MONA OFFSHORE WIND PROJECT

Environmental Statement

Volume 1, Chapter 3: Project Description
(F01_ F02 Tracked)

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Image of an offshore wind farm

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Prepared by:

RPS

Prepared for:

Mona Offshore Wind Ltd.

Deadline 7 Changes

This document has been updated at Deadline 7 of the Mona Offshore Wind Project examination in order to address the errata included in the Errata Sheet (REP4-088). Table 3.37 has also been updated to align with the programme presented in the Applicant's Response to Hearing Action Points (S_D1_5).

This document has also been updated at Deadline 7 of the Mona Offshore Wind Project examination in order to reflect the change to the Order Limits, forming the Change Request, which was accepted by the Examining Authority on 19 December 2024.

The following figures have been updated to reflect the updated onshore red line boundary change:

- Figure 3.2: Location of the Mona Offshore Wind Project.
- Figure 3.15: Mona Landfall.
- Figure 3.16: Mona Onshore Development Area.
- Figure 3.19: Temporary construction compound and laydown areas.
- Figure 3.20: Onshore Substation.
- Figure 3.21: Onshore Substation access.
- Figure 3.22: Indicative location of the attenuation pond.

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Glossary

Term	Meaning
Geophysical surveys	Surveys of the seabed which collect data on seabed form and boulder mapping.
Geotechnical surveys	Surveys of the seabed which collect data on underlying seabed geology and rock layers.
Helicopter refuge area	A defined area clear of any surface infrastructure
High Voltage Alternating Current	Form of electricity that is used by the UK National Grid and is delivered to consumers.
Hydrodynamics	Physical processes of water movement e.g. ocean currents.
Licencing Authority	The organisation responsible for granting licences for activities related to the Mona Offshore Wind Project. Natural Resources Wales (NRW) is the responsible authority for deemed marine licences in Welsh waters and works with the Planning Inspectorate to ensure that deemed marine licences are transposed into the Development Consent Order (DCO).
Lines of orientation	Lines on roughly the same bearing through the Mona Array Area.
Maximum design scenario (MDS)	The MDS represents the parameters that make up the realistic worst case scenario. This is selected from a range of parameters and may be different for different receptors and activities.
Micrositing	The final selection of the position of infrastructure which may move ~~in the order of a few metres~~up to 50 m to avoid an obstruction. Micrositing will not involve moving the position of any infrastructure outwith the Mona Offshore Wind Project Offshore Order Limits
Micrositing allowance	Radius of the circle around the nominal offshore surface structure position within which the final wind turbine position can be located.
Nominal offshore surface structure position	Offshore surface structure position given in design plan (submitted post-consent to NRW in consultation with MCA and Trinity House)
Offshore Substation Platform (OSP) topside	The topside of an offshore substation is the section that is located above the sea surface and houses the electrical equipment.
Onshore Substation	Where the power generated by the wind farm is adjusted (including voltage, power quality and power factor as required) to meet the UK System-Operator Transmission-Owner Code (STC) for supply to the existing National Grid Bodelwyddan substation.
Project Design Envelope (PDE)	The PDE sets out the design assumptions and parameters from which the realistic MDSs are drawn for the Mona Offshore Wind Project EIA.
Search and rescue (SAR) access lane	A defined lane which allows search and rescue operations to transit safely along a line of orientation through the Mona Array Area.
Tolerance allowance	Radius of the circle around the nominal offshore surface structure position within which the target wind turbine position can be located.
Unexploded Ordnance	Remains of explosive devices that did not detonate when they were deployed.

Acronyms

Acronym	Description
AfL	Agreement for Lease
BEIS	Business, Energy and Industrial Strategy
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CBRA	Cable Burial Risk Assessment
CL: AIRE	Contaminated Land: Applications in Real Environments
CoCP	Code of Construction Practice
CPT	Cone Penetration Testing
CTV	Crew Transfer Vessels
DCO	Development Consent Order
DGC	Defence Geographic Centre
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
GCN	Great Crested Newt
GIS	Gas Insulated Switchgear
HDD	Horizontal Directional Drilling
HSE	Health, Safety and Environment
HVAC	High Voltage Alternating Current
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICPC	International Cable Protection Committee
IR	Infra-red
JB	Joint Bays
JUV	Jack-Up Vessel
LAT	Lowest Astronomical Tide
LB	Link Bays
MBES	Multi-Beam Echosounder
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NEQ	Net Explosive Quantity
NPS	National Policy Statement
NRW	Natural Resources Wales

