# Erebus Floating Wind

## Technical Appendix 19.3 Flood Consequence Assessment

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| Client: | Offshore Wind Consultants Limited |
| Project/Proposal No: | 2923 |
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# Document Information

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# 1. Introduction

## 1.1 Context

ITPEnergised (ITPE) has been appointed by Offshore Wind Consultants Limited to carry out a Flood Consequence Assessment (FCA) for the onshore component of the Erebus Floating Windfarm (Proposed Development). This assessment will highlight any flood risks that may arise from the Proposed Development and recommended mitigation measures to reduce any potential flood impact. Project Erebus (hereinafter referred to as 'the Project') comprises construction, operation and decommissioning of a Floating Offshore Wind (FLOW) development in the Celtic Sea and the associated onshore infrastructure for grid connection at Pembroke Power Station.

The purpose of this report is to outline any potential flood risks to the Proposed Development, the impact of the Proposed Development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate any identified flood risk. The focus of the assessment is solely the onshore elements of the Proposed Development, therefore the landfall site, cables route, substation, and grid location.

## 1.2 Policy and Guidance

This report has been prepared in accordance with the advice and requirements prescribed in current best practice documents relating to management of flood risk in development published by the Construction Industry Research and Information Association (CIRIA)[1], Planning Policy Wales (PPW) and Technical Advice Note 15 (TAN15): Development, flooding and coastal erosion[2]..

The assessment also references and takes due consideration (where appropriate) of the following principal guidance and policy documents:

- Flood and Water Management Act, 2010
- Water Resources Act, 1991
- Pembrokeshire County Council Local Flood Risk Management Strategy (2015)
- The Carmarthenshire & Pembrokeshire Stage 1 Strategic Flood Consequence Assessment (2019)
- Pembrokeshire County Council Local Development Plan (2013) and Local Development Plan Review (2017)
- Pembrokeshire Coast National Park Local Development Plan
- Lavernock Point to St Ann's Head Shoreline Management Plan 2, Halcrow (2012)

## 1.3 Site Location and Context

The Proposed Development is located at land between West Angle Bay and Pembroke River, near Rhoscrowther, Wales. The proposed cable route makes landfall to the west at the West Angle Bay area at NGR: SM 85262 03264. The route from landfall to the substation is approximately 24km long, traveling mainly through agricultural land in the Angle Peninsula Coast. The cable route connects to a substation located at NGR: SM 93487 01406. Angle is part of the Pembrokeshire Country Council District and all relevant guidance has been considered.

[1] CIRIA Report C624, Development and Flood risk: guidance for the construction industry (October 2004)
[2] Welsh Government, Technical Advice Note 15 (December 2021) available online https://gov.wales/sites/default/files/publications/2021-09/technical-advice-note-15.pdf

## 1.4 Proposed Development

Once complete, Erebus will have between 6 and 10 floating wind turbine generators of a total capacity up to 100 MW supported by semi-submersive platforms and infrastructure. The turbines will be located approximately 35km southwest of Pembrokeshire coastline, in an outline area of 43.5km$^2$. Turbines will have interconnective cables and a single offshore export cable to land. Onshore cable routing will connect the landfall location to the substation and grid connection point.

The proposed cable route makes landfall to the west at the West Angle Bay area. The route from landfall to the substation is approximately 14km long, with proposed temporary construction compounds along route. This substation is under 2km south of Pembroke Power Station, which connects the Project to the national grid.

The onshore infrastructure which will be the focus of this assessment is to include the export cable, onshore substation, cable corridor, underground cables, transition bay, joint bays/inspection chambers, access points and other associated infrastructure.

## 1.5 Topography

Topography across the site is illustrated in Figure 19.3.1. The cable route landfall location is at an elevation of 6mAOD. The route travels 580m east reaching heights of 14m AOD before turning south, steeply increasing to a height of 52m AOD over a distance of 890m. For the next 3.67km the route travels east, staying within a range of 52m-63m AOD, running roughly parallel to Angle Road along the height of the Angle Peninsula Coast.

The route slopes north, traveling east between an altitude of 30m-45m AOD, parallel to the Angle Bay disused Oil Terminal before sloping up again, towards Angle Road at an altitude of 62mAOD. The final 2.43km of the cable route descends in a north-eastern direction towards the substation, located at an altitude of 47m AOD.

The majority of the cable route travels along high ground within the Angle Peninsula, in close proximity to Angle Road. The beginning and end of the route represent the greatest change in gradient.

## 1.6 Geology and Hydrogeology

### 1.6.1 Geology

#### 1.6.1.1 Superficial

Review of the British Geological Survey (BGS) online geology maps indicate that the majority of the cable route is not situated along any underlying superficial deposits. There is an extent of Blown Sand, which intercepts the middle section of the route for a 2.22km extents. A more discrete section is underlain by Tidal Flat Deposits, consisting of sand silt and clay is confined to a small area to the immediate east of the Blow Sand deposits.

#### 1.6.1.2 Bedrock

Reference to the BGS online geology maps indicates that the bedrock geology underlying the site is almost exclusively part of the Milford Haven Group, consisting of Argillaceous rocks and sandstone.

At landfall, the underlying bedrock is Black Rock Subgroup and Gully Oolite Formation consisting of limestone. This changes when the route turns south towards Angle Road, the route crosses a multitude of bedrock classifications along its initial 1km rise, including, the Avon Group, consisting of limestone and mudstone, the Skrinkle Sandstone Formation, the Ridgeway Conglomerate Formation and the Milford Haven Group. The cable remains underlain by the final profile from Hubberton to the substation, briefly cutting though Cosheston Group by Hoplass Solar farm.

### 1.6.2 Hydrogeology

The majority of the Proposed Development is underlain by low productivity bedrock aquifers, with the exception of the northern landfall location and the grid connection area which are partially underlain by a moderately productive aquifer described as a massive karstic limestone aquifer with rapid response to rainfall. Yields highly variable from dry to 40 L/s.

Review of BGS Geoindex Onshore interactive mapping indicates areas of this moderately productive aquifer is designated as a Principal bedrock aquifer. The majority of the site however is underlain by designated as a Secondary A bedrock aquifer. The mapped superficial deposits are classed as a Secondary A superficial aquifer.

The WFD groundwater body in the area is the Pembrokeshire Carboniferous Limestone. This groundwater body currently has good status for qualitative, chemical and overall status.

Review of site-specific ground investigations along the onshore cable route has been undertaken within the context of groundwater. Trial pits and borehole logs encountered groundwater at 14 of the 58 exploratory locations at depths between 0.55m below ground level (bgl) to 5.3m bgl.

### 1.6.3 Local Hydrology

The area is coastal and watercourses within the vicinity of the proposed cable route are generally fed by springs. The area is subdivided into numerous small catchments which discharge directly to tidal headwaters.

No WFD surface water bodies have been identified within the zone of effect for the onshore cabling activities. The closest WFD surface water body to the proposed route is the Castlemartin Corse - headwaters to tidal limit which is not located within the site of the proposed onshore development. Castlemartin Corse waterbody has an overall classification of Moderate.

A hydrological summary and catchment characteristics of a number of the surface water catchments local to the development have been reviewed using the FEH webservice and are shown in Table 1 below.

