RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Environmental Statement

Volume 7

Appendix 20-4 Flood Risk Assessment

June 2024

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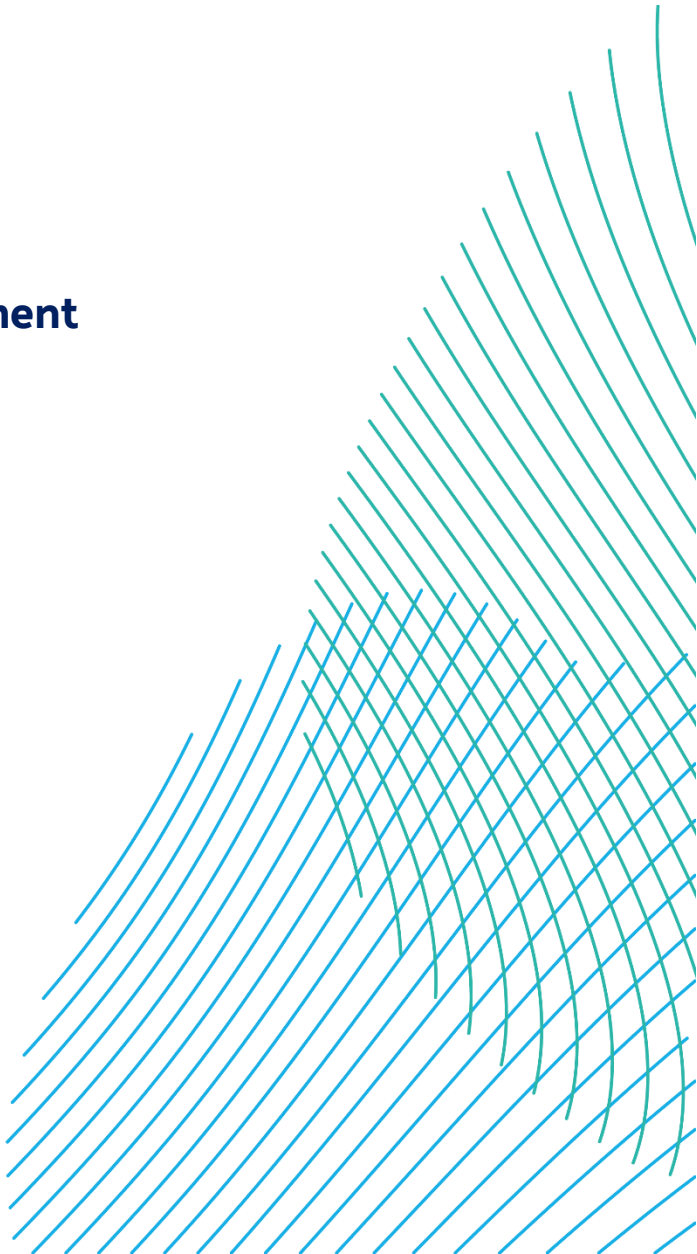

Unrestricted

Company:	**RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited**	Asset:	**Development**
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Glossary

Term	Definition
Aquifer	Geological strata that hold water.
Coastal / Tidal Flooding	When high tide events overtop the shoreline to cause flooding to land behind.
Coastal catchment	Land which drains directly to the coastal or estuarine waters, rather than through a river water body – not part of a river water body catchment.
Concurrent Scenario	A potential construction scenario for the Projects where DBS East and DBS West are both constructed at the same time.
Development Scenario	Description of how the DBS East and/or DBS West Projects would be constructed either in isolation, sequentially or concurrently.
Dogger Bank South (DBS) Offshore Wind Farms	The collective name for the two Projects, DBS East and DBS West.
Fluvial Flooding	When flows within watercourses exceed the capacity of the watercourse causing out of bank flows.
Geomorphology	The study of landforms and the processes that shape them.
Groundwater	Water stored below the ground in rocks or other geological strata.
Horizontal Directional Drill (HDD)	HDD is a trenchless technique to bring the offshore cables ashore at the landfall and can be used for crossing other obstacles such as roads, railways and watercourses onshore.
In Isolation Scenario	A potential construction scenario for one Project which includes either the DBS East or DBS West array, associated offshore and onshore cabling and only the eastern Onshore Converter Station within the Onshore Substation Zone and only the northern route of the onward cable route to the proposed Birkhill Wood National Grid Substation.
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.

Term	Definition
Landfall	The point on the coastline at which the Offshore Export Cables are brought onshore, connecting to the onshore cables at the Transition Joint Bay (TJB) above mean high water.
Link Boxes	An underground metal box placed within a concrete pit where the metal sheaths between adjacent export cable sections are connected and earthed, installed with a ground level manhole to allow access to the Link Box for regular maintenance or fault-finding purposes.
Main River	Main Rivers are usually large rivers or streams that are designated under the Water Resources Act (1991) and are shown on the statutory Main River Map. They are managed by the Environment Agency, who carry out construction, maintenance and improvement works to manage flood risk.
Mitigation Areas	Areas captured within the Development Area specifically for mitigating expected or anticipated impacts.
Offshore Development Area	The Offshore Development Area for ES encompasses both the DBS East and West Array Areas, the Inter-Platform Cable Corridor, the Offshore Export Cable Corridor, plus the associated Construction Buffer Zones.
Onshore Converter Stations	A compound containing electrical equipment required to transform and stabilise electricity generated by the Projects so that it can be connected to the electricity transmission network. There will be one Onshore Converter Station for each Project.
Onshore Development Area	The Onshore Development Area for ES is the boundary within which all onshore infrastructure required for the Projects would be located including Landfall Zone, Onshore Export Cable Corridor, accesses, Temporary Construction Compounds and Onshore Converter Stations.
Onshore Export Cable Corridor	This is the area which includes cable trenches, haul roads, spoil storage areas, and limits of deviation for micro-siting. For assessment purposes, the cable corridor does not include the Onshore Converter Stations, Transition Joint Bays or temporary access routes; but includes Temporary Construction Compounds (purely for the cable route).

Term	Definition
Onshore Export Cables	Onshore Export Cables take the electric from the Transition Joint Bay to the Onshore Converter Stations.
Onshore Grid Connection Points	The Onshore Grid Connection Points is the location where the electricity produced by the Projects would be transferred to the national grid. There are two Onshore Grid Connection Points, one for each Project, which will be located in the same place.
Onshore Substation Zone	Parcel of land within the Onshore Development Area where the Onshore Converter Station infrastructure (including the haul roads, Temporary Construction Compounds and associated cable routeing) would be located.
Ordinary watercourse	Rivers which are not Main Rivers are called 'ordinary watercourses'. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses.
Other trenchless techniques	Other techniques (aside from HDD) for installation of ducts or cables where trenching may not be suitable such as micro tunnelling or auger boring.
Sequential Scenario	A potential construction scenario for the Projects where DBS East and DBS West are constructed with a lag between the commencement of construction activities. Either Project could be built first.
Surface water flooding	Surface water flooding occurs when rainwater does not drain away through normal drainage systems or soak into the ground but lies on or flows over the ground instead.
Temporary Construction Compound	An area set aside to facilitate construction of the Projects. These will be located adjacent to the Onshore Export Cable Corridor and within the Onshore Substation Zone, with access to the highway.
The Applicants	The Applicants for the Projects are RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited. The Applicants are themselves jointly owned by the RWE Group of companies (51% stake) and Masdar (49% stake).
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).

Term	Definition
Transition Joint Bay (TJB)	The Transition Joint Bay (TJB) is an underground structure at the landfall that houses the joints between the Offshore Export Cables and the Onshore Export Cables.
Transition Joint Bay Compound (TJB)	A temporary construction compound located with the 'Landfall Zone' to undertake the trenchless crossing technique i.e. Horizontal Directional Drilling (HDD) and for the construction of the Transition Joint Bays.

Acronyms

Term	Definition
AOD	Above Ordnance Datum
AP	Annual Probability
AStGWF	Areas Susceptible to Groundwater Flooding
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
OCoCP	Outline Construction Code of Practice
DBS	Dogger Bank South
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
EIA	Environmental Impact Assessment
ES	Environmental Statement
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
HDD	Horizontal Directional Drilling
IDB	Internal Drainage Board
IDD	Internal Drainage District
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
NFM	Natural Flood Management
NPPF	National Planning Policy Framework

Term	Definition
NPS	National Policy Statement
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SPZ	Source Protection Zones
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TJB	Transition Joint Bay
WFD	Water Framework Directive

20.4 Flood Risk Assessment

20.4.1 Introduction

1. RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited (hereafter 'the Applicants') are proposing to construct an offshore wind farm off the coast of East Riding of Yorkshire, named Dogger Bank South (DBS) East and DBS West Offshore Wind Farms (herein 'the Projects'). **Volume 7, Chapter 5 Project Description (application ref: 7.5)** provides a description of the main components of the Projects, including details on construction, operation, maintenance and decommissioning.

2. **Volume 7, Chapter 5 Project Description (application ref: 7.5)** details the key offshore and onshore components of the Projects, which includes a maximum of 200 wind turbines, offshore platforms, offshore export cables from the Array Areas to landfall, Onshore Export Cables, Onshore Converter Stations within the Onshore Substation Zone and onward connections to a proposed new National Grid substation.

3. The Projects are taking a design envelope approach, also known as the 'Rochdale Envelope' approach. As discussed in **Volume 7, Chapter 5 Project Description (application ref: 7.5),** flexibility is required for the following key aspects:

   - Wind turbine capacity, including technology advancements prior to construction;
   - Construction and maintenance methodologies; and
   - Development Scenarios (in isolation, sequential or concurrent approaches).

4. The location of the Landfall Zone, Onshore Export Cables and Onshore Converter Stations has been confirmed during the design freeze, prior to completion of the Environmental Statement (ES), which will support the Development Consent Order (DCO) application. These design refinements have also been assessed and discussed in this updated Flood Risk Assessment (FRA).

5. The final detailed design of the Projects infrastructure will be confirmed through detailed engineering design studies that will be undertaken post-consent. In order to provide a precautionary but robust assessment at this stage of the development process, a worst case scenario has been considered in terms of the potential flood risk impact that may arise.

6. The following document comprises an FRA which has been developed to support **Volume 7, Chapter 20 Flood Risk and Hydrology (application ref: 7.20)** of the ES.

20.4.1.1 Aims

7. The aim of this FRA is to provide sufficient justification to regulators and other stakeholders that the Projects are appropriate and in line with planning and national policy requirements regarding flood risk. The assessment is proportionate to the scale and nature of the Projects, as required by national policy.

8. The aims of this FRA are:

- To establish whether the Projects are likely to be affected by current or future flooding from any source of flood risk;
- To assess and identify the potential for the Projects to increase flood risk elsewhere to off-site receptors;
- To provide recommendations on potential measures required to reduce flood risk, if applicable; and
- To provide information required to support the EIA with regards to flooding, supported by the application of the Sequential Test and, where necessary, the Exception Test.

20.4.1.2 Methodology

9. This FRA has been prepared in accordance with the methodology and guidance set out in:

- EN-1 Overarching National Policy Statement for Energy (Department for Energy Security and Net Zero, 2024);
- National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2023);
- Planning Practice Guidance (PPG) for Flood Risk and Coastal Change (Ministry of Housing, Communities & Local Government, 2022); and
- Environment Agency's climate change allowance guidance (Environment Agency, 2022).

10. The relevance and the applicability of the above policy and guidance has been considered within this FRA and summarised in section 20.4.2. In addition, the appropriate climate change allowances have been reviewed and included within section 20.4.6 of this FRA.

20.4.1.3 Study Area

11. Due to the scale of the Projects spanning an area from the coastline of the East Riding of Yorkshire to approximately 35km inland, the flood risk varies across the Onshore Development Area. Therefore, to aid in this assessment, the Onshore Development Area has been sub-divided into key sections within this document, as shown on **Figure 20-4-1**.

12. The flood risk to the Landfall Zone, Onshore Export Cable Corridor and Onshore Converter Stations within the Onshore Substation Zone are identified separately within this FRA report as outlined below:

    - Landfall Zone;
    - Onshore export cable corridor; and
    - Onshore Substation Zone.

13. This FRA is structured to introduce all relevant polices and guidance related to flood risk, prior to identifying the existing flood risk within the study area for each element of the Projects. It should be noted that the flood extents related to the Environment Agency Flood Zones apply to areas landward of Mean High Water Springs (MHWS), and therefore flood risk above MHWS has been considered within this FRA.

14. Following the identification of the flood risk to each element of the Projects, mitigation measures related to the construction and operation of these is then discussed to ensure that there is no increase in flood risk either to, or as a result of, the Projects. This includes all the temporary and permanent works associated with the Projects within the Onshore Development Area, as shown on **Figure 20-4-1**. It also includes consideration of the proposed Watercourse Crossing Methodology along the Onshore Export Cable Corridor, as shown on **Figure 20-4-1** and **Figure 20-4-2**, for the various different types of watercourses, as shown on **Figure 20-4-1** and Internal Drainage Board maintained drains as shown on **Figure 20-4-2**, that would be crossed by the Projects.

20.4.2 Policy, Guidance and Consultation

15. **Table 20-4-1** outlines all documents that are referenced in this FRA. In the following section, the documents and their constraints related to the Projects are discussed in greater detail.

Table 20-4-1 Summary of Policy and Guidance Documents

Policy or Guidance Document	Author / Produced on Behalf Of	Year Published / Updated
National		
EN-1 Overarching National Policy Statement for Energy	Department for Energy Security and Net Zero	Updated November 2023, formally adopted January 2024
National Planning Policy Framework	Ministry of Housing, Communities and Local Government	2012, updated 2023
Planning Practice Guidance (PPG) for Flood Risk and Coastal Change	Ministry of Housing, Communities & Local Government	2014, updated 2022
Flood risk assessments: climate change allowances guidance	Environment Agency	2016, updated 2022
Local		
East Riding Local Plan Update 2020 – 2039 Draft Strategy Document Update	East Riding of Yorkshire Council	May 2021
Flood Risk Sequential and Exception Test Supplementary Planning Document	East Riding of Yorkshire Council	Adopted November 2021
East Riding Local Flood Risk Management Strategy (2015 -2027)	East Riding of Yorkshire Council	December 2015

Policy or Guidance Document	Author / Produced on Behalf Of	Year Published / Updated
Draft East Riding Local Flood Risk Management Strategy 2 (2021-2027 and beyond)	East Riding of Yorkshire Council	Consultation draft published in Cabinet Supporting Papers (December 2021)
Strategic Flood Risk Assessment: Level 1	Capita produced on behalf of East Riding of Yorkshire Council	November 2019
Flamborough Head to Gibraltar Point Shoreline Management Plan	Humber Estuary Coastal Authorities Group	December 2010
Hull and Coastal Streams Catchment Flood Management Plan	Environment Agency	December 2010

16. EN-1 Overarching National Policy Statement (NPS) for Energy provides an overview and strategic direction for the Projects. However, the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2023), Planning Practice Guidance (PPG) for Flood Risk and Coastal Change (Ministry of Housing, Communities and Local Government, 2022) and 'Flood risk assessments: climate change allowances guidance' (Environment Agency, 2022) provide the detailed direction as to how flood risk should be considered at all stages of the planning and development process.

