water bodies resulting from increased sediment supply due to the construction of DEP or SEP in isolation, following the implementation of mitigation measures, are given in **Table 20-20**.

118. The mitigation measures outlined in **Section 20.6.1.2.5** would reduce the quantity of sediment that would enter surface watercourses. These measures therefore considerably reduce the supply of sediment from the proposed works such that there would be very limited potential for changes to the geomorphology or water quality of surface water receptors to occur. These measures would reduce the magnitude of effect representing a residual adverse impact of **minor adverse** or **negligible** significance.

20.6.1.2.7 Residual Impacts – DEP and SEP Together

119. Following the implementation of mitigation measures, the magnitude of effects to surface water receptors would be reduced to negligible across all receptors. The residual impact significance resulting from increased sediment supply due to the construction of DEP or SEP together, following the implementation of mitigation measures, are given in **Table 20-21**.

120. The mitigation measures outlined in **Section 20.6.1.2.5** would reduce the supply of sediment from the proposed development with the potential to enter surface watercourses. These measures therefore considerably reduce the supply of sediment from the proposed works such that there would be very limited potential for changes to the geomorphology or water quality of surface water receptors to occur. These measures will reduce the magnitude of effect and the residual impact down to **minor adverse** or **negligible** significance.

20.6.1.2.8 Summary – DEP or SEP in Isolation

Table 20-20: Impacts associated with an increased sediment supply resulting from the construction of DEP or SEP

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	The process of HDD at landfall will require a works area of approximately 5,600 m^2, which will provide a potential source of sediment which could enter the surface drainage system. However, this area comprises a small percentage of the overall catchments (6.96% of the River Glaven catchment) and will therefore have a low magnitude of effect.	Low	Minor adverse	Negligible	Minor adverse
	Spring Beck	Low		High	Moderate adverse	Medium	Minor adverse
	Coastal catchment	Low		Low	Minor adverse	Negligible	Negligible
River Bure	River Bure	Medium	As a very worst case, only 1.97% of the catchment will be affected by the construction of the onshore cable corridor. Surface water bodies are crossed by trenched crossings twice, which can provide a mechanism for sediment to enter the surface water drainage system. However, with best practice sediment control mitigation	Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			measures in place and a small proportion of the overall catchment being affected the magnitude of effect is considered to be negligible.				
	Scarrow Beck	Medium	Only a very small proportion, 0.77% for Scarrow Beck and 1.33% for Mermaid Stream, of the entire catchments at their very western extents will be disturbed by the construction of the onshore cable corridor. No water body crossings are due to take place, either trenched or by HDD, therefore any sediment generated is likely to be naturally intercepted before it can enter the surface drainage system and will have a negligible impact in the Scarrow Beck and a low magnitude in the Mermaid Stream.	Negligible	Minor adverse	Negligible	Minor adverse
	Mermaid Stream	Medium		Low	Minor adverse	Negligible	Minor adverse
River Wensum	Blackwater Drain	High	A very small proportion (a maximum of 1.07%) of the Blackwater Drain catchment is due to be affected by the construction of the onshore cable corridor. The cable corridor	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			intercepts the very eastern extent (see **Figure 20.3**) of the catchment, therefore the magnitude of effect is expected to be low. With mitigation measures, the quantity of sediment entering the surface water drainage system would be reduced leading to a lower magnitude of effect which would not lead to noticeable change in key characteristics of the watercourse.				
	Swannington Beck	High	The construction of the cable corridor will dissect the Swannington Beck catchment, affecting a maximum 5.14% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away along its length. The impact prior to mitigation is likely to be low magnitude, but with the implementation of mitigation measures which prevent sediment from entering the surface drainage	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			system, magnitude is likely to be reduced to negligible as there will then be no measurable change to the water body.				
	Wensum	High	Although a small proportion, 0.7%, of the entire catchment will be disturbed by the construction of the onshore cable corridor, activities will be taking place adjacent to, and within, some water bodies which are tributaries to the River Wensum itself. There is therefore a potential mechanism for sediment generated to enter the surface drainage system without natural attenuation where it can impact on hydrology, geomorphology and ecosystems within the water bodies. However, this is a localised and short-term impact and mitigation measures will ensure sediment supply is managed.	Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tud	High	The onshore cable corridor currently covers 0.94% of the catchment of the River Tud. No Ordinary Watercourse crossings are likely to be required, therefore potential for sediment to be generated and released into the catchment is negligible. In addition, the impacts are temporary and mitigation measures will be in place to ensure sediment supply is managed.	Negligible	Minor adverse	Negligible	Minor adverse
River Yare	River Yare	Medium	A very small proportion of each catchment is likely to be disturbed by construction works, a maximum of 1.29%. The cable corridor crosses the River Yare catchment in two different locations, but only crosses three Ordinary Watercourses, with the remainder of the area being removed from surface water bodies. A maximum of 3.12% of the catchment of the River Tiffey is likely to be exposed with only 3 Ordinary Watercourses being	Low	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			crossed. Therefore, there is unlikely to be a large amount of sediment entering the surface water drainage system. If mitigation measures are implemented this would be further reduced through sediment management.				
	Intwood Stream	Low	The Intwood Stream catchment will be affected by both the onshore cable corridor and onshore substation with up to 4.62% of the overall catchment due to be disturbed. The cable corridor passes through areas adjacent to minor water bodies, with three trenched crossings likely to occur. However, with mitigation measures implemented to minimise the quantity of sediment entering the surface drainage network, the magnitude of impact is likely to be low.	Low	Minor adverse	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tas	Medium	Only 2.13% of the catchment of the River Tas is likely to be disturbed by the construction of the onshore cable corridor and onshore substation. This is a small proportion of the very western edge of the catchment, approximately 1km away from the River Tas itself. Any sediment runoff is likely to be naturally intercepted prior to entering the river and would be a temporary impact.	Low	Minor adverse	Negligible	Minor adverse

20.6.1.2.9 Summary – DEP and SEP Concurrently

Table 20-21: Impacts associated with an increased sediment supply resulting from the construction of DEP and SEP Concurrently

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	The process of HDD at landfall will require a works area of approximately 5,600 m^2, which will	Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Spring Beck	Low	provide a potential source of sediment which could enter the surface drainage system. However, this area comprises a small percentage of the overall catchments (6.96% of the River Glaven catchment) and will therefore have a low magnitude of effect.	High	Moderate adverse	Medium	Minor adverse
	Coastal catchment	Low		Low	Minor adverse	Negligible	Negligible
River Bure	River Bure	Medium	As a very worst case, only 1.97% of the catchment will be affected by the construction of the onshore cable corridor. Surface water bodies are crossed by trenched crossings twice, which can provide a mechanism for sediment to enter the surface water drainage system. However, with best practice sediment control mitigation measures in place and a small proportion of the overall catchment being affected the magnitude of effect is considered to be negligible.	Low	Minor adverse	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Scarrow Beck	Medium	Only a very small proportion, 0.77% for Scarrow Beck and 1.33% for Mermaid Stream, of the entire catchments at their very western extents will be disturbed by the construction of the onshore cable corridor. No water body crossings are due to take place, either trenched or by HDD, therefore any sediment generated is likely to be naturally intercepted before it can enter the surface drainage system and will have a negligible impact in the Scarrow Beck and a low magnitude in the Mermaid Stream.	Negligible	Minor adverse	Negligible	Negligible
	Mermaid Stream	Medium		Negligible	Minor adverse	Negligible	Negligible
River Wensum	Blackwater Drain	High	A very small proportion (a maximum of 1.07%) of the Blackwater Drain catchment is due to be affected by the construction of the onshore cable corridor. The cable corridor intercepts the very eastern extent (see **Figure 20.3**) of the catchment, therefore the	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			magnitude of effect is expected to be low. With mitigation measures, the quantity of sediment entering the surface water drainage system would be reduced leading to a lower magnitude of effect which would not lead to noticeable change in key characteristics of the watercourse.				
	Swannington Beck	High	The construction of the cable corridor will dissect the Swannington Beck catchment, affecting a maximum 5.14% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away along its length. The impact prior to mitigation is likely to be low magnitude, but with the implementation of mitigation measures which prevent sediment from entering the surface drainage system, magnitude is likely to be	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			reduced to negligible as there will then be no measurable change to the water body.				
	Wensum	High	Although a small proportion, 0.7%, of the entire catchment will be disturbed by the construction of the onshore cable corridor, activities will be taking place adjacent to, and within, some water bodies which are tributaries to the River Wensum itself. There is therefore a potential mechanism for sediment generated to enter the surface drainage system without natural attenuation where it can impact on hydrology, geomorphology and ecosystems within the water bodies. However, this is a localised and short-term impact and mitigation measures will ensure sediment supply is managed.	Negligible	Minor adverse	Negligible	Minor adverse
	River Tud	High	The onshore cable corridor currently covers 0.94% of the catchment of the River Tud. No	Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			Ordinary Watercourse crossings are likely to be required, therefore potential for sediment to be generated and released into the catchment is negligible. In addition, the impacts are temporary and mitigation measures will be in place to ensure sediment supply is managed.				
River Yare	River Yare	Medium	A very small proportion of each catchment is likely to be disturbed by construction works, a maximum of 1.29%. The cable corridor crosses the River Yare catchment in two different locations, but only crosses three Ordinary Watercourses, with the remainder of the area being removed from surface water bodies. A maximum of 3.12% of the catchment of the River Tiffey is likely to be exposed with only 3 Ordinary Watercourses being crossed. Therefore, there is unlikely to be a large amount of sediment entering the surface	Low	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			water drainage system. If mitigation measures are implemented this would be further reduced through sediment management.				
	Intwood Stream	Low	The Intwood Stream catchment will be affected by both the onshore cable corridor and onshore substation with up to 4.62% of the overall catchment due to be disturbed. The cable corridor passes through areas adjacent to minor water bodies, with three trenched crossings likely to occur. However, with mitigation measures implemented to minimise the quantity of sediment entering the surface drainage network, the magnitude of impact is likely to be low.	Low	Minor adverse	Negligible	Negligible
	River Tas	Medium	Only 2.13% of the catchment of the River Tas is likely to be disturbed by the construction of the onshore cable corridor and onshore	Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			substation. This is a small proportion of the very western edge of the catchment, approximately 1km away from the River Tas itself. Any sediment runoff is likely to be naturally intercepted prior to entering the river and would be a temporary impact.				

20.6.1.3 Impact 3: Supply of contaminants to surface and groundwaters

121. During construction, there is potential for the accidental release of lubricants, fuels and oils from construction machinery. This can occur as a result of spillages, leakage from vehicle storage areas and direct release from construction machinery working directly in or adjacent to water bodies. There is also potential for accidental leakages of foul water from welfare facilities, and construction materials including concrete and inert drilling fluids. These can enter surface waters and connected groundwaters through run-off, especially following rainfall.

122. A significant leakage or spillage has the potential to cause adverse impacts 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 (see **Chapter 22 Onshore Ecology and Ornithology**), if pollutant concentrations are sufficiently high.

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

124. The magnitude of the potential impact upon a surface water catchment or body of groundwater is proportional to the area of each catchment that would be affected during construction (i.e. the total footprint of construction activities within the PEIR boundary). As discussed in **Section 20.6.1.2**, for the purposes of this assessment, the area of each catchment affected is the same for each scenario.

20.6.1.3.1 Magnitude of effect - DEP or SEP in Isolation

125. The area of each catchment that is affected during construction of DEP and SEP in isolation is given in **Table 20-18**. This is taken into consideration when considering the magnitude of effect in each water body, as discussed in **Table 20-22**. The magnitude of effect ranges from negligible in Scarrow Beck and Mermaid Stream, to medium in the River Tud and Intwood Stream due to a higher proportion of the catchment being affected, or construction works taking place in close proximity to the Main River or its tributaries.

20.6.1.3.2 Magnitude of effect – DEP and SEP Together

126. The construction of DEP and SEP concurrently is likely to lead to a marginally greater magnitude of effect than a sequential construction scenario due to the greater amount of construction machinery present in the catchment at one time. The area of each catchment that is affected during construction of DEP and SEP concurrently is given in **Table 20-18** and is taken into consideration when considering the magnitude of effect in each water body as discussed in **Table 20-23**. However due to the current similarities in the areas of each catchment proposed to be affected, the magnitude of effect is considered to be the same for each scenario as discussed in **Section 20.6.1.2.1**.

20.6.1.3.3 Impact Significance - DEP or SEP in Isolation

127. Prior to mitigation, impacts are considered to be of minor adverse significance in all surface water bodies with the exception of the River Wensum, River Tud, Blackwater Drain and Swannington Beck where their high sensitivity has the potential to combine with an effect of low magnitude representing an impact of moderate adverse significance. The impact significance associated with a potential supply of contaminants as a result of the construction of DEP or SEP in isolation is given in **Table 20-22**.

20.6.1.3.4 Impact Significance – DEP and SEP Together

128. Prior to mitigation, impacts are considered to be of minor adverse significance in all surface water bodies with the exception of the River Wensum, River Tud, Blackwater Drain and Swannington Beck where their high sensitivity has the potential to combine with an effect of low magnitude representing an impact of moderate adverse significance. The impact significance associated with a potential supply of contaminants as a result of the construction of DEP or SEP concurrently is given in **Table 20-23**.

20.6.1.3.5 Mitigation

129. Construction will adopt specific measures relevant to the prevention of contaminant supply to water bodies. These will prevent immediate discharge of contaminated water from the onshore cable corridor 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 development boundary and transported off site for disposal at a licensed facility.
- During construction, the onshore cable installation will be designed such that it will be bounded by parallel drainage channels (one on each side) to intercept drainage within the working width. Additional drainage channels will be installed to intercept water from the cable trench. This will be discharged at a controlled rate into local ditches or drains via temporary interceptor drains. Depending upon the precise location, water from the channels will be infiltrated or discharged into the existing drainage network.

- Construction drainage will be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. If water enters the trenches during installation from surface runoff of groundwater seepage, this will be pumped via settling tanks, sediment basins or mobile treatment facilities to remove sediment, before being discharged into local ditches or drains via temporary interceptor drains. Existing land drains will be reinstated following construction.

130. In addition, buffer strips of vegetation will be retained adjacent to water bodies where possible, to intercept any contaminated runoff. To protect groundwater bodies, excavation will be shallow, limited to approximately 1.6m below the surface, except where it passes below road and rail infrastructure or water bodies where it maybe deeper.

20.6.1.3.6 Residual Impacts - DEP or SEP in Isolation

131. Following the implementation of mitigation measures, the magnitude of effects to water bodies will be reduced. The resulting magnitude of effect and impact significance to surface and groundwaters due to the construction of DEP or SEP in isolation are given in **Table 20-22**.

132. The mitigation measures outlined in **Section 20.6.1.3.5** will reduce the likelihood and quantity of contaminants entering surface and groundwater bodies, so that the magnitude will reduce from low (a discernible alteration in water quality across a minority of the receptors' length) to negligible (no measurable change in water quality). Therefore, the residual impacts will be reduced to **minor adverse** or **negligible** significance.

20.6.1.3.7 Residual Impacts – DEP and SEP Together

133. The mitigation measures outlined in **Section 20.6.1.3.5** will reduce the likelihood and quantity of contaminants entering surface and groundwater bodies, so that the magnitude will reduce from low (a discernible alteration in water quality across a minority of the receptors' length) to negligible (no measurable change in water quality). Therefore, the residual impacts will be reduced to **minor adverse** or **negligible** significance.