*Table 1 Hydrological characteristics of local catchments*

| Waterbody Catchment | Area ($km^2$) | SAAR[1] (mm) | URBEXT[2] (%) | SPRHOST[3] (%) | PROPWET[4] |
|---|---|---|---|---|---|
| South Studdock | 0.62 | 923 | 0.000 | 30.8 | 0.44 |
| Goldbourgh East | 2.01 | 1055 | 0.000 | 31.3 | 0.44 |
| Boldbourgh West | 1.94 | 1061 | 0.000 | 31.8 | 0.44 |
| Castlemartin Course | 17.77 | 1043 | 0.001 | 31.5 | 0.44 |

*[1]SAAR = Standard Annual Average Rainfall*
*[2]URBEXT = Extent of Urban and Suburban Land Cover*
*[3]SPRHOST = Standard Percentage Runoff using UK Hydrology of Soil Types (HOST) Classification*
*[4]PROPWET = Proportion of Time the Soil Moisture Deficit (SMD) was equal to, or below, 6mm during 1961-1990*

# 2. Planning and Guidance Context

## 2.1 National Planning Policy

### 2.1.1 TAN 15

TAN15 provides technical guidance on flood risk and development which is supplementary to Planning Policy Wales. It is a framework for assessing flood risks that defines Flood Zones and vulnerability classes aiming to direct development away from areas of flood risk where possible.

In accordance with TAN15, a FCA must consider

- The consequences of flooding on a development
- The consequences (i.e., overall impacts) of the development flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that flood having a probability of 0.1%.
- Whether appropriate mitigation measures can be incorporated within the design of the development to ensure that development minimises risk to life, damage to property and disruption to people living and working on the site or elsewhere on the floodplain.

#### 2.1.1.1 Flood Zone Category

In 2021 Natural Resources Wales (NRW) published the Flood Map for Planning which displays flood risk zones with climate change accounting. This will support the revised TAN15 which is due to be implemented June 2023. While this map does not yet have official status in planning, it is recognised by NRW as the "best available information" on and has therefore been used to inform this assessment.

Review of the Flood Zone data sets confirms that the onshore Proposed Development is almost exclusively in Flood Zone 1, considered to be little or no risk of flooding, with a less than 0.1% (1 in 1000) annual probability of flooding, as set out in Figure 1 on the TAN15 guidance. This indicates that a justification test is not required.

Despite this, further consideration of flood risk from minor tributaries that may not be fully represented within the national scale flood risk mapping will be considered.

Due to the offshore nature of the project, a transitional segment of the route at the landfall site requires a section of development to exist on the coast, and in Flood Zone 3 for coastal flood risk. A short section of cable route at the grid connection location will also need to consider coastal flood risk as Pembroke Power Station is located within Flood Zone 3.

#### 2.1.1.2 Development Vulnerability Classification

The definition of development vulnerability classification is provided in TAN 15 and reproduced in Table 2 below.

*Table 2 Development categories from TAN15*

| Development category | Types |
|---|---|
| Emergency services | Hospitals, ambulance stations, fire stations, police stations, Coast Guard stations, command centres, emergency depots and buildings used to provide emergency shelter in times of flood |
| Highly vulnerable development | All residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites |
| Less vulnerable developments | General industry, employment commercial and retail developments, transport on utilities infrastructure, car parks, |

| | |
|---|---|
| | mineral extraction sites and associated processing facilities, excluding waste disposal sites |

The nature of the onshore Proposed Development can be considered in two parts, the cable route itself, and the substation. The substation is clearly defined as a 'highly vulnerable development', being classed as a power station. The section of the cable route is defined as utilities infrastructure and therefore as 'less vulnerable'.

### 2.1.2 NRW – Flood Risk Activity Permit

A main river is legally defined as a watercourse that is shown on a main river map. If the location of a proposed activity is on a main river, the works will require application for a flood risk activity permit.

Review of the "Main Rivers Map" confirms there are no main rivers located within the proximity of the onshore cable route.

## 2.2 Local Planning Policy

### 2.2.1 Pembrokeshire County Council Local Flood Risk Management Strategy

Under the Flood and Water Management Act 2010, Pembrokeshire County Council (PCC) became the Lead Local Flood Authority, with the role of overseeing the management of flood risk from local sources in Pembrokeshire.

The Local Flood Risk Management Strategy outlines their responsibilities and permissive powers with respect to flood risk and coastal erosions. In respect to Proposed Development the plan outlines PCC's position on consenting in respect to ordinary watercourses.

An ordinary watercourse includes all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers and passages, through which water flows (other than public sewers and watercourses defined as Main Rivers under the Water Resources Act, 1991).

Under the act, anyone wishing to culvert or insert any obstruction in an ordinary watercourse needs permission to do so. Consent under the above legislation is required for both permanent and temporary works.

As Lead Local Flood Authority for the area, PCC is responsible for issuing of permits. The clear guiding principles are to ensure that obstructions in watercourses are kept to a minimum and must not increase the risk of flooding.

### 2.2.2 Pembrokeshire County Council Local Development Plan

PCC Local Development Plan (LDP) was adopted in 2013 and provides a policy framework for development in Pembrokeshire (excluding the areas of Pembrokeshire Coast National Park). Policies set out within the LDP guide decisions for onshore development within PCC jurisdiction and will be viewed as material considerations in the determination of planning applications.

In 2017 a review of the LDP commenced and is expected to be adopted in 2021.Until that time, the current LDP provides a policy mission for pre application discussions on development considerations. Relevant policies include are stated below.

GN.1 General Development Policy states the following in relation to flooding:

*Where there are concerns that a proposal would cause harm to health and safety through contamination, adverse impact on air quality, land instability, flooding or erosion, professional advice will be sought from the relevant authority. Where such concerns relate to fluvial or coastal flooding and / or erosion, the provisions of the relevant Shoreline Management Plan and / or Catchment Flood Management Plan will inform consideration of the health and safety issues.*

GN.2 Sustainable Design states the following in relation to flooding:

*"Designs will need to incorporate responses to the likely impact of climate change in relation to increased temperatures via natural shading, cooling and ventilation and the implications of storms and flooding."*

GN.4 Resource Efficiency and Renewable and Low-carbon Energy Proposals states the following in regard to renewable energy development:

*"Developments which enable the supply of renewable energy through environmentally acceptable solutions will be supported."*

### 2.2.3 Pembrokeshire Coast National Park Local Development Plan

Pembrokeshire Coast National Park (PCNP) LDP was adopted in 2010 and provides policies to guide decisions on development within the jurisdiction of the National Park. LDP review has progressed and it is expected that LDP 2 will be adopted shortly at which point it will form the basis of consideration of the development within the National Park.

The following extracts of the Local Development Plan set out policies relevant to flood prevention and the proposed development.

*Policy 29 Sustainable Design:*

All proposals for development will be expected to demonstrate an integrated approach to design and construction, and will be required to be well designed in terms of:

a) Water and drainage

b) Resilience to climate change

*Policy 34 Flooding and Coastal Inundation:*

In planning for the future development of the National Park:

a) Development will be directed away from those areas which are at risk from flooding now, or as predicted for the future by Natural Resources Wales Development Advice Maps or Shoreline Management Plan 2 unless there are sound social or economic justifications in accordance with the advice set out in Technical Advice Note 15.

b) Sustainable defence of the coast will be permitted to protect existing communities or assets where practicable and where they do not jeopardise the longer term and natural evolution of the coast.

### 2.2.4 Lavernock Point to St Ann's Head Shoreline Management Plan 2

Lavernock Point to St Ann's Head Shoreline Management Plan (SMP) provides a large-scale assessment of the risks associated with coastal erosion and flooding at the coast. It also presents policies to help manage these risks to people and to the developed, historic and natural environment in a sustainable manner.

The following extract from Policy Scenario Area 18 sets out policies relevant to flood prevention at the proposed landfall location:

*"West Angle Bay is the only defended frontage, with a short length of seawall reducing the risk of coastal erosion and flooding to a small number of assets including a car park and a café…*

*…The recommended policy along much of this frontage is no active intervention to allow the coastline to evolve naturally and preserve the environmental interest…*

*…It is considered unlikely that public funding will be made available to maintain existing defences at West Angle Bay due to the limited socio-economic value of assets at risk, and therefore a policy of*

*no active intervention is recommended which will allow existing defences to fail. Existing defences could be maintained/ improved subject to the availability of private/ other funding and obtaining necessary consents, licences and approvals."*

# 3. Flood Consequence Assessment

## 3.1 Sources of Information

### 3.1.1 Desktop Study

The desktop study has included a data review of the project file and an internet search of historical flood incidents and online mapping. Recent site investigation data has also been reviewed to inform this assessment.