17. The planning system should ensure that new development is safe and not exposed unnecessarily to the risks associated with flooding. This FRA sets out the planning and wider context within which the Projects need to be considered, along with the flood risk to the Onshore Development Area.

20.4.2.1 Overarching National Policy Statement for Energy (EN-1)

18. The overarching NPS for Energy (EN-1) (2023) comprises an update to the previous EN-1 Overarching National Policy Statement (NPS) for Energy (2011).

19. The Government issued a statement on the proposed updates to the whole suite of NPS documents in November 2023. This confirmed that the energy NPS had been revised in 2023 and that they cover the overarching needs case for different types of energy infrastructure as well as renewable electricity generation. The overarching NPS for Energy (EN-1) subsequently came into force on 17 January 2024.

20. This FRA has been considered within the context of the above revised NPS; however, it is noted that the NPS are aligned with the guidance set out in NPPF and the supporting PPG in relation to flood risk. Therefore, the FRA has focused on the guidance set out within the NPPF.

20.4.2.2 National Planning Policy Framework

21. The NPPF sets out the UK Government planning policies for England and seeks to ensure that flood risk is considered at all stages of the planning and development process. Its policies aim to avoid inappropriate development in areas at highest risk of flooding, and to direct development away from these areas.

22. The revised NPPF (2023) provides clarification that all strategic policies and plans should apply a sequential, risk-based approach to the location of development, taking into account all sources of flood risk (e.g. fluvial, coastal, surface water, groundwater, reservoir and sewer flooding). It also provides guidance on how this is to be considered in the context of the location of site-specific development.

20.4.2.3 Planning Practice Guidance for Flood Risk and Coastal Change

23. Further guidance on the application of the Sequential Test and Exception Test is provided in the supporting Planning Practice Guidance (PPG) for Flood Risk and Coastal Change (Ministry of Levelling Up, Communities and Local Government, 2022), which was updated on 25 August 2022. This is in terms of all sources of flood risk, Flood Zones and the Vulnerability Classification relevant to the development.

24. Within the supporting PPG (Paragraph 027), it is noted that:

"*For nationally or regionally important infrastructure the area of search to which the Sequential Test could be applied will be wider than the local authority boundary.*"

25. As is required for Nationally Significant Infrastructure Projects (NSIPs), the Projects have been subject to an extensive search and site selection process, as demonstrated by **Volume 7, Chapter 4 Site Selection and Assessment of Alternatives (application ref: 7.4)**, which included consideration of flood risk issues as part of the assessment.

26. The 2022 update to the PPG (published on 25th August 2022) requires the Sequential Test to assess the flood risk from all sources, as well as summarising an additional consideration with regards to flood risk management infrastructure. This is in terms of development vulnerability for reasonably alternative sites.

27. For the purposes of the FRA, based on the indicative flood risk issues in relation to the Projects, the application of a sequential approach has been considered, specifically with regard to the Onshore Converter Stations as this will comprise the only above ground infrastructure once operational.

28. This assessment has sought to consider the potential flood risk from all sources in greater detail with the aim of sequentially locating it, wherever possible, to avoid the risk. Further details with regard to the consideration of the Sequential Test, and where necessary the Exception Test, are provided in section 20.4.5 of this FRA.

29. Flood Zones are informed by the extent of modelling undertaken by the Environment Agency and can be found on the Environment Agency Flood Map for Planning website (Environment Agency, 2024), which has also been reproduced for ease of reference on **Figure 20-4-3**.

30. All designated Main Rivers, as well as some of the larger Ordinary Watercourses included in the modelling, are considered within the Flood Zone dataset.

31. Flood Zones are defined in Table 1 of the PPG (2022) as follows:

- Flood Zone 1 – Low Probability:
  - Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
- Flood Zone 2 – Medium Probability:
  - Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
- Flood Zone 3a – High Probability:
  - Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
- Flood Zone 3b – Functional Floodplain:
  - This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional

floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:

- land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
- land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

- Local authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

32. The updated PPG (2022) provides guidance on how the Sequential Test should be applied to other sources of flooding, and specifically surface water flooding. When considering the risk of flooding from surface water, the online national mapping showing surface water flood extents, has been considered alongside the above Flood Zone information, which has also been reproduced for ease of reference on **Figure 20-4-4** (Gov, 2024).

20.4.2.4 Environment Agency's Climate Change Allowances

33. The Environment Agency originally published its guidance on climate change allowances for Flood Risk Assessments in February 2016, which was subsequently updated in July 2021 and May 2022.

34. The latest climate change guidance sets out the Environment Agency's recommended climate change allowances for development when considering flood risk and coastal change for planning purposes (Environment Agency, 2022).

35. The updated Environment Agency guidance comprised a number of amendments, including updates on the values to be used, how to apply the peak river allowances as well as updates to the approach with regard to peak rainfall allowances. The updated guidance on peak river flow allowances included amendments to utilise the UKCP18 projections and provided a change of approach from the use of river basin districts to the use of management catchments. Additionally, there was a change in guidance on how to apply peak river flow allowances such that the Central allowance is to be adopted for all assessments except for Essential Infrastructure, where the Higher Central allowance is to be applied.

36. The updated guidance on the values for peak rainfall allowance are now provided for 1% annual probability (AP) events and for 3.3% AP events, as well as 2 future epochs rather than 3 epochs. Furthermore, the guidance on the approach to adopt for the application of peak rainfall allowances has changed, using the Central allowance for development with a lifetime up to 2100 and the Upper End allowance for development with a lifetime from 2100 to 2125.

20.4.2.5 East Riding Local Plan

37. The East Riding Local Plan was adopted in 2016; however, the council is also required to review and update the Local Plan within 5 years of adoption. Therefore, a draft Local Plan Strategy Document Update was produced in 2021 by East Riding of Yorkshire Council.

38. As the development proposals is for the construction of Offshore Wind Farms, the relevant policies in the Local Plan and subsequent draft Local Plan Strategy Document Update have been considered as follows:

- Policy SI: Sustainable development states:
  - "*When considering development proposals, the Council will take a positive approach that reflects the three overarching objectives of sustainable development as set out in paragraph 8 of the National Planning Policy Framework, economic, social and environmental, whilst taking into account local circumstances. It will work proactively with applicants to find solutions which mean that proposals can be approved wherever possible, and to secure development that supports the Council's Vision and Objectives for the Local Plan and the other documents which make up the development plan.*
  - *The Local Plan should be read as a whole and in conjunction with the other documents which make up the development plan. Planning applications that accord with the policies in the development plan will be approved without delay unless Chapter 4 Spatial Strategy 4 East Riding Local Plan Strategy Documents Update – Draft May 2021 37 material considerations indicate otherwise.*
  - *Proposals should ensure that, where appropriate, development will support the future sustainable growth of settlements. Future access and connectivity to neighbouring land should be taken into consideration.*"

39. The draft Local Plan Strategy Document Update notes that the council will take a positive approach that reflects the economic, social and environmental aspects of sustainable development, as set out in the NPPF.

40. Chapter 4 Spatial Strategy of the draft Local Plan Strategy Document Update (2021) discusses the need to address climate change within the East Riding of Yorkshire. It highlights the need for the council to consider mitigating against climate change through the implementation of "*renewable and low carbon energy technologies*" and adapting to these measures by considering "*the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development*."

41. Furthermore, section 4.17 of the draft Local Plan Strategy Document Update states:

- "*The Council has recently declared a climate emergency and has recommended that a climate change strategy be prepared that identifies key opportunities for mitigation and adaptation for the East Riding. Prior to this, the Humber Industrial Strategy Prospectus (2019) had already set the ambition to develop the Humber into a net-zero carbon industrial economy by 2040. The prospectus recognises that the 'Energy Estuary' contributes to over a quarter of the UK's energy and is at the forefront of developing the UK's world-leading offshore wind sector.*
- *In terms of onshore wind, the East Riding alone has a grid connected operational capacity in the order of 330MW of electricity. This is likely to be one of the highest wind energy capabilities in the country. In addition to wind energy, a number of solar, bio-renewable and other renewable energy projects are operational or permitted. As such, the East Riding is in a good position to support the shift to a low carbon economy…*"

42. Policy S2: Addressing Climate Change of the draft Local Plan Strategy Document Update states:

- "*Development Proposals will be supported where they contribute to a reduction in greenhouse gas emissions and incorporate adaptation to the expected impacts of climate change.*
- *Directing most new development to areas where there are services, facilities, homes and jobs, which reduces the need to travel and where it can be served more easily by sustainable modes of transport.*
    - *Efficiently using land, mineral, energy and water resources.*
    - *The re-use of the area's building stock and previously developed land.*

- *Building at higher densities where appropriate and supporting opportunities for mixed use development.*
- *Promoting sustainable modes of transport and well-connected places.*
- *Promoting the creation of economic clusters for the renewable and low carbon energy sector.*
- *Incorporating high standards of sustainable design and construction which involve the prudent and efficient use of natural resources and built-in resilience to the impacts of climate change (e.g., overheating, flood risk).*
- *Incorporating renewable, low carbon and decentralised energy generation in appropriate locations and schemes.*
- *Supporting proposals that protect, enhance and link habitat networks to allow biodiversity to adapt to climate change.*
- *Conserving, enhancing and linking green infrastructure networks to provide flood management, shading for urban areas and natural air conditioning.*
- *Steering development away from areas of high flood risk, as far as possible, and ensuring development is as resilient as possible to any residual risks.*
- *Supporting sustainable flood management proposals.*
- *Implementing the most recent Shoreline Management Plan.*
- *Managing development in coastal areas and facilitate the re-location/roll back of development from areas between Barmston and Spurn Point.*
- *Exploiting carbon capture approaches through the creation and expansion of woodland, restoration of peat bogs and coastal ecosystems, and the deployment of new technologies.*"

43. In addition, Policy ENV6: Managing Environmental Hazards of the draft Local Plan Strategy Document Update is relevant, as it states:

- "*Environmental hazards, such as flood risk, coastal change, nutrient deposition, aerial pollution, groundwater pollution and other forms of pollution, will be managed to ensure that development does not result in unacceptable consequences to its users, the wider community, and the environment.*
- *Flood risk*

- *The risk of flooding to development, from all sources both now and in the future, will be managed by applying a sequential test to ensure that development is steered towards areas of lowest risk, as far as possible. The sequential test will, in the first instance, be undertaken on the basis of the East Riding Strategic Flood Risk Assessments (SFRA) and the Environment Agency's Flood Map, within appropriate search areas. Where development cannot be steered away from Flood Zone 3, the sub-delineation of Zone 3, detailed within the relevant SFRA, will be used to apply the sequential test, with preference given to reasonably available sites that are in the lower risk/hazard zones. Where necessary, development must also satisfy the exception test.*
- *If, following applications of the sequential test, it has not been possible to successfully steer development to a site at low risk of flooding from all sources now and in the future, a sequential approach will be taken to the site design and layout, aiming to steer the most vulnerable of uses towards the lowest risk parts of the site and upper floors.*

- *Flood risk will be proactively managed by ensuring that new developments:*
  - *limit surface water run-off to existing run-off rates on greenfield sites, and on previously developed land reduce existing run-off rates by a minimum of 30%, or to greenfield run-off rate;*
  - *do not increase flood risk within or beyond the site;*
  - *incorporate Sustainable Drainage Systems (SuDS) into major development proposals and proposals at risk of flooding, unless demonstrated to be inappropriate;*
  - *do not culvert or otherwise build over watercourses, unless supported by the Risk Management Authority;*
  - *have a safe access/egress route from/to Flood Zone 1 or establish that it will be safe to seek refuge at a place of safety within a development;*
  - *incorporate high levels of flood resistant and resilient design if located in a flood risk area;*
  - *are adequately set-back from all watercourses including culverted stretches; and*
  - *adhere to other relevant SFRA recommendations.*"

44. This FRA has considered flood risk to the Projects in the context of the above policies set out in the Local Plan and draft Local Plan Strategy Document Update.

20.4.2.6 Flood Risk Sequential and Exception Test Supplementary Planning Document

45. In addition, to the East Riding Local Plan Update, East Riding of Yorkshire Council produced a Supplementary Planning Document (SPD) in 2021, which replaced a previous document entitled the Flood Risk Note for the Planning Application Process.

46. The 2021 update changed the status of the document, so it became a SPD and also was amended to reflect both the revised NPPF and also the new evidence base that had become available, namely the Strategic Flood Risk Assessments, which were updated in 2019 and 2020.

47. The SPD sets out the data and information that East Riding of Yorkshire Council expect to be reviewed when undertaking the Sequential Test process and the extent of the search area to be considered, based on development type.

48. It is confirmed that the guidance and datasets named in the SPD have been subject to consideration when assessing the appropriateness of the Projects in the context of flood risk within this FRA.

20.4.2.7 Preliminary Flood Risk Assessment

49. A Preliminary Flood Risk Assessment (PFRA) was produced for the county in 2011, to meet the requirements set out by the Flood Risk Regulations 2009 and the European Floods Directive.

50. The PFRA provides a high-level overview of the potential risk of flooding from local sources and identifies areas at flood risk which may require more detailed studies. The PFRA is used to inform the development of the Local Flood Risk Management Strategy and has been considered in the Strategic Flood Risk Assessment.

51. As such, this FRA has also carried out an assessment of the information contained within the Local Flood Risk Management Strategy and Strategic Flood Risk Assessment(s) in the following sections.

20.4.2.8 Local Flood Risk Management Strategy

52. The East Riding Local Flood Risk Management Strategy (LFRMS) (2015 - 2027) was produced by East Riding of Yorkshire Council in 2015. It outlines the aims and objectives of the Council in their role as the Lead Local Flood Authority (LLFA) and provides policies based on these aims.