20.6.1.3.8 Summary - DEP or SEP in Isolation

Table 20-22: Impact of supply of contaminants associated with the construction of DEP or SEP in Isolation

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	HDD will be taking place at the landfall with the drilling rig, drilling fluid and fuels and oils associated with construction machinery. In addition, a temporary works compound will be required with fuel storage. The presence of these activities increases the likelihood of a contamination event occurring, however only a small proportion of the catchment of the River Glaven will be affected (1.16%), and best practice mitigation measures will be in place at all times.	Low	Minor adverse	Negligible	Minor adverse
	Spring Beck	Low		Low	Negligible	Negligible	Negligible
	Coastal catchment	Low		Low	Negligible	Negligible	Negligible
River Bure	River Bure	Medium	As a very worst case, only 1.97% of the catchment will be affected by the construction of the onshore cable corridor. Although surface water bodies are crossed, mitigation measures will minimise the contaminant generation along the	Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			onshore cable corridor, reducing the magnitude of effect.				
	Scarrow Beck	Medium	Only a very small proportion of each catchment will be crossed by the cable corridor (0.81% and 1.33% respectively). These areas are not in close proximity to surface water bodies, therefore the potential for contaminants to enter the surface water drainage system is very small. Mitigation measures would not be required, although best practice measures are embedded into the design.	Negligible	Minor adverse	N/A	Minor adverse
	Mermaid Stream	Medium		Negligible	Minor adverse	N/A	Minor adverse
River Wensum	Blackwater Drain	High	A very small proportion (a maximum of 1.07%) of the Blackwater Drain catchment is due to be affected by the construction of the onshore cable corridor. The cable corridor intercepts the very eastern extent (see **Figure 20.3**) of the catchment and only crosses one Ordinary Watercourse, therefore there is low potential for contaminants to enter	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			the surface water drainage system. Mitigation measures will minimise the contaminant generation along the onshore cable corridor, reducing the magnitude of effect.				
	Swannington Beck	High	The construction of the cable corridor will require a maximum 5.14% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a tributary of the Beck, lying between 150m and 600m away along its length. The effect prior to mitigation is likely to be of low magnitude, but with the implementation of mitigation measures which minimise contaminant generation along the onshore cable the magnitude is likely to be negligible.	Low	Moderate adverse	Negligible	Minor adverse
	River Wensum	High	Although a small proportion, 0.69%, of the entire catchment will be disturbed by the construction of the onshore cable corridor, activities will be taking place adjacent to, and	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			within, some water bodies which are tributaries to the River Wensum itself. Therefore, if a contamination event were to occur, there is a mechanism for it to enter the surface water drainage system via surface runoff and affect water quality. However, mitigation measures will ensure that contaminant generation is minimised.				
	River Tud	High	The onshore cable corridor covers 0.94% of the catchment of the River Tud. There is potential that a trenched crossing could occur in close proximity to the River Tud itself which would provide a mechanism for contaminants to enter the river if a leak or spillage event were to occur. However, the impacts are temporary and with mitigation measures in place to ensure contaminant generation is minimised, the magnitude of effect is likely to be low.	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
River Yare	River Yare	Medium	A very small proportion of each catchment is likely to be disturbed by construction works, a maximum of 3.12%. The cable corridor crosses the River Yare catchment in two different locations, but only crosses 3 Ordinary Watercourses. It is unlikely that contaminants would enter the surface water drainage system and with mitigation measures implemented to minimise the potential for contaminant generation this would be reduced.	Low	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium		Low	Minor adverse	Negligible	Minor adverse
	Intwood Stream	Low	Construction for both the onshore cable corridor and onshore substation are likely to occur in the catchment of the Intwood Stream, with up to 4.62% likely to be disturbed. A construction and laydown area of 1ha may be included as part of this and is likely to contain fuel storage areas. However, mitigation measures will be implemented to minimise the	Medium	Minor adverse	Low	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			potential for contaminant generation.				
	River Tas	Medium	Only 2.13% of the catchment of the River Tas is likely to be disturbed by the construction of the onshore cable corridor and onshore substation. This is a small proportion of the very western edge of the catchment, approximately 1km away from the River Tas itself. Although this may include a construction and laydown area of 1ha, mitigation measures to reduce contaminant generation will be in place.	Low	Minor adverse	Negligible	Minor adverse
Groundwater Bodies	North Norfolk Chalk	High	An area of approximately 2.68 km^2 would be affected by construction activities. This accounts for approximately 0.5% of the total groundwater body. This means that any adverse impacts are likely to be spatially limited.	Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Broadland Rivers Chalk and Crag	High	An area of approximately 14.95km^2 would be affected by construction activities. This accounts for approximately 0.5% of the total groundwater body. This means that any adverse impacts are likely to be spatially limited.	Negligible	Minor adverse	Negligible	Minor adverse

20.6.1.3.9 Summary - DEP and SEP concurrently

Table 20-23: Impact of supply of contaminants associated with the construction of DEP and SEP concurrently

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	HDD will be taking place at the landfall with the drilling rig, drilling fluid and fuels and oils associated with construction machinery. In addition, a temporary works compound will be required with fuel storage. The presence of these	Low	Minor adverse	Negligible	Minor adverse
	Spring Beck	Low		Low	Negligible	Negligible	Negligible
	Coastal catchment	Low		Low	Negligible	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			activities increase the likelihood of a contamination event occurring, however only a small proportion of the catchment of the River Glaven will be affected (1.16%), and best practice mitigation measures will be in place at all times.				
River Bure	River Bure	Medium	As a very worst case, only 1.97% of the catchment will be affected by the construction of the onshore cable corridor. Although surface water bodies are crossed, mitigation measures will minimise the contaminant generation along the onshore cable corridor, reducing the magnitude of effect.	Low	Minor adverse	Negligible	Minor adverse
	Scarrow Beck	Medium	Only a very small proportion of each catchment will be crossed by the cable corridor (0.81% and 1.33% respectively). These areas are not in close proximity to surface water bodies, therefore the potential for contaminants to enter the surface water drainage system is very	Negligible	Minor adverse	N/A	Minor adverse
	Mermaid Stream	Medium		Negligible	Minor adverse	N/A	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			small. Mitigation measures would not be required, although best practice measures are embedded into the design.				
River Wensum	Blackwater Drain	High	A very small proportion (a maximum of 1.07%) of the Blackwater Drain catchment is due to be affected by the construction of the onshore cable corridor. The cable corridor intercepts the very eastern extent (see **Figure 20.3**) of the catchment and only crosses one Ordinary Watercourse, therefore there is low potential for contaminants to enter the surface water drainage system. Mitigation measures will minimise the contaminant generation along the onshore cable corridor, reducing the magnitude of effect.	Low	Moderate adverse	Negligible	Minor adverse
	Swannington Beck	High	The construction of the cable corridor will require a maximum 5.14% of the overall catchment. The cable corridor also runs adjacent to IDB drain DRN111G0201 which is a	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			tributary of the Beck, lying between 150m and 600m away along its length. The effect prior to mitigation is likely to be of low magnitude, but with the implementation of mitigation measures which minimise contaminant generation along the onshore cable the magnitude is likely to be negligible.				
	River Wensum	High	Although a small proportion, 0.69%, of the entire catchment will be disturbed by the construction of the onshore cable corridor, activities will be taking place adjacent to, and within, some water bodies which are tributaries to the River Wensum itself. Therefore, if a contamination event were to occur, there is a mechanism for it to enter the surface water drainage system via surface runoff and affect water quality. However, mitigation measures will ensure that contaminant generation is minimised.	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tud	High	The onshore cable corridor covers 0.94% of the catchment of the River Tud. There is potential that a trenched crossing could occur in close proximity to the River Tud itself which would provide a mechanism for contaminants to enter the river if a leak or spillage event were to occur. However, the impacts are temporary and with mitigation measures in place to ensure contaminant generation is minimised, the magnitude of effect is likely to be low.	Low	Moderate adverse	Negligible	Minor adverse
River Yare	River Yare	Medium	A very small proportion of each catchment is likely to be disturbed by construction works, a maximum of 3.12%. The cable corridor crosses the River Yare catchment in two different locations, but only crosses three Ordinary Watercourses. It is unlikely that contaminants would enter the surface water drainage system and with mitigation measures	Low	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			implemented to minimise the potential for contaminant generation this would be reduced.				
	Intwood Stream	Low	Construction for both the onshore cable corridor and onshore substation are likely to occur in the catchment of the Intwood Stream, with up to 4.62% likely to be disturbed. A construction and laydown area of 1ha may be included as part of this and is likely to contain fuel storage areas. However, mitigation measures will be implemented to minimise the potential for contaminant generation.	Medium	Minor adverse	Low	Minor adverse
	River Tas	Medium	Only 2.13% of the catchment of the River Tas is likely to be disturbed by the construction of the onshore cable corridor and onshore substation. This is a small proportion of the very western edge of the catchment, approximately 1km away from the River Tas itself.	Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
			Although this may include a construction and laydown area of 1ha, mitigation measures to reduce contaminant generation will be in place.				
Groundwater Bodies	North Norfolk Chalk	High	An area of approximately 2.68 km^2 would be affected by construction activities. This accounts for approximately 0.5% of the total groundwater body. This means that any adverse impacts are likely to be spatially limited.	Negligible	Minor adverse	Negligible	Minor adverse
	Broadland Rivers Chalk and Crag	High	An area of approximately 14.95km^2 would be affected by construction activities. This accounts for approximately 0.5% of the total groundwater body. This means that any adverse impacts are likely to be spatially limited.	Negligible	Minor adverse	Negligible	Minor adverse

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

134. Initial site preparation activities and construction works will alter surface drainage patterns and surface flows by changing the distribution of surface drainage across the landfall, onshore cable corridor and onshore substation area. Infiltration will 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 can alter site runoff characteristics.

135. Temporary changes to surface flows as a result of trenched crossings of ordinary watercourses may also occur, particularly if the capacity of any pumps or flumes are exceeded. Any changes in surface flows can alter and/or increase flood risk in the proposed onshore development area, particularly in third party land and property in Flood Zones 2 or 3.

136. Subsurface flow patterns can be altered as a result of changes to infiltration rates, surface flows and the installation of impermeable subsurface infrastructure.

137. Therefore, the construction of the onshore infrastructure associated with DEP and SEP has the potential to generate increased surface water flows resulting 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.

138. Note that the potential flood risk implications of the proposed development are described in more detail in the separate Flood Risk Assessment (**Appendix 20.2**).

20.6.1.4.1 Magnitude of effect - DEP or SEP in Isolation

139. The magnitude of effect associated with these potential changes to surface water runoff and flood risk are proportional to the area of land that would be affected during construction. The magnitude of effects as a result of the construction of DEP or SEP in isolation are discussed in **Table 20-24**. and range from low to medium related to the number of watercourse crossings and the area of land affected.

20.6.1.4.2 Magnitude of effect – DEP and SEP Together

140. It is considered that the magnitude of effect resulting from the construction of DEP and SEP concurrently is greater than if it were constructed sequentially. This is due to the larger area of land take required at any one time, which has the potential to alter surface drainage patterns, at a single time for the concurrent scenario.

141. The magnitude of effect associated with these potential changes to surface water runoff and flood risk are proportional to the area of land that would be affected during construction. The magnitude of effects as a result of the construction of DEP or SEP in isolation are discussed in **Table 20-25** and range from low to medium related to the number of watercourse crossings and the area of land affected.

20.6.1.4.3 Impact Significance - DEP or SEP in Isolation

142. The impact significance of changes to surface water and flood risk resulting from the construction of DEP or SEP is given in **Table 20-24**. Prior to mitigation this ranges from negligible to moderate adverse due to the high sensitivity of some catchments particularly the River Wensum and the River Tud.

20.6.1.4.4 Impact Significance – DEP and SEP Together

143. The impact significance of changes to surface water and flood risk resulting from the construction of DEP or SEP is given in **Table 20-25**. Prior to mitigation this ranges from negligible to moderate adverse due to the high sensitivity of some catchments particularly the River Wensum and the River Tud.

20.6.1.4.5 Mitigation

144. Changes in surface water runoff resulting from the increase in impermeable area from the construction of the onshore cable corridor and particularly the onshore substation will be attenuated and discharged at a controlled rate, in consultation with the LLFA and the Environment Agency. This controlled runoff rate will be equivalent to the greenfield runoff rate.

145. During construction, the onshore cable installation will be designed such that it will be bounded by parallel drainage channels (one on each side) to intercept drainage within the working width. Additional drainage channels will be installed to intercept water from the cable trench. This will be discharged at a controlled rate into local ditches or drains via temporary interceptor drains. Depending upon the precise location, water from the channels will be infiltrated or discharged into the existing drainage network.

146. Construction drainage will be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land. If water enters the trenches during installation from surface runoff of groundwater seepage, this will be pumped via settling tanks, sediment basins or mobile treatment facilities to remove sediment, before being discharged into local ditches or drains via temporary interceptor drains. Existing land drains will be reinstated following construction.

147. Along the cable corridor, temporary culverts will be adequately sized to avoid impounding flows (including allowing for increased winter flows as a result of climate change).

148. Further details on mitigation measures for flood risk are included in **Appendix 20.2 FRA**.

20.6.1.4.6 Residual Impacts - DEP or SEP in Isolation

149. Following the implementation of mitigation measures, the magnitude of effects relating to changes in surface water drainage and flood risk would be reduced. The resulting magnitude of effect and impact significance to river and groundwater bodies due to the construction of DEP or SEP in isolation, are given in **Table 20-24**.

150. The mitigation measures set out in **Section 20.6.1.4.5** will not reduce the area of impermeable ground that will be created during construction. However, the measures will ensure that runoff rates will remain the same as the greenfield rate through the use of appropriate construction drainage measures. Consequently, any potential change in flood risk would be reduced and the change would not be permanent. This would limit the magnitude of effect to **negligible**.

20.6.1.4.7 Residual Impacts – DEP and SEP concurrently

151. Following the implementation of mitigation measures, the magnitude of effects relating to changes in surface water drainage and flood risk would be reduced. The resulting magnitude of effect and impact significance to river and groundwater bodies due to the construction of DEP or SEP concurrently, are given in **Table 20-25**.

152. The mitigation measures set out in **Section 20.6.1.4.5** would not reduce the area of impermeable ground that will be created during construction. However, the measures will ensure that runoff rates will remain the same as the greenfield rate through the use of appropriate construction drainage measures. Consequently, there will be a reduction in the level of alteration to the flood risk and the change will not be permanent. The magnitude of effect will therefore be limited to **negligible**.