### 3.1.2 Welsh Government Mapping

Strategic information regarding the current flood risk at the site from various sources has been obtained from the Natural Resources Wales website[3].

Flood mapping indicates areas at flood risk from rivers, the sea, surface water and reservoirs.

### 3.1.3 Strategic Flood Risk Assessment

The Carmarthenshire & Pembrokeshire Stage 1 Strategic Flood Consequence Assessment (SFCA)[4] has been reviewed to inform potential flood risk at the site location from all potential sources.

This document does not identify any fluvial food risk from the main watercourses in Pembrokeshire, however, the coastal location of the Proposed Development is highlighted as being susceptible to tidal flooding. Title surge events caused by low pressure systems threaten low lying developments around the coast. A mean rise in sea level due to climate change will increase this risk with time. Pembrokeshire's coastline extends 299 kilometres from Amroth to St Dogmaels. The SFCA indicates larger urban areas in Carmarthenshire and Pembrokeshire are more Vulnerable to surface water flooding.

The above have been considered in the context of the Project.

## 3.2 Climate Change Considerations

### 3.2.1 Context

The most recent advice on climate change is available online from the Welsh Government website within *"Flood Consequence Assessments: Climate change allowances"*[5].

The publication confirms that peak sea level and peak river flow are all expected to increase in the future. The guidance recommends that as outlined in TAN15, considerations for future climate change are included in FCAs for proposed developments.

[3] National Resources Wales Flood Risk Map for Planning(2021) Online Interactive Maps, available at: https://flood-map-for-planning.naturalresources.wales/ (accessed on 3rd December 2021)
[4] The Carmarthenshire & Pembrokeshire Stage 1 Strategic Flood Consequence Assessment (SFCA) (2019) available at https://www.carmarthenshire.gov.wales/media/1221476/strategic-assessment.pdf
[5] Welsh Government (2021) Flood Consequence Assessments: Climate change allowances available online at:https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf (accessed 3rd December 2021)

### 3.2.2 Peak River flow

It is conceivable that climate change uplifts on peak river flow could, over the lifetime of the proposed development (taken as 25 years) increase the potential fluvial flood risk to the substation location from the surrounding tidal tributaries.

The aforementioned climate change guidance[5] details uplifts to peak flow to be applied within each River Basin District in Wales. Table 3 below replicates the EA's guidance for the "Western Wales" basin which the Proposed Development is located in.

*Table 3 TAN 15 Potential Climate Change Induced River Flow Increases*

| Allowance category for West Wales basin | Total potential change anticipated for the '2020s' | Total potential change anticipated for the '2050s' | Total potential change anticipated for the '2080s' |
|---|---|---|---|
| Upper end estimate | 25% | 40% | 75% |
| Change factor/ central estimate | 15% | 25% | 30% |
| Lower end estimate | 5% | 10% | 15% |

It is recommended that the central estimate, or change factor, for the 2050s for the relevant river basin district should be used to assess the potential impact of climate change as part of a flood consequence assessment, based on a project lifespan of 25 years from commencement of operation in 2026.

### 3.2.3 Sea Level Rise

The aforementioned climate change guidance [5] details projections of relative mean sea level rise for each local authority area.

The guidance has been updated to reflect greater confidence in the revised projections of global mean sea level presented by UKCP18. Guidance now specifies a higher central allowance (70$^{th}$ percentile) and upper end allowance (95th percentile). The uplifts for Pembrokeshire Local Authority area are presented in Table 4 below.

*Table 4 TAN 15 Potential Climate Change Induced Sea Level Rise*

| Allowance (percentile) | Pembrokeshire mean sea level rise (metres) by 2100 | Pembrokeshire mean sea level rise (metres) by 2120 |
|---|---|---|
| 70$^{th}$ | 0.83 | 0.99 |
| 95$^{th}$ | 1.10 | 1.31 |
| **Location** | **0.5% AEP CFB Extreme Sea Level (mAOD)[6]** | **0.5% AEP Extreme Sea Level + Climate Change (mAOD)** |
| Angle Bay | 4.76 | 5.86 |
| Milford Haven | 4.81 | 5.91 |

[6] Coastal Design Sea Levels - Coastal Flood Boundary Extreme Sea Levels (2018) Environment Agency

## 3.3 Flood Risk During Operation

### 3.3.1 Overview

This section will consider only those flood risks posed once the project is fully complete and operational. As noted in Section 2.1.1.2, under TAN 15 the onshore Proposed Development can be considered within two vulnerability classifications: The onshore substations classed as highly vulnerable infrastructure, and the export cable, classed as less vulnerable infrastructure.

### 3.3.2 Screening Assessment

A 'Screening Assessment' is used to identify if any sources of flood risk are required to be investigated in more detail i.e., consideration / specification of bespoke flood mitigation measures for the site development.

There are a number of potential sources of flooding which should be evaluated in in the context of operation:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal / coastal flooding;
- Flooding from land or pluvial flooding;
- Flooding from groundwater;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.

The flood risk from each of these potential sources was evaluated using all information available from the desk study, including review of the NRW Flood Map for Planning, and is summarised in Table 5 and Table 6 below.

#### 3.3.2.1 Substation Operational Flood Risk Screening

*Table 5 Substation - Flood Risk Screening Assessment for Operation Phase*

| Potential Flood Source | Screening Assessment of Flood Risk at Site[1] | Justification | Requiring Further Consideration i.e. Technical Assessment? |
|---|---|---|---|
| Fluvial flooding | Low | The western watercourse of the Goldborough Pill runs 70m to the south of the proposed substation. The site location was visited by an ITPEnergised hydrologist who observed the substation to be located on high ground on the eastern bank of the river. The riverbanks slope steeply away from the site, dropping several metres before the watercourse is reached. This is confirmed through review of OS Terrain 5 data that suggests a 24.5m elevation increase from the watercourse to the substation location.<br><br>Taking into account the predicted impacts of climate change on river flows as outlined in Section 3.2, any future flood risk to the site within the lifespan of the project from fluvial sources remains highly unlikely.<br><br>This is confirmed by review of the NRW Flood Map for Planning for river flood risk which shows the substation is exclusively within Flood Zone 1. Therefore, flood risk from fluvial sources during the operation of the substation is considered low. | No |
| Tidal flooding | None | The substation is located approximately 400m from the tidal headwaters of the Milford haven. The NRW Flood Map for Planning has been reviewed and shows no coastal flood risk at the location of the proposed substation area. This has been further confirmed by reviewing the Coastal Flood Boundary Data set published by the Environment Agency in partnership with NRW which indicates the 1000-year peak coastal flood level would be 5.07mAOD. The substation will be located at above 40mAOD.<br>Therefore, there is considered to be no flood risk from tidal sources during the operation of the substation. | No |
| Flooding from land | Low | Review of the NRW Flood Map for Planning highlights no areas of surface water flood risk within the proposed substation location. | No |