53. There is a requirement to identify flood risk areas including those areas in Flood Zone 1 which have critical drainage problems, and which have been notified as a flood risk area to the local authority by the Environment Agency. These are also referenced by the Environment Agency as Critical Drainage Areas (CDAs).

54. Consideration of CDAs is necessary to inform key flood risk priorities. The East Riding LFRMS does not reference areas designated as CDAs. Therefore, it is concluded that the Onshore Development Area is not located within areas designated as CDAs.

55. It is noted that drainage catchments have been considered within the East Riding LFRMS, based on a number of hydraulic catchments. The mapping indicates that the Landfall Zone, Onshore Export Cable Corridor and Onshore Converter Stations within the Onshore Substation Zone fall within the Barmston Main Drain and the River Hull catchments.

56. In addition, the East Riding LFRMS notes that the Kingston upon Hull and Haltemprice catchment has been designated by the Government as a relevant flood risk area.

57. A review of the mapping indicates catchment is located to the south of the Onshore Converter Stations, as such it is concluded that no elements of the Projects are located within a flood risk area.

58. Policy CI: Providing infrastructure and facilities within the East Riding LFRMS states:

    - "*Proposals for new and/or improved infrastructure and facilities will be supported where they enhance the quality and range of services and facilities or facilitate delivery of new development needs*."

59. As the Projects comprise the construction of offshore wind farms, it is concluded that that this infrastructure will enhance the use of renewable energy within the local area, as well as at a national scale.

20.4.2.9 Strategic Flood Risk Assessment

60. A Strategic Flood Risk Assessment (SFRA) is a high-level strategic document carried out by local authorities to provide a comprehensive and robust appraisal of the extent and nature of flood risk from all sources of flooding, at present and in the future. The SFRA takes into consideration the impacts of climate change and assesses the impact that land use changes and development are likely to have on flood risk.

61. The East Riding of Yorkshire produced a Level 1 Strategic Flood Risk Assessment (SFRA) in November 2019. This covers the entire administrative area of the East Riding of Yorkshire.

62. The SFRA identified areas in Flood Zones 3b, 3a, 2 and 1, as well as risks of flooding from other sources. It also provides a comprehensive summary of historic flooding information.

63. The SFRA notes that the primary fluvial / tidal flood risk in the East Riding is associated with the Humber estuary, River Hull, River Aire, River Derwent, Market Weighton canal, River Ouse and Dutch River. However, it also notes that much of the council area is defended against fluvial and coastal flooding. As such, much of the flood risk to the area is residual and likely to be as a result of flood events exceeding the standard of protection afforded by the defence, defence or pumping failure, or flooding behind the defences due to local runoff or groundwater.

64. It also notes that coastal flood risk will be influenced by coastal erosion. In the future, this may introduce areas to the risk of flooding where localised high ground or smaller sea cliffs are eroded away. This effect may be accelerated by climate change (e.g. sea level rise), or as a result of changing wave climate. As such, it indicates that Shoreline Management Plans should be referenced in areas where coastal erosion may increase the risk of coastal flooding now or in the future.

65. The SFRA also notes that, as part of the development of the PFRA, the LLFA examined settlements to identify indicative Flood Risk Areas. It considered Goole, Beverley and Bridlington to be at substantial risk of surface water flooding, as well as the Flood Risk Area which included the Haltemprice area of the East Riding. As such, integrated (combined fluvial and surface water) modelling was undertaken to provide a more detailed analysis of the risk of flooding from surface water.

66. The Projects are located wholly within the East Riding of Yorkshire. Given that the study area of the Level 1 SFRA covers the entirety of this administrative area, as shown on Appendix A of the Level 1 SFRA, the extensive information and mapping within the Level 1 SFRA has been considered in the production of this FRA.

67. In addition, the council undertook Level 2 SFRAs for Goole and Hedon in 2020 as these were in areas considered to be at particular risk from flooding. The Projects are not located within the study area for either of the Level 2 SFRAs and therefore are not considered relevant to this assessment.

20.4.2.10 Catchment Flood Management Plans

68. Catchment Flood Management Plans (CFMPs) consider all types of inland flooding including from rivers, groundwater, surface water and tidal flooding. Flooding directly from the sea (coastal flooding) is covered in Shoreline Management Plans (SMPs).

69. CFMPs consider the likely impacts of climate change, the effects of how we manage the land and how areas can be developed sustainably to establish flood risk management policies which will deliver sustainable flood risk management for the long term.

70. The Onshore Development Area is located in the Hull and Coastal Streams Catchment Flood Management Plan. As with other key documents, the information provided in the CFMP is considered in the production of this FRA.

20.4.2.11 Shoreline Management Plans

71. Shoreline Management Plans (SMPs) are non-statutory plans for coastal defence management planning. They aim to identify the best ways to manage flood and erosion risk and develop an 'intent of management' for the shoreline.

72. The Onshore Development Area, specifically the Landfall Zone at Skipsea, is within the study area of the Flamborough Head to Gibraltar Point Shoreline Management Plan.

73. The Landfall Zone is within Policy Unit C Wilsthorpe to Atwick and the short, medium and long term policy for this unit is 'No Active Intervention'.

74. However, the SMP notes for this policy unit that:

    "*No Active Intervention will occur though all epochs. However, works may be necessary to maintain the functionality of the Barmston Drain. In keeping with existing permissions, the privately owned defences at Ulrome currently protecting caravan parks would not be maintained under this policy and erosion of the shoreline would occur.*"

75. The information set out within the SMP for this policy unit has been considered in the assessment of flood risk, specifically in relation to the Landfall Zone.

20.4.2.12 Flood Risk Stakeholders and Ongoing Consultation

76. The key stakeholders for the Projects in terms of flood risk are the Lead Local Flood Authority (East Riding of Yorkshire Council), the Environment Agency and the Beverly and North Holderness Internal Drainage Board. The Applicants have commenced engagement with all three key stakeholders to ensure flood risk related to their specific watercourses are fully considered and that permitting requirements regarding the need to cross watercourses within their administrative control are addressed. This engagement will continue throughout the DCO process.

20.4.2.12.1 Environment Agency

77. The Environment Agency is a key flood risk stakeholder to the Projects. This is due to their permissive powers related to the management of the Main Rivers that the Onshore Export Cable Corridor will be required to cross.

78. To inform this FRA, a data request was submitted to the Environment Agency to obtain data and information of specific relevance to the Projects.

79. A Product 4, 5, 6 and 8 data request was submitted to the Environment Agency, via email, on 19th October 2023 and a response provided on 28th November 2023. The information provided as part of this data request has been considered within this FRA.

20.4.2.12.2 East Riding of Yorkshire Council (Lead Local Flood Authority)

80. The Onshore Development Area is located within the unitary authority area of the East Riding of Yorkshire Council, and as such, they are the relevant Lead Local Flood Authority (LLFA) for the Projects.

81. Under the Flood and Water Management Act 2010, LLFAs are responsible for managing flooding from surface water, groundwater and ordinary watercourses. Among other responsibilities, they are required to deliver a strategy for local flood risk management in their areas, to investigate flooding and to maintain a register of flood risk assets.

82. As the LLFA, East Riding of Yorkshire Council is also responsible for consenting works that affect the flow of an Ordinary Watercourse under the terms of the Flood and Water Management Act 2010, Land Drainage Act 1991 and Water Resources Act 1991.

83. To inform this FRA, a data request was submitted to the LLFA, via email on 19th October 2023, for historic flood records, reported incidents of surface water flooding and any information held in the Flood Risk Asset Register (FRAR) within proximity to the proposed works.

84. The LLFA responded on 1st November 2023 with the following information, which has been reviewed and incorporated into this FRA, where applicable:

- Details of historic flooding: flood outlines on DEFRA's Data Services platform and River Hull Integrated Catchment Strategy, for specific analysis of risk near the Onshore Substation Zone;
- Relevant Section 19 reports;
- Detailed information on flood risk assets (embankments) which are crossed by the Onshore Development Area; and
- East Riding flood data map for planning.

20.4.2.12.3 Beverley and Holderness Internal Drainage Board

85. A review of the mapping provided by the Association of Drainage Authorities has confirmed that the Onshore Development Area is partially located within an Internal Drainage District (IDD) overseen by the Beverley and North Holderness Internal Drainage Board (IDB).

86. They are the Land Drainage Authority for Ordinary Watercourses within their IDD and they have permissive powers to manage water levels and undertake flood alleviation works in their area.

20.4.2.13 Permitting / Consenting Requirements

87. Any works, either temporary or permanent, which will alter the flow of water along a watercourse or require the erection of a culvert, bridge or modification to the channel will require consent from the corresponding relevant authorities such as the Environment Agency, LLFA or IDB.

88. As set out in the Environmental Permitting (England and Wales) Regulations 2016, a permit or exemption is required for any activities which will take place:

- On or within 8 metres (m) of a Main River (16m, if the Main River is tidal);
- On or within 8m of a flood defence structure or culverted Main River (16m, if Main River is tidal);
- Any activity within 16m of a sea defence structure;
- Quarrying or excavation within 16m of any Main River, flood defence (including a remote defence) or culvert; and / or
- Activities carried out on the floodplain of a Main River, more than 8m from the riverbank, culvert or flood defence structure (or 16m, if the Main River is tidal) and planning permission has not already been obtained.

89. Additionally, in accordance with the Flood and Water Management Act 2010 and Section 23 of the Land Drainage Act 1991, consent is required from the LLFA for the construction of a culvert or other structure that may affect the flow within an Ordinary Watercourse.

90. Furthermore, any crossings over Ordinary Watercourses, within the IDD for Beverley and North Holderness IDB will require the appropriate consents from the IDB and will need to be undertaken in accordance with the Beverley and North Holderness IDB Byelaws.

91. All Main Rivers and Ordinary Watercourses identified to be crossed by the Projects are identified and listed within the Obstacle Crossing Register included as **Volume 7, Appendix 5-2 (application ref: 7.5.5.2)** along with the proposed crossing methodology.

92. As noted above, the Applicants will continue to engage, throughout the DCO process, with all three of the key stakeholders (i.e. Environment agency, East Riding of Yorkshire Council and IDB) to ensure flood risk related to their specific watercourses are fully considered and that the appropriate permitting requirements regarding the need to cross watercourses within their administrative control are confirmed and addressed.

20.4.3 Baseline Environment

20.4.3.1 Hydrology

93. The Humber River Basin Management Plan (RBMP) has been developed to comply with the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 by the Environment Agency (Environment Agency, 2022). The RBMP defines river water body catchments based on surface hydrological catchments with an area of greater than 5km^2. In accordance with the approach adopted for **Volume 7, Chapter 20 Flood Risk and Hydrology (application ref: 7.20)** the Onshore Development Area in this FRA considers flood risk in the context of these surface hydrological catchments.

94. The majority of the Onshore Development Area falls within the river waterbody catchment of the River Hull. This river system drains the eastern side of the Yorkshire Wolds and flows in a generally north-south direction to join the Humber Estuary at Hull. Within the Landfall Zone, there are several short watercourses that flow directly to the coast. In addition, several of the River Hull's tributaries rise very close to the coast and flow inland to join the Main River.

95. The Onshore Development Area lies within three river water body catchments and crosses the following water bodies, as shown on **Volume 7, Figure 20-1 (application ref: 7.20.1)**:

- Barmston Sea Drain operational catchment;
  - Barmston Sea Drain/Skipsea Drain to Confluence;
  - Humber Coastal catchment;
- Upper Hull operational catchment;
  - Mickley Dike catchment;
  - Old Howe/Frodingham Beck to River Hull;
- Lower Hull operational catchment;
  - Catchwater Drain;
  - Foredyke Stream Upper;
  - Foredyke Stream Lower to Holderness Drain;
  - Holderness Drain Source to Foredyke Stream;
  - Beverley and Barmston Drain;
  - Hull from Arram Beck to Humber;
  - High Hunsley to Arram Area; and
  - High Hunsley to Woodmansey Are.

96. The Onshore Development Area crosses the following Environment Agency Main Rivers, with key watercourses shown on **Figure 20-4-1**:

- Stream Dyke;
- Monk Dyke;
- Meaux and Routh East Drain;
- Holderness Drain;
- River Hull;
- Beverley and Barmston Drain; and
- Catchwater Drain.

97. Based on the LLFA's Flood Risk Asset Register, the Onshore Development Area crosses the following named watercourses (includes Environment Agency Main Rivers and Ordinary Watercourses), as well as numerous unnamed watercourses, with key watercourses shown on **Figure 20-4-1**:

- Bently Moor Wood Northern Drain;
- Strawberry Drain;
- Skipsea Drain;
- Dunnington Sewer;
- Nunkeeling Drain;
- Bowlams Dike;
- Monk Dike;
- Meaux and Routh East Drain;
- River Hull;
- Beverley and Barmston Drain; and
- Arram Catchwater Drain South.

98. The Onshore Development Area also crosses the following drains which are located within the IDD for the Beverley and North Holderness IDB, as shown on **Figure 20-4-2**:

- Skipsea Drain;
- Dunnington Sewer;
- Arnold and Riston Drain;
- Turf Gutter;
- Turf Gutter and Eske River Side Drain;
- South Bullock Drain;
- Storkhill Drain;

- South Bullock (N. Branch – Diggins Arms); and
- South Bullock (S. Branch – Chalk Arm).

20.4.3.2 Existing Surface Water Drainage System

99. In addition to the above information, it is noted that the Projects will be located on predominantly rural, agricultural land, where there is likely to be limited existing formal surface water drainage systems.

100. However, as noted above, there are a large number of agricultural land drains and Ordinary Watercourses that will need to be crossed along the Onshore Export Cable Corridor.

20.4.3.3 Geology and Hydrogeology

101. The British Geological Survey (BGS) 1:50,000 scale solid and superficial geology geological mapping has been reviewed for the Onshore Development Area.

102. As would be expected from a linear project of this nature, the geological conditions within the Onshore Development Area vary. However, these can be summarised as follows:

- Superficial Deposits:
  - Till, Devensian – Diamicton
  - Superficial Deposits – Sand and gravel
  - Alluvium – Clay, silt, sand and gravel
  - Glaciofluvial Deposits, Devensian
  - Lacustrine Deposits – Sand, silt and clay
- Bedrock Geology:
  - Rowe Chalk Formation – Chalk
  - Flamborough Chalk Formation – Chalk.

103. Superficial deposits are varied but are dominated by till (diamicton). A wide belt of alluvium (sand, silt and clay), interspersed with more restricted pockets of glaciofluvial sand and gravel, runs north-south through the Onshore Development Area. Around the periphery of Beverley there are also Quaternary river terrace sediments and areas of head (head is poorly sorted, poorly stratified angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope).