Acronym	Description
Ofgem	Office of Gas and Electricity Markets
OFTO	Offshore Transmission Operator
OSP	Offshore Substation Platform
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
pUXO	Potential UXO
SAC	Special Area of Conservation
SAR	Search and Rescue
SBES	Single Beam Echosounder
SBP	Sub-Bottom Profiler
SSCS	Seabed Scour Control Systems
SWMP	Site Waste Management Plan
SuDS	Sustainable Drainage System
TJB	Transition Joint Bays
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance

Units

Unit	Description
cd	Candela
dB	Decibel
μPa	Micro Pascal (10^{-6})
kHz	Kilohertz
kJ	Kilojoules
kV	Kilovolts
kg	Kilograms
km	Kilometres
km^2	Kilometres squared
m	Metres
m^3	Metres cubed
m^2	Metres squared
mm	Millimetres
nm	Nautical miles
%	Percentage

3 Project description

3.1 Introduction to the Mona Offshore Wind Project

3.1.1.1 Mona Offshore Wind Limited (the Applicant), a joint venture of bp Alternative Energy Investments Ltd (hereafter referred to as bp) and Energie Baden-Württemberg AG (hereafter referred to as EnBW) is developing the Mona Offshore Wind Project. This chapter of the Environmental Statement provides an outline description of the offshore and onshore components required for the construction, operation and maintenance, and decommissioning phases of the Mona Offshore Wind Project, based on the project design information and the current understanding of the receiving environment.

3.1.1.2 The Applicant has, through the Environmental Impact Assessment (EIA) process (i.e. from Scoping, statutory consultation on the Preliminary Environmental Information Report (PEIR) and non-statutory consultation throughout the pre-application phase of the Mona Offshore Wind Project), refined the proposed envelope, made design and construction commitments and provided more detailed realistic Maximum Design Scenarios (MDSs) where available. The refined parameters are presented in this Environmental Statement and draft Development Consent Order (DCO). The final Mona Offshore Wind Project design will be selected after development consent has been granted, in line with the parameters stated in the project description within this Environmental Statement and the DCO and standalone Natural Resources Wales (NRW) marine licence as granted.

3.2 Project design status

3.2.1.1 The Project Design Envelope (PDE) approach (also known as the Rochdale Envelope approach) will be adopted for the EIA of the Mona Offshore Wind Project, in accordance with industry good practice. The PDE sets out the design assumptions and parameters from which the realistic MDSs are drawn for the Mona Offshore Wind Project EIA. Further information on the Rochdale Envelope approach is presented in Volume 1, Chapter 5: EIA Methodology of the Environmental Statement.

3.2.1.2 The Mona Offshore Wind Project is within the development process. Therefore, the ‘envelope’ has been designed to include flexibility to accommodate further project refinement during detailed design, post consent. Offshore wind is a continually evolving industry with a constant focus on safety, increased efficiency and cost reduction, therefore improvements in technology and construction methodologies occur frequently and an unnecessarily prescriptive approach could preclude the adoption of new technology and methods. Consequently, this chapter sets out a series of parameters.

3.2.1.3 This project description does not refer directly to the generation capacity of the wind turbines but rather their physical dimensions. Subsequently, the assessments are not linked directly to the overall capacity of the Mona Offshore Wind Project or individual wind turbine capacity, but rather the physical dimensions of the wind turbines such as tip height and rotor diameter.