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| | | As part of the development, runoff from developed surfaces will be collected and formally drained via appropriate drainage measures designed to industry standards, ensuring no increase in flood risk downstream. Any potential upgradient overland flow catchments will be managed accordingly to ensure the substation remains free of surface water during operation. Details of the proposed drainage design are present in Technical Appendix 19.4. Flood risk from surface water during the operation of the substation is considered low. | |
| Groundwater flooding | Low | Reviewing the site-specific Ground Investigation Factual Report shows both boreholes and 3 out of 10 trial pits encountered groundwater in the location of the proposed substation. Groundwater was encountered at depths between 2 and 2.4m.<br>The formation for the proposed substation level 46.85mAOD and finished flood level for the substation is assumed at a minimum of 300m above formation level. There are no basement levels or flood sensitive equipment proposed below ground level therefore flood risk from groundwater during the operation of the substation is considered low. | No |
| Flooding from sewers / artificial drains | Negligible | The land of the proposed substation development and the surrounding area is rural and in agricultural use.<br><br>The bounding road to the north of the development site was surveyed by an ITPEnergised hydrologist confirming the presence of open trackside drainage ditches on the opposite side of the road to the proposed substation. Were these to surcharge, runoff would follow the natural gradient west to east away from proposed infrastructure. There are no other sewers nearby.<br><br>Risk from surface water sewer surcharge is considered negligible. | No |
| Flooding due to infrastructure failure / blockage | None | Review of the SFCA indicates that the site is not located in or near to any canals or reservoirs and that there are no records of breaching or overtopping in the area.<br><br>There is no other significant infrastructure i.e. culverts, pumping stations, aqueducts etc located upstream or in hydraulic continuity / proximity to the site which may pose a flood risk during a failure scenario. Therefore, there is considered to be no flood risk from infrastructure failure during the operation of the substation. | No |

### 3.3.2.2 Cable Route Operational Flood Risk Screening

*Table 6 Cable Route - Flood Risk Screening Assessment for Operation Phase*

| Potential Flood Source | Screening Assessment of Flood Risk at Site[1] | Justification | Requiring Further Consideration i.e. Mitigation? |
|---|---|---|---|
| Fluvial flooding | None | The proposed cable route is exclusively within Flood Zone 1 of the NRW Flood Map for Planning for river flood risk.<br><br>The finished cable route will be installed with a minimum cover of 1.1m from the top of the cables to finished ground level. The cable and cable ducting will be designed to prevent water ingress. At watercourse crossing locations, installation will ensure a minimum cover level of 2m below watercourse beds to account for erosion. Therefore, the proposed cable will not be sensitive to flood risk from fluvial sources. | No |
| Tidal flooding | Low | The proposed cable route is almost exclusively within Flood Zone 1 of the NRW Flood Map for Planning for coastal flood risk.<br><br>Two short sections of cable are located within Flood Zone 3, at the landfall location and at the grid connection location. These will be considered further within the context of TAN15 requirements. | Yes |
| Flooding from land | Low | The proposed cable route is almost exclusively within Flood Zone 1 of the NRW Flood Map for Planning for flood risk from surface water and small watercourses. There are small areas of surface water risk located along the cable route which are illustrated in Figures 19.3.2 – 19.3.5.<br><br>The finished cable route will be installed with a minimum cover of 1.1m from the top of the cables to finished ground level. The cable and cable ducting will be designed to prevent water ingress. Where possible detailed design will ensure that joint bays, the transition joint bay and link boxes will be sited away from areas of surface water risk. If it is necessary to locate infrastructure such as joint bays within areas of surface water flood risk these will be designed to prevent water ingress. Therefore, the proposed cable will not be sensitive to flood risk from surface water. | No |

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| Groundwater flooding | Low | Reviewing the site-specific Ground Investigation Factual Report shows that of the 45 ground investigation locations along the cable route (boreholes and trial pits), groundwater was encountered at 9 locations, at depths ranging from 0.5 – 5.3m. The finished cable route will be installed to depths of up to 2.5m.<br><br>The cable and cable ducting will be designed to prevent water ingress. If it is necessary to locate infrastructure such as joint bays within areas that encounter high groundwater these will be designed to prevent water ingress. Therefore once operational, subterranean elements of the Proposed Development are not considered to be flood sensitive and risk from this source is considered low. | No |
| Flooding from sewers / artificial drains | None | The only surface water sewer system identified onsite is the network at the West Angle Bay landfall location.<br><br>The finished cable route will be installed with a minimum cover of 1.1m from the top of the cables to finished ground level and will not be sensitive to flood risk due to sewer surcharge. | No |
| Flooding due to infrastructure failure / blockage | None | Review of the SFCA indicates that the site is not located in or near to any canals or reservoirs and that there are no records of breaching or overtopping in the area.<br><br>There is no other significant infrastructure i.e. culverts, pumping stations, aqueducts etc located upstream or in hydraulic continuity / proximity to the site which may pose a flood risk during a failure scenario. | No |

Based on the outcome of assessment in Table 5 and 6, the following material risks are to be further assessed;

- Tidal flooding with respect to the cable route

### 3.3.3 Tidal Flood Risk

Review of NRW Flood Map for Planning shows two sections of the proposed cable route encroach within Flood Zone 3 for flood risk from the sea. These are located at the landfall location, where the offshore cable route infrastructure comes to landfall and the last section of the onshore cable route where the cable enters Pembroke Power Station.

The current TAN 15 guidance development states the following in regard to development within areas of high flood risk from Rivers or Sea:

*Development will only be justified if it can be demonstrated that*

*1). its location in a high-risk zone is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement*

*; or,*

*Its location in a high-risk zone is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;*

*and,*

*2). It concurs with the aims of PPW and meets the definition of previously developed land;*

*and,*

*3). The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.*

#### 3.3.3.1 Condition 1

The conditions of item 1 are satisfied at both locations. Developing renewable energy essential to sustaining existing developments by providing energy security and mitigating the impacts of climate change. The Pembrokeshire Local Development Plan details the council's strategy for promoting green energy generation in the area, as noted in Section 2.2.2.2.

Offshore wind necessitates a transitional section of the development to be within the intertidal zone, hence the requirement for construction within Zone 3 at the landfall location. The grid connection at Pembroke Power Station is also integral to the Proposed Development. As the existing power station is located within flood Zone 3, it is not possible to avoid this small area of encroachment in order to complete the grid connection.

#### 3.3.3.2 Condition 2

The locations of the onshore development that are within Flood Zones 3 are required for the installation of subterranean cable route infrastructure.

The finished cable route will be installed with a minimum cover of 1.1m from the top of the cables to finished ground level. Upon completion the excavations will be refilled using stored surface material and restored to their original state and function. EIA Chapter 4: Proposed Development gives details of the methodology used to restore trench excavations on onshore and agricultural land. EIA Chapter 6: Marine and Coastal Processes, Section 6.6 provides further detail on restoration of the intertidal zone.

Therefore, following completion of the development there will be no increase to developed land.

#### 3.3.3.3 Condition 3

Section 7 of the current TAN 15 guidance states the following in regard to acceptability for flood consequences

*Where development [in areas of high risk] is justified the assessment can be used to establish whether suitable mitigation measures can be incorporated within the design to ensure that development is as safe as possible and there is:*

- *minimal risk to life;*
- *minimal disruption to people living and working in the area,*
- *minimal potential damage to property;*
- *minimal impact of the proposed development on flood risk generally; and,*
- *minimal disruption to natural heritage.*

Once complete and operational, the Proposed Development within the tidal flood risk zone will comprise solely of a subterranean cable. In reference to TAN15 Section 5 this will be entirely "less vulnerable" development. There will be no risk to life, people, or infrastructure as a result. Following excavation and installation, land will be restored to predevelopment conditions and will not impede or impact flood mechanisms in the area.

The development will be safe for its lifetime against flood risk. The finished cable route will be installed with a minimum cover of 1.1m from the top of the cables to finished ground level and the cable ducting will be designed to prevent water ingress. The transition joint bay at landfall will be located inland, within Flood Zone 1 for tidal flood risk. It will also be located above the 0.5% flood from the sea, with accounting for climate change on the 95$^{th}$ percentile for 2120, as indicated in Figure 19.3.2.