104. Superficial deposits support extensive Secondary (undifferentiated) aquifers. For these features, it is not possible to apply either a Secondary A or B definitions, because of the variable characteristics of the rock type – they have only a minor value. The Onshore Development Areas also crosses several Secondary A aquifers in the River Hull valley and other alluvial settings. Secondary A aquifers comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers. Small Secondary B aquifers are also present near the coast in the Skipsea area. Secondary B aquifers are lower permeability layers which may yield limited amounts of groundwater due to localised features such as fissures, permeable horizons and weathering.

105. The Bedrock geology of the Onshore Development Area is defined as being a Principal aquifer. Principal aquifers provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.

20.4.4 Flood Risk to the Projects

106. The following sections explore the baseline risk of flooding to the key onshore elements of the Projects, as follows:

- Section 20.3.4.1: Landfall Zone;
- Section 20.3.4.2: Onshore Export Cable Corridor;
- Section 20.3.4.3: Onshore Substation Zone; and
- Section 20.3.4.4: Temporary Construction Compounds.

107. Where a flood risk either to or from the Projects is identified, appropriate mitigation methods are identified in section 20.4.7 Mitigation, including measures related to design mitigation, surface water drainage and flood warning and evacuation.

20.4.4.1 Landfall Zone

20.4.4.1.1 Overview of Proposed Activities

108. The Offshore Export Cables make landfall near Skipsea. The Offshore Export Cables will be connected to the Onshore Export Cables in the Transition Joint Bays (TJBs), which will be constructed prior to the installation of the Offshore Export Cables.

109. The Landfall Zone extends inland to allow the TJBs to be located beyond any areas at risk of natural coastal erosion, and to provide space for temporary construction logistics and access requirements.

110. A trenchless solution (likely to be an HDD) would be used to install ducts that would house the cables under the beach. A total of six completed ducts would be installed. The ducts would run from the TJBs, located landward of landfall, to an exit location which may be at an intertidal location (short trenchless crossing) or further offshore within the subtidal zone (long trenchless crossing). TJBs are permanent infrastructure where the Offshore and Onshore Export Cables are joined. The Offshore Export Cables would be pulled ashore through these pre-installed trenchless crossing ducts and would interface with the Onshore Export Cables at the TJBs. No above ground permanent infrastructure would be installed within the intertidal area above Low Astronomical Tide (LAT).

111. A TJB Compound, the location of which is subject to detailed design and as such is not currently shown as part of the indicative design, and a Satellite Temporary Construction Compound, which is shown on **Figure 20-4-1**, would be located within the Landfall Zone to accommodate the drilling rigs and ducting. In addition, an emergency access route is provided along the beach to the north of Skipsea. This would only be used in an emergency and would not be used for any vehicle movements etc during the construction phase.

112. Further details related to the Landfall Zone and works are provided in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**.

20.4.4.1.2 Historical Flooding

113. To understand the likely risk of flooding to the Projects, a review of the Environment Agency historic flood events and their frequency has been undertaken, as shown on **Figure 20-4-3** (Environment Agency, 2024). This review aims to provide context to flooding in the Onshore Development Area, identifying areas of focus where there are likely to be flooding issues. However, it should be noted that the absence of historical flood records does not necessarily confirm that flooding has not occurred.

114. **Figure 20-4-3a** shows the Environment Agency Flood Zone and Historic Flood Extents in relation to the Landfall Zone (Environment Agency, 2024). Flood extents related to the Environment Agency Flood Zones apply to areas landward of MHWS, and therefore flood risk above MHWS has been considered within this FRA It indicates that the Landfall Zone is primarily situated in a location along the coastline that has not been affected by a historic flood extent. However, the mapping indicates that historic flooding has occurred to the west of Skipsea, associated with the Skipsea Drain.

20.4.4.1.3 Flood Zones

115. The Landfall Zone is situated along the coastal frontage at Skipsea and extends approximately 90m inland. This is shown on each figure associated with this FRA, **Figure 20-4-1, Figure 20-4-2, Figure 20-4-3 and Figure 20-4-4.**

116. As indicated on **Figure 20-4-3a**, the Landfall Zone is shown to be partially situated within Flood Zone 3 which is associated with the potential flood risk along the beach. The TJB Compound and Temporary Construction Compound within the Landfall Zone would be located sufficiently inland such that they would be located within Flood Zone 1.

20.4.4.1.4 Flooding from Rivers

117. Given the Landfall Zone and its proximity to the North Sea, the dominant source of flooding is from tidal sources, as opposed to being at risk from fluvial sources.

118. Therefore, there would be no fluvial risk to the Landfall Zone based on the existing flood risk. Furthermore, the methodology for installing the Onshore Export Cables via trenchless techniques means that they will be located below ground once operational.

20.4.4.1.5 Flooding from the Sea

119. Given that the Landfall Zone is situated along the coastal frontage to the east of Skipsea and that the Flood Zone 3 extent is shown to partially affect the Landfall Zone, it is concluded that there is a tidal flood risk to the Landfall Zone at Skipsea, during the construction phase.

120. However, based on the use of trenchless techniques for installation of the Onshore Export Cables as they make landfall, the tidal flood risk once operational is considered to be low.

20.4.4.1.6 Flooding from Surface Water

121. At the Landfall Zone, the majority of the area is not considered to be at risk from surface water flooding during a 3.3% Annual Probability (AP) (High Risk), 1% AP (Medium Risk) or 0.1% AP (Low Risk) surface water flood event.

122. However, there are some areas at increased risk of surface water flooding to the north of Hornsea Road.

123. Any surface water flood risk to the Landfall Zone and the Onshore Export Cables in this location will be temporary in nature and removed once construction is complete, as all onshore infrastructure associated with the Onshore Export Cables will be located below ground. Furthermore, the land will be reinstated, and existing ground levels will be maintained.

124. On this basis, the risk of flooding from surface water is therefore considered to be low for the Landfall Zone and the temporary onshore construction compound.

20.4.4.1.7 Flooding from Groundwater

125. The Onshore Development Area is underlain by a single groundwater body, comprising Hull and East Riding Chalk.

126. This area is located over superficial deposits of Till, Devensian – Diamicton, Glaciofluvial Deposits, Devensian – Sand and gravel and Lacustrine deposits.

127. The SFRA shows the Areas Susceptible to Groundwater Flooding (AStGWF), which is a strategic scale map showing groundwater flood areas based on a 1km square grid. The data shows the proportion of each 1km grid square where geological and hydrogeological conditions indicate groundwater might emerge.

128. The mapping demonstrates that the Landfall Zone is situated in an area where <25% of the area is classified as being at risk of groundwater emergence.

129. Once operational, the effect that the Landfall Zone and Onshore Export Cables will have on groundwater flows is likely to be low, as the target depth for the Onshore Export Cables will be between 1.6m and 2m below ground. Given the operational depth of the Onshore Export Cables, they are likely to be constructed within the superficial deposits.

130. As the construction works require earthworks in order to place the Onshore Export Cables, it is important to note that perched groundwater may be present and could be encountered during the below-ground engineering works.

131. However, the potential presence of groundwater will be identified as part of the ground investigations and appropriate mitigation measures incorporated into the Projects, as required.

132. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the **Outline Code of Construction Practice (OCoCP) (Volume 8, application ref: 8.9)**, produced to accompany the ES and will be submitted as part of the DCO application.

133. Based on the above information, there is likely to be a low groundwater flood risk to the Landfall Zone during construction and any risk will be mitigated, as outlined above.

20.4.4.1.8 Flooding from Sewers

134. The SFRA has been reviewed to assess the risk of sewer flooding to the Landfall Zone. The SFRA has not provided any data to show that sewer flooding has occurred at the Landfall Zone.

135. Furthermore, the Landfall Zone is located within existing rural areas and, therefore, it is likely that there is a limited foul sewer network in the local area. Therefore, the risk of flooding from sewers is considered to be low.

20.4.4.1.9 Flooding from Reservoirs

136. The Environment Agency Flood Risk from Reservoirs map shows that the Landfall Zone is not at risk from reservoir flooding under any situation. Therefore, there is no risk of flooding from this source.

20.4.4.1.10 Flooding from Canals and other Artificial Sources

137. The Landfall Zone is not located near to any canals or other artificial sources. As such, there is no risk of flooding from canals or other artificial sources to the Landfall Zone.

20.4.4.1.11 Summary of Landfall Zone Flooding

138. Overall, the Landfall Zone is not at risk of flooding from sewers, canals or other artificial sources or reservoirs. In addition, there is a low risk of flooding associated with groundwater sources.

139. The Landfall Zone is partially located within Flood Zone 3; however, the predominant risk of flooding at this location is tidal.

140. As such, there is no risk of fluvial flooding (from Main Rivers), given the dominant source of flooding to the areas within Flood Zone 3 are tidal.

141. The Landfall Zone is also considered to be at low risk from surface water flooding, as any areas identified as having a higher risk of surface water flooding appear to be associated with watercourses or localised areas of lower-lying land. The strategy for controlling surface water runoff is detailed in the **Outline Drainage Strategy (Volume 8, application ref: 8.12)**.

20.4.4.2 Onshore Export Cable Corridor

20.4.4.2.1 Overview of Proposed Activities

142. A 75m, to 90m at complex trenchless crossings, wide onshore cable corridor is being considered for the purposes of the ES assessment, as presented in **Volume 7, Chapter 5 Project Description (application ref: 7.5).**

143. From the landfall at Skipsea, the Onshore Export Cable Corridor travels west, crossing Hornsea Road (B1242), and continuing to Dunnington Lane before turning and heading south past Dunnington, Nunkeeling, Catfoss, and across West Road (A1305) at Sigglesthorne.

144. The Onshore Export Cable Corridor then turns southwest and continues passing the village of Riston Grange, crossing Whitecross Road (A165) and again crossing Hornsea Road (A1305) as it heads west north of Tickton. The route then crosses Driffield Road (A164) to the north of Beverley before turning south crossing Constitution Hill (A1035) to the west of Beverley, down across York Road, Newbald Road, and Broadgate (B1230), before reaching the Onshore Substation Zone located at Beverley Road along the A1709 and A164.

145. The extent of the Onshore Export Cable Corridor is shown on **Figure 20-4-1**.

146. This section of the FRA covers the entirety of the Onshore Export Cable Corridor over its length of approximately 32km, which is wholly located within the East Riding of Yorkshire administrative area. Further details are provided in **Volume 7, Chapter 5 Project Description (application ref: 7.5).**

20.4.4.2.2 Historical Flooding

147. To understand the likely risk of flooding to the Projects, a review of historical flood events and its frequency has been undertaken. This review aims to provide context to flooding in the Onshore Development Area, identifying areas of focus where there are likely to be flooding issues. However, it should be noted that the absence of historical flood records does not necessarily confirm that flooding has not occurred.

148. **Figure 20-4-3 a-c** shows the Environment Agency Flood Zone and Historic Flood Extents in relation to the Onshore Export Cable Corridor (Environment Agency, 2024). It indicates that parts of the Onshore Export Cable Corridor have been affected by historical flooding. These appear to be associated with a small area around the Skipsea Drain and also locations around the River Hull and Beverley and Barmston Drain. From a review of mapping these appear to relate to locations shown to be within Flood Zones, as described below.

20.4.4.2.3 Flood Zones

149. Most of the Onshore Export Cable Corridor is situated within Flood Zone 1, however there are some sections which are located within Flood Zone 2 or Flood Zone 3, as shown on **Figure 20-4-3 a-c.**

150. From Skipsea to Long Riston, most of the Onshore Export Cable Corridor is situated within Flood Zone 1. However, there are three relatively small, isolated areas along this section which are located in Flood Zone 2 or Flood Zone 3.

151. At these specific locations, the Onshore Export Cable Corridor is required to cross over a series of watercourses, comprising the Skipsea Drain, Dunnington Sewer and Stream Dike.

152. A 9.9km section of the Onshore Export Cable Corridor between Long Riston and Beverly (west of Whitecross Road (A165) to east of Driffield Road (A164)) is located mostly within Flood Zone 2 or Flood Zone 3, according to the Environment Agency Flood Map for Planning (Environment Agency, 2024). This section of the Onshore Export Cable Corridor crosses 4 Main Rivers and several Ordinary Watercourses.

153. The remaining route of the Onshore Export Cable Corridor from Driffield Road (A164) to the Onshore Converter Stations is located in Flood Zone 1, with an isolated area at the end of the corridor in Flood Zone 2 and Flood Zone 3. This flood risk appears to be related to several Ordinary Watercourses which cross the onshore cable corridor.

20.4.4.2.4 Flooding from Rivers

154. Information provided within **Volume 7, Appendix 5-2**, **Obstacle Crossing Register (application ref: 7.5.5.2)** and set out in **Table 20-13** of **Volume 7, Chapter 20 Flood Risk and Hydrology (application ref: 7.20)** indicates the Onshore Export Cable Corridor will cross seven Environment Agency Main Rivers as well as a number of Ordinary Watercourses. Subsequently, there may be a risk of fluvial flooding during the construction of the Onshore Export Cables. Key watercourses and maintained drains along the Onshore Export Cable Corridor and the proposed Watercourse Crossing Methodology are shown on **Figure 20-4-1** and **Figure 20-4-2**.

155. All Main Rivers will be crossed using trenchless techniques, to avoid direct interaction with these watercourses.

156. It is acknowledged that there may be a flood risk associated with Ordinary Watercourses which are intercepted by the Onshore Export Cable Corridor.

157. The crossing methods for Ordinary Watercourses will be considered on an individual basis and agreed with both the LLFA and IDB at the detailed design stage.

158. The approach to Ordinary Watercourse crossings is discussed in **Section 5.6.16** of **Volume 7, Chapter 5 Project Description (application ref: 7.5).** Furthermore, a summary of the methodology to be adopted is provided within **Volume 7, Appendix 5-2 Obstacle Crossing Register (application ref: 7.5.5.2).** In addition, a summary of the proposed watercourse crossing type is shown on **Figure 20-4-1** and **Figure 20-4-2**. This includes the proposed use of trenchless crossing methods for a number of key watercourses, whilst the remaining watercourses are likely to be crossed using open cut trenching techniques.

159. As previously noted, the appropriate consent from the Environment Agency, LLFA and the IDB for the construction phase of the Projects will be identified and obtained, to ensure that both Main Rivers and Ordinary Watercourses are not impacted by the works.