20.6.1.4.8 Summary – DEP or SEP in Isolation

Table 20-24: Impact of changes to surface water drainage and flood risk as a result of construction of DEP or SEP in isolation

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Glaven	Medium	1.16	Only a small proportion of each catchment would be directly affected by construction activities for the landfall and/or onshore cable corridor. All of the catchments either have no trenched crossings, or only have one except for the catchment of the River Bure, which will have four trenched crossings, the Spring Beck	Low	Minor adverse	Negligible	Minor adverse
	Spring Beck	Low	N/A		Low	Minor adverse	Negligible	Minor adverse
	Coastal catchment	Low	N/A		Negligible	Negligible	Negligible	Negligible
River Bure	Scarrow Beck	Medium	0.81		Negligible	Minor adverse	Negligible	Minor adverse
	River Bure	Medium	1.97		Low	Minor adverse	Negligible	Minor adverse
	Mermaid Stream	Medium	1.33		Negligible	Minor adverse	Negligible	Minor adverse
River Wensum	Blackwater Drain	High	1.07		Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Swanningt on Beck	High	5.14	three, and Swannington Beck two. Across entire catchments, these activities will not lead to a high magnitude change in surface water drainage or flood risk and the low number of trenched crossings mean that there is no potential for flood water flow to be affected by the capacity of pumps or flumes at trenched crossings. In addition, mitigation measures will be	Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				in place, including SuDS, which will minimise the impact of any changes to surface water flows.				
	Wensum	High	0.69	The River Wensum will have six trenched crossings and the River Tud 12 which may increase the potential flood risk due to the capacity of pumps and flumes which could be overwhelmed. However, a small proportion of each catchment will be affected by	Low	Moderate adverse	Negligible	Minor adverse
	River Tud	High	0.94		Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				activities which could affect surface water drainage. Therefore, magnitude of effect is anticipated to be low.				
River Yare	River Yare	Medium	1.29	The River Yare will have three trenched crossings, the River Tiffey will have one, the Intwood Stream only two and the River Tas none. Although the Intwood Stream has a greater proportion of its	Negligible	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium	3.12		Negligible	Minor adverse	Negligible	Minor adverse
	Intwood Stream	Low	4.62		Medium	Minor adverse	Low	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Tas	Medium	2.13	catchment likely to be affected by the onshore substation, this is likely to reduce in area as the design is refined. Particularly with mitigation measures in place, the magnitude of effect on surface water runoff and flood risk will be minimal.	Low	Minor adverse	Negligible	Minor adverse
Groundwater Bodies	North Norfolk Chalk	High	0.5	A very low proportion of the total area of the groundwater body catchments will be affected by the construction of the landfall,	Negligible	Minor adverse	Negligible	Minor adverse
	Broadland Rivers Chalk and Crag	High	0.5		Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				onshore cable corridor and onshore substation. This is likely to have a minimal impact on subsurface flows and the potential to cause flood risk.				

20.6.1.4.9 Summary – DEP and SEP Concurrently

Table 20-25: Impact of changes to surface water drainage and flood risk as a result of construction of DEP and SEP Concurrently

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Glaven	Medium	1.16	Only a small proportion of each	Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	Spring Beck	Low	N/A	catchment would be directly affected by construction activities for the landfall and/or onshore cable corridor. All of the catchments either have no trenched crossings, or only have one except for the catchment of the River Bure, which will have four trenched crossings, the Spring Beck three, and Swannington Beck two. Across entire catchments, these activities will not lead to a	Low	Minor adverse	Negligible	Minor adverse
	Coastal catchment	Low	N/A		Negligible	Negligible	Negligible	Negligible
River Bure	Scarrow Beck	Medium	0.81		Negligible	Minor adverse	Negligible	Minor adverse
	River Bure	Medium	1.97		Low	Minor adverse	Negligible	Minor adverse
	Mermaid Stream	Medium	1.33		Negligible	Minor adverse	Negligible	Minor adverse
River Wensum	Blackwater Drain	High	1.07		Negligible	Minor adverse	Negligible	Minor adverse
	Swannington Beck	High	5.14		Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				high magnitude change in surface water drainage or flood risk and the low number of trenched crossings mean that there is no potential for flood water flow to be affected by the capacity of pumps or flumes at trenched crossings. In addition, mitigation measures will be in place, including SuDS, which will minimise the impact of any changes to surface water flows.				

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Wensum	High	0.69	The River Wensum will have six trenched crossings and the River Tud 12 which may increase the potential flood risk due to the capacity of pumps and flumes which could be overwhelmed. However, a small proportion of each catchment will be affected by activities which could affect surface water drainage. Therefore, magnitude of effect is	Low	Moderate adverse	Negligible	Minor adverse
	River Tud	High	0.94		Low	Moderate adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				anticipated to be low.				
River Yare	River Yare	Medium	1.29	The River Yare will have three trenched crossings, the River Tiffey will have one, the Intwood Stream only two and the River Tas none. Although the Intwood Stream has a greater proportion of its catchment likely to be affected by the onshore substation, this is likely to reduce in area as the design is refined. Particularly with mitigation	Negligible	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium	3.12		Negligible	Minor adverse	Negligible	Minor adverse
	Intwood Stream	Low	4.62		Medium	Minor adverse	Low	Minor adverse
	River Tas	Medium	2.13		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				measures in place, the magnitude of effect on surface water runoff and flood risk will be minimal.				
Groundwater Bodies	North Norfolk Chalk	High	0.5	A very low proportion of the total area of the groundwater body catchments will be affected by the construction of the landfall, onshore cable corridor and onshore substation. This is likely to have a minimal impact on subsurface flows and the potential	Negligible	Minor adverse	Negligible	Minor adverse
	Broadland Rivers Chalk and Crag	High	0.5		Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Percentage of catchment affected by construction	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				to cause flood risk.				

20.6.2 Potential Impacts during Operation

20.6.2.1 Impact 1: Supply of contaminants to surface and groundwater

153. Operational activities at the landfall, along the onshore cable corridor and at the onshore substation will include planned and unplanned maintenance. This could lead to a 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. This in turn could consequently impact upon aquatic ecology.

154. Contaminants may leak into surface waters during operation through surface runoff or accidental spillage or leakage of fuel oils or lubricants from vehicles during operational activities, which could impact upon surface water quality and that of connected groundwaters (including aquifers which support potable water supplies, particularly in SPZ1). This could have subsequent impacts upon aquatic ecology and the use of water resources for licensed and unlicensed abstractions.

20.6.2.1.1 Magnitude of effect - DEP or SEP in Isolation

155. 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 (**Table 20-26**). This is based on the area of the installed onshore cable, onshore substation and permanent access roads within each catchment.

Table 20-26: Maximum area of permanent development in each water body catchment for DEP or SEP in isolation

Catchment	Water body catchment	Estimated total area permanent development	
		m^2	%
North Norfolk Rivers	Glaven	316	0.0005
	Spring Beck	317	0.0004
	Coastal catchment	N/A	N/A
River Bure	Scarrow Beck	253	0.0004
	River Bure	920	0.0009
	Mermaid Stream	84	0.0004
River Wensum	Blackwater Drain	316	0.0005
	Swannington Beck	692	0.0024
	Wensum	588	0.0003
	River Tud	293	0.0004
River Yare	River Yare	471	0.0007

Catchment	Water body catchment	Estimated total area permanent development	
		m²	%
	River Tiffey	433	0.0016
	Intwood Stream	635	0.0022
	River Tas	32,655	0.0544
Groundwater	North Norfolk Chalk	686	0.0001
	Broadland Rivers Chalk and Crag	37,480	0.0012

156. Magnitudes of effect in each receptor resulting from operational activities at the landfall and along the cable corridor are, prior to mitigation, negligible due to the relatively infrequent and highly localised nature of likely operation and maintenance activities, which in turn are unlikely to generate large volumes or contaminants that could have a discernible alteration to the water quality of receptors. In the event of a cable failure the affected stretch of cable (500-1,000m section) would be pulled out of the duct and replaced. To do this the junction bays, which are below ground at either end of that stretch of cable, would be exposed to get access to those bays, and then backfilled after the works are complete. This activity would be highly localised and may not be required during the operational life of the cable infrastructure.

157. The Intwood Stream and River Tas are exceptions where the magnitude is likely to be **low** as the catchments contain the onshore substation. This will require more frequent maintenance and foul water drainage and also represent a larger area of impermeable above-ground infrastructure with the potential to cause an increase in surface water runoff. This can translate to a greater potential for contaminants to be released into the surface water system.

20.6.2.1.2 Magnitude of effect – DEP and SEP Together

158. 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 (**Table 20-26**). This is based on the area of the installed onshore cable, onshore substation and permanent access roads within each catchment.

Table 20-27: Maximum area of permanent development in each water body catchment for DEP and SEP together

Catchment	Water body catchment	Estimated total area permanent development	
		m²	%
North Norfolk Rivers	Glaven	841	0.0011
	Spring Beck	634	0.0004

Catchment	Water body catchment	Estimated total area permanent development	
		m^2	%
	Coastal catchment	N/A	N/A
River Bure	Scarrow Beck	505	0.0008
	River Bure	1,840	0.0019
	Mermaid Stream	167	0.0008
River Wensum	Blackwater Drain	633	0.0010
	Swannington Beck	1,385	0.0048
	Wensum	1,176	0.0006
	River Tud	586	0.0008
River Yare	River Yare	941	0.0014
	River Tiffey	866	0.0032
	Intwood Stream	1,270	0.0044
	River Tas	62,810	0.1047
Groundwater	North Norfolk Chalk	72,460	0.0002
	Broadland Rivers Chalk and Crag	1,372	0.0024

159. Magnitudes of effect in each receptor, prior to mitigation, are negligible due to the relatively infrequent nature of likely operation and maintenance activities, which in turn are unlikely to generate large volumes or contaminants that could have a discernible alteration to the water quality of receptors (see **Section 20.6.2.1.1** for further details).

160. The Intwood Stream and River Tas are exceptions where the magnitude is likely to be **low** as the catchments contain the onshore substation which will require more frequent maintenance and foul water drainage and also represent a larger area of impermeable above-ground infrastructure with the potential to cause an increase in surface water runoff. This can translate to a greater potential for contaminants to be released into the surface water system.

20.6.2.1.3 Impact Significance - DEP or SEP in isolation

161. Prior to mitigation, the impact significance of potential supply of contaminants into water bodies resulting from the operation of DEP or SEP is negligible or minor adverse across all receptors. This is discussed in **Table 20-28**.

20.6.2.1.4 Impact Significance – DEP and SEP together

162. Prior to mitigation, the impact significance of potential supply of contaminants into water bodies resulting from the operation of DEP and SEP is negligible or minor adverse across all receptors. This is discussed in **Table 20-29**.

20.6.2.1.5 Mitigation

163. Operational drainage at the onshore substation will be developed according to the principles of the sustainable drainage system (SuDS) discharge hierarchy. Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable: i) into the ground (infiltration); ii) to a surface water body; iii) to a surface water sewer, highway drain or another drainage system; or iv) to a combined sewer. This will include attenuation ponds and hydrocarbon interceptors to prevent the supply of contaminants (including oils and fine sediment).

164. All fuels, oils, lubricants and other chemicals used at the onshore substation will be stored in an impermeable bund with at least 110% of the stored capacity. Damaged containers will be removed from site and all refuelling will take place in a dedicated impermeable area, using a bunded bowser. The refuelling and fuel storage area will be located at least 10m from the nearest watercourse. Biodegradable oils will be used where possible.

165. Spill kits will be available on site at all times. Sand bags or stop logs will also be available for deployment on the outlets from the site drainage system in case of emergency.

166. Given the sporadic nature of maintenance activities along the cable corridor and the predicted lack of impact, no permanent mitigation is proposed beyond that suggested for the substation site. Any excavations would employ best-practice measures to manage runoff and the supply of sediment and contaminants from construction sites, (cf. **Sections 20.6.1.2.5** and **20.6.1.3.5**).

20.6.2.1.6 Residual Impacts - DEP or SEP in Isolation and Together

167. Following the implementation of mitigation measures at the onshore substation, the River Tas and Intwood Stream would experience a negligible residual impact following the implementation of the mitigation measures outlined above. These measures would prevent sufficient contaminants entering the surface water system and connected groundwater bodies, to cause a measurable change in the water quality of surface water receptors and would prevent alterations to the characteristics of these water bodies. The residual impacts to groundwater bodies would be of **minor adverse** significance due to their high sensitivity to change as principal aquifers with medium-high vulnerability. Residual impacts are shown in **Table 20-28**.

20.6.2.1.7 Summary – DEP or SEP in Isolation

Table 20-28: Impacts associated with the supply of contaminants due to the operation of DEP or SEP in Isolation

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	316	The permanent infrastructure associated with the onshore cable corridor will have a limited spatial extent within each catchment. Infrequent maintenance activities would be necessary during the operational life of DEP or SEP. However, the mechanism for contaminants to enter the surface water drainage system as a result of the operation of the project is limited.	Negligible	Negligible	Negligible	Negligible
	Spring Beck	Low	317		Negligible	Negligible	Negligible	Negligible
	Coastal catchment	Low	N/A		Negligible	Negligible	Negligible	Negligible
River Bure	Scarrow Beck	Medium	253		Negligible	Negligible	Negligible	Negligible
	River Bure	Medium	920		Negligible	Negligible	Negligible	Negligible
	Mermaid Stream	Medium	84		Negligible	Negligible	Negligible	Negligible
River Wensum	Blackwater Drain	High	316		Negligible	Minor adverse	Negligible	Negligible
	Swannington Beck	High	692		Negligible	Minor adverse	Negligible	Negligible
	River Wensum	High	588		Negligible	Minor adverse	Negligible	Negligible
	River Tud	High	293		Negligible	Minor adverse	Negligible	Negligible
River Yare	River Yare	Medium	471		Negligible	Negligible	Negligible	Negligible
	River Tiffey	Medium	433		Negligible	Negligible	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Intwood Stream	Medium	635	Both the Intwood Stream and the River Tas contain elements of the proposed onshore substation. This forms a small proportion of the overall catchment for each, and although some routine maintenance would be required throughout the operational life of the project, however, mitigation measures will be in place to control any potential accidental release of foul drainage and surface water drainage.	Low	Minor adverse	Negligible	Negligible
	River Tas	Medium	32,655		Low	Minor adverse	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	686	Less than 0.5% of the overall area of each groundwater body will be impacted by the onshore project area. Inert solid plastic insulated cables will be used, removing the potential for fluid leakage into groundwater. Infrequent planned and unplanned maintenance activities would be necessary during the operational life of the project. Mitigation measures will control potential for accidental release of foul drainage and surface water drainage from the substation.	Negligible	Minor adverse	Negligible	Negligible
	Broadland Rivers Chalk and Crag	High	37,480		Negligible	Minor adverse	Negligible	Negligible

20.6.2.1.8 Summary – DEP and SEP Together

Table 20-29: Impacts associated with the supply of contaminants due to the operation of DEP and SEP Together

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	841		Negligible	Negligible	No impact	N/A
	Spring Beck	Low	634		Negligible	Negligible	No impact	N/A
	Coastal catchment	Low	N/A		Negligible	Negligible	No impact	N/A
River Bure	Scarrow Beck	Medium	505		Negligible	Negligible	No impact	N/A
	River Bure	Medium	1,840		Negligible	Negligible	Negligible	Negligible
	Mermaid Stream	Medium	167		Negligible	Negligible	Negligible	Negligible
River Wensum	Blackwater Drain	High	633		Negligible	Minor adverse	Negligible	Negligible
	Swannington Beck	High	1,385		Negligible	Minor adverse	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	1,176		Negligible	Minor adverse	Negligible	Negligible
	River Tud	High	586		Negligible	Minor adverse	Negligible	Negligible
River Yare	River Yare	Medium	941		Negligible	Negligible	Negligible	Negligible

	River Tiffey	Medium	866	The permanent infrastructure associated with the onshore cable corridor will have a limited spatial extent within each catchment. There is no expected requirement to undertake routine maintenance, although some planned and unplanned activities may be necessary during the operational life of DEP and SEP. Therefore, the mechanism for contaminants to enter the surface water drainage system as a result of the operation of the project is limited.	Negligible	Negligible	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Intwood Stream	Low	1,270	Both the Intwood Stream and the River Tas contain elements of the proposed onshore substation. This forms a small proportion of the overall catchment for each, and although some routine maintenance is likely to be required, mitigation measures will be in place to control any potential accidental release of foul drainage and surface water drainage.	Low	Minor adverse	Negligible	Negligible
	River Tas	Medium	62,810		Low	Minor adverse	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	1,372	Less than 1% of the overall area of each groundwater body will be impacted by the onshore project area. Inert solid plastic insulated cables will be used in place of oil insulated cables, removing the potential for fluid leakage into groundwater. There is no requirement to undertake routine maintenance along the cable corridor (although some planned and unplanned activities may be necessary during the operational life of	Negligible	Minor adverse	Negligible	Negligible
	Broadland Rivers Chalk and Crag	High	72,460		Negligible	Minor adverse	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				the project). Mitigation measures will control potential for accidental release of foul drainage and surface water drainage from the substation.				