## 3.4 Flood Risk During Construction

### 3.4.1 Overview

This section will consider potential flood risks posed during the project construction phase.

The construction phase of the project will need to consider exposure of a greater number of flood risk sensitive receptors when compared with the operation phase, including but not limited to; site personnel, construction vehicles, site compounds, incomplete and sensitive construction areas, stockpiles and potential pollutants.

### 3.4.2 Screening Assessment

As before, the 'Screening Assessment' is used to identify if any sources of flood risk are required to be investigated in more detail i.e., consideration / specification of bespoke flood mitigation measures for the site development.

The potential sources of flooding to be evaluated in the context of construction include;

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal / coastal flooding;
- Flooding from land or pluvial flooding;
- Flooding from groundwater;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.

The flood risk from each of these potential sources was evaluated using all information available from the desk study, including review of the NRW Flood Map, and is summarised in Table 7 below.

#### 3.4.2.1 Construction Phase Flood Risk Screening

*Table 7 Flood Risk Screening Assessment for the Construction Phase*

| Potential Flood Source | Screening Assessment of Flood Risk at Site[1] | Justification | Requiring Further Consideration i.e. Mitigation? |
|---|---|---|---|
| Fluvial flooding | Medium | As part of the export cable installation a number of watercourses and drainage ditches must be crossed. While there are no main rivers within the watercourse crossing schedule and no areas of fluvial flood risk identified on the NRW flood risk mapping, there remains a level of risk associated with construction within or near to watercourses. | Yes |
| Tidal flooding | Medium | Construction works at the landfall site will require complex operations within an area of coastal flood risk and mitigation measures are required. A small area of construction at Pembroke Power Station will also take place within the coastal flood boundary. | Yes |
| Flooding from land | Low | Review of NRW Flood Map indicate some isolated areas of surface water flood risk along the cable route – these have been illustrated in Figure 19.3.1. Mitigative measures for surface water flood risk management will be considered. | Yes |
| Groundwater flooding | Low | Figure 19.3.2 and 19.3.3 illustrate those locations where groundwater was encountered along the cable route and at the proposed substation. There are instances where the groundwater level encountered is higher that the proposed depth of excavations, therefore further consideration of this flood source is required. | Yes |
| Flooding from sewers / artificial drains | Low | There is considered to be a very low risk of flooding from sewers or artificial drains due to the rural setting of development. Only the area at the landfall site was observed to be serviced by an existing sewer network. | No |
| Flooding due to infrastructure failure / blockage | Low | Review of the SFCA indicates that the site is not located in or near to any canals or reservoirs and that there are no records of breaching or overtopping in the area. There is no other significant infrastructure such as pumping stations or aqueducts etc located upstream or in hydraulic continuity / proximity to the site which may pose a flood risk during a failure scenario.<br><br>It is anticipated that buried services and land drainage will be encountered during cable installation. This is discussed further in Section 3.4.7.2. | Yes |

Based on the outcome of assessment in Table 7 the following material risks are to be further assessed;

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal / coastal flooding;
- Flooding from land;
- Flooding from groundwater;
- Flooding due to infrastructure failure / blockage.

### 3.4.3 Fluvial Flood Risk Control Measures

Due to the high altitude of the majority of the cable route with respect to the local topography, few rivers or tributaries are encountered. The majority of the onshore element of the proposed development, both cable route and substation, are located in Flood Zone 1, identified on the NRW flood risk mapping as having very low risk from fluvial sources. Review of the NRW Recorded Flood Extents dataset does not highlight any recorded incidents of fluvial flooding.

As the cable route encounters several watercourse crossings it is considered there remains a level of fluvial flood risk associated with construction within or near to watercourses.

Areas potentially sensitive to fluvial flood risk and watercourse crossing locations are identified on Figure 19.3.2 to 19.3.5.

A total of 15 watercourse crossings have been confirmed via survey and data review. These are mostly observed to be minor watercourses with narrow, shallow channels and small catchments, spring fed to tidal headwaters or land drainage channels of adjacent agricultural fields and local roads.

Table 8 gives a high-level overview of those features noted. Further detail on the nature of these water features and on the crossing, procedure can be found in the Watercourse Crossing Schedule in Appendix B.

*Table 8 Summary of Watercourse Crossings*

| Watercourse ID | Type | Likely Crossing Methodology |
|---|---|---|
| WCX_001 | Drainage | Open cut trench with over pumping |
| WCX_002 | Drainage | Open cut trench with over pumping |
| WCX_003 | Watercourse | Open cut trench with over pumping |
| WCX_004 | Drainage | Open cut trench with over pumping |
| WCX_005 | Drainage | Trenchless (HDD) |
| WCX_006 | Drainage | Trenchless (HDD) |
| WCX_007 | Watercourse | Open cut trench with over pumping |
| WCX_008 | Watercourse | Open cut trench with over pumping |
| WCX_009 | Drainage | Open cut trench with over pumping |
| WCX_010 | Watercourse | Open cut trench with over pumping |
| WCX_011 | Watercourse | Trenchless (HDD) |
| WCX_012 | Watercourse | Open cut trench with over pumping |
| WCX_013 | Watercourse | Open cut trench with over pumping |
| WCX_014 | Watercourse | Open cut trench with over pumping |

| | | |
|---|---|---|
| WCX_015 | Watercourse | Open cut trench with over pumping |
| WCX_16 | Watercourse | Open cut trench with over pumping |

A number of mitigative measures are proposed to minimise the risk of flooding and impacts during the construction at the watercourse crossing locations.

Watercourse crossings will take place during periods of normal to low flow to avoid conveyance related flood risk effects.

All mobile equipment when not required to facilitate scheduled works will not be stored within areas of identified fluvial flood risk.

For open cut trench methodology, watercourse sections will be isolated using barriers that span the width of the channel. Water will be extracted and diverted downstream by over pumping methods before treatment to remove silt prior to downstream discharge.

Where an HDD method is used to cross watercourses, the depth of HDDs at crossings will be such that the riverbed is undisturbed and pressurised bentonite in the drill hole does not leak into watercourses. The HDD compounds will be placed in an appropriate location, as far from flood potential as reasonably possible within the requirements of the HDD design to reduce the potential for impacts if flooding does occur.

Given the relatively low presence of fluvial flood risk across the site it is considered highly unlikely that any HDD compounds will be located within the flood risk zone. If the floodplain cannot be avoided, to minimise impacts on natural drainage within the functional floodplain the following measures will be incorporated:

- Access tracks will not be elevated. Where this is not possible cross drainage will be installed to allow natural drainage;
- Soil storage alongside the cable trenches will not be continuous but will incorporate breaks of 3-4 m at regular intervals;
- Pre-construction drainage measures will be installed within the working corridor to minimise disruption to natural drainage pathways.

It is noted that without information from detailed HDD feasibility studies, the use of HDD for watercourse crossing cannot be confirmed. Should the HDD feasibility study conclude that this option is not feasible open cut trench methodology will be used with appropriate mitigations.

Where an access track necessitates a temporary watercourse crossing, appropriate design will ensure flood flow conveyance and sediment transfer conditions are commensurate with existing conditions. Temporary bridges or culverts will be removed within 12 months following construction of the onshore infrastructure.

Following implementation of the described mitigation measures, flood risk to the proposed development from fluvial sources during the construction phase is considered to be Low.

### 3.4.4 Tidal Flood Risk Control Measures

Construction at the landfall site will expose a number of flood risk sensitive receptors to an area of high coastal flood risk, therefore tidal flood risk mitigation will be required.