20.4.4.2.5 Flooding from the Sea

160. The Onshore Export Cable Corridor is considered to be at low risk from tidal flooding, as the sections located within Flood Zone 2 or Flood Zone 3 are associated with fluvial flooding.

161. Therefore, there would be no tidal flood risk to the Onshore Export Cable Corridor based on the existing flood risk.

20.4.4.2.6 Flooding from Surface Water

162. The Environment Agency Surface Water Risk maps shown on **Figures 20-4-4 a-c** (Environment Agency, 2024) indicate that there are a number of isolated areas of surface water flooding along the Onshore Export Cable Corridor. Some of these isolated areas appear to be areas of ponding, likely to be linked to areas of lower ground levels resulting in pockets of surface water.

163. The areas where the Onshore Export Cable Corridor crosses over either Main Rivers or Ordinary Watercourses are identified as being at increased risk of surface water flooding. This is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

164. There are some areas at greater surface water risk between Whitecross Road (A165) and Driffield Road (A164). It is noted that these are in similar locations to the areas at increased fluvial flood risk and, as such, it is likely that the flood risk in this location may be linked.

165. Further information on watercourse crossings is discussed in section 20.3.7 Mitigation.

166. However, any surface water flood risk to the Onshore Export Cable Corridor will be temporary in nature and removed once construction is complete as all onshore infrastructure associated with the Onshore Export Cables will be located below ground and the land will be reinstated with the existing ground levels maintained. Furthermore, measures to address the potential surface water drainage issues are set out in the **Outline Drainage Strategy (Volume 8, application ref: 8.12)** to accompany the DCO application.

20.4.4.2.7 Flooding from Groundwater

167. The Onshore Development Area is underlain by a single groundwater body comprising Hull and East Riding Chalk.

168. The Onshore Export Cable Corridor is situated over superficial deposits of Till, Devensian formation which are classified as a Secondary (undifferentiated) superficial aquifer and Alluvium, Sand/Gravel and Glaciofluvial deposit formations which are classified as Secondary A superficial aquifer. Alluvium and Glaciofluvial deposit formations are classified as Secondary A superficial aquifer.

169. The SFRA shows the Areas Susceptible to Groundwater Flooding (AStGWF), which is a strategic scale map showing groundwater flood areas based on a 1km square grid. The data shows the proportion of each 1km grid square where geological and hydrogeological conditions indicate groundwater might emerge.

170. The mapping demonstrates that the onshore cable corridor passes through several areas susceptible to groundwater emergence.

171. The Onshore Export Cable Corridor passes through areas at relatively low risk of groundwater emergence (i.e. < 25% of the area within the 1km grid is at risk of groundwater emergence) through to areas at greater risk (i.e. >= 75% of the 1km grid is at risk of groundwater emergence).

172. Notwithstanding the above, once operational, the effect that the Onshore Export Cables will have on groundwater flows is likely to be low, as the target depth for the Onshore Export Cables will be between 1.6m and 2m below ground. Given the operational depth of the Onshore Export Cables, they are likely to be constructed within the superficial deposits.

173. As the construction works require earthworks in order to place the Onshore Export Cables, it is important to note that perched groundwater may be present below areas of the onshore cable corridor and could be encountered during the below-ground engineering works.

174. However, the potential presence of groundwater will be identified as part of the ground investigations and appropriate mitigation measures incorporated into the Projects, as required.

175. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the **OCoCP (Volume 8, application ref: 8.9)**, produced to accompany the ES and will be submitted as part of the DCO application.

176. Based on the above information there is likely to be a low to moderate groundwater flood risk along the Onshore Export Cable Corridor during construction and any risk will be mitigated, as outlined above.

20.4.4.2.8 Flooding from Sewers

177. The SFRA has been assessed to review the potential sewer flood risk to the Onshore Export Cable Corridor. The SFRA states the following:

"*New Sewer systems are typically designed to accommodate the 3.3% AP storm without flooding at the ground surface in accordance with Sewers for Adoption. However, many of the existing sewers were not built to this specification. These sewers can become overloaded as new development adds to the loads on the network.*

Even where sewers are built to the current specification, they may become overwhelmed by events with a higher magnitude. Sewer flooding can also be caused due to blockages, collapses or equipment (e.g., pumping station) failure.

Many of the systems in East Riding were constructed prior to the introduction of the now required design standard 3.3% AP (1 in 30 years). The limitations of the sewer system in East Riding were highlighted in 2007, when the existing drainage structure and public sewers were overwhelmed by the prolonged and heavy rainfall. However, since then Yorkshire Water have undertaken work to update and improve the sewer system in East Riding."

178. There is no specific information in the SFRA to indicate sewer flooding is an issue along the route of the Onshore Export Cable Corridor.

179. In addition, the Onshore Export Cable Corridor is located within existing rural and agricultural land. Therefore, it is likely that there is a limited foul sewer network and the risk of flooding from sewers is considered to be low.

20.4.4.2.9 Flooding from Reservoirs

180. The Environment Agency Flood Risk from Reservoirs map shows that none of the Onshore Export Cable Corridor is at risk from reservoir flooding under any situation. Therefore, there is no risk of flooding from this source.

20.4.4.2.10 Flooding from Canals and other Artificial Sources

181. The SFRA flood risk mapping has been reviewed alongside other online mapping, and it appears that the Onshore Export Cable Corridor is not located near to any canals or artificial sources. As such, there is no risk of flooding from canals or other artificial sources to the Onshore Export Cable Corridor.

20.4.4.2.11 Summary of Flooding at Onshore Export Cable Corridor

182. Overall, the Onshore Export Cable Corridor is not at risk of flooding from tidal, sewers, canals or other artificial sources or reservoirs. There is a variable risk from low to moderate of groundwater flooding occurring along parts of the Onshore Export Cable Corridor.

183. The main risk of flooding to the Onshore Export Cable Corridor is likely to be fluvial flooding. Most of the Onshore Export Cable Corridor is located in Flood Zone 1, however there are key sections of the Onshore Export Cable Corridor, between Long Riston and Beverly (west of Whitecross Road (A165) to east of Driffield Road (A164), located within Flood Zone 2 or Flood Zone 3. This flood risk appears to be related to a number of Main Rivers and Ordinary Watercourses.

184. In addition, locations where the Onshore Export Cable Corridor crosses Ordinary Watercourses there is an increased risk of surface water flooding. However, this is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

185. There are some isolated pockets of surface water flooding along the Onshore Export Cable Corridor which are likely to be linked to areas of lower ground levels. However, any surface water flood risk to the Onshore Export Cable Corridor will be temporary in nature and removed once construction is complete, as all onshore infrastructure will be located below ground.

186. A summary of mitigation measures is provided in section 20.4.7, including the need for construction phase drainage and consideration of flood warning and evacuation requirements. Furthermore, measures to address flood risk along the Onshore Export Cable Corridor would be secured within the **OCoCP (Volume 8, application ref: 8.9)**, produced to accompany the ES and submitted as part of the DCO application.

20.4.4.3 Onshore Substation Zone and Onward Connection to the Proposed Birkhill Wood National Grid Substation

20.4.4.3.1 Overview of Proposed Activities

187. The Onshore Converter Stations within the Onshore Substation Zone will be located to the south-west of Beverley. It is situated to the south of the A1079 and to the west of Poplar Farm and the Driffield Road (A164). This is shown on **Figure 20-4-1c**.

188. The Onshore Converter Stations will be a gas-insulated (GIS) switchgear design. The Onshore Substation Zone is of sufficient size to accommodate the maximum footprint required for both DBS East and DBS West and associated landscaping and drainage.

189. The Onshore Converter Stations will be constructed to accommodate the connection of both Projects to the transmission grid. The permanent footprint of one Onshore Convertor Station will be up to 64,16m^2 and the permanent footprint of two Onshore Converter Stations will be up to 128,832m^2.

190. In addition, there is also onward cabling from the Onshore Converter Stations to the Proposed Birkhill Wood National Grid Substation, which is considered within this section of the FRA. It extends approximately 2.5km South East from the Onshore Substation Zone with a cable corridor width of up to 100m during construction.

20.4.4.3.2 Historical Flooding

191. To understand the likely risk of flooding to the Projects a review of historical flood events and its frequency has been undertaken. This review aims to provide context to flooding in the Onshore Development Area, identifying areas of focus where there are likely to be flooding issues. However, it should be noted that the absence of historical flood records does not necessarily confirm that flooding has not occurred.

192. **Figure 20-4-3 a-c** shows the Environment Agency Flood Zone and Historic Flood Extents (Environment Agency, 2024) in relation to the Onshore Substation Zone This map demonstrates that the Onshore Substation Zone is not located in an area that has been affected by historical flooding.

20.4.4.3.3 Flood Zones

193. According to the Environment Agency Flood Zone Map, as shown on **Figure 20-4-3c** (Environment Agency, 2024), the Onshore Substation Zone is wholly located within Flood Zone 1. It is located approximately 265m from the nearest Flood Zone 2 extent, which is to the north-east of the Onshore Substation Zone. The onward cable connection to the Proposed Birkhill Wood National Grid Substation crosses a small area of Flood Zone 3, to the south of the A1079. This flood risk appears to be related to several Ordinary Watercourses in proximity to Jillywood Farm.

20.4.4.3.4 Flooding from Rivers

194. A review of mapping indicates that there is an Ordinary Watercourse, comprising a small drain located along a field boundary, running through the centre of the Onshore Substation Zone.

195. However, as the Environment Agency Flood Map for Planning (Environment Agency, 2024) indicates the Onshore Substation Zone is located within Flood Zone 1, it can be concluded that fluvial flood risk to the site is relatively low.

196. In addition, as noted above the onward cable connection from the Substation Zone to the Proposed Birkhill Wood National Grid Substation crosses a small area of Flood Zone 3. In this location, the crossing methods for the Ordinary Watercourses will be considered on an individual basis and agreed with the LLFA at the detailed design stage.

197. The approach to Ordinary Watercourse crossings is discussed in **Section 5.6.16** of **Volume 7, Chapter 5 Project Description (application ref: 7.5).** Furthermore, a summary of the methodology to be adopted is provided within **Volume 7, Appendix 5-2 Obstacle Crossing Register (application ref: 7.5.5.2).** In addition, a summary of the proposed watercourse crossing type is shown on **Figure 20-4-1c**.

20.4.4.3.5 Flooding from the Sea

198. The Onshore Substation Zone is situated inland and approximately 25km away from the nearest coastline. Furthermore, it is defined as being in Flood Zone 1 and therefore it can be concluded that Onshore Substation Zone, including the Onshore Convertor Stations and onward cabling to the Proposed Birkhill Wood National Grid Substation, are not at risk from tidal flooding.

20.4.4.3.6 Flooding from Surface Water

199. As noted above, the Environment Agency Surface Water Flood Map, shown on **Figure 20-4-4c**) (Environment Agency, 2024) indicates there is an Ordinary Watercourse (ditch) which runs through the centre of the Onshore Substation Zone, from west to east. There is also a ditch which runs from south to north prior to connecting into the west to east ditch.

200. There is an overland flow path running from the north-west, which flows across the field and through the centre of the Onshore Substation Zone, before joining the main Ordinary Watercourse.

201. Most of the footprint of the Onshore Converter Stations is likely to remain unaffected by surface water flooding during the 3.3% AP and 1% AP event, with the risk limited to the area immediately adjacent to the Ordinary Watercourse. However, the mapping indicates the increased surface water flow is likely to occur during the 0.1% AP surface water event.

202. Whilst the area at increased risk is relatively isolated and small in nature, it should be considered in the design of the Onshore Converter Stations.

203. Furthermore, as noted above the onward cable route to the Proposed Birkhill Wood National Grid Substation crosses a small area of Flood Zone 3, which is also shown to be at risk from surface water flooding. In this location, the crossing methods for the Ordinary Watercourses will be considered on an individual basis and agreed with the LLFA at the detailed design stage.

20.4.4.3.7 Flooding from Groundwater

204. The Onshore Development Area is underlain by a single groundwater body comprising Hull and East Riding Chalk.

205. The Onshore Substation Zone is located over superficial deposits which are Till, Devensian - Diamicton. Till, Devensian formation is classified as a Secondary (undifferentiated) superficial aquifer. Secondary undifferentiated means rock deposits with variable permeability and storage properties that are neither consistently Secondary A nor Secondary B.

206. The SFRA shows the Areas Susceptible to Groundwater Flooding (AStGWF), which is a strategic scale map showing groundwater flood areas based on a 1km square grid. The data shows the proportion of each 1km grid square where geological and hydrogeological conditions indicate groundwater might emerge.

207. The mapping demonstrates that the Onshore Substation Zone is located in an area which is not susceptible to groundwater flooding.

208. The Onshore Substation Zone could be located above a secondary A and Secondary (Undifferentiated) Aquifer. Therefore, it is important to note that perched groundwater may be present and could be encountered during the below-ground engineering works.

209. However, the potential presence of groundwater will be identified as part of the ground investigations and appropriate mitigation measures incorporated into the Projects, as required.

210. If perched groundwater were to be encountered, it would need to be mitigated by appropriate construction techniques and in accordance with an appropriate method statement. This will be secured within the **OCoCP (Volume 8, application ref: 8.9)**, produced to accompany the ES and submitted as part of the DCO application.

211. Based on the above information there is likely to be a low groundwater flood risk to the Onshore Substation Zone during construction and any risk will be mitigated, as outlined above.

20.4.4.3.8 Flooding from Sewers

212. The SFRA has been reviewed to assess the risk of sewer flooding to the Onshore Substation Zone. The SFRA has not provided any specific data to show that sewer flooding has occurred within the area proposed for the Onshore Converter Stations.

213. Furthermore, the Onshore Substation Zone is located within existing agricultural land. Therefore, it is likely that there is a limited foul sewer network within proximity of this location.

214. Therefore, the risk of flooding from sewers is considered to be low for the Onshore Substation Zone, including the Onshore Convertor Stations.

20.4.4.3.9 Flooding from Reservoirs

215. The Environment Agency Flood Risk from Reservoirs map shows that the Onshore Substation Zone is not at risk from reservoir flooding under any situation. Therefore, there is no risk of flooding from this source.

20.4.4.3.10 Flooding from Canals and other Artificial Sources

216. The Onshore Substation Zone is not located near to any canals or other artificial sources. Subsequently, there is no risk of flooding from canals or other artificial sources.

20.4.4.3.11 Summary of Flooding at the Onshore Substation Zone

217. Overall, the Onshore Substation Zone is not considered to be at risk of flooding from tidal, sewers, reservoirs, canals or other artificial sources. There is also a low risk of flooding from groundwater sources.