20.6.2.2 Impact 2: Changes to surface and groundwater flows and flood risk

168. The permanent above ground infrastructure, including the onshore substation and any new permanent access tracks, will result in permanent changes to land use. Although permeable surface treatments will be used where possible, jointing pits along the onshore cable corridor, and the onshore substation, with associated infrastructure such as roads this change in land use from greenfield agricultural land would result in an increase in impermeable land area.

169. The presence of the buried cable ducting along the onshore cable corridor may impact upon subsurface flow corridors as it will introduce an impermeable barrier which may change 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 proposed onshore project area (including shallow aquifers and deeper Principal Aquifers). However, the relatively shallow depth of the cable infrastructure means that any impacts are likely to be highly localised and confined to shallow near-surface groundwater bodies.

170. An increase in the impermeable area in a catchment will result in a reduced rate of infiltration and therefore a potential increase in surface runoff. Changes in surface water runoff and subsurface flows could be sufficient to impact upon 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, encouraging geomorphological adjustment. Geomorphological changes may also impact upon in-channel habitat conditions for aquatic organisms. Impacts on geomorphology and in-channel habitats are likely to be particularly marked if drainage from a large area is discharged at a discrete location within the existing surface drainage network.

171. 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.

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

20.6.2.2.1 Magnitude of effect - DEP or SEP in Isolation

173. 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 cable corridor, onshore substation and permanent access roads within each catchment (**Table 20-26**).

174. The magnitude of effect in each receptor is discussed in **Table 20-30**, but is anticipated to be low in the Intwood Stream, River Tas and groundwater bodies due to the presence of permanent onshore substation infrastructure in the Intwood Stream and River Tas catchments which could alter surface flow patterns. The magnitude of effect in all other receptors is anticipated to be negligible due to the lack of mechanism for impact during operation.

20.6.2.2.2 Magnitude of effect – DEP and SEP Together

175. 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 cable corridor, onshore substation and permanent access roads within each catchment (**Table 20-27**).

176. The magnitude of effect in each receptor is discussed in **Table 20-31,** but is anticipated to be low in the Intwood Stream, River Tas and groundwater bodies due to the presence of permanent onshore substation infrastructure in the Intwood Stream and River Tas catchments which could alter surface flow patterns. The magnitude of effect in all other receptors is anticipated to be negligible due to the lack of mechanism for impact during operation.

20.6.2.2.3 Impact Significance - DEP or SEP in Isolation

177. The impact significance for each receptor as a result of the operation of DEP or SEP in isolation is given in **Table 20-30**, and is assessed as negligible or minor adverse for all receptors.

20.6.2.2.4 Impact Significance – DEP and SEP Together

178. The impact significance for each receptor as a result of the operation of DEP and SEP together is given in **Table 20-31**, and is assessed as negligible or minor adverse for all receptors.

20.6.2.2.5 Mitigation

179. Surface water drainage at the onshore substation will be designed to meet the requirements of the NPPF and NPS EN-5, with runoff limited, where feasible, through the use of infiltration techniques which can be accommodated within the area of development. The drainage will be developed according to the principles of the SuDS discharge hierarchy. Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable: i) into the ground (infiltration); ii) to a surface water body; iii) to a surface water sewer, highway drain or another drainage system; or iv) to a combined sewer. No mitigation is proposed specifically along the onshore cable corridor.

20.6.2.2.6 Residual Impacts - DEP or SEP in isolation

180. Following the implementation of mitigation measures, the potential for increased surface water runoff and flood risk during the operational phase of either DEP or SEP is reduced. Therefore, the magnitude of impact is reduced to negligible across those receptors associated with the onshore substation – the River Tas, the Intwood Stream and the groundwater bodies. The remaining surface water bodies which are associated with onshore cable corridor will see no reduction in magnitude of effect as no mitigation measures are proposed. However, they are likely to experience only a negligible magnitude of effect. Therefore across all receptors, the residual impact is considered to be **minor adverse** where they have high or medium sensitivity, and **negligible** where they have low sensitivity. The residual impacts are given **in Table 20-30**.

20.6.2.2.7 Residual Impacts – DEP and SEP together

181. Following the implementation of mitigation measures, the potential for increased surface water runoff and flood risk during the operational phase of both DEP and SEP together is reduced. Therefore, the magnitude of impact is reduced to negligible across those receptors associated with the onshore substation – the River Tas, the Intwood Stream and the groundwater bodies. The remaining surface water bodies which are associated with onshore cable corridor will see no reduction in magnitude of effect as no mitigation measures are proposed. However, they are likely to experience only a negligible magnitude of effect. Therefore, across all receptors, the residual impact is considered to be **minor adverse** where they have high or medium sensitivity, and **negligible** where they have low sensitivity. The residual impacts are given in **Table 20-31**.

20.6.2.2.8 Summary – DEP or SEP in isolation

Table 20-30: Impacts to surface and groundwater flows and flood risk associated with the operation of DEP or SEP in isolation

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	316	As a result of the limited spatial extent of permanent impermeable development along the cable corridor, the effect is considered to be of negligible magnitude in the North Norfolk Rivers, River Bure and River Wensum catchments as well as the two catchments in the River Yare	Negligible	Minor adverse	Negligible	Minor adverse
	Spring Beck	Low	317		Negligible	Negligible	Negligible	Negligible
	Coastal catchment	Low	N/A		Negligible	Negligible	Negligible	Negligible
River Bure	Scarrow Beck	Medium	253		Negligible	Minor adverse	Negligible	Minor adverse
	River Bure	Medium	920		Negligible	Minor adverse	Negligible	Minor adverse
	Mermaid Stream	Medium	84		Negligible	Minor adverse	Negligible	Minor adverse
River Wensum	Blackwater Drain	High	316		Negligible	Minor adverse	Negligible	Minor adverse
	Swanningt on Beck	High	692		Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	River Wensum	High	588	that contain only the onshore cable corridor. No operational mitigation measures are proposed for the cable corridor and associated infrastructure therefore the magnitude of effect will remain negligible.	Negligible	Minor adverse	Negligible	Minor adverse
	River Tud	High	293		Negligible	Minor adverse	Negligible	Minor adverse
River Yare	River Yare	Medium	471		Negligible	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium	433		Negligible	Minor adverse	Negligible	Minor adverse
	Intwood Stream	Low	635	A small proportion of each catchment could potentially be impacted by changes to surface water runoff, groundwater flows and flood	Low	Minor adverse	Negligible	Negligible
	River Tas	Medium	32,655		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				risk resulting from the permanent presence of the onshore substation. However, mitigation measures implemented to ensure that runoff rates remain at their greenfield rates will reduce the magnitude to no impact.				

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	686	It is expected that subsurface (groundwater) flows will pass above or below the ducting and will not change significantly. As a result, although there will be some minor changes in the distribution of flows, there is unlikely to be a significant perturbation / change in overall flow directions and quantities. Furthermore, the size and shallow	Low	Minor adverse	Negligible	Minor adverse
	Broadland Rivers Chalk and Crag	High	37,480		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				depth of the impermeable subsurface barrier created by the cable ducting in comparison to the size of the groundwater bodies which underlie the onshore project area comprises 0.38% and 3.7% of the overall area of the North Norfolk Chalk and Broadland Rivers Chalk groundwater bodies respectively. This will result in an effect upon				

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				infiltration rates, groundwater flows, sub-surface flow corridors and alterations in the distribution of groundwater of low magnitude.				

20.6.2.2.9 Summary – DEP and SEP together

Table 20-31: Impacts to surface water runoff and flood risk associated with the operation of DEP and SEP together

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
North Norfolk Rivers	River Glaven	Medium	841	As a result of the limited spatial extent of permanent	Negligible	Minor adverse	Negligible	Minor adverse
	Spring Beck	Low	N/A		Negligible	Negligible	Negligible	Negligible

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Coastal catchment	Low	634	impermeable development along the cable corridor, the effect is considered to be of low magnitude in the North Norfolk Rivers, River Bure and River Wensum catchments as well as the two catchments in the River Yare that contain only the onshore cable corridor.	Negligible	Negligible	Negligible	Negligible
River Bure	Scarrow Beck	Medium	505		Negligible	Minor adverse	Negligible	Minor adverse
	River Bure	Medium	1,840		Negligible	Minor adverse	Negligible	Minor adverse
	Mermaid Stream	Medium	167		Negligible	Minor adverse	Negligible	Minor adverse
River Wensum	Blackwater Drain	High	633		Negligible	Minor adverse	Negligible	Minor adverse
	Swanningt on Beck	High	1,385		Negligible	Minor adverse	Negligible	Minor adverse
	River Wensum	High	1,176		Negligible	Minor adverse	Negligible	Minor adverse
	River Tud	High	586		Negligible	Minor adverse	Negligible	Minor adverse
River Yare	River Yare	Medium	941		Negligible	Minor adverse	Negligible	Minor adverse
	River Tiffey	Medium	866		Negligible	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
	Intwood Stream	Low	1,270	A small proportion of each catchment could potentially be impacted by changes to surface water runoff, groundwater flows and flood risk resulting from the permanent presence of the onshore substation. However, mitigation measures implemented to ensure that runoff rates remain at their greenfield rates will reduce the magnitude to no impact.	Low	Minor adverse	Negligible	Negligible
	River Tas	Medium	62,810		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
Groundwater Bodies	North Norfolk Chalk	High	1,372	It is expected that subsurface (groundwater) flows will pass above or below the ducting and will not change significantly. As a result, although there will be some minor changes in the distribution of flows, there is unlikely to be a significant perturbation / change in overall flow directions and quantities. Furthermore, the size and shallow depth of the impermeable subsurface barrier created by the	Low	Minor adverse	Negligible	Minor adverse
	Broadland Rivers Chalk and Crag	High	72,460		Low	Minor adverse	Negligible	Minor adverse

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				cable ducting in comparison to the size of the groundwater bodies which underlie the onshore project area comprises 0.38% and 3.7% of the overall area of the North Norfolk Chalk and Broadland Rivers Chalk groundwater bodies respectively. This will result in an effect upon infiltration rates, groundwater flows, sub-surface flow routes and alterations in the distribution of				

Catchment	River water body catchment	Sensitivity	Estimated total area permanent development (m^2)	Assessment	Magnitude	Impact significance prior to mitigation	Magnitude following mitigation	Residual Impact Significance
				groundwater of low magnitude.				

20.6.3 Potential Impacts during Decommissioning

182. No decision has yet been made regarding the final decommissioning policies for either DEP or SEP as it is recognised that industry best 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.

183. 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 impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.

20.7 Cumulative Impacts

20.7.1 Identification of Potential Cumulative Impacts

184. The first step in the cumulative assessment is the identification of which residual impacts assessed for DEP and/or SEP on their own have the potential for a cumulative impact with other plans, projects and activities (described as ‘impact screening’). This information is set out in **Table 20-32** below, together with a consideration of the confidence in the data that is available to inform a detailed assessment and the associated rationale. Only potential impacts assessed in **Section 20.6** as negligible or above are included in the CIA (i.e. those assessed as ‘no impact’ are not taken forward as there is no potential for them to contribute to a cumulative impact).

185. **Table 20-32** concludes that in relation to Water Resources and Flood Risk, all impacts identified in **Section 20.6** have the potential to act cumulatively with other projects.

Table 20-32: Potential Cumulative Impacts (impact screening)

Impact	Potential for Cumulative Impact	Rationale
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. The likelihood of a temporal overlap may increase with the sequential scenario where construction will take place over a longer period of time.
Increased sediment supply	Yes	Other projects being constructed within 1km of the onshore construction area associated with DEP and SEP may also cause an increase in sediment supply to the surface water drainage system which could act cumulatively. DEP and SEP being constructed concurrently may have a greater cumulative effect

		due to the greater area of exposed land during construction which has the potential to cause more sediment runoff.
Supply of contaminants	Yes	Other projects being constructed within 1km of the onshore construction area of DEP and SEP may act cumulatively to reduce surface and groundwater quality in the event that they cause a supply of contaminants to be released into the surface water drainage system. There is greater potential for cumulative effects under the sequential scenario as more works are required over a greater timescale to complete each project and reinstate the works area in between, therefore there is more time for a contamination event to occur.
Changes to surface water runoff and flood risk	Yes	Any project involving construction within 1km of the onshore project infrastructure could also cause changes in surface flow patterns, compaction and an increase in impermeable area. This could act cumulatively to cause further changes to surface water runoff and flood risk.
Supply of contaminants	Yes	All new developments are likely to have operational or maintenance requirements which may require regular access by machinery, therefore increasing the likelihood of contaminants being released and acting cumulatively. However, operational activities associated with DEP and SEP are largely confined to the onshore substation site and as such could only result in cumulative impacts in the catchments which contain the substation (the River Tas and the Intwood Stream).
Changes to surface water runoff and flood risk	Yes	As a result of the limited spatial extent of permanent impermeable development along the cable corridor, 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 (the River Tas and the Intwood Stream).

20.7.2 Other Plans, Projects and Activities

186. The second step in the cumulative assessment is the identification of the other plans, projects and activities that may result in cumulative impacts for inclusion in the CIA (described as 'project screening'). This information is set out in **Table 20-33** below, together with a consideration of the relevant details of each, including current status (e.g. under construction), planned construction period, closest distance to DEP & SEP, status of available data and rationale for including or excluding from the assessment.

187. The project screening has been informed by the development of a CIA Project List which forms an exhaustive list of plans, projects and activities in a very large study area relevant to DEP and SEP. 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. Those projects that are located more than 20km away are not included in **Table 20-33** (unless an exception is stated) as there is no mechanism for impacts to act cumulatively on water resources and flood risk over that distance as no works will be taking place in the same catchments.

Table 20-33: Summary of projects considered for the CIA in relation to Water Resources and Flood Risk (project screening)

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
Hornsea Project Three Offshore Wind Farm	Approved	2021-2025 (single phase) 2021-2031 (two phase)	0km, direct intersection of the two cable corridors	High	Y	There is potential that this project could be constructed in two phases meaning that the entire construction period could be either ten years or six years. Therefore, there could be temporal overlap of construction with SEP and SEP which could lead to cumulative impacts in direct disturbance of water bodies, contaminant and sediment release and changes to surface water drainage. The onshore infrastructure for this project follows a very similar route to that of the DEP and SEP, therefore potential impacts would affect the same catchments.
Norfolk Vanguard Offshore Wind Farm	DCO quashed	2022-2027	0km – onshore cable corridor crosses the DEP and SEP onshore cable corridor.	High	Y	The onshore cable route for both the Norfolk Vanguard and Norfolk Boreas offshore wind farms will also pass through the catchments of the Mermaid

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
Norfolk Boreas Offshore Wind Farm	DCO consented	2023-2028	0km – onshore cable corridor crosses the DEP and SEP onshore cable corridor	High	Y	Stream, River Bure, Blackwater Drain and the River Wensum. There may be concurrent construction, therefore some cumulative effects may occur in direct disturbance of water bodies, supply of sediment and contaminants.
Great Yarmouth Third River Crossing	DCO consent received with modification	2022-2024	Approximately 30km – included here because this project lies on the River Yare which is downstream of the water bodies potentially affected by DEP and SEP.	High	N	This is not taken further in this CIA due to the distance upstream that the construction works for DEP and SEP will be occurring; any potential impacts relating to sediment release or contaminants will have been reduced due to mitigation measures and best practice measures and will have dissipated and diluted. Therefore, they will not act cumulatively at this point downstream.