3.3 Overview of the Mona Offshore Wind Project

3.3.1 Mona Offshore Wind Project Boundary

3.3.1.1 The Mona Offshore Wind Project is presented in Figure 3.2 and consists of the following:

- Mona Array Area: This is where the wind turbines, Offshore Substation Platforms (OSPs), foundations (for both wind turbines and OSPs), inter-array cables, interconnector cables and offshore export cables will be located
- Mona Offshore Cable Corridor and Access Areas: The corridor located between the Mona Array Area and the landfall up to Mean High Water Springs (MHWS), in which the offshore export cables will be located and in which the intertidal access areas are located
- Intertidal access areas: The area from MHWS to Mean Low Water Springs (MLWS) which will be used for access to the beach and construction related activities
- Landfall: This is where the offshore export cables make contact with land and the transitional area where the offshore cabling connects to the onshore cabling
- Mona Onshore Development Area: The area in which the landfall, Onshore Cable Corridor, Onshore Substation, mitigation areas, temporary construction facilities (such as access roads and construction compounds), operational access to the Onshore Substation and the connection to National Grid infrastructure will be located
- Mona Onshore Substation: This is where the new substation will be located, containing the components for transforming the power supplied from the offshore wind farm up to 400 kV
- Mona 400 kV Grid Connection Cable Corridor: The corridor from the Mona onshore substation to the National Grid substation.

3.3.2 Agreement for Lease area

3.3.2.1 The Applicant entered into Agreement for Lease (AfL) for the Mona Offshore Wind Project in January 2023. The AfL for the Mona Array Area covers approximately 500 km^2 and is located in the east Irish Sea, 28.2 km (15.2 nm) from the Anglesey coastline, 39.9 km (21.5 nm) from the northwest coast of England, and 42.3 km (22.8 nm) from the Isle of Man (when measured from MHWS).

3.3.2.2 Subsequent to the identification of the AfL site, the Mona Offshore Wind Project has refined the area for development down from the AfL area (which was consulted upon in the Statutory Consultation) to the Mona Array Area, an area of approximately 300 km^2 which is presented within the Environmental Statement. The Mona Array Area (as shown on Figure 3.2) is 28.8 km (15.6 nm) from the north coast of Wales, 46.9 km (25.3 nm) from the northwest coast of England, and 46.6 km (25.2 nm) from the Isle of Man (when measured from MHWS). The reduction in the area for development to the Mona Array Area reduces potential impacts on several receptors associated with the following chapters:

- Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement
- Volume 2, Chapter 8: Seascape and visual resources of the Environmental Statement
- Volume 4, Chapter 3: Socio-economics of the Environmental Statement
- Volume 4, Chapter 4: Human health assessment of the Environmental Statement.

3.3.3 Project infrastructure overview

3.3.3.1 The Mona Offshore Wind Project will be located in the east Irish Sea, with a landfall on the North Wales coastline and a connection to the Bodelwyddan National Grid substation.

3.3.3.2 The Mona Offshore Wind Project will consist of up to 96 wind turbines. The maximum proposed number of turbines has been reduced from 107 proposed in the PEIR. The reduction in the maximum number of turbines, together with the increase in the minimum separation distance between wind turbines (see section 3.5.5), reduce potential impacts on several receptors associated with the following chapters:

- Volume 2, Chapter 1: Physical Processes of the Environmental Statement
- Volume 2, Chapter 4: Marine mammals of the Environmental Statement
- Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement
- Volume 2, Chapter 6: Commercial fisheries of the Environmental Statement
- Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement
- Volume 2, Chapter 8: Seascape and visual resources of the Environmental Statement
- Volume 4, Chapter 1: Aviation and Radar of the Environmental Statement.

3.3.3.3 The proposed capacity of the Mona Offshore Wind Project is over 350 MW, therefore it is within the Planning Act 2008 thresholds for Welsh offshore schemes. The final capacity of the Mona Offshore Wind Project will be determined based on available technology and constrained by the design envelope of the wind turbines presented in this chapter. The offshore infrastructure will also include up to 360 km of offshore export cables, 50 km of interconnector cables and 325 km of inter-array cables.

3.3.3.4 The onshore infrastructure will consist of up to four circuits. Each cable circuit will consist of three cables, giving a total of up to 12 cables laid in trefoil formation or flat. The cables will be buried in up to four trenches and will connect to an onshore High Voltage Alternating Current (HVAC) substation (the Onshore Substation). From the Onshore Substation, a 400kV Grid Connection Corridor will extend to the Bodelwyddan National Grid substation. The 400 kV Grid Connection will rely on ‘Enabling Works’ at the Bodelwyddan National Grid substation.

3.3.3.5 National Grid are responsible for undertaking works at the National Grid Bodelwyddan Substation to facilitate the connection of the Mona Offshore Wind Project. These ‘Enabling Works’ include an extension to the National Grid Bodelwyddan Substation.