218. The Onshore Substation Zone is located in Flood Zone 1 and is therefore considered to be at low risk from fluvial flooding.

219. The Environment Agency Surface Water Flood Map (Environment Agency, 2024) indicates there are two Ordinary Watercourses and an overland flow path running through the centre of the proposed footprint for the Onshore Converter Stations.

220. Most of the footprint of the Onshore Converter Stations is likely to remain unaffected by surface water flooding during the 3.3% AP and 1% AP event, with the risk limited to the area immediately adjacent to the Ordinary Watercourse.

221. However, the mapping indicates an increased risk of surface water or overland flow during the 0.1% AP surface water event. Whilst the area at increased risk is relatively isolated and small in nature, it should be considered in the design of the Onshore Converter Stations.

222. The onward cable route to the Proposed Birkhill Wood National Grid Substation crosses a small area of Flood Zone 3, which is also shown to be at risk from surface water flooding. In this location, the crossing methods for the Ordinary Watercourses will be considered on an individual basis and agreed with the LLFA at the detailed design stage.

20.4.4.4 Temporary Construction Compounds

20.4.4.4.1 Overview of Proposed Activities

223. Temporary Construction Compounds are required to support the onshore cable installation. This will include several satellite compounds and two main compounds per project. In addition, the TJBs at the landfall would have their own dedicated TJB Temporary Construction Compound and each trenchless crossing would have an associated entry and exit compound on each side of the obstacle.

224. Two possible Main Construction Compounds would be required to support the cable duct installation and cable pulling works. This would be a larger site used to take deliveries of materials, store materials and host temporary site offices.

225. The construction works will also require a series of Satellite Temporary Construction Compounds that would operate as support bases for the onshore construction works as the cable work fronts pass through an area. They may house portable offices, welfare facilities, localised stores, as well as acting as staging posts for localised secure storage for equipment and component deliveries. Each of these would also have access to the highway.

226. Each Satellite Temporary Construction Compound (up to approximately 15 in total) would be approximately 75m x 75m in size with direct access into the construction easement. Each possible Main Temporary Construction Compound would be 100m x 100m.

227. In addition, there will be two Temporary Substation Construction Compounds within the Onshore Substation Zone. The Temporary Construction Compounds are shown on **Figure 20-4-1**. Three locations for the Temporary Construction Compounds within the Substation Zone are identified however only two compounds would be used for a Sequential and Concurrent Scenario and one compound for an In Isolation Scenario. The exact locations of the Temporary Construction Compounds within these zones would be confirmed during the detailed design.

228. A review of the indicative Temporary Construction Compound zones, as shown on **Figure 20-4-1**, has been undertaken as part of this FRA.

20.4.4.4.2 Review of Flood Risk from All Sources

229. The majority of the indicative Temporary Construction Compounds are located in Flood Zone 1, as shown on **Figure 20-4-3**.

230. However, there are a number of locations where the Onshore Export Cable Corridor passes through Flood Zone 2 and Flood Zone 3, where there is also a need to locate a Temporary Construction Compound.

231. A review of the Environment Agency Flood Zone mapping (Environment Agency, 2024) shows there are two Temporary Construction Compounds likely to be located in Flood Zone 3, as seen on **Figure 20-4-3c**, as follows:

- North of the A1035 and to the north of Tickton; and
- Adjacent to and on the northern side of the A1035, Hull Bridge Road.

232. In addition, there are two Temporary Construction Compounds likely to be located in Flood Zone 2, as seen on **Figure 20-4-3c**, as follows:

- West of Monk Dike and east of Routh; and
- Adjacent to Field House Farm and on the southern side of the A1035).

233. In addition, whilst many of the indicative Temporary Construction Compounds appear to be located in areas at limited risk of surface water flooding, there are small areas of surface water flooding, including areas of ponding as well as overland flow paths, as shown on **Figure 20-4-4**.

234. The Temporary Construction Compounds are located within existing agricultural land and therefore, it is likely that there is a limited foul sewer network within the proximity of their locations. The risk of flooding from sewers is therefore considered to be low for the Temporary Construction Compounds.

235. The indicative locations for the Temporary Construction Compounds are within areas that are not at risk of flooding from reservoir sources under any situation. Therefore, there is no risk of flooding from this source.

236. The Temporary Construction Compounds are not located near to any canals or other artificial sources. As such, there is no risk of flooding from canals or other artificial sources to these elements of the Projects.

237. To address the flood risk from both fluvial flooding and surface water flooding, there is a need to ensure the impact is mitigated by the use of appropriate construction techniques and in accordance with an appropriate method statement.

238. Measures to ensure that any flood risk to or from these Temporary Construction Compounds are summarised in section 20.4.7 of this FRA. Details of the construction drainage are set out within the **Outline Drainage Strategy (Volume 8, application ref: 8.12)**.

239. Furthermore, these will be secured within the Surface Water Management and Flood Risk Plan included in the **OCoCP (Volume 8, application ref: 8.9)**, which has been produced to accompany the ES and submitted as part of the DCO application.

240. Once construction is complete, all Temporary Construction Compounds and temporary access tracks will be fully reinstated and would have no operational use and therefore no further mitigation would be required.

20.4.5 Consideration of the Sequential and Exception Test

20.4.5.1 Overview of National Guidance

241. The NPPF requires the application of the Sequential Test and, where necessary, the Exception Test. Guidance on the application of the Sequential Test is provided in the Planning Practice Guidance (PPG) for Flood Risk and Coastal Change (updated on 25th August 2022), which provides criteria in relation to the appropriate allocation of development types and flood risk. As stated in Paragraph 023 of the PPG:

"*The aim of the sequential approach is to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding. Avoiding flood risk through the sequential test is the most effective way of addressing flood risk because it places the least reliance on measures like flood defences, flood warnings and property level resilience features.*

The aim of the Sequential Test is to ensure that a sequential risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites:

- *Within medium risk areas; and*
- *Then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.*"

242. As noted in Paragraph 031 of the PPG:

"*The Exception Test is not a tool to justify development in flood risk areas when the Sequential Test has already shown that there are reasonably available, lower risk sites, appropriate for the proposed development. It would only be appropriate to move onto the Exception Test in these cases where, accounting for wider sustainable development objectives, application of relevant local and national policies would provide a clear reason for refusing development in any alternative locations identified.*

The Exception Test should only be applied if the Sequential Test has shown that there are no reasonably available, lower-risk sites, suitable for the proposed development, to which the development could be steered."

243. Following the consideration of the Sequential Test, the need for the Exception Test depends on the potential vulnerability of the proposed development, based on the Flood Risk Vulnerability Classification and the Flood Zone within which it would be located, as summarised in Table 2 of the PPG which has been reproduced as **Table 20-4-2**.

244. Furthermore, Paragraph 031 of the PPG provides the following guidance on the criteria required to pass the Exception Test, whereby it should be demonstrated that:

- development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk; and
- the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

245. The NPPF clarifies that both elements of the Exception Test should be satisfied for development to be allocated or permitted in situations where suitable sites at lower risk of flooding are not available following application of the Sequential Test.

Table 20-4-2 Flood Risk Vulnerability and Flood Zone 'Incompatibility' Table 2 of the PPG

Flood Zones	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test required	✓	✓	✓
Flood Zone 3a †	Exception Test required †	**X**	Exception Test required	✓	✓
Flood Zone 3b *	Exception Test required *	**X**	**X**	**X**	✓ *

Key:
✓ Exception Test is not required
X Development should not be permitted

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* *In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:*
  - *remain operational and safe for users in times of flood;*
  - *result in no net loss of floodplain storage;*
  - *not impede water flows and not increase flood risk elsewhere.*

20.4.5.2 Project Specific Considerations

246. Based on the guidance in both the NPPF and supporting PPG, is the Projects are classed as '**Essential Infrastructure**', which is defined as:
   - Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk;
   - Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including infrastructure for electricity supply including generation, storage and distribution systems; including electricity generating power stations, grid and primary substations storage; and water treatment works that need to remain operational in times of flood;
   - Wind turbines; and
   - Solar farms.

247. Based on the guidance set out in the PPG, development classed as '*Essential Infrastructure*' is considered acceptable in Flood Zones 1 and 2, whilst development located within Flood Zone 3 is required to pass the Exception Test.

20.4.5.2.1 Application of the Sequential Test

248. With regards to applying the Sequential Test for all sources of flood risk, it is noted that, principally, the Projects are to be located in Flood Zone 1, including the majority of the Onshore Export Cable Corridor and the Onshore Substation Zone.

249. Permanent above-ground structures, comprising the Onshore Converter Stations, are to be located within Flood Zone 1. Therefore, this is in accordance with the Sequential Test guidance, in relation to placing development in the lowest flood risk areas.

250. Subterranean development is also located primarily in Flood Zone 1, with some locations in Flood Zone 2 and 3 where it is required to pass under, or in proximity to, existing watercourses.

251. Due to the large-scale nature of the works, it is acknowledged that there are locations where infrastructure associated with the Projects is required to pass through Flood Zone 3. This relates specifically to the Onshore Export Cable Corridor and areas adjacent to the Landfall Zone. It is also noted that the principal interaction with Flood Zone 3 is at key locations along the Onshore Export Cable Corridor (i.e. between Long Riston and Beverly (west of Whitecross Road (A165) to east of Driffield Road (A164)) where there is also a need to cross the existing watercourses.

252. Due to the linear nature of the Projects, it is not possible to avoid areas of Flood Zone 3 entirely. Subsequently, elements of the Projects which are located within Flood Zone 3, including parts of the Onshore Export Cable Corridor and Landfall Zone, require consideration of the Exception Test.

253. With regards to surface water flood risk, it is noted that the Landfall Zone and Onshore Substation Zone are principally at low risk of surface water flooding, although there are localised areas that are at increased risk.

254. Whilst there are areas within the footprint of the Onshore Substation Zone which are likely to be at increased surface water flood risk, this is relatively localised to the existing ditches. As such, mitigation measures have been identified within the design to ensure there is no adverse impact on flood risk as a result of the Projects. In addition, details of the operational drainage are set out within the **Outline Drainage Strategy (Volume 8, application ref: 8.12**).

255. Therefore, it is considered that flood risk concerns can be appropriately mitigated. On this basis, the Projects are considered to be in accordance with the Sequential Text, in that areas principally at low risk have been identified over those areas at increased risk.

256. With regards to other sources of flooding, it is noted that the Projects have been located such that they are at low risk of flooding from reservoirs, sewers, groundwater, canals and other artificial sources.

257. On this basis, it is concluded that the Project has been appropriately sequentially located, in accordance with the guidance set out in the PPG. In addition to this, the sequential approach has been adopted in the location of key elements of the infrastructure, wherever possible.

20.4.5.2.2 Application of the Exception Test

258. As noted in the previous section, it is not possible for a Project of this scale to wholly avoid areas at increased risk of flooding from all sources.

259. Following the guidance set out in the PPG, it is therefore necessary to consider the requirements of the Exception Test for the elements of the Projects which are located in Flood Zone 3. This is of specific relevance to the Onshore Export Cable Corridor and at the Landfall Zone.

260. It is concluded that the Projects pass the first element of the Exception Test requirements, which comprises the provision of wider sustainability benefits to the community. This is on the basis that the Projects, as Nationally Significant Infrastructure Projects (NSIP), provide energy certainty utilising a sustainable and renewable source of energy at a national scale.

261. With regard to the second part of the Exception Test, it is necessary to consider the Project in the context of its scale and that the majority of the Onshore Export Cable Corridor, as well as the Onshore Substation Zone, are not located within an area considered to be at risk of fluvial or tidal flooding.

262. Elements that are likely to pass through areas at increased risk of flooding, i.e. Flood Zone 3 or high surface water flood risk, comprise the subterranean development i.e. Onshore Export Cables.

263. For the subterranean development, it is only during the construction works that there is the potential for a temporary increase in flood risk. This will be mitigated through the use of appropriate measures, as outline in section 20.4.7 which would be secured within the **OCoCP (Volume 8, application ref: 8.9**), produced to accompany the ES and submitted as part of the DCO application.

264. As such, the subterranean development will not be vulnerable to flood risk during its operational lifetime and will not increase flood risk elsewhere.

265. Once operational, the flood risk to the Onshore Export Cable Corridor would have been removed, as the Jointing Bays and the Onshore Export Cables would be wholly located underground, with the latter sealed through a watertight manhole cover with no interaction with the above ground Flood Zones. The only visible above ground structures will be a manhole inspection cover at the surface.

266. In addition, it is proposed that at the Landfall Zone the Projects would be constructed through the use of trenchless techniques. Therefore, during construction and once operational, there would be limited interaction with the above ground Flood Zones.

267. On the basis of the above, when applying the Exception Test it has been demonstrated that the Projects would provide wider sustainability benefits to the community associated with the provision of renewable energy, and that it can be designed such that it would be safe for its lifetime without increasing flood risk elsewhere.

20.4.6 Climate Change

268. In the future, the risk of flooding from all potential sources of flood risk are likely to be amplified as a result of the predicted changes associated with climate change.

269. PPG for Flood Risk and Coastal Change (Ministry of Levelling Up, Communities and Local Government, 2022) provides guidance on development lifetime and specifically states in Paragraph 006 that:

"The lifetime of a non-residential development depends on the characteristics of that development but a period of at least 75 years is likely to form a starting point for assessment."

270. It is noted that the characteristics of this type of project differ from other non-residential development and is governed by the lifetime of key elements of the Projects.

271. In line with the information provided within **Volume 7, Chapter 5 Project Description (application ref: 7.5)** the Projects are expected to have a design life of 30 years or 32 years in a Sequential Scenario, with operation likely to commence from 2029. To ensure consistency in approach this FRA has adopted the same development lifetime in its assessment. Therefore, flood risk up to, approximately, 2061 has been taken into consideration within this FRA.

272. Furthermore, the only above ground infrastructure, during the operational phase, is the Onshore Converter Stations, which are located in Flood Zone 1 (i.e. at low risk from either coastal or fluvial flooding). Therefore, it is considered that climate change in the future is unlikely to have a significant influence on the Projects and as such this has also been taken into consideration within this FRA.

273. Given the potential sources of flooding identified in this FRA and the nature of various elements of the Projects, there are two main aspects of climate change which are likely to impact the Projects, both in terms of flood risk to infrastructure and increasing the potential off-site impacts on other receptors. These factors comprise an increase in peak river flows and an increase in the duration and intensity of rainfall events, which is likely to increase the magnitude of surface water flooding.