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
A47 North Tuddenham to Easton	Pre-application DCO	January-March 2022/2023-2024-2025	0km – DEP and SEP cable corridor crosses the A47in directly where improvement works are taking place.	Medium	Y	There is a possibility that there will be temporal overlap in the construction of these two projects. Cumulative impacts could occur in all construction impacts within the River Tud catchment.
Improvement of the Thickthorn A11/A47 junction	Pre-application DCO	January – March 2023 until 2024-2025. Duration likely to be 26 months	2.5km	Low	Y	There is potential for a temporal overlap in construction for this project. If construction does overlap, concurrent construction in the Intwood Stream and River Yare catchments could cause cumulative effects in supply of sediment and contaminants, and also in flood risk.
A47 Blofield to North Burlingham	Pre-application DCO	Unknown – estimated duration is 16 months	Approximately 13km	Low	N	The relatively localised nature of impacts likely to be associated with this project and the distance from the onshore substation area for DEP and SEP mean that cumulative impacts are unlikely. Supplies of sediment and contaminants

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
						are likely to be naturally attenuated before acting cumulatively.
Construction of permeable surfaced footpath and access road for pedestrians and emergency and maintenance vehicles at Mulbarton County First School	Approved	Unknown	1km from onshore cable corridor	Medium	N	This project comprises only 263m^2 of permeable footpath. There is unlikely to be any temporal overlap in construction and it will not cause an increase in flood risk.
Change of use from warehousing to use for waste processing and production of waste derived fuel at SPC Atlas Works.	Approved	Unknown	1.13km from onshore cable corridor	High	N	Consultation with both Natural England and the Environment Agency has concluded that this project will have no impact to flood risk or the water environment. In addition, there is unlikely to be any temporal overlap as approval was granted in 2018, and construction must begin within three years.

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
Demolition of four existing dwellings and development of 10 residential units south of Swannington.	Approved (reserved matters application)	Unknown	0km from onshore cable corridor – overlap with RLB in southern corner	High	Y	If there is temporal overlap of construction activities, there is potential for cumulative impacts in sediment supply and contaminant supply during construction. There are not anticipated to be any operational cumulative impacts associated with this project.
EIA Screening Opinion request for the proposed development of a ground mounted solar farm and associated infrastructure, occupying approx. 35 ha of land north of the Street, Cawston	Screening decision – EIA not required	Unknown	0km from onshore cable corridor – entire proposed development area contained within DEP and SEP study area.	Medium	N	Although there is a potential spatial overlap between the two projects, this proposed solar farm will require minimal construction works and is not anticipated to have any impacts to water resources or flood risk. There is little potential for contaminant release at construction or operational phase, therefore no mechanism for cumulative impacts.
Infiltration lagoon to serve Food	Approved	Unknown	0km from onshore cable corridor –	Medium	N	This attenuation lagoon serves as sustainable drainage and

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
Enterprise Park 2 north of Colton			entire proposed development contained within DEP and SEP study area			will therefore prevent impacts on the surface drainage network from the Food Enterprise Park. It is unlikely that there will be any temporal overlap, therefore no mechanism for cumulative impact.
Erection of agricultural building and shed at the Old Hall, Colton	Approved	Exact period unknown but must start by 2021.	0km, overlap with DEP/SEP study area at Colton	Medium	N	There is unlikely to be a temporal overlap in construction with this project. In addition, the planning permission stipulates a requirement to use SuDs and conclude that it will not increase the risk of flooding.
Demolition of a garage and outbuilding, erection of detached garage and single storey side extension in Bodham, Holt.	Approved	Unknown	0km – direct overlap	High	N	This proposal has a very small footprint in comparison to DEP and SEP, and also in comparison the River Glaven catchment. There is unlikely to be any temporal overlap in construction, therefore no

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
						potential for cumulative impacts.
Demolition of garages, and replacement with wheelchair adaptable bungalow.	Pre-application advice given	Unknown	0km – direct overlap	Low	N	This proposal has a very small footprint in comparison to DEP and SEP, and also in comparison the River Glaven catchment. There is unlikely to be any temporal overlap in construction, therefore no potential for cumulative impacts.
Erection of detached double garage and detached outbuilding to provide two self-contained holiday lets.	Pre-application advice given	Unknown	0km – direct overlap	Low	N	This proposal is likely to have a very small footprint in comparison to the area of the River Glaven catchment and DEP or SEP onshore project area. There is unlikely to be temporal overlap, and therefore no mechanism for cumulative impact.
Demolition of former school and	Pre-application advice given	Unknown	0km – direct overlap	Low	N	This proposal is likely to have a very small footprint in comparison to the area of the

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
construction of four dwelling houses.						River Glaven catchment and DEP or SEP onshore project area. There is unlikely to be temporal overlap, and therefore no mechanism for cumulative impact.
Affordable housing development in the field adjacent to Sheringham Road, Weybourne.	Pre-application advice given	Unknown	0km – direct overlap	Low	N	This proposal is likely to have a very small footprint in comparison to the River Glaven catchment and DEP or SEP onshore project area. It is likely that it will include a sustainable drainage system, and will be of insufficient scale to cause significant cumulative impacts
Prior notification to erect replacement agricultural storage building at Weybourne	Permission not required	Unknown	0km – direct overlap	Medium	N	This proposal is likely to have a very small footprint in comparison to the River Glaven catchment and DEP or SEP onshore project area. It is likely that it will include a sustainable drainage system, and will be of insufficient scale

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
						to cause significant cumulative impacts
Land west of Norwich Road, Swainsthorpe	Pending consideration	Unknown	0km – direct overlap to southern edge of substation location	Medium	Y	The construction period for this project is unknown, therefore there is potential for a temporal overlap with the construction of DEP and SEP. If construction does overlap, concurrent construction in the River Tas catchment could cause cumulative impacts in supply of sediment, contaminants and also flood risk. The potential for cumulative impacts on flood risk and contaminant release may also occur during operation.
Construction of up to 650 dwellings, primary school, sixth form college and associated infrastructure on land to the north	EIA Scoping Opinion submitted and concluded to be required	Unknown	Approximately 0.75km	Medium	Y	The construction period for this project is unknown, therefore there is potential for concurrent construction to occur. If construction does overlap, concurrent construction in the River Tiffey catchment could

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
east of Wymondham						cause cumulative impacts in supply of sediment, contaminants and also flood risk. The potential for cumulative impacts on flood risk may also occur during operation.
Erection of chalet bungalow and associated single garage on Barford Road, Marlingford	Approval with conditions	Unknown	Approximately 0.5km	High	N	The small scale of this development and the existing properties already on site mean that there is unlikely to be any cumulative impacts with the cable corridor for DEP and SEP.
81ha solar farm proposed by EDF energy to be constructed between Mulbarton and Swainsthorpe.	Pre-planning application submission public consultation	6 months, anticipating to start in 2021 or 2022.	Approximately 0.5km	Low	N	Due to the short construction period, there is unlikely to be any temporal overlap in construction if installation begins in 2021 or 2022. No cumulative impacts are likely during operation as there is limited potential for contamination to occur during

Project	Status	Construction Period	Closest Distance from the Onshore Cable Corridor or Substation (km)	Confidence in Data	Included in the CIA (Y/N)	Rationale
						operation and surface water runoff will not be impacted.
Gas powered electricity generator and related infrastructure to be constructed off Mangreen Lane, Dunston	Approved with conditions	Permission granted in 2018 with the condition that works must begin within three years. Construction expected in 2021 at the latest.	0km direct overlap with the onshore substation area	High	N	As construction must be started by 2021, whilst DEP and SEP will not commence until 2024, it is unlikely that there will be any temporal overlap in construction. As it will have been constructed this project will form part of the baseline.
49.9MW battery storage facility, fencing and access road on land east of the existing Norwich 400kV substation off Mangreen Lane, Dunston	Approved with conditions			High	N	

20.7.3 Assessment of Cumulative Impacts

188. Having established the residual impacts from DEP and/or SEP with the potential for a cumulative impact, along with the other relevant plans, projects and activities, the following sections provide an assessment of the level of impact that may arise.

20.7.3.1 Cumulative Impact during Construction 1 – Direct Disturbance of Watercourses

189. Hornsea Project Three follows a similar landfall, cable corridor and onshore substation location so also has the potential to cause direct disturbance to Ordinary Watercourses within the North Norfolk, River Bure, River Wensum and River Yare operational catchments. Norfolk Vanguard and Norfolk Boreas will both also cross Ordinary Watercourses in the catchments of the River Bure and River Wensum, and Blackwater Drain. However, the mitigation measures for DEP and SEP laid out in **Section 20.6.1.1.5** will prevent any adverse impacts in these watercourses resulting from the construction of DEP and SEP.

190. Hornsea Project Three has committed to trenchless crossings of all Main Rivers and IDB maintained Ordinary Watercourses but may carry out trenched crossings in smaller and less sensitive Ordinary Watercourses. This means that although any cumulative impacts are likely to be limited, there is potential for cumulative impacts to occur. However, the number of trenched crossings and the residual impact for each receptor is not given in the submitted Environmental Statement and the overall residual impact following mitigation is anticipated to be minor adverse as a result of the construction of Hornsea Project Three (Ørsted, 2018).

191. Mitigation measures proposed for Hornsea Project Three include the installation of pre-installed culvert (flume) pipes in the watercourse under the construction accesses and haul road. The pipe would be of suitable size to accommodate the water volumes and flows, or temporary bridging may be installed. The access and haul roads would be removed at the end of the construction programme and measures would be implemented to ensure that watercourses, including their banks, are reinstated to their previous condition where possible. These measures will minimise the potential for cumulative impacts when combined with similar commitments by DEP and SEP (**Section 20.6.1.1.5**).

192. Norfolk Vanguard will have completed cable installation by 2024 when DEP & SEP is proposed to begin construction, therefore will have no potential for temporal overlap and cumulative impacts through direct disturbance of water bodies. However, whilst Norfolk Vanguard will be installing cable ducts for Norfolk Boreas, a temporary haul road with associated watercourse crossings using temporary culverts will still be required for the cable pulling phase of Norfolk Boreas. Cable pulling is anticipated to occur during 2026 and 2027 when pre-construction works, including establishing the access roads, will have begun for DEP and SEP.

193. Catchments where watercourse crossings may occur simultaneously for both Norfolk Boreas and DEP and SEP are shown in **Table 20-34**.

Table 20-34: Trenched or culverted crossings in catchments affected by both Norfolk Boreas Offshore Wind Farm and DEP and SEP

Receptor	Sensitivity	Number of crossings: Norfolk Boreas	Number of crossings: DEP and SEP	Total	Residual impact Norfolk Boreas	Residual Impact DEP and SEP
River Bure	Medium	5	2	10	Minor adverse	Minor adverse
Mermaid Stream	Medium	0	0	0	No impact	Minor adverse
Blackwater Drain	High	1	0	1	Minor adverse	Minor adverse
River Wensum	High	0	2	3	No impact	Minor adverse

194. In the Mermaid Stream and River Wensum, no greater effect will occur cumulatively than for DEP and/or SEP alone. However, in both the River Bure and the Blackwater Drain catchments, there is potential that Norfolk Boreas and DEP and SEP could act cumulatively to cause a greater level of direct disturbance to surface watercourses than each alone.

195. **Table 20-14** defines that between four and nine trenched crossings in a catchment equates to a low magnitude of effect, therefore the cumulative effect of both Norfolk Boreas and DEP and SEP in the catchment of the River Bure will not increase the magnitude of effect defined in the DEP and SEP assessment. Likewise, the effect of one further crossing in the catchment of the Blackwater Drain will mean that the magnitude of effect remains low. Overall cumulative impacts remain no greater than for DEP and SEP, i.e. no greater than minor adverse significance.

196. The works for the A47/A11 junction at Thickthorn will require a watercourse crossing on the Cantley (or Thickthorn) Stream and a realignment of part of the channel (Highways England, 2018) which is a tributary of the Intwood Stream. However, this will increase the number of trenched crossings in the catchment from three associated with DEP and SEP to four, alongside a realignment which could involve temporary cofferdams. This equates to five in-channel disturbances which remains a negligible significance of impact. With the implementation of mitigation measures compliant with the DMRB, no cumulative impacts are anticipated.

197. Direct disturbance to two watercourses in the catchment of the River Tud may occur as part of construction works for the A47 North Tuddenham to Easton improvements (Highways England, 2019). These comprise a stream south of Hockering and the River Tud itself. Highways England has committed to best practice measures implemented through a Construction Environmental Management Plan with water quality monitoring prior, during and post construction. It is expected that these mitigation measures will prevent cumulative impacts from occurring.

198. The proposed construction of up to 650 dwellings on the north east edge of Wymondham will lead to the direct disturbance of at least two drains in the River Tiffey catchment. When considered cumulatively with DEP and SEP, this will lead to a worst case scenario of five watercourses undergoing direct disturbance due to construction. As shown in **Table 20-14**, this is considered to constitute a low magnitude of impact, therefore no overall increase in the magnitude of effect will occur. Together with the implementation of mitigation measures, it is considered unlikely that cumulative impacts will occur.

20.7.3.2 Cumulative Impact during Construction 2 – Increased Supply of Sediment

199. The following projects identified in **Table 20-33** may also contribute an increased supply of sediment to surface water receptors potentially affected by DEP and SEP:

- Hornsea Project Three – has potential to cause impacts in the same catchments as DEP and SEP;
- Norfolk Boreas – River Bure, River Wensum and Blackwater Drain;
- Development of 10 dwellings near Swannington – Swannington Beck;
- A47/A11 junction at Thickthorn – Intwood Stream; and
- A47 North Tuddenham to Easton – River Tud.

200. Construction works for these projects could increase the potential for erosion and entrainment of soil particulates, resulting in an increase in the supply of fine sediment to surface water bodies through surface runoff. The potential cumulative impacts in each receptor are discussed in **Table 20-35**.