To maintain the necessary flexibility to the Project, two potential installation options have been developed for landfall: HDD or open-cut trenching. The preferred option for landfall is HDD as this will reduce the footprint of impact on shallow sub-tidal and intertidal marine habitats. However, without information from detailed HDD feasibility studies, and further geotechnical site investigation works that would only be undertaken post-submission (2022), risk remains that HDD

may not be technically feasible. Therefore, open cut trenching is also considered as a contingency option.

Where an HDD method is used, HDD compounds will be placed in an appropriate location, as far from coastal flood potential as reasonably possible within the requirements of the HDD design to reduce the potential for impacts if flooding does occur.

All mobile equipment when not required to facilitate scheduled works at the HDD locations will not be stored within areas of identified tidal flood risk.

Should the HDD feasibility study conclude that this option is not feasible, open cut trench methodology would be used. In the West Angle Bay Landfall location this would require the temporary breakout of existing coastal defences at West Angle Bay. Sheet piling will be installed to provide trench shuttering to minimise the extent of the excavation works and provide safe trench support from the seaward side. Temporary demountable defences would be installed on the landward side for the duration of the cable installation period and reinstatement of the flood defences to ensure no decrease in the level of flood protection.

Further detail on potential impacts and proposed mitigation for both open cut trench and HDD methodologies on the coastal and intertidal areas is given in Chapter 6 Marine and Coastal Processes Section 6.6.

Construction within the coastal flood boundary will also be required at Pembroke Power Station, which is located within Flood Zone 3. For the purposes of construction here and at the landfall location a site-specific Flood Action Plan will be developed in partnership with the appointed contractor. This will include details of safe systems of work, access and egress routes, a detailed response plan to a flood risk event and the roles and responsibilities of those onsite in the event of a flood.

Following implementation of the described mitigation measures, flood risk to the proposed development from tidal sources during the construction phase is considered to be Low.

Areas potentially sensitive to tidal flood risk are identified on Figure 19.3.2 to 19.3.5.

### 3.4.5 Surface Water Flood Risk Control Measures

There are a limited number of surface water flood risk areas identified on the National Wales Flood Risk Mapping which could potentially impact the proposed cable route.

Works will be planned and programmed, where possible, to be completed during low rainfall months which will limit the potential for impacts.

All mobile equipment when not required to facilitate scheduled works will not be stored within areas of identified surface water flood risk.

Prior to construction, cleaning of existing field ditches and culverts will be undertaken to alleviate drainage blockages or restrictions.

Mitigation measures to maintain surface water flow during cable installation should be put in place to prevent direct impacts on the hydrology and geomorphology of surface water courses. Standard settlement management measures should also be used, if appropriate, e.g., settlement ponds, covering stockpiles to prevent run off, silt curtains in water courses etc.

Areas potentially sensitive to surface water flood risk are identified on Figures 19.3.2 to 19.3.5.

### 3.4.6 Flooding from Groundwater

Groundwater flood risk indicators have been mapped on Figure 19.3.6 and 19.3.7, including groundwater depths extracted from the site-specific ground investigation report. Hydrogeological features have been included within the main EIA chapter 19 Figure 19.5.

The majority of the Proposed Development is underlain by low productivity bedrock aquifers, with the exception of the landfall and substation locations which are partially underlain by a moderately productive aquifer. Ground investigations identified groundwater at varying depths along the cable route and within the substation compound.

At the substation location, groundwater was encountered at locations in close proximity to the proposed development as illustrated in Figure 19.3.4. Along the cable route, 5 no. number of trial pits and 1 borehole identified shallow groundwater at higher levels than proposed excavations.

In order to minimise the impacts of groundwater inundation on the construction process, prior to excavations, temporary cut-off drains will be installed parallel to where the proposed trench lines to prevent soil and groundwater entering the trenches. Dewatering of the excavations may be required at locations where groundwater is higher than the excavation depth in order to provide sound working conditions for the construction phase. In addition, the proposed substation SUDs pond will be lined to prevent risk of groundwater intrusion compromising the capacity of the surface water drainage system.

### 3.4.7 Additional Mitigation Measures

#### 3.4.7.1 Weather Warnings

Weather will be monitored closely at all stages throughout construction works and appropriate action taken in the event of serious, inclement weather and / or flooding.

Designated persons will be registered to receive flood warnings, flood alerts and weather warnings for the local area. Note that those areas of site at risk of surface water flooding will be most susceptible to flooding from extreme rainfall events therefore MET office extreme weather warnings will be relevant. A final check of the weather forecast will be made 24 hours ahead of works to allow contingency and/or emergency preparedness measures to be put in place.

#### 3.4.7.2 Inundation from damaged buried services

Review of watermain and sewage maps of the area show that the cable route is in proximity to existing infrastructure at several locations along the route. It is also known that significant existing land drainage infrastructure is present within the agricultural areas. It is the contractor's responsibility to identify the location of existing pipes and use good practise construction methods to avoid any damage during construction that could cause flooding.

# 4. Conclusions

ITPEnergised (ITPE) has been appointed by Offshore Wind Consultants Limited to carry out a FCA for the onshore component of the Erebus Floating Windfarm. All potential sources of flooding to the site have been considered. This report confirms that once operational, no material flood risk sources have been identified that will impact the onshore Proposed Development or surrounding areas. The Proposed Development is almost exclusively in Flood Zone 1, considered to be at little or no risk of flooding from all sources and thus no permanent specific flood risk mitigation measures are required.

During the construction phase the Project will be vulnerable to several types of flooding, including fluvial, tidal, surface and groundwater flooding. The risk of fluvial flooding is associated with a total of 16 water crossings. There are a limited number of surface water flood risk areas identified on the NRW Flood Map for Planning which could potentially impact the proposed cable route construction and mitigation measures are also included in case of groundwater intrusion to excavations during construction. Coastal flooding is a risk applicable to the landfall location and at Pembroke Power Station during construction.

Control measures to be implemented during construction have been outlined for each flood risk source. Following implementation of site-specific mitigation measures and good practice construction methods as outlined in the CEMP, flood during the construction phase of the development from all sources is considered to be Low.

Taking all of the above into account it is considered there are no overriding impediments to the development being granted planning permission on the grounds of flood risk.

# DRAWINGS

185000 190000 195000

205000

200000

N

KEY

Onshore Consent Boundary

**Elevation (mAOD)**

**Value**

50

0

0 0.9 1.8 km

**Scale 1:35,000 @ A3**

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**Figure 19.3.1**

**Topography**

Geodetic Parameters: British National Grid

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|---|---|---|---|
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185000

N

WCX_01

West Angle Bay
Chapel Bay Fort (dis)
West Pill
Chapel Bay
Chapel Bay
IRB & LB Sta
Ellen's Well
North Hill
Sewage Works
Dovecote
Castle Farm
Tower
Sch
Jetty
Angle
B 4320
North Studdock Cottage
North Studdock
Castle (rems of)
The Ridge
The Hall
Home Farm
Lodge
Waterfall
South Studdock
Hubberton
(dis)
Bangeston Wood
Airfield (disused)
Carters Green
Bangeston
Whitedole Bay
Parsonsquarry Bay
Island
Pembrokeshire Coast Path
Guttle Hole (Natural Arch)
Cave
Fort
MLW
MHW
Spr
Sprs

185000

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**KEY**

- Onshore Consent Boundary
- Watercourse Crossing

**NRW Flood Map for Planning**

River
- Flood Zone 2
- Flood Zone 3

Sea
- Flood Zone 2
- Flood Zone 3

Surface Water and Small Watercourses
- Flood Zone 2 & 3
- 0.5% AEP Extreme Sea Level plus climate change

0 0.25 0.5 km

Scale 1:10,000 @ A3

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**Figure 19.3.2**

**Flood Risk Source Locations A**

Geodetic Parameters: British National Grid

| Date: | Drawn by: | Checked by: | Version: |
|---|---|---|---|
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190000