274. Whilst storm surges and waves are likely to be larger in the future and sea levels will be higher than in the present day, this is unlikely to affect the Project, as the elements of the infrastructure likely to be affected by this source of flooding will be located below-ground once operational.

275. Given the Projects are NSIPs then consideration has also been given to the guidance related to the credible maximum scenario. For the credible maximum scenario, the Environment Agency guidance sets out the following key criteria, which it also notes should be used as a 'sensitivity test':

- the H++ climate change allowances for sea level rise;
- the upper end allowance for peak river flow;
- the sensitivity test allowances for offshore wind speed and extreme wave height; and
- an additional 2mm for each year on top of sea level rise allowances from 2017 for storm surge.

276. As noted above, given the only above ground infrastructure, during the operational phase, is the Onshore Converter Stations, which are located in Flood Zone 1 (i.e. at low risk from either coastal or fluvial flooding) it is also not considered appropriate to assess the credible maximum scenario further.

277. On the basis that future flood risk, taking into account climate change, will only affect the Onshore Converter Stations, which are inland and not affected by coastal flooding, the only criteria above considered to be of potential relevance relates to the use of the Upper End allowance for peak river flow. This is discussed further in the following section.

20.4.6.1 Peak River Flow Allowances

278. The latest climate change guidance sets out the Environment Agency's recommended climate change allowances for development when considering flood risk and coastal change for planning purposes (Environment Agency, 2022).

279. As noted above, the Environment Agency guidance on climate change allowance related to peak river flow and fluvial flooding is only likely to be relevant to the Onshore Converter Stations, once operational, as the Onshore Export Cables will be located below ground once constructed.

280. The Projects are wholly situated in the Hull and East Riding Management Catchment Allowance. The peak river flow allowances for this Management Catchment are summarised in **Table 20-4-3** below.

Table 20-4-3 Hull and East Riding Management Catchment Peak River Flow Allowances (Environment Agency, 2022)

Epoch	Central	Higher Central	Upper End
2020s	9%	15%	33%

Epoch	Central	Higher Central	Upper End
2050s	9%	17%	37%
2080s	20%	33%	66%

281. Given that the only above ground infrastructure during the operational phase of the Projects would be the Onshore Converter Stations, located within Flood Zone 1 and approximately 265m from the nearest Flood Zone 2 and Flood Zone 3 extent to the north-east of the A1079 at a lower ground elevation, an increase in fluvial flooding relating to climate change is unlikely to affect the Onshore Converter Stations.

282. The Onshore Converter Stations are located in proximity to Ordinary Watercourses and therefore the effects of climate change may lead to an increased risk in flooding associated with these sources. However, this risk will be addressed as part of the proposed mitigation measures related to the localised drainage ditches which are included within the operational drainage design for the Onshore Converter Stations, as set out in the **Outline Drainage Strategy (Volume 8, application ref: 8.12)**.

20.4.6.2 Peak Rainfall Allowances

283. The Environment Agency guidance setting out the appropriate climate change allowances to be adopted for different development lifetimes (Environment Agency, 2022) are summarised as follows:

- Development with a lifetime beyond 2100:
  - This includes development proposed in applications or local plan allocations
  - For FRAs and SFRAs assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).
  - Design your development so that for the upper end allowance in the 1% annual exceedance probability event:
    - there is no increase in flood risk elsewhere
  - your development will be safe from water flooding.
- Development with a lifetime of 2061 and 2100:

- For development with a lifetime between 2061 and 2100 take the same approach (as for a development with a lifetime beyond 2100) but use the central allowance for the 2070s epoch (2061 to 2125).

- Development with a lifetime up to 2060:
  - For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

284. As noted above, the Projects are located in the Hull and East Riding Management Catchment. The peak rainfall allowances applicable to this Management Catchment are summarised in **Table 20-4-4,** for the 3.3% AP event and **Table 20-4-5** for the 1% AP event below.

Table 20-4-4 3.3% Annual Exceedance Rainfall Event Allowances

Parameter	Central	Upper End
2050s	20%	35%
2070s	25%	35%

Table 20-4-5 1% Annual Exceedance Rainfall Event Allowances

Parameter	Central	Upper End
2050s	20%	40%
2070s	25%	40%

285. When reviewing the guidance on credible maximum scenarios for NSIPs, it is noted that there is no specific guidance on allowances to be included in relation to peak rainfall in the future and therefore the above Environment Agency climate change guidance (Environment Agency, 2022) has been considered within this FRA as well as within the development of the operational drainage design.

286. Given the design lifetime of the Projects the Environment Agency guidance indicates that the Central allowance for the 2070s epoch 1% AP event would be applicable, requiring a 25% allowance for peak rainfall to be incorporated into the design.

287. However, the Projects have also taken into account the local guidance provided in East Riding of Yorkshire Council's Combined Planning Note and Standing Advice on Sustainable Drainage Systems (SuDS) & Surface Water Drainage Requirements for New Development (2016). As such, the Projects have adopted a conservative approach by adopting an allowance of 40% within the design of the operational surface water drainage, as set out in the **Outline Drainage Strategy (Volume 8, application ref: 8.12)**.

20.4.7 Mitigation Measures

288. Residual risk is the risk that remains after flood management or mitigation measures have been installed or included within the design. This FRA has considered the mitigation measures inherently included within the design of the Projects, the residual flood risk to and from the Projects and whether there is a need for additional mitigation measures to manage the remaining residual flood risk.

20.4.7.1 Design Mitigation

20.4.7.1.1 Onshore Development Area

289. As previously noted, the Onshore Development Area is primarily located within Flood Zone 1, i.e. outside of Flood Zones 2 and 3, in areas at low risk of flooding from fluvial or tidal sources. In addition, the Onshore Development Area is principally located in areas at low risk of surface water flooding.

290. As such, within the design of the Projects the sequential approach has been adopted in regard to the location of above-ground structures with infrastructure being located in Flood Zone 1 and at low risk of surface water flooding, where possible.

20.4.7.1.2 Landfall Zone

291. A trenchless solution (likely to be HDD) will be used to install the ducts, which will house the cables, under the beach and across to the TJB to the rear of the Landfall Zone.

292. In addition, the TJB Compound and Temporary Construction Compound would be located sufficiently inland such that it is located in Flood Zone 1 (i.e. at low risk from tidal / coastal flooding) and at low risk of surface water flooding.

293. During construction, there will be an emergency access route along the beach to the north of Skipsea; however, this will not be utilised for construction traffic, as all materials will be brought in via the sea, and its use will be limited to emergency access to the beach front for workers or if there was a drilling fluid breakout.

294. Post-construction at the landfall there will be no permanent above ground elements, except for the proposed Link Boxes which will, where possible, be located adjacent to field boundaries and primarily comprise only a manhole at the surface.

295. Additionally, it is proposed that, following construction, land drainage will be reinstated on a case by case basis to ensure there would be no impact on surface water drainage as a result of the Projects.

20.4.7.1.3 Onshore Export Cable Corridor

296. All Main Rivers will be crossed using trenchless techniques, to avoid direct interaction with these watercourses. The cable entry and exit pits will be at least 20m from any Main River, or from the nearest toe of any flood defences and would be installed at a depth to minimise potential interaction with current, or any planned, infrastructure (e.g., sheet piles), at least 2m below the channel bed, in some locations the depth may be up to 20m below the channel bed. Although ground disturbance will occur at entry and exit points, there will be no direct impact on the watercourses themselves.

297. In these locations, the use of trenchless techniques will be confirmed and agreed with the regulators to confirm there will be no impact on flood risk during the construction works.

298. The crossing methods for Ordinary Watercourses will be considered on an individual basis, following discussion with the LLFA and IDB. The proposed approach to Ordinary Watercourse Crossings is discussed in **Section 5.6.1.6** of **Volume 7, Chapter 5 Project Description (application ref: 7.5)**. Furthermore, a summary of the methodology to be adopted is provided within **Volume 7, Appendix 5-2 Obstacle Crossing Register (application ref: 7.5.5.2)**. In addition, a summary of the proposed watercourse crossing type is shown on **Figure 20-4-1** and **Figure 20-4-2**. This includes the proposed use of trenchless crossing methods for a number of key watercourses, whilst the remaining watercourses are likely to be crossed using open cut trenching techniques.

299. Open cut trenched crossings involve installing temporary dams upstream and downstream of the crossing point, which has the potential to directly alter the hydrology of the watercourses. To mitigate this the amount of time that temporary measures are in place will be restricted, wherever possible. Furthermore, the cable trench is excavated in the dry area of river bed between the two dams with the river flow maintained using a temporary pump or flume. Additionally, scour protection will be provided, as necessary, to protect the bed downstream from high energy flow.

300. There is the potential for the installation techniques to affect the bed and banks of the watercourse, which could result in an impact on flows along the watercourse and indirectly a change in flood risk, which will need to be managed during construction.

301. At all watercourse crossing locations, a site-specific investigation will be carried out at detailed design stage, to identify the local ground and groundwater conditions, enable a site-specific risk assessment to be undertaken and to understand the potential impact of any works on flows along the watercourse and flood risk in the local area.

302. During construction, the Onshore Export Cable Corridor 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. Depending upon the precise location along the Onshore Export Cable Corridor, water from the channels will be infiltrated or discharged into the drainage network.

303. Following construction of the Onshore Export Cables, there will be no permanent above ground elements, except for the proposed Link Boxes which will, where possible, be located adjacent to field boundaries and primarily comprise only a manhole at the surface.

304. Additionally, it is proposed that, following construction, land drainage will be reinstated on a case by case basis to ensure there would be no impact on surface water drainage.

305. Where Temporary Construction Compounds and the Onshore Export Cable Corridor are located in Flood Zone 2 and 3 temporary spoil storage would be located to avoid blocking or diverting surface water flow paths. Topsoil and subsoil will be stored in separate stockpiles in line with DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298, or the latest relevant available guidance.

306. Once the stockpile has been completed the area should be cordoned off with secure fencing to prevent any disturbance or contamination by other construction activities or spoil mobilisation. If the soil is to be stockpiled for more than six months, the surface of the stockpiles should be seeded with a grass / clover mix to minimise soil erosion or spoil mobilisation. In the worst case soil storage may need to be up to six years.

307. Furthermore, measures to address flood risk along the Onshore Export Cable Corridor will be secured within the **OCoCP (Volume 8, application ref: 8.9)**, produced to accompany the ES and will be submitted as part of the DCO application.

20.4.7.1.4 Onshore Substation Zone

308. The Onshore Substation Zone is not considered to be at risk of flooding from tidal, sewers, reservoirs, canals or other artificial sources. There is a low risk of flooding from groundwater sources and fluvial flooding. Some areas of the Onshore Substation Zone are shown to be at risk of flooding from surface water.

309. Most of the footprint of the Onshore Converter Stations is likely to remain unaffected by surface water flooding during the 3.3% AP and 1% AP event, with the risk limited to the area immediately adjacent to the Ordinary Watercourse. However, the mapping indicates increased surface water flow during the 0.1% AP event. This has been considered within the design of the operational drainage at the onshore converter stations, as discussed in section 20.4.7.2 of this FRA and in further detail in the **Outline Drainage Strategy (Volume 8, application ref: 8.12)**.

20.4.7.2 Surface Water Drainage

310. An **Outline Drainage Strategy (Volume 8, application ref: 8.12)** has been undertaken for the Projects to accompany the DCO application. It provides details on the outline drainage strategy for the Onshore Converter Stations as well as both pre- and post-construction land drainage. This would also be secured within the **OCoCP (Volume 8, application ref: 8.9)**, produced to accompany the ES and will be submitted as part of the DCO application.

20.4.7.2.1 Pre-Construction: Onshore Infrastructure

311. Prior to commencement of the construction works, detailed drainage surveys and ground investigations will be undertaken to support the development of the detailed drainage design for all elements of the onshore infrastructure.

312. The drainage infrastructure will be developed and agreed with the appropriate regulators, where relevant, and implemented to minimise water within the working areas, ensure ongoing drainage of surrounding land and that there is no increase in surface water flood risk.

313. This will assess the current and proposed runoff rates, volume of storage required and the proposed approach for discharge of water from the Projects.

20.4.7.2.2 Construction: Onshore Export Cable Corridor

314. The Onshore Export Cable Corridor will only be at risk of flooding during the construction phase.

315. However, during the construction phase there is a risk that drainage ditches and surface water flow routes could be adversely affected should the works not be appropriately managed or the ground reinstatement not carefully implemented.

316. Where Temporary Construction Compounds and the Onshore Export Cable Corridor are located in Flood Zone 2 and 3 temporary spoil storage would be located to avoid blocking or diverting surface water flow paths. Topsoil and subsoil will be stored in separate stockpiles in line with DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites PB13298, or the latest relevant available guidance.

317. Once the stockpile has been completed the area should be cordoned off with secure fencing to prevent any disturbance or contamination by other construction activities or spoil mobilisation. If the soil is to be stockpiled for more than six months, the surface of the stockpiles should be seeded with a grass/clover mix to minimise soil erosion or spoil mobilisation. In the worst case soil storage may need to be up to six years.

318. During construction, along the Onshore Export Cable Corridor it will be necessary to install additional field drainage parallel to the cable trenches along the Onshore Export Cable Corridor to ensure the existing drainage characteristics of the land are maintained and there is no increase in flood risk to on- and off-site receptors both during and as result of construction.

319. All temporary drainage would pass through a silt interceptor before being discharged. The requirements for temporary drainage will be defined during the detailed design of the Projects; however, the proposed approach is summarised in the **OCoCP (Volume 8, application ref: 8.9)**, including the need for the development of a Surface Water Management and Flood Risk Plan.

320. The detailed methodology to be used for any temporary construction at crossing points over existing ditches and watercourses shall be agreed with the Environment Agency, LLFA and IDB, as appropriate. To manage this ahead of the main works, the Principal Contractor will develop the construction drainage in consultation with the landowner and other statutory stakeholders.

20.4.7.2.3 Construction: Temporary Construction Compounds

321. The exact location of the Temporary Construction Compounds, within the wider Temporary Construction Compound zones, is yet to be confirmed. However, this FRA has assessed each of the areas identified for the Temporary Construction Compounds, as shown on **Figure 20-4-4**, and the potential for the implementation of Temporary Construction Compounds to result in an increase in surface water during the construction phase as the impermeable area is likely to temporarily increase.

322. This will be managed through the implementation of temporary surface water drainage which summarised in the **Outline Drainage Strategy (Volume 8, application ref: 8.12)** and the **OCoCP (Volume 8, application ref: 8.9)** and will be refined during the detailed design of the Projects.