Table 20-35: Potential for cumulative impact due to an increased supply of sediment

Receptor	Cumulative project residual impact	DEP and SEP residual Impact	Cumulative Impact
Hornsea Project Three			
River Glaven	Minor adverse	Minor adverse	The ES for Hornsea Project Three does not consider the residual impact on each receptor individually and considers that the potential impact of HDD and open cut crossing methods as a whole across all receptors. The residual impact as such is considered to be minor adverse across all affected catchments. Detailed mitigation measures are given in the Outline Code of Construction Practice (Ørsted, 2018) which will prevent the release of sediment into the surface water drainage system that drains into each watercourse. These measures are similar to those proposed by DEP and SEP (**Section 20.6.1.2.5**), and include: • Active management of surface drainage; • Retention of bankside vegetation to act as a buffer for sediment and silt; • Reducing disturbance close to watercourses to the minimum required for works; • Excavated materials to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into watercourses; and • Ongoing consultation with the Environment Agency and Natural England.
Spring Beck	Minor adverse	Negligible	
Coastal catchment	Minor adverse	Negligible	
Scarrow Beck	Minor adverse	Minor adverse	
River Bure	Minor adverse	Minor adverse	
Mermaid Stream	Minor adverse	Minor adverse	
Blackwater Drain	Minor adverse	Minor adverse	

Receptor	Cumulative project residual impact	DEP and SEP residual Impact	Cumulative Impact
Swannington Beck	Minor adverse	Moderate adverse	Although the potential for cumulative impacts exists due to potential temporal overlap of construction, and work in the same catchments; stringent mitigation measures to be implemented by both projects will act to prevent cumulative impacts that are greater than DEP and SEP alone.
River Wensum	Minor adverse	Moderate adverse	
River Tud	Minor adverse	Minor adverse	
River Yare	Minor adverse	Minor adverse	
River Tiffey	Minor adverse	Minor adverse	
Intwood Stream	Minor adverse	Minor adverse	
River Tas	Minor adverse	Minor adverse	

Receptor	Cumulative project residual impact	DEP and SEP residual Impact	Cumulative Impact
A47/A11 junction at Thickthorn			
Intwood Stream	N/A as only a Scoping Report has so far been carried out (Highways England, 2018)	Minor adverse	Impacts on specific receptors have not been assessed in the scoping report for the A47/A11 junction. However, the proposed scheme involves construction work in the catchment of the Intwood Stream and also in-channel works in the Cantley (or Thickthorn) Stream, which is a tributary of the Intwood Stream, to widen culverts and also a possible realignment (Highways England, 2018). This could lead to the release of sediment into the Cantley Stream with potential effects on the hydrological and geomorphological regime of the Intwood Stream downstream. However, the scheme is located over 2km to the north of the DEP and SEP PEIR boundary. Furthermore, the two schemes are located in different sub-catchments with DEP and SEP located in the main Intwood Stream catchment, and the A47/A11 scheme being located in the sub-catchment of the Cantley Stream approximately 1.6km upstream of the Intwood Stream. The spatial distribution of the two projects means that any sediment released by either project is likely to undergo attenuation in the sub-catchments of the receptor and will not act cumulatively to increase the magnitude of impact.
Norfolk Boreas Offshore Wind Farm			
River Bure	Minor adverse	Negligible	

Receptor	Cumulative project residual impact	DEP and SEP residual Impact	Cumulative Impact
Mermaid Stream	Minor adverse	Negligible	Both Norfolk Boreas and DEP and SEP have committed to use HDD to cross Main Rivers and IDB drains with the cable infrastructure and use temporary crossing methods such as Bailey bridges to provide access during construction. However, both will use temporary culverts to cross Ordinary Watercourses which may lead to the release of sediment into these watercourses. However, the ES for Norfolk Boreas states that less than 0.03% of each catchment will be disturbed ground during the construction of the cable corridor. This is likely to be similar to the area of disturbed ground for DEP and SEP as all four catchments will contain only the cable corridor, haul road and potentially some construction compounds. An area of less than 1%, or just over 1%, of disturbed ground in each catchment is unlikely to produce significant quantities of sediment.
Blackwater Drain	Minor adverse	Minor adverse	
River Wensum	Minor adverse	Minor adverse	
Development of 10 dwellings near Swannington			
Swannington Beck	N/A	Moderate adverse	The nearest watercourse to this development is a field drain located 385m northwest according to the associated geo-environmental report and is likely to drain into the Swannington Beck. The area of the site is small compared to the area of the catchment and, although it is located in close proximity to the proposed cable corridor for DEP and SEP, it is contained to a small area and it is likely that any release of sediment will be attenuated in the catchment prior to reaching a watercourse. Therefore, no cumulative impacts are anticipated.

Receptor	Cumulative project residual impact	DEP and SEP residual Impact	Cumulative Impact
A47 North Tuddenham to Easton			
River Tud	N/A as only a Scoping Report has so far been carried out (Highways England, 2018)	Minor adverse	The construction works associated with this project include a bridge structure over the River Tud which may involve temporary construction works in the river channel, near Hockering, with the potential to mobilise sediment, although this does not directly overlap with the proposed cable corridor of DEP and SEP. Mitigation measures will be implemented in accordance with relevant DMRB Standards to ensure that there are no adverse impacts on the watercourse, and monitoring of the baseline conditions will also be undertaken.
New headquarters for supply, maintenance, repair and hire of agricultural, horticultural and construction machinery at Swainsthorpe.			
River Tas	N/A as no EIA has been carried out	Minor adverse	It must be noted that currently there is an overlap in proposed construction area with this project and DEP and SEP, this would be resolved during the ongoing design process, however there is a possibility that they would end up adjacent to one another. In addition, the construction of both projects would see a concentration of exposed soil in one area of the catchment of the River Tas, approximately 700m from the watercourse itself. However, there are no watercourses (such as drainage ditches) due to be directly disturbed by this project. The area of the construction site covers 0.115km^2. When considered with the potential area of exposed land during the construction of DEP

Receptor	Cumulative project residual impact	DEP and SEP residual Impact	Cumulative Impact
			and SEP, this makes a total of approximately 1.39km^2 which constitutes approximately 2.32% of the overall catchment. This is considered to equate to a low magnitude of impact and therefore does not alter the overall magnitude of effect in this catchment if considered cumulatively. No direct assessment of impacts to surface water bodies has yet been undertaken as part of this planning application, however a commitment has been made in the planning statement to ensure that there is no deterioration in surface or groundwater quality.
Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham			
River Tiffey	Only at EIA Scoping stage, therefore no definitive residual impact yet.	Minor adverse	Construction works associated with this large scale housing development may lead to the release of sediment into the drainage network. There is potential for temporal overlap in construction as no construction date has been confirmed, and the site is located only 750m away from the PEIR Boundary. A commitment is made in the Scoping Report to develop an appropriate runoff management plan for implementation during the construction phase which would enable prevention of impacts to water quality. In addition, only up to 5.4% of the catchment will be exposed at any one time if concurrent construction were to occur. This equates to a low magnitude of effect. With the mitigation measures imposed for DEP and SEP, it is unlikely that cumulative impacts will occur.

20.7.3.3 Cumulative Impact during Construction 3 – Supply of Contaminants

201. DEP and SEP (and associated catchments) identified in **Section 20.7.3.2** also have the potential to result in the accidental release of contaminants such as oils, fuels and lubricants into surface water bodies during construction. The residual impacts resulting from the construction of DEP and SEP together are predicted to be either negligible or minor adverse significance across all catchments.

202. The following projects identified in **Table 20-33** may also contribute an increased supply of contaminants to surface water receptors potentially affected by DEP and SEP:

- Hornsea Project Three – has potential to cause impacts in the same catchments as DEP and SEP;
- Norfolk Boreas – River Bure, River Wensum and Blackwater Drain;
- Development of 10 dwellings near Swannington – Swannington Beck;
- A47/A11 junction at Thickthorn – Intwood Stream; and
- A47 North Tuddenham to Easton – River Tud.

203. The construction works associated with each of the projects listed above could increase the potential for contaminants to be released into surface waters through accidental spillage or release of fuels, oils, lubricants, foul waters and construction materials. The potential for cumulative impacts in each receptor is discussed in **Table 20-36**.

Table 20-36: Potential cumulative impacts in each receptor associated with a potential increased supply of contaminants

Receptor	Cumulative project residual impact	DEP and SEP residual impact	Cumulative Impact
Hornsea Project Three			
River Glaven	Minor adverse	Minor adverse	The ES for Hornsea Project Three does not consider the residual impact on each receptor individually and considers that the potential impact of degradation of water quality due to the release of contaminants is minor adverse across all affected catchments. Detailed mitigation measures are given in the Outline Code of Construction Practice (Ørsted, 2018) which will prevent adverse impacts on each water body, which are similar to those proposed by DEP and SEP. These include: • Active management of drainage from the construction site; • Retention of bankside vegetation; • Bunding of areas a risk of spillage including vehicle maintenance and storage areas; • Bunded areas to have impermeable bases; • Construction materials to be handled and stored in a way that minimises risks posed to the aquatic environment; • Where possible, less toxic alternative materials to be used; and
Coastal catchment	Minor adverse	Minor adverse	
River Bure	Minor adverse	Minor adverse	
Blackwater Drain	Minor adverse	Minor adverse	
Swannington Beck	Minor adverse	Minor adverse	
River Wensum	Minor adverse	Minor adverse	
River Tud	Minor adverse	Minor adverse	
River Yare	Minor adverse	Minor adverse	
Intwood Stream	Minor adverse	Minor adverse	
River Tas	Minor adverse	Minor adverse	

North Norfolk Chalk	Minor adverse	Minor adverse	• Maintaining plant and machinery in good condition to minimise the risk of leaks. Although there may be a temporal overlap in construction, and in some cases an overlap in receptors affected, the mitigation measures will prevent the potential for cumulative effects, and the residual impacts resulting from each project alone will not be increased.
Broadland Rivers Chalk and Crag	Minor adverse	Minor adverse	
A47/A11 junction at Thickthorn			
Intwood Stream	N/A as only a Scoping Report has so far been carried out (Highways England, 2018)	Minor adverse	Impacts on specific receptors have not been assessed in the scoping report for the A47/A11 junction. However, the proposed scheme involves construction work in the catchment of the Intwood Stream and also in-channel works in the Thickthorn Stream, which is a tributary of the River Yare, to widen culverts and also a possible realignment (Highways England, 2018). This could lead to the release of contaminants into the Thickthorn Stream with potential effects on the water quality of the River Yare downstream. However, the scheme is located over 2km to the north of the DEP and SEP PEIR boundary. Furthermore, the two schemes are located in different sub-catchments with DEP and SEP located in the main Intwood Stream catchment, and the A47/A11 scheme being located in the sub-catchment of the Cantley Stream approximately 1.6km upstream of the Intwood Stream. The spatial distribution of the two projects means that any sediment released by either project is likely to undergo attenuation in the sub-catchments of the receptor and will not act cumulatively to increase the magnitude of effect.
River Yare		Minor adverse	

			In addition, best practice construction measures will be implemented in the construction of the A47/A11 junction through the Construction Environment Management Plan (CEMP) which will be developed in accordance with CIRIA Guidelines (CIRIA C543, 2002; CIRIA C648, 2006; and CIRIA C741, 2015).
Norfolk Boreas Offshore Wind Farm			
River Bure	Minor adverse	Negligible	The construction processes associated with both Norfolk Boreas and DEP and SEP have the potential to lead to the accidental release of lubricants, fuels and oils from construction machinery. However, the ES for Norfolk Boreas states that less than 0.03% of each catchment will be disturbed ground during the construction of the cable corridor. The cable corridors of each project cross in one location in the Blackwater Drain catchment where they maybe a greater risk of contaminants entering the surface water receptors. However, mitigation measures to ensure that the release of contaminants is controlled are included in both projects, based on recognised construction industry best practice. These will ensure that cumulatively, the impacts on these receptors will be no worse than DEP and SEP alone.
Mermaid Stream	Minor adverse	Negligible	
River Wensum	Minor adverse	Minor adverse	
Blackwater Drain	Minor adverse	Minor adverse	
North Norfolk Chalk Groundwater Body	Minor adverse	Minor adverse	
Development of 10 dwellings near Swannington			
Swannington Beck	N/A	Moderate adverse	The nearest watercourse to this development is a field drain located 385m northwest according to the associated geo-environmental report and is likely to drain into the Swannington Beck. The area of the site is small compared to the area of the catchment and, although it is located in close proximity to the proposed cable corridor for DEP and SEP, it is contained to a small area and it is unlikely that any release of

			contaminants will be washed into a watercourse. Therefore, no cumulative impacts are anticipated.
A47 North Tuddenham to Easton			
River Tud	N/A as only a Scoping Report has so far been carried out (Highways England, 2018)	Minor adverse	The construction works associated with this project include a bridge structure over the River Tud which may involve temporary construction works in the river channel, near Hockering, with the potential to cause contaminant release into the surface water drainage system, particularly the River Tud. Mitigation measures will be implemented in accordance with relevant DMRB Standards and in accordance with CIRIA Guidelines (CIRIA C532, 2002; CIRIA C648, 2006; and CIRIA C741, 2015a), to ensure that there is no deterioration in WFD status and monitoring of the baseline conditions will also be undertaken. Therefore, no cumulative impacts are anticipated.
New headquarters for supply, maintenance, repair and hire of agricultural, horticultural and construction machinery at Swainsthorpe.			
River Tas	N/A as no EIA carried out.	Minor adverse	The construction processes involved with building the new headquarters could potentially lead to the release of contaminants into surface water bodies through accidental spillage and leakage. This risk would be higher if concurrent construction were to occur with DEP and SEP. No direct assessment of impacts to surface water bodies has yet been undertaken as part of this planning application, however a commitment has been made in the planning statement to ensure that there is no deterioration in surface or groundwater quality. In addition, a CEMP for biodiversity has been conditioned by the local planning authority which will help to ensure that no damage to sensitive habitats or species will occur, including by contaminant release. When combined with the

			mitigation measures proposed for DEP and SEP, no cumulative impacts are anticipated.
Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham			
River Tiffey	Only at EIA Scoping stage, therefore no definitive residual impact yet.	Minor adverse	This project is due to be constructed on what is currently arable agricultural land and therefore unlikely to be contaminated. Risk of contamination to watercourses and groundwater comes only from leakage and accidental spillage of construction fuels and lubricants as well as runoff from construction containing sediment. A commitment has been made to mitigating any potential contamination through the use of an appropriate SuDS and runoff management plan during construction. The potential for contamination during construction as a result of DEP and SEP is considered to be low with best practice mitigation measures in place. Therefore, it is considered that no cumulative impacts are likely that would be of greater magnitude than DEP and SEP alone.

20.7.3.4 Cumulative Impact during Construction 4 – Changes to Surface and Groundwater Flows and Flood Risk

204. The projects identified in **Table 20-33** have the potential to result in an increase in impermeable ground within the catchments identified in **Section 20.7.3.2** and to cause an alteration in surface water drainage patterns and subsurface flow characteristics. During the construction stage, impacts could occur as a result of site preparation, construction activities and the development of surface infrastructure for the various projects. The potential cumulative impacts in each receptor are discussed in **Table 20-37**.

Table 20-37: Potential for cumulative impacts in each receptor associated with an increase in surface and groundwater flows and flood risk

Receptor	Cumulative project residual impact	DEP and SEP residual impact	Cumulative Impact
Hornsea Project Three			
River Glaven	Minor adverse	N/A	The ES for Hornsea Project Three does not consider the residual impact on each receptor individually and considers that the potential impact of changes to field drainage and drainage infrastructure across all affected catchments would be minor adverse. Detailed mitigation measures are given in the Outline Code of Construction Practice (Ørsted, 2018) which will ensure that flow rates are unaffected either directly or indirectly and prevent an increase in the potential flood risk which are similar to those proposed by DEP and SEP. These include: • The onshore compounds, construction access and haul roads will comprise permeable surfaces; • Temporary culvert crossings will be installed with appropriately sized flume pipes, equal to or greater than the diameter of the flume upstream; • Drainage would be installed either side of the Hornsea Three onshore cable corridor to ensure existing land drainage flow is maintained and is not altered and channelled by the cable corridor; and • Any existing field drainage intercepted during construction works will be reinstated following installation of the cable corridor.
Coastal catchment	Minor adverse	N/A	
River Bure	Minor adverse	N/A	
Blackwater Drain	Minor adverse	N/A	
Swannington Beck	Minor adverse	Minor adverse	
River Wensum	Minor adverse	Minor adverse	
River Tud	Minor adverse	N/A	
River Yare	Minor adverse	Minor adverse	
Intwood Stream	Minor adverse	Minor adverse	
River Tas	Minor adverse	Minor adverse	
North Norfolk Chalk	Minor adverse	N/A	

<table>
<tr><th>Receptor</th><th>Cumulative project residual impact</th><th>DEP and SEP residual impact</th><th>Cumulative Impact</th></tr>
<tr><td>Broadland Rivers Chalk and Crag</td><td>Minor adverse</td><td>N/A</td><td>Although there may be a temporal overlap in construction, and in some cases an overlap in receptors affected, the mitigation measures will prevent the potential for cumulative impacts in surface and groundwater flows and flood risk.</td></tr>
<tr><td colspan="4">A47/A11 junction at Thickthorn</td></tr>
<tr><td>Intwood Stream</td><td rowspan="2">N/A as only a Scoping Report has so far been carried out (Highways England, 2018)</td><td>Minor adverse</td><td rowspan="2">This scheme is located over 2km from the cable corridor of DEP and SEP. Its purpose is to improve the Thickthorn Junction of the A47/A11 by creating an interchange link road between the A11 and the A47 to provide bi-directional free flowing interchange links. It is building on existing infrastructure and will therefore not be introducing impermeable ground to a catchment where it does not already exist. The Scoping Report (Highways England, 2019) identifies pilings and foundations as having the potential to act as groundwater dams. However, it is considered that these are localised effects, and the distance between the two schemes and the shallow nature of the cable corridor for DEP and SEP means this is not likely to act cumulatively.