N

The Hall

Angle Bay

Sand & Mud

MLW

MHW

Wales Coast Path

Spr

Lodge

Bangeston Wood

42

Carters Green

Bangeston

Hardings Hill

W

53

Rocket Cart House

61

60

Middlehill

Broomhill

Resr

40

35

Sprs

18

10

15

WCX_02

WCX_03

WCX_04

WCX_05

WCX_06

WCX_07

WCX_08

WCX_09

WCX_10

Broomhill Cottage

B 4320

War Meml

The Devil's Quoit Burial Chamber

Tumulus

Kilpaison Burrows

Dunes

Sprs

Black Cave

Gravel Bay

87

88

89

90

Broomhill Burrows

Pembrokeshire Coast Path

Pit (dis)

The Hoary Rocks

Freshwater

190000

**KEY**

- Onshore Consent Boundary
- Watercourse Crossing

**NRW Flood Map for Planning**

River
- Flood Zone 2
- Flood Zone 3

Sea
- Flood Zone 2
- Flood Zone 3

Surface Water and Small Watercourses
- Flood Zone 2 & 3

0 0.25 0.5 km

Scale 1:10,000 @ A3

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**Figure 19.3.3**

**Flood Risk Source Locations B**

Geodetic Parameters: British National Grid

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190000

200000

N

WCX_10
WCX_09
WCX_11
WCX_14
WCX_15
WCX_12
WCX_13

Eastington and remains of Manor House
Rhoscrowther
St Degman's Well
Cheveralton
Greenhill
Resr
Rose Villa
Green Hill Reservoir
Green Hill
Sunnyridge
Vine Cottage
Neath Bridge
Neath
Hoplass
Wallaston Cross
Wogaston
Willow Brook
Wallaston
Wallaston Green
Quarry (dis)
Tumuli
Newton
Newton Burrows
Harry Standup
Tel Ex
Reservoir
Corseside

ANGLE C

00 01 02 90 91 92 93

Sprs Spr W

**KEY**

Onshore Consent Boundary

Watercourse Crossing

**NRW Flood Map for Planning**

River

Flood Zone 2

Flood Zone 3

Sea

Flood Zone 2

Flood Zone 3

Surface Water and Small Watercourses

Flood Zone 2 & 3

0 0.25 0.5 km

Scale 1:10,000 @ A3

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**Figure 19.3.4**

**Flood Risk Source Locations C**

Geodetic Parameters: British National Grid

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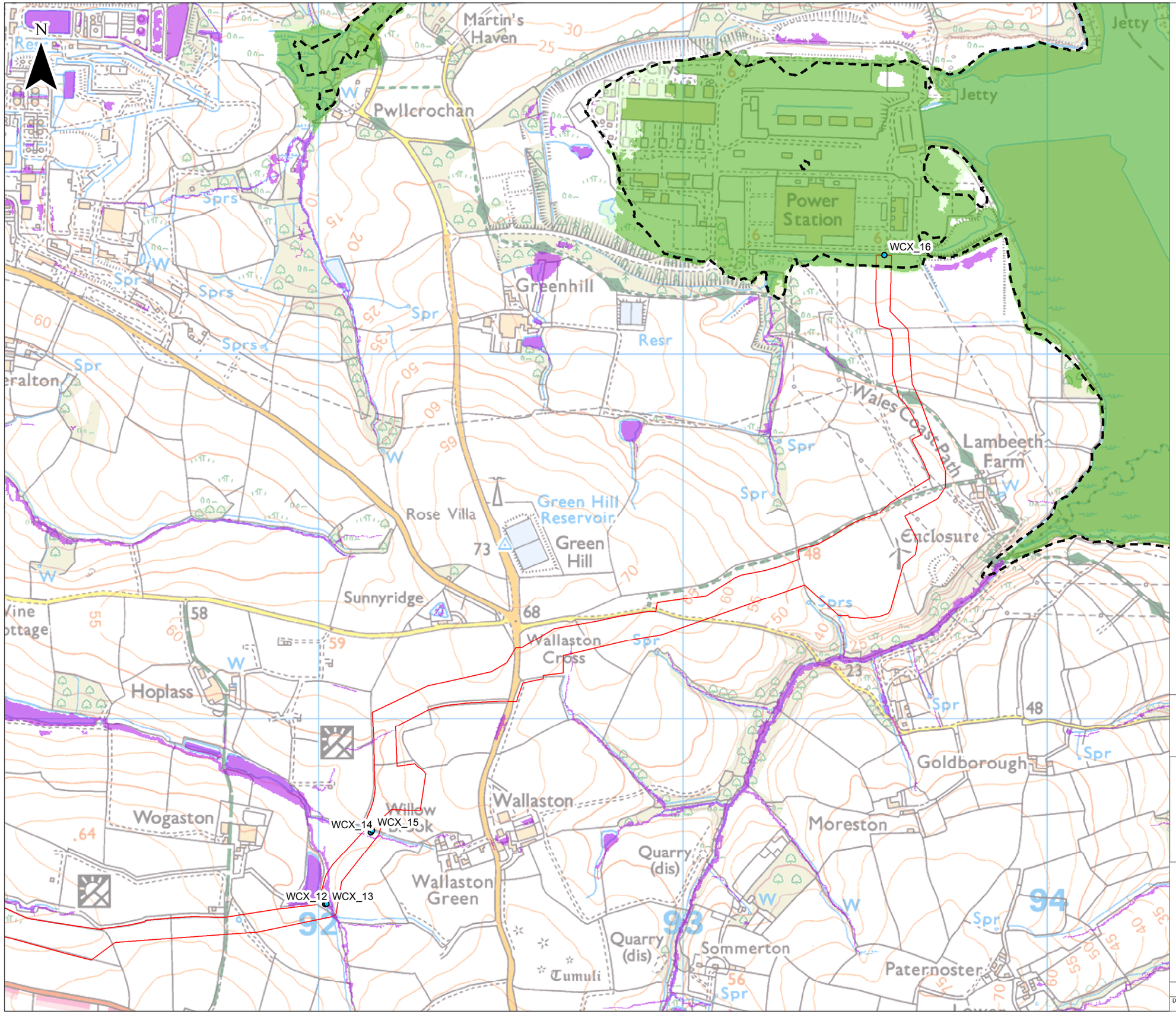


**KEY**

- Onshore Consent Boundary
- Watercourse Crossing

**NRW Flood Map for Planning**

River
- Flood Zone 2
- Flood Zone 3

Sea
- Flood Zone 2
- Flood Zone 3

Surface Water and Small Watercourses
- Flood Zone 2 & 3
- 0.5% AEP Sea Level + Climate change