323. The Temporary Construction Compounds will only be at risk of surface water flooding during construction as, following completion, the compounds and any associated temporary access tracks will be fully reinstated and would have no operational use.

324. The detailed methodology to be used for any Temporary Construction Compounds drainage shall be agreed with the Environment Agency, LLFA and IDB, as appropriate. To manage this ahead of the main works, the Principal Contractor will develop the construction drainage in consultation with the landowner and other statutory stakeholders.

20.4.7.2.4 Post-Construction

325. Following construction of the Landfall Zone and Onshore Export Cables there will be no permanent above ground elements. Furthermore, all Temporary Construction Compounds and temporary access tracks will be fully reinstated and would have no operational use.

326. Additionally, it is proposed that, following construction, land drainage will be reinstated on a case by case basis to ensure there would be no impact on surface water drainage.

20.4.7.2.5 Operational: Onshore Converter Stations

327. As part of this FRA the discharge of surface water from the Onshore Converter Stations have been considered within the context of the surface water flood risk and the need to ensure that any drainage solutions do not result in an increase in flood risk either to or from the Onshore Converter Stations.

328. Surface water drainage requirements will be designed to meet the requirements of the NPPF, NPS EN-1 and the CIRIA SuDS Manual C753 (CIRIA, 2015), as well as East Riding of Yorkshire Council's Combined Planning Note and Standing Advice on Sustainable Drainage Systems (SuDS) & Surface Water Drainage Requirements for New Development (2016). Runoff from the Onshore Converter Stations will be limited and discharged in accordance with best practice.

329. A summary of the SuDS hierarchy is provided as follows:

- Rainwater re-use (rainwater harvesting/greywater recycling);
- Soakaway or other infiltration system;
- Hybrid solution of infiltration and discharging to a surface water body;
- To a surface water body (e.g., an ordinary watercourse);
- To a surface water sewer, highway drain, or other drainage system; and
- To a combined sewer.

330. The **Outline Drainage Strategy (Volume 8, application ref: 8.12**) provides details of the proposed surface water drainage design, including the approach to the adoption of the Sustainable Drainage System (SuDS) Hierarchy. It provides confirmation that sufficient storage will be provided to attenuate surface water and discharge it at a controlled rate following a rainfall event, in accordance with best practice guidance and policy including that set out by the East Riding of Yorkshire Council. An indicative volume and location for the proposed attenuation features has been provided and this will be confirmed, in accordance with the above guidance, during the development of the detailed design.

331. The operational drainage at the Onshore Converter Stations will be developed in consultation with the East Riding of Yorkshire Council (as the LLFA) to ensure the runoff rates are maintained at pre-development rates. This will include confirmation of the greenfield runoff rate, proposed runoff rates, volume of storage required and the final proposed approach for discharge of water from the Onshore Converter Stations.

332. The **Outline Drainage Strategy (Volume 8, application ref: 8.12)** considers the likely maintenance requirements of the new drainage infrastructure.

333. It confirms that a management and maintenance plan for the surface water drainage infrastructure will be agreed with relevant stakeholders and that it will remain the responsibility of the asset owner or operator for the lifetime of the development.

20.4.7.3 Flood Warning and Evacuation

334. While construction work is taking place, site workers and users will be required to monitor local weather forecasts and ensure there is an evacuation route in place in the event that either fluvial or surface water flooding takes place during the construction phase of the development. This will also need to include any works being undertaken at the landfall, in the area at risk from tidal flooding.

335. Where there are Environment Agency Flood Alerts and Flood Warnings, it is recommended that site workers and users sign up to receive the relevant flood warnings and alerts.

336. Specific Flood Warning and Evacuation Plans, to be incorporated into the wider emergency response planning documents for the Projects, should be produced for the construction phase at both the landfall and along the Onshore Export Cable Corridor. This is specifically relevant to construction works at watercourse crossing locations where personnel or materials may be located in Flood Zone 2 or Flood Zone 3 and at the landfall where workers may, albeit temporarily, be located in Flood Zone 2 or Flood Zone 3.

337. All personnel should be made aware of any access routes and any flood warnings issued for those areas should result in the relevant access routes being cleared of all project personnel and, where possible, all plant and materials.

338. A site-specific Emergency Response, Evacuation and Pollution Control Plan, incorporating specific flood warning elements, will be produced by the Projects. It should include practical steps for protecting construction workers and personnel, be easy to communicate and consider delegated responsibility, or whether personnel are likely to require additional support during a flood event. This will be secured within the **OCoCP (Volume 8, application ref: 8.9)**, produced to accompany the ES and will be submitted as part of the DCO application.

339. The Emergency Response, Evacuation and Pollution Control Plan will include the following aspects;

- A list of important contacts, including Floodline, utilities companies and insurance providers;
- A description or map showing locations of service shut off points;
- Basic strategies for protecting property, machinery or materials, including moving assets to safety where possible, turning off or isolating services and moving to safety; and
- Safe access and egress routes.

340. As noted above, the Environment Agency provide a free Flood Alert ("*flooding is possible*") and Flood Warning ("*flooding is expected*") service for flooding. It is recommended that the Emergency Response, Evacuation and Pollution Control Plan considers how receipt of these flood alerts or warnings may affect the Projects.

341. It should be noted that large parts of the Onshore Export Cable Corridor are in rural undeveloped areas that may not be covered by flood warnings. Furthermore, it is important to note that Environment Agency flood alerts and warnings are not issued in response to surface water flooding.

342. As such, the Emergency Response, Evacuation and Pollution Control Plan will need to include independent checks of potential adverse weather conditions (i.e. Met office weather warnings) alongside any alerts or warnings issued by the Environment Agency. These checks will also account for risks outside flood alerts or flood warnings and will enable contractors and site managers to consider how this information will affect planned works, especially areas in proximity to key watercourses.

343. During construction, contractors and management should liaise with the relevant risk management authorities and emergency planning officers so they are aware of any forecast related to heavy rainfall events. The potential for flooding can then be assessed to enable work to stop, especially in areas in close proximity to key watercourses, and the site cleared of all personnel, as required.

344. The Onshore Substation Zone is located within Flood Zone 1 and, as such, any personnel within this area would be at low risk of flooding from fluvial sources. However, there is a potential risk of surface water flooding to the Onshore Converter Stations.

345. Once operational, requirements for personnel to access the Onshore Substation Zone will be limited and transient in nature i.e. there will be no requirements to remain on site overnight.

346. As such, the Onshore Converter Stations could be evacuated, upon receipt of a heavy rainfall warning, prior to an event. This ensures site users and operators of the Onshore Converter Stations would not be placed at risk during such an event.

347. In addition, the risk of surface water flooding is relatively localised in nature and egress routes from the Onshore Converter Stations would be readily available to areas that are not identified as being at risk.

20.4.8 Conclusions

348. The Projects have been considered within the context of the guidance set out in the NPPF and the supporting PPG. On this basis, all potential sources of flood risk to the onshore infrastructure within the Onshore Development Area have been considered.

20.4.8.1 Landfall Zone

349. The Landfall Zone is not at risk of flooding from sewers, canals or other artificial sources or reservoirs. In addition, there is a low risk of flooding associated with groundwater sources.

350. In terms of tidal flood risk to the Landfall Zone, when the Onshore Export Cables make landfall, it is likely that they will be required to pass under areas shown as being in Flood Zone 2 and Flood Zone 3.

351. However, as the Onshore Export Cables at landfall will be installed using trenchless techniques and will comprise below ground infrastructure they will not be at risk from flooding once operational.

20.4.8.2 Onshore Export Cable Corridor

352. A review of the flood risk along the Onshore Export Cable Corridor has been undertaken and it has been noted that it will primarily be located in Flood Zone 1. However, there are some sections of the Onshore Export Cable Corridor which are located within Flood Zone 2 and Flood Zone 3, associated with a number of Main Rivers as well as Ordinary Watercourses.

353. In addition, the locations where the Onshore Export Cable Corridor crosses the Ordinary Watercourses there are areas at increased risk of surface water flooding. However, this is primarily limited to the width of the watercourse channel and relates to the lower lying area comprising the channel itself and the land draining into it.

354. The use of trenchless techniques has been embedded in the scheme design for the crossing of Main Rivers and as such the impact of flood risk in these locations would be low.

355. Trenched and trenchless crossings will be carried out on Ordinary Watercourses crossed by the Onshore Export Cable Corridor. For the trenched crossings, any temporary damming of watercourses along the Onshore Export Cable Corridor will be designed such that the original flow volumes and rates are maintained to ensure the flood risk is not increased.

356. Furthermore, these would be temporary impacts, as the bed and banks are to be reinstated to their original level, position and profile. At these locations, a site-specific investigation would be carried out at detailed design stage, to identify the local ground and groundwater conditions, A site specific risk assessment would be undertaken to understand the potential impact of any works on flows along the watercourse and flood risk in the local area.

357. Once operational, there will be no flood risk to or from the Onshore Export Cables linked to fluvial, tidal, surface or sewer flooding as they will be located wholly below ground.

358. In addition, any residual risk of flooding from groundwater shall be mitigated using suitable waterproofing of the cables, links and boxes and Jointing Bays.

20.4.8.3 Onshore Substation Zone and Onshore Cable Route to the Proposed Birkhill Wood National Grid Substation

359. The Onshore Substation Zone is not considered to be at risk of flooding from tidal, sewers, reservoirs, canals or other artificial sources. There is also a low risk of flooding from groundwater sources.

360. In addition, the Onshore Substation Zone is located in Flood Zone 1, which represents a low risk of flooding from fluvial sources.

361. With regards to the surface water flood risk, the Environment Agency Surface Water Flood Map, shown on **Figure 20-4-4**, ((Environment Agency, 2024) indicates that the Onshore Substation Zone has areas of surface water flood risk located within the proposed footprint of the Onshore Converter Stations.

362. The Environment Agency Surface Water Flood Map, shown on **Figure 20-4-4,** (Environment Agency, 2024) indicates the presence of an Ordinary Watercourse and overland flow path passing runs through the centre of the Onshore Converter Stations.

363. Whilst the area at increased risk is relatively small in comparison with the wider Onshore Substation Zone, the indictive drainage design includes measures to mitigate this risk.

364. On this basis, whilst overall the risk of flooding from surface water is considered to be low for the Onshore Converter Stations, there is a need to consider this in greater detail as part of the final design of the surface water drainage.

365. Furthermore, surface water drainage requirements for the Onshore Converter Stations have taken into account the SuDS Hierarchy to meet the requirements of the relevant policy and guidance.

366. The operational drainage at the Onshore Converter Stations will be designed taking into account of the greenfield runoff rate, proposed runoff rates, volume of storage required and the proposed approach for discharge of water from the Onshore Converter Stations.

367. Once operational, access to the Onshore Converter Stations will be limited and transient in nature i.e. there will be no requirement to remain on site overnight and the site can be evacuated, upon receipt of a heavy rainfall warning. This ensures operators of the site would not be placed at risk during such an event.

368. Furthermore, the onshore cable route to the Proposed Birkhill Wood National Grid Substation crosses a small area of Flood Zone 3, which is also shown to be at risk from surface water flooding. In this location, the crossing methods for the Ordinary Watercourses will be considered on an individual basis and agreed with the LLFA at the detailed design stage.

20.4.8.4 Summary of Flood Risk

369. In summary, this FRA has been undertaken in accordance with NPPF and the methodology and criteria provided for the application of the Sequential Test and Exception Test within the PPG.

370. As noted previously, the Projects are to be located principally in Flood Zone 1 and at low risk from surface water flooding, including the majority of the Onshore Export Cable Corridor and the Onshore Substation Zone. Furthermore, there is a low risk of flooding from all other sources of flood risk.

371. Permanent above-ground structures, comprising the Onshore Converter Stations, are to be located within Flood Zone 1 and are therefore in accordance with the Sequential Test guidance related to placing development in the lowest flood risk areas.

372. Subterranean development is also located primarily in Flood Zone 1, with some locations in Flood Zone 2 and 3 where it is required to pass under, or in proximity to, existing watercourses.

373. With regards to surface water flood risk, it is noted that the Landfall Zone and Onshore Converter Stations are principally at low risk of surface water flooding.

374. Therefore, it is considered that flood risk concerns can be appropriately mitigated within the detailed design. On this basis, the Projects are in accordance with the Sequential Test in that areas principally at low risk have been identified over those areas at increased risk.

375. Due to the large-scale nature of the works, it is acknowledged that there are locations where infrastructure is required to pass through or to be located in Flood Zone 3 or at increased risk of surface water flooding. This relates to the Onshore Export Cable Corridor and areas adjacent to the Landfall Zone. It is also noted that the principal interaction with Flood Zone 3 is at key locations along the Onshore Export Cable Corridor (associated with the need to cross existing watercourses).

376. Due to the linear nature of the Projects, it is not possible to avoid these areas entirely, and whilst they have been avoided, where possible, this is not entirely possible. As such, it is noted that elements of the Projects located within Flood Zone 3, comprising the Onshore Export Cable Corridor and Landfall Zone require consideration of the Exception Test.

377. Taking into account the two parts of the Exception Test, it is concluded that the first part comprising the provision of wider sustainability benefits to the community has been passed on the basis that the Projects, as NSIPs provide energy certainty utilising a sustainable and renewable source of energy at a national scale.

378. With regard to the second part of the Exception Test, it is necessary to consider the Project in the context of its scale and that the majority of the Onshore Export Cable Corridor, as well as the Onshore Converter Stations, are not located within an area considered to be at risk of fluvial or tidal flooding.

379. Elements that are likely to pass through areas at increased risk of flooding, i.e., Flood Zone 3 or high surface water flood risk, comprise the subterranean development which, following construction, will not be vulnerable to flood risk during its operational lifetime and will not increase flood risk elsewhere.

380. For the subterranean development, it is only during the construction works that there is the potential for a temporary increase in flood risk and this will be mitigated through the use of appropriate management measures.

381. Therefore, it is considered that the second part of the Exception Test has been passed, as it has been demonstrated that the infrastructure can be designed such that it would be safe for its lifetime, without increasing flood risk elsewhere.

382. On the basis of the flood risk identified both to and from the Project, and consideration of both the Sequential Test and Exception Test, it is therefore concluded that the Projects are appropriate in terms of flood risk and is in accordance with the NPPF.

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Figure 20-4-1 to 20-4-4

RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Windmill Hill Business Park

Whitehill Way

Swindon

Wiltshire, SN5 6PB