In addition, both projects will implement mitigation measures (Section 20.6.1.4.5) which for the A47/A11 junction include monitoring of groundwater flows and the development and implementation of a drainage strategy, to be incorporated into the Construction Environmental Management Scheme, including the use of SuDS. Compensatory storage will also be provided where construction could lead to the loss of floodplain storage. These</td></tr>
<tr><td>River Yare</td><td>Minor adverse</td></tr>
</table>

Receptor	Cumulative project residual impact	DEP and SEP residual impact	Cumulative Impact
			measures will prevent cumulative impacts from occurring where mitigation measures are used together.
Norfolk Boreas Offshore Wind Farm			
River Bure	Minor adverse: 0.01% of catchment affected and five temporary crossings	Minor adverse: 0.81% of catchment affected	Within the catchments in which both projects will construct infrastructure, particularly where the cable corridors cross in the Blackwater Drain catchment, there is potential for an increase in impermeable ground, reduced infiltration and changes to surface water flows to act cumulatively to alter surface and groundwater flows and increase flood risk. However, both projects will lead to a very small increase in the proportion of each catchment with impermeable ground which will remain of negligible impact when combined. In addition, both projects will implement mitigation measures (**Section 20.6.1.4.5**) including the implementation of construction drainage, including SuDS measures, which will maintain the greenfield runoff rate at the onshore substation, and ensuring that temporary culverts used in trenched crossings are adequately sized to avoid impounding flows. These measures will ensure that there will be no cumulative impact greater than that of DEP and SEP alone.
Mermaid Stream	Minor adverse: 0.01% of catchment affected and no temporary crossings	Minor adverse: 1.33 of catchment affected	
River Wensum	Minor adverse: 0.01% of catchment affected and four temporary crossings	Minor adverse: 0.69 of catchment affected	
Blackwater Drain	Minor adverse: 0.03% of catchment affected and one temporary crossing.	N/A	

Receptor	Cumulative project residual impact	DEP and SEP residual impact	Cumulative Impact
Development of 10 dwellings near Swannington			
Swannington Beck	N/A	Minor adverse	The area of the construction site is small compared to the area of the catchment and, although it is located in close proximity to the proposed cable corridor for DEP and SEP, it is contained to a small area. There are existing properties on the site with associated impermeable ground, therefore there is unlikely to be a large increase in area once demolition and construction is under way. Any changes to surface water flows are likely to be highly localised and of insufficient magnitude to act cumulatively with construction works for the onshore substation.
A47 North Tuddenham to Easton			
River Tud	N/A as only a Scoping Report has so far been carried out (Highways England, 2018)	Minor adverse	Although the potential for cumulative impacts to surface and groundwater flows exist due to the overlap of construction works in the River Tud catchment, both projects will implement mitigation measures (**Section 20.6.1.4.5**) These would include a temporary surface water drainage strategy which would be developed to ensure that there will be no increase in run-off and flood risk during the construction phase. SuDS would be implemented where appropriate. These measures will prevent the two projects from acting cumulatively to increase flood risk.

Receptor	Cumulative project residual impact	DEP and SEP residual impact	Cumulative Impact
New headquarters for supply, maintenance, repair and hire of agricultural, horticultural and construction machinery at Swainsthorpe			
River Tas	Low	Minor adverse	If there is temporal overlap in construction between this project and DEP and SEP, there is potential for up to 2.32% of the catchment to be exposed in close proximity, which would alter surface run-off and flows in this area. Compaction from both projects could have the potential to lead to an increase in flood risk during construction. However, no water bodies would be directly disturbed by the construction of the headquarters. In addition, the flood risk and drainage strategy produced for this project concludes that there will be no increase in flood risk as a result of construction. Therefore, no cumulative impacts are anticipated that would be greater than DEP and SEP alone.
Erection of up to 650 dwellings, primary school and sixth form with associated infrastructure at Wymondham			
River Tiffey	Only at EIA Scoping stage, therefore no definitive residual impact yet.	Minor adverse	If there is temporal overlap in construction between the two projects, up to 5.4% of the catchment will be exposed at one time which may have the potential to alter the surface flows and increase flood risk during construction. However, Environment Agency flood maps suggest that both the DEP and SEP PEIR Boundary within the River Tiffey catchment and the dwellings at Wymondham are at very low risk of surface water flooding from extreme rainfall. Risk from surface water flooding is also considered low and the use of SuDS and appropriate surface water runoff management and flow control measures will be included during construction to mitigate changes in

Receptor	Cumulative project residual impact	DEP and SEP residual impact	Cumulative Impact
			runoff prior to discharge from the site. Therefore, no cumulative impacts are anticipated.

20.7.3.5 Cumulative Impact during Operation 1 – Supply of contaminants

205. No impacts to those receptors associated with the cable corridor due to a supply of contaminants during operation are anticipated as a result of the operation of DEP and SEP, therefore only those projects which may cause an increase in the supply of contaminants in the catchment of the Intwood Stream and River Tas are considered for operational cumulative impacts.

206. Hornsea Project 3 considers that operational processes will have a minor adverse impact in the catchments of the River Tas and Intwood Stream which contain the substation for both Hornsea Project 3 and DEP and SEP, whereas DEP and SEP consider that the residual impact will be negligible. Operational practices will involve management plans including spill procedures, clean up and remediation of contaminated water runoff and water quality monitoring (if required) in order to mitigate against any decrease in water quality status.

207. The A47/A11 junction at Thickthorn is located in the catchment of the Intwood Stream. The scheme may lead to an increase in traffic volume and therefore an increased likelihood of spillages and contamination occurring. However, the implementation of SuDS incorporating suitable pollution prevention measures in both projects will help to prevent cumulative effects from occurring.

208. The operation of the headquarters for the sale, maintenance and hire of agricultural, horticultural and construction machinery at Swainsthorpe could potentially lead to contaminants entering the surface drainage systems in the same catchment (River Tas) as the onshore substation. However, this project has committed to using SuDS in the Flood Risk Assessment and Drainage Strategy including potential water quality management features as part of the detailed design stage such as swales, filter drains or a basin forebay area. There is also a commitment to ensure that no adverse impacts to water quality occur.

209. The Scoping Report for the proposed construction of 650 dwellings at Wymondham includes a commitment to install SuDS to mitigate against operational runoff of contaminated water and improve water quality prior to discharge from site. In the catchment of the River Tiffey,

210. Norfolk Boreas Offshore Wind Farm, the A47 North Tuddenham to Easton works, the construction of 10 dwellings at Swannington, 650 dwellings at Wymondham and the headquarters at Swainsthorpe are not considered to act cumulatively with DEP and SEP to increase the supply of contaminants during operation.

20.7.3.6 Cumulative Impact during Operation 2 – Changes to surface water runoff and flood risk

211. It is considered that operational changes to surface and groundwater flows along the cable corridor would be so small, and so localised, that they will not act cumulatively with the projects that overlap, namely Hornsea Three, Norfolk Vanguard and Boreas and the two highways projects.

212. Cumulative impacts may occur in the catchments affected by the substation, the River Tas and the Intwood Stream. The projects that overlap within these catchments are Hornsea Three and the A47/A11 Junction at Thickthorn.

213. The proposed onshore substation for Hornsea Three is situated in the catchments of the River Tas and the Intwood Stream, along with the onshore substation for DEP and SEP. Hornsea Three is predicted to have a negligible impact on flood risk as the substation area is located in Flood Zone 1, and a commitment is made to mitigation measures that will ensure that there is no change from the baseline hydrological environment. DEP and SEP has also committed to ensuring greenfield runoff rates are maintained, therefore no overall increase in flood risk will occur.

214. The Scoping Report for A47/A11 Junction at Thickthorn (Highways England, 2018) states that operational impacts include an increase in impermeable area which could result in an increase in peal flow rates and volumes. However, appropriate mitigation by attenuation will be implemented to ensure that there is no increase in surface water run-off peak flow rate, including SuDS. Compensatory flood storage will also be included to mitigate the loss of floodplain storage. DEP & SEP will also aim to ensure that greenfield runoff rates from the onshore substation area remain unchanged through mitigation measures (**Section 20.6.2.2.5**), therefore cumulative impacts are unlikely to occur. In addition, the spatial separation between the two projects within the Intwood Stream catchment indicates that localised changes to groundwater flow and small changes to flood risk or surface water flows will not act cumulatively across the catchment.

215. Cumulatively, the permanent infrastructure associated with the onshore substation of DEP and SEP and the headquarters for the sale, maintenance and hire of agricultural, horticultural and construction machinery at Swainsthorpe will increase the area of impermeable ground in the catchment of the River Tas. However, the Flood Risk and Drainage Strategy for the headquarters concludes that, with the implementation of mitigation measures including SuDS, there will be no increase in flood risk once constructed. DEP and SEP is also predicted to have a negligible impact on flood risk, therefore no cumulative impacts are anticipated.

20.8 Transboundary Impacts

216. There are no transboundary impacts with regard to Water Resources and Flood Risk as the onshore project area would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and are not considered further.

20.9 Inter-relationships

217. 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.
- 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.

218. A summary of the potential inter-relationships between water resources, ground conditions and terrestrial ecology is provided in **Table 20-38**.

Table 20-38: Surface water and flood risk inter-relationships

Topic and description	Related chapter	Where addressed in this chapter	Rationale
Construction			
Impacts on the quality and quantity of groundwater	Chapter 19 Ground Conditions and Contamination	Sections 20.6.1.3 and 20.6.1.4	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 (particularly chalk rivers)
Impacts on water-dependent habitats and designated sites	Chapter 23 Onshore Ecology	Sections 20.6.1.1, 20.6.1.2, 20.6.1.3 and 20.6.1.4	Potential changes to the hydrology, geomorphology and water quality of the River Wensum SAC and SSSI during construction could impact upon water-dependent biological communities (including the designated interest features)
Operation			
Impacts on the quality and quantity of groundwater	Chapter 19 Ground Conditions and Contamination	Sections 20.6.2.1 and 20.6.2.2	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 (particularly chalk rivers)
Impacts on water-dependent habitats and designated sites	Chapter 23 Onshore Ecology	Sections 20.6.2.1 and 20.6.2.2	Potential changes to the hydrology, geomorphology and water quality of the River Wensum SAC and SSSI during construction could impact upon water-dependent biological communities (including the designated interest features)
Decommissioning			

Topic and description	Related chapter	Where addressed in this chapter	Rationale
Impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.			

20.10Interactions

219. The impacts identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between impacts are presented in **Table 20-39**. This provides a screening tool for which impacts have the potential to interact. **Table 20-40** provides an assessment for each receptor (or receptor group) as related to these impacts.

220. Within **Table 20-40** the impacts are assessed relative to each development phase (Phase assessment, i.e. construction, operation or decommissioning) to see if (for example) multiple construction impacts affecting the same receptor could increase the level of impact upon that receptor. Following this, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across all development phases.

221. The significance of each individual impact is determined by the sensitivity of the receptor and the magnitude of effect; the sensitivity is constant whereas the magnitude may differ. Therefore, when considering the potential for impacts to be additive it is the magnitude of effect which is important – the magnitudes of the different effects are combined upon the same sensitivity receptor.

Table 20-39: Interaction between impacts - screening

Potential Interaction between Impacts				
Construction				
	Impact 1: Direct disturbance of surface water bodies	Impact 2: Increased sediment supply	Impact 3: Supply of contaminants	Impact 4: Changes to surface water runoff and flood risk
Impact 1: Direct disturbance of surface water bodies	-	Yes	Yes	Yes

Potential Interaction between Impacts				
Impact 2: Increased sediment supply	Yes	-	Yes	Yes
Impact 3: Supply of contaminants	Yes	Yes	-	No
Impact 4: Changes to surface water runoff and flood risk	Yes	Yes	No	-

Operation		
	Impact 1: Supply of contaminants	Impact 2: Changes to surface water runoff and flood risk
Impact 1: Supply of contaminants	-	No
Impact 2: Changes to surface water runoff and flood risk	No	-

Table 20-40: Interaction between impacts – phase and lifetime assessment

Receptor	Highest significance level				
	Construction	Operation	Decommissioning	Phase assessment	Lifetime assessment
Surface watercourses	Moderate adverse	Minor adverse	Moderate 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 will be no direct disturbance during operation, and further measures will be in place to prevent the supply of contaminants or changes to flow patterns during operation. It is therefore considered that there will therefore be no pathway for interaction to exacerbate the potential impacts associated with	**No greater than individually assessed impact** The greatest magnitude of effect will 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.

	Highest significance level				
				these activities during or between any of the project phases.	
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. 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 that there will therefore 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 will occur as a result of subsurface excavations during the construction phase. Once this disturbance impact has ceased, any further impact 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.

20.11 Assessment Summary

222. This chapter has provided a characterisation of the existing environment for surface water and flood risk based on both existing data (e.g. national flood risk and WFD classification datasets) and site-specific survey data (e.g. a geomorphological walkover survey).

223. The assessment has established that surface and groundwater receptors could be affected as a result of direct disturbance, the supply of fine sediment and contaminants, and changes to flow patterns during the construction and decommissioning phases. The residual impacts on the majority of receptors during these phases would be negligible or minor adverse.

224. 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 residual impacts will be negligible or minor adverse.

225. The assessment has demonstrated that although the scenario involving DEP or SEP in isolation has a smaller land take (and would hence result in a smaller area of disturbance in each catchment) than DEP and SEP delivered together, the small margins mean that this does not result in any significant differences between the residual impacts of each scenario.