3.3.3.6 In Autumn 2023, National Grid published a consultation document on their proposals. The proposals include extending the existing substation with a new building (approximately 1,263 m^2) and providing new gantries, access road and developer cable sealing ends. The Mona Offshore Wind Project includes the termination of the 400 kV cables within the National Grid Bodelwyddan Substation extension (as shown by Work Area 26 of the Works Plan (Document Reference B3)). The extension to National Grid Bodelwyddan Substation extension is considered as part of the cumulative impact assessment within the onshore chapters of the Environmental Statement.

3.3.3.7 The key components of the Mona Offshore Wind Project are shown in Figure 3.1 and the key parameters are presented in Table 3.1.

3.3.3.8 The Applicant intends to commence construction of the Mona Offshore Wind Project in 2026 and for it to be fully operational by 2030, in order to help meet UK and Welsh Government renewable energy targets.

Table 3.1: Key parameters for the Mona Offshore Wind Project.

Parameter	Value
Mona Array Area (km^2)	300
Average water depth (m LAT)	-39.39
Maximum number of wind turbines	96
Maximum blade tip height above LAT (m)	364
Maximum number of OSPs	4
Maximum number of offshore export cables	4
Maximum number of onshore export cables	12
Maximum number of trenches for onshore export cables	4
Maximum length of inter-array cables (km)	325
Maximum length of interconnector cables (km)	50
Maximum length of offshore export cables (km)	360
Maximum length of onshore export cables (km)	15
Maximum length of 400 kV grid connection cables (km)	1

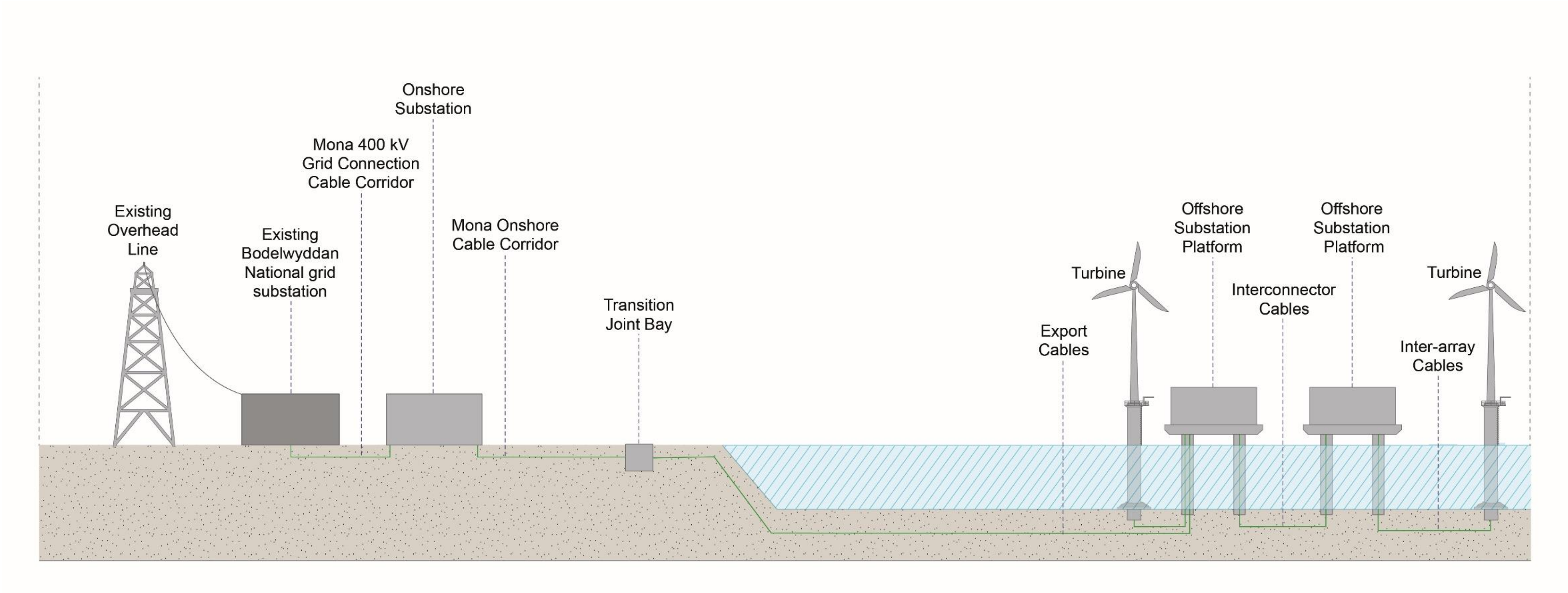

Figure 3.1: Overview of the Mona Offshore Wind Project infrastructure.