0 0.25 0.5 km

Scale 1:10,000 @ A3

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**Figure 19.3.5**

**Flood Risk Source Locations D**

Geodetic Parameters: British National Grid

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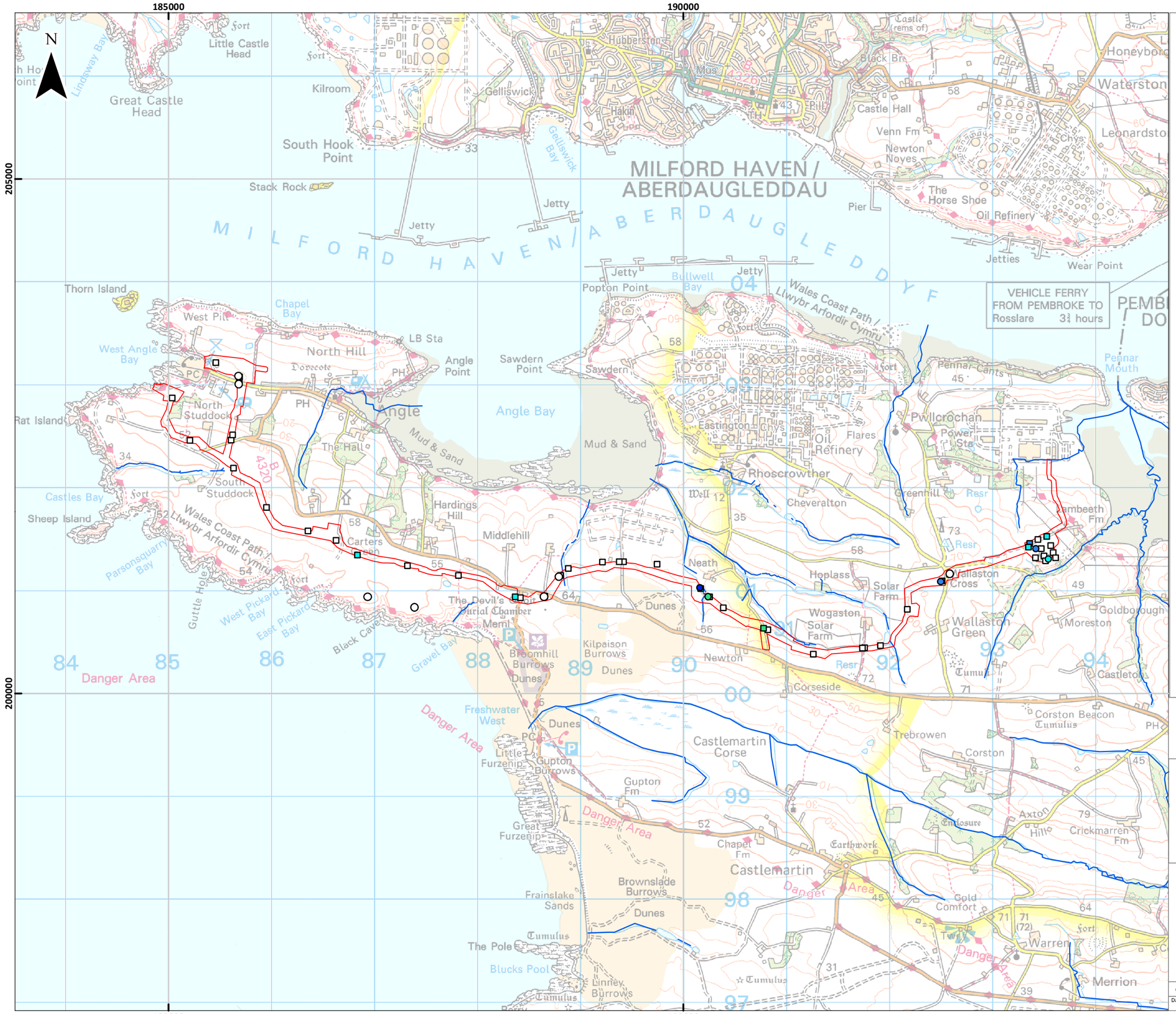


**KEY**

- Onshore Consent Boundary
- Watercourses

**Groundwater Depth**

**Boreholes**

- 0.000
- 0.001 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000
- >3

**Trial Pits**

- 0.000
- 0.001 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000
- >3

0 0.9 1.8 km

Scale 1:35,000 @ A3

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**Figure 19.3.6**

**Ground Investigation Record - Groundwater Depths**

Geodetic Parameters: British National Grid

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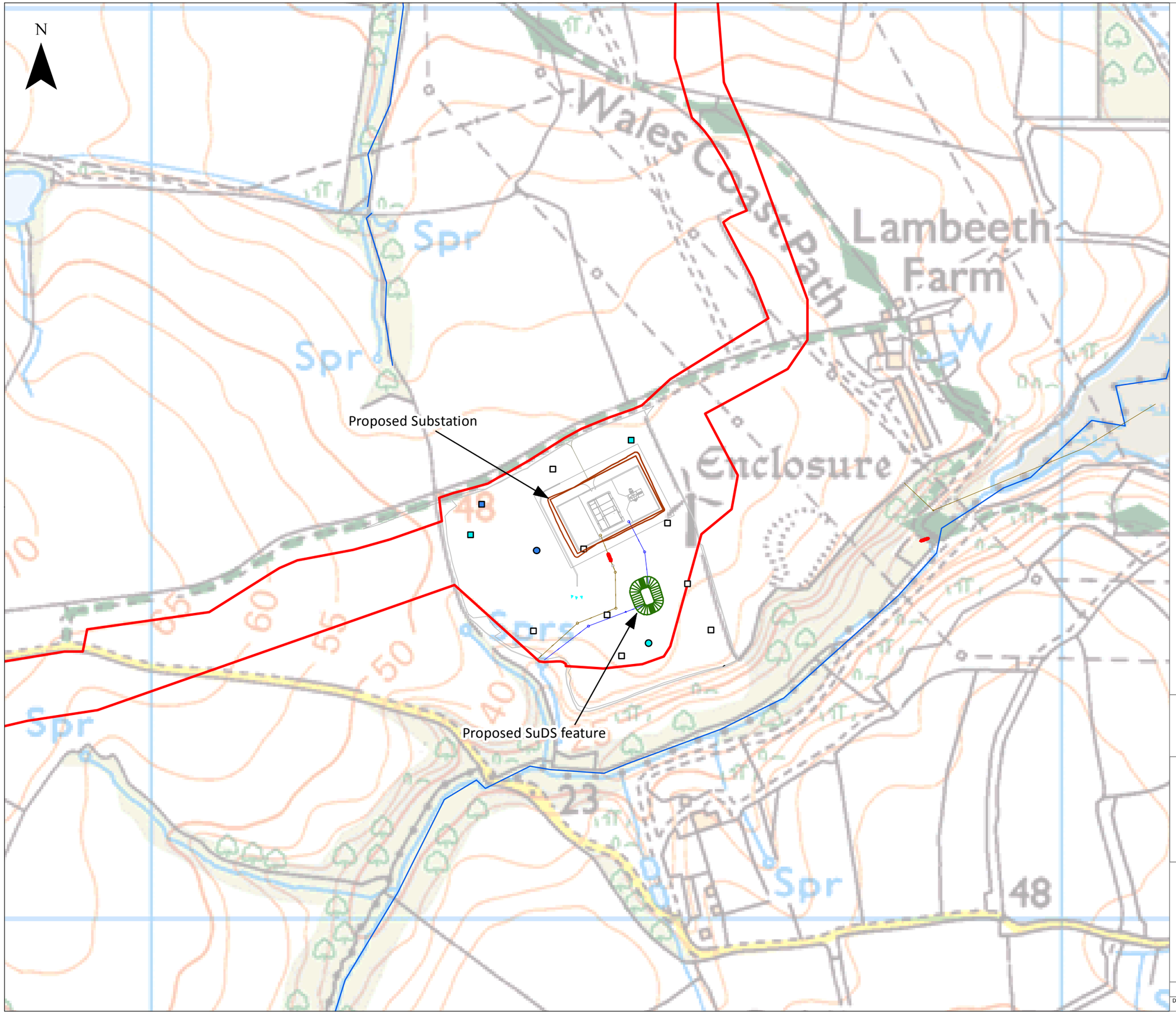


**KEY**

**Groundwater Depth**

**Boreholes**

- 0.000
- 0.001 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000
- >3

**Trial Pits**

- 0.000
- 0.001 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000
- >3
- Onshore Consent Boundary
- Watercourses

0 0.1 0.2 km

**Scale 1:4,000 @ A3**

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**Figure 19.3.7**

**Ground Investigation Record - Groundwater Depths Substation Location**

Geodetic Parameters: British National Grid

| Date: | Drawn by: | Checked by: | Version: |
|---|---|---|---|
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