Table 20-41: Summary of potential impacts on Water Resources and Flood Risk

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
Construction						
Impact 1: direct disturbance of surface water bodies	Spring Beck	Low	Negligible	Minor adverse	• HDD techniques used to cross all Main Rivers • HDD used to cross floodplain meadow channels within 200m of channel (where applicable) • If temporary dams are used, the amount of time that they are in place would be minimised; • Prior to dewatering between temporary dams, a fish rescue would take place;	Minor adverse
	River Glaven	Medium	No impact	No impact		N/A
	Coastal Catchment	Low	No impact	No impact		N/A
	Scarrow Beck	Medium	No impact	No impact		N/A
	River Bure	Medium	Low	Minor adverse		Minor adverse
	Mermaid Stream	Medium	No impact	No impact		N/A
	Blackwater Drain	High	No impact	No impact		N/A
	Swannington Beck	High	Negligible	Minor adverse		Minor adverse
	River Wensum	High	Negligible	Minor adverse		Minor adverse
	River Tud	High	No impact	No impact		N/A

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	River Yare	Medium	Negligible	Minor adverse	• Flumes or pumps would be adequately sized to ensure flows downstream are maintained; • Scour protection would be used downstream of flumes or pumps to protect river bed downstream. • Cable ducts would be installed two metres below the bed of water body to avoid exposure during high flows; and • Vegetation will not be removed from banks unless necessary to undertake works.	Minor adverse
	River Tiffey	Medium	Negligible	Minor adverse		Minor adverse
	Intwood Stream	Low	Low	Minor adverse		Minor adverse
	River Tas	Medium	No impact	No impact		N/A

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	North Norfolk Chalk	High	N/A	N/A	N/A	N/A
	Broadland Rivers Chalk and Crag	High	N/A	N/A	N/A	N/A
Impact 2: Increased sediment supply	Spring Beck	Low	High	Moderate adverse	• Limiting work along the onshore cable corridor to short sections at any one time; • Strip topsoil from the entire width of the onshore cable corridor for each section then store and cap to minimise erosion from wind and rain; • Re-distribute topsoil over the work front area once trenching complete and back-filled;	Minor adverse
	River Glaven	Medium	Low	Minor adverse		Minor adverse
	Coastal Catchment	Low	Low	Minor adverse		Negligible
	Scarrow Beck	Medium	Negligible	Minor adverse		Negligible
	River Bure	Medium	Low	Minor adverse		Negligible
	Mermaid Stream	Medium	Negligible	Minor adverse		Negligible
	Blackwater Drain	High	Low	Moderate adverse		Minor adverse
	Swannington Beck	High	Low	Moderate adverse		Minor adverse
	River Wensum	High	Negligible	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	River Tud	High	Negligible	Minor adverse	• Temporary works areas would comprise permeable hard-standing material; • A CMS would be developed adhering to construction industry good practice measures including minimising subsoil exposure, on-site retention of sediment, intercepting sediment runoff at source in the drainage system using suitable filters and cleaning wheels of construction vehicles leaving the site.	Minor adverse
	River Yare	Medium	Low	Minor adverse		Minor adverse
	River Tiffey	Medium	Low	Minor adverse		Minor adverse
	Intwood Stream	Low	Low	Minor adverse		Negligible
	River Tas	Medium	Low	Minor adverse		Minor adverse
	North Norfolk Chalk	High	N/A	N/A	N/A	N/A

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	Broadland Rivers Chalk and Crag	High	N/A	N/A	N/A	N/A
Impact 3: Supply of contaminants	Spring Beck	Low	Low	Negligible	Specific measures will be included in the CMS including: • Concrete and cement mixing and washing areas would be situated at least 10m away from water bodies; • All washing out of equipment would be carried out in contained areas and water would be collected for disposal off-site;	Negligible
	River Glaven	Medium	Low	Minor adverse		Minor adverse
	Coastal Catchment	Low	Low	Negligible		Negligible
	Scarrow Beck	Medium	Negligible	Minor adverse		Minor adverse
	River Bure	Medium	Low	Minor adverse		Minor adverse
	Mermaid Stream	Medium	Negligible	Minor adverse		Minor adverse
	Blackwater Drain	High	Low	Moderate adverse		Minor adverse
	Swannington Beck	High	Low	Moderate adverse		Minor adverse
	River Wensum	High	Low	Moderate adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	River Tud	High	Low	Moderate adverse	• Fuels, oils, lubricants and other chemicals would all be stored in impermeable bunds with at least 10% of the stored capacity; • Any damaged containers would be removed from site;	Minor adverse
	River Yare	Medium	Low	Minor adverse		Minor adverse
	River Tiffey	Medium	Low	Minor adverse		Minor adverse
	Intwood Stream	Low	Medium	Minor adverse		Minor adverse
	River Tas	Medium	Low	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	North Norfolk Chalk	High	Negligible	Minor adverse	• All refuelling would take place in a dedicated impermeable area using a bunded bowser, located at least 10m from water bodies; • Spill kits, sand bags and stop logs would be available on site at all times; • Foul drainage would be collected through mains connection to an existing mains sewer or collected in a septic tank within the boundary of the development for disposal at a licensed facility.	Minor adverse
	Broadland Rivers Chalk and Crag	High	Negligible	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
					• Buffer strips to be retained adjacent to water bodies where possible to intercept contaminated runoff.	
Impact 4: Changes to surface water runoff and flood risk	Spring Beck	Low	Low	Minor adverse	• Changes in surface water runoff from in the increase in impermeable area would be attenuated and discharged at a controlled rate equivalent to the greenfield runoff rate, in consultation with the LLFA and Environment Agency;	Minor adverse
	River Glaven	Medium	Low	Minor adverse		Minor adverse
	Coastal Catchment	Low	Negligible	Negligible		Negligible
	Scarrow Beck	Medium	Negligible	Minor adverse		Minor adverse
	River Bure	Medium	Low	Minor adverse		Minor adverse
	Mermaid Stream	Medium	Negligible	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	Blackwater Drain	High	Negligible	Minor adverse	• Drainage channels would be created during construction to intercept water from the cable trench to control the release of surface waters from onshore development activities; • A SWDP would be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land; and	Minor adverse
	Swannington Beck	High	Low	Moderate adverse		Minor adverse
	River Wensum	High	Low	Moderate adverse		Minor adverse
	River Tud	High	Low	Moderate adverse		Minor adverse
	River Yare	Medium	Negligible	Minor adverse		Minor adverse
	River Tiffey	Medium	Negligible	Minor adverse		Minor adverse
	Intwood Stream	Low	Medium	Minor adverse		Minor adverse
	River Tas	Medium	Low	Minor adverse		Minor adverse
	North Norfolk Chalk	High	Negligible	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	Broadland Rivers Chalk and Crag	High	Negligible	Minor adverse	• If water enters the trenches during installation from surface runoff or groundwater seepage, this will be pumped via settling tanks, sediment basins or mobile treatment facilities before being discharged into local ditches or drains.	Minor adverse
Operation						
Operational Impact 1: Supply of Contaminants	Spring Beck	Low	Negligible	Negligible		N/A
	River Glaven	Medium	Negligible	Negligible		N/A
	Coastal Catchment	Low	Negligible	Negligible		N/A
	Scarrow Beck	Medium	Negligible	Negligible		N/A
	River Bure	Medium	Negligible	Negligible		Negligible
	Mermaid Stream	Medium	Negligible	Negligible		Negligible
	Blackwater Drain	High	Negligible	Minor adverse		Negligible

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	Swannington Beck	High	Negligible	Minor adverse	• A drainage strategy will be developed according to the principles of SuDS discharge hierarchy, this will include attenuation ponds and hydrocarbon interceptors to prevent the supply of contaminants (including oils and fine sediment); • At the onshore substation, all fuels, oils, lubricants and other chemicals will be stored in an impermeable bund with at least 110% capacity; • Damaged containers will be removed from site;	Negligible
	River Wensum	High	Negligible	Minor adverse		Negligible
	River Tud	High	Negligible	Minor adverse		Negligible
	River Yare	Medium	Negligible	Negligible		Negligible
	River Tiffey	Medium	Negligible	Negligible		Negligible
	Intwood Stream	Medium	Low	Minor adverse		Negligible
	River Tas	Medium	Low	Minor adverse		Negligible
	North Norfolk Chalk	High	Negligible	Minor adverse		Negligible
	Broadland Rivers Chalk and Crag	High	Negligible	Minor adverse		Negligible

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
					• Refuelling will take place in a dedicated impermeable area, using a bunded bowser, located at least 10m from all water bodies; and • Spill kits, sand bags and stop logs will be available on site at all times in case of an emergency.	
Operational Impact 2: Changes to surface water runoff and flood risk	Spring Beck	Low	Negligible	Negligible		Negligible
	River Glaven	Medium	Negligible	Minor adverse		Minor adverse
	Coastal Catchment	Low	Negligible	Negligible		Negligible
	Scarrow Beck	Medium	Negligible	Minor adverse		Minor adverse
	River Bure	Medium	Negligible	Minor adverse		Minor adverse
	Mermaid Stream	Medium	Negligible	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
	Blackwater Drain	High	Negligible	Minor adverse	• Post construction surface water drainage requirements will be presented in the final SWDP and will meet the requirements of the National Planning Policy Framework (NPPF) and National Policy Statement (NPS) EN-5; • Runoff will be limited, where feasible, through the use of infiltration techniques which can be accommodated within the area of development;	Minor adverse
	Swannington Beck	High	Negligible	Minor adverse		Minor adverse
	River Wensum	High	Negligible	Minor adverse		Minor adverse
	River Tud	High	Negligible	Minor adverse		Minor adverse
	River Yare	Medium	Negligible	Minor adverse		Minor adverse
	River Tiffey	Medium	Negligible	Minor adverse		Minor adverse
	Intwood Stream	Low	Low	Minor adverse		Negligible
	River Tas	Medium	Low	Minor adverse		Minor adverse
	North Norfolk Chalk	High	Low	Minor adverse		Minor adverse
	Broadland Rivers Chalk and Crag	High	Low	Minor adverse		Minor adverse

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
					• The drainage strategy will be developed according to the principles of the SuDS discharge hierarchy; • Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable: i) into the ground (infiltration); ii) to a surface water body; iii) to a surface water sewer, highway drain or another drainage system; or iv) to a combined sewer.	
Decommissioning						

Potential impact	Receptor	Sensitivity	Magnitude	Pre-mitigation impact	Mitigation measures proposed	Residual impact
No decision has yet been made regarding the final decommissioning policies for either DEP or SEP as it is recognised that industry best 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. 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 impacts associated with the decommissioning phase would be no greater than those identified for the construction phase.						

20.12References

Broadland District Council and North Norfolk District Council (2017) Strategic Flood Risk Assessment [online] Available at: https://www.north-norfolk.gov.uk/media/3914/strategic-flood-risk-assessment-2017-level-1-report.pdf. Accessed 01/10/2020
Construction Industry Research and Information Association (CIRIA)'s (2001) Control of water pollution from construction sites: Guidance for consultants and contractors (C532)
Department of Energy and Climate Change (2011a) Overarching NPS for Energy (EN-1) [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf . Accessed 30/09/2020.
Department of Energy and Climate Change (2011b) NPS for Renewable Energy Infrastructure (EN-3) [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf . Accessed 30/09/2020.
Department of Energy and Climate Change (2011c) NPS for Electricity Networks Infrastructure (EN-5) [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47858/1942-national-policy-statement-electricity-networks.pdf. Accessed 30/09/2020.
Environment Agency (2004) Pollution Prevention Guidelines: Safe storage and disposal of used oils: PPG8. [online] Available: https://webarchive.nationalarchives.gov.uk/20140328095348/http://cdn.environment-agency.gov.uk/pmho0304bhxb-e-e.pdf. Accessed 12/10/2020
Environment Agency (2007) Pollution Prevention Guidelines: Works and Maintenance in or Near Water: PPG5. [online] Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485199/pmho1107bnkg-e-e.pdf. Accessed 12/10/2020
Environment Agency (2009) Pollution Prevention Guidelines: Incident Response Planning: PPG21. [online] Available: https://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx. Accessed 12/10/2020
Environment Agency (2013) Pollution Prevention Guidelines: PPG1 Understanding Your Environmental Responsibilities – Good Environmental Practices [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/485211/LIT_1404.pdf. Accessed 12/10/2020
Environment Agency (2015). Anglian river basin district River basin management plan [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme

nt_data/file/718327/Anglian_RBD_Part_1_river_basin_management_plan.pdf. Accessed 01/10/2020
Environment Agency Flood Map for Planning [online] Available at: https://flood-map-for-planning.service.gov.uk/ Accessed
European Commission (EC) (2000). The Water Framework Directive (WFD) (Council Directive 2000/60/EC).
EPS (2018) Phase I & II Geo-Environmental Assessment Station Road Swannington. [online] Available at: https://secure.broadland.gov.uk/MVM.DMS/Planning%20Application/735000/735340/20181400%20Phase%20I%20and%20II%20GeoEnvironmental%20Assessment.pdf. Accessed 08/11/2020
Flood and Water Management Act (2010) C29. [online] Available at: https://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf. Accessed 01/10/2020
Greater Norwich Development Partnership (2014) Joint Core Strategy for Broadland, Norwich and South Norfolk. [online] Available at: https://www.south-norfolk.gov.uk/sites/default/files/JCS_Adopted_Version_Jan_2014.pdf. Accessed 02/10/220
Highways England (2018) A47/A11 Thickthorn Junction EIA Scoping Report. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010037/TR010037-000008-THIC%20Scoping%20Report.pdf. Accessed 06/11/2020
Highways England (2019) A47 North Tuddenham to Easton EIA Scoping Report. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010038/TR010038-000028-TUDD%20-%20Scoping%20Report.pdf. Accessed 09/11/2020
Ørsted (2018) Hornsea Project Three Environmental Statement – Hydrology and Flood Risk. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000544-HOW03_6.3.2_Volume%203%20-%20Ch%202%20-%20Hydrology%20and%20Flood%20Risk.pdf. Accessed 09/11/2020
Ørsted (2018) Hornsea Project Three Outline Code of Construction Practice. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-000649-HOW03_8.5_Outline%20Code%20of%20Construction%20Practice.pdf. Accessed 09/11/2020
Ministry of Housing, Communities and Local Government, 2019. National Planning Policy Framework [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf. Accessed 01/10/2020

Ministry of Housing, Communities and Local Government, 2014. Guidance – Flood risk and coastal change [online] Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change. Accessed 01/10/2020.
Natural England (undated) Designated Sites View. River Wensum SSSI Citation.
Norfolk County Council (2011) Preliminary Flood Risk Assessment Report [online] Available at: https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management-policies/local-flood-risk-management-strategy. Accessed 01/10/2020.
Norfolk County Council (2015) Norfolk Local Flood Risk Management Strategy [online] Available at: https://www.norfolk.gov.uk/what-we-do-and-how-we-work/policy-performance-and-partnerships/policies-and-strategies/flood-and-water-management-policies/local-flood-risk-management-strategy. Accessed 02/10/2020.
North Norfolk District Council (2012) North Norfolk Local Development Framework Core Strategy Incorporating Development Control Policies. [online] Available at: https://www.north-norfolk.gov.uk/media/1370/3-_core_strategy_-incorporating_development_control_policies-_adopted_2008_-updated_2012.pdf#page=2. Accessed 02/10/2020
Norwich City Council, South Norfolk District Council (2017) Greater Norwich Area Strategic Flood Risk Assessment. [online] Available at: https://gnlp.oc2.uk/docfiles/14/2017s5962_greater_norwich_area_sfra_final_v2.0.pdf. Accessed 01/10/2020.
PINS (2018). Planning Inspectorate Advice Note Nine: Rochdale Envelope.
Standards for Highways (2020) Design Manual for Roads and Bridges. [online] Available at: https://www.standardsforhighways.co.uk/dmrb/ Accessed 02/10/2020.
The Water Framework Directive (Standards and Classification) Directions (England and Wales (2015).
Vattenfall (2019) Environmental Statement Volume 1 Chapter 20, Water Resources and Flood Risk. [online] Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000406-6.1.20%20Environmental%20Statement%20Chapter%2020%20Water%20Resources%20and%20Flood%20Risk.pdf. Accessed 09/11/2020
Water Environment (Water Framework Directive) (England and Wales) Regulations (2017).