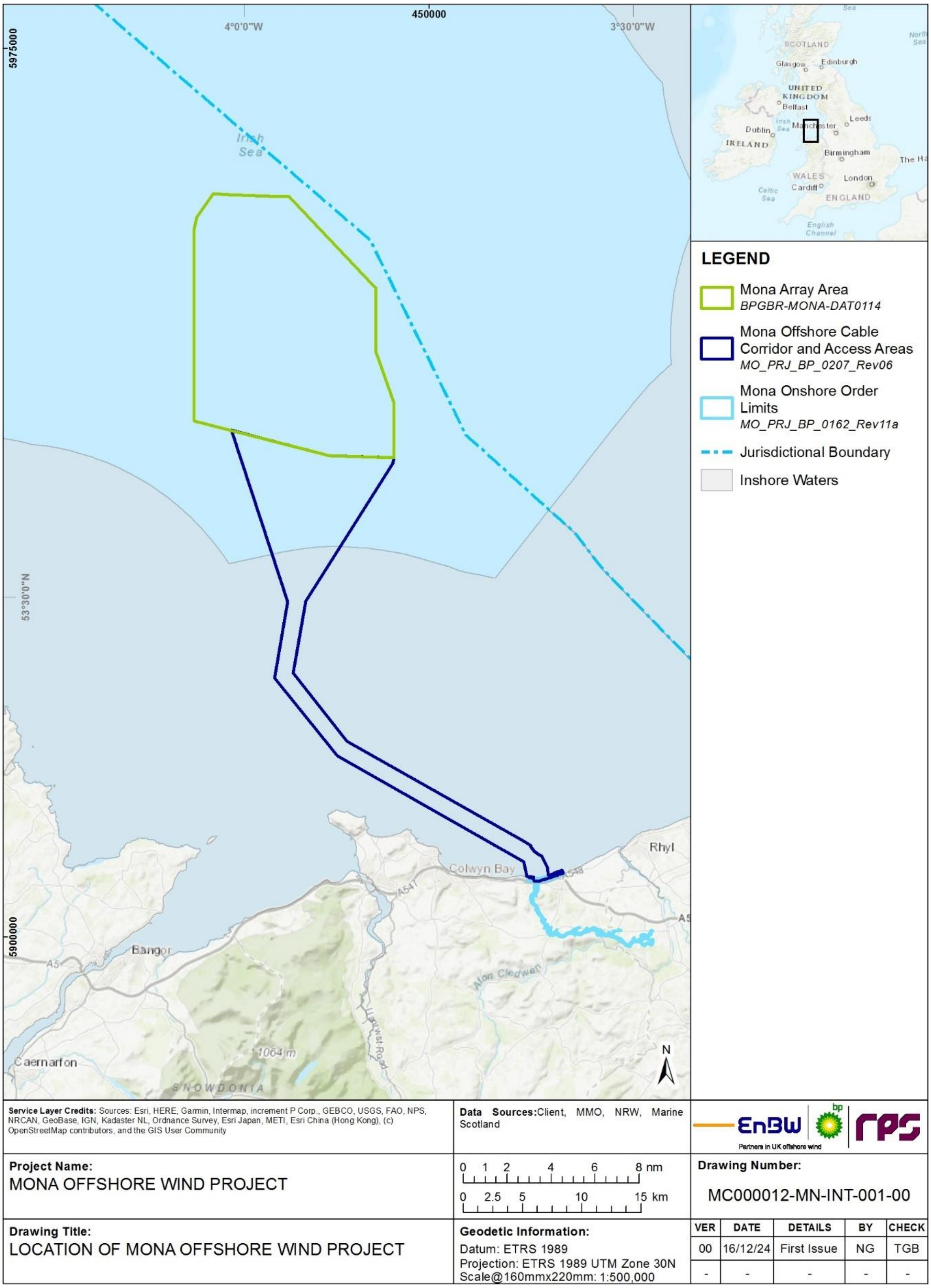

Figure 3.2: Location of the Mona Offshore Wind Project.

3.4 Consultation

3.4.1.1 Comprehensive consultation and engagement with stakeholders have formed an integral part of the development of the Mona Offshore Wind Project. The following section provides a high level summary of the consultation and engagement activities that have been undertaken as part of the Mona Offshore Wind Project. More details on all public consultations can be found in the Consultation report (Document Reference E3).

- EIA Scoping May – June 2022: The EIA Scoping Report outlined details of the proposed approach to EIA and was submitted to the Planning Inspectorate in May 2022. The Applicant received a response from the Secretary of State for Business, Energy and Industrial Strategy (BEIS) in the form of the Scoping Opinion in June 2022 (Planning Inspectorate, 2022). The Preliminary Environmental Information Report (PEIR) and the Environmental Statement have been directly informed by the Scoping Opinion
- Non-statutory Public Consultation 7 June to 3 August 2022: The Applicant carried out the first phase of non-statutory public consultation in the summer of 2022. During the consultation period, several promotional activities and events took place including a consultation website was launched to provide a platform to share consultation material and three events, two pop-up events and a webinar were held
- Non-statutory targeted Public Consultation 26 September to 7 November 2022: A second stage of targeted non-statutory consultation was held in autumn 2022 seeking views on potential sub-station locations. During the consultation period, several promotional activities and events took place, focused on the area in the vicinity of National Grid's existing Bodelwyddan substation in Denbighshire
- Statement of Community Consultation (7 October to 4 November 2022 and 9 March to 6 April 2023: The Applicant prepared an initial Statement of Community Consultation (SoCC) in autumn 2022. This set out how local communities would be consulted on the Mona Offshore Wind Project.
- Statutory Public Consultation 19 April to 7 June 2023: Statutory consultation was undertaken in accordance with the Planning Act 2008 during the spring of 2023. The Consultation report (Document Reference E3) details all aspects of the consultation and how it was delivered as per sections 42, 47, 48 and 49 of the 2008 Act
- Additional Statutory Consultation Autumn/Winter 2023/2024: Throughout the development process through continued diligent inquiry, additional landowners and interests have been identified. All have been contacted and had the opportunity to provide their feedback on the PEIR documents. Details of this additional consultation can also be found in the Consultation report (Document Reference E3)

3.5 Offshore infrastructure

3.5.1 Overview

3.5.1.1 This section describes the geophysical and geotechnical site investigation surveys as well as Unexploded Ordnance (UXO) clearance required to be undertaken before construction commences. Once these are completed, construction will commence with site preparation activities. Site preparation may include boulder clearance, sandwave clearance and seabed preparation activities. This section then goes on to describe the offshore infrastructure that will be constructed within the Mona Array Area and Mona Offshore Cable Corridor and Access Areas following the completion of the site preparation activities. The offshore infrastructure will include: wind turbines, OSPs, foundations, inter-array cables, interconnector cables, offshore export cables, and scour and cable protection. This section also describes the aids to navigation and safety practices that the Applicant will adopt.

3.5.2 Pre-construction site investigation surveys

3.5.2.1 Pre-construction site investigation surveys will be undertaken to provide detailed information on seabed conditions, morphology and geology layers, and to identify the presence/absence of any potential obstructions or hazards. Pre-construction site investigation surveys are likely to include geophysical and geotechnical surveys which will be conducted within, and in the vicinity of, the footprint of the Mona Array Area and Mona Offshore Cable Corridor and Access Areas. Geophysical survey works will be carried out to provide detailed UXO, bedform and boulder mapping, bathymetry, a topographical overview of the seabed and an indication of sub-layers. Geotechnical surveys will be conducted at specific locations within the Mona Array Area and Mona Offshore Cable Corridor and Access Areas.

3.5.2.2 The geophysical site investigation is anticipated to include the following activities which are commonly undertaken as best practice for offshore wind farms. Frequencies and sound levels for sonar equipment has been included:

- Multi-Beam Echosounder (MBES) (200 to 500 kHz; 180 to 240 dB re 1 μPa)
- Sidescan Sonar (SSS) (200 to 700 kHz; 216 to 228 dB re 1 μPa)
- Single Beam Echosounder (SBES) (200 to 400 kHz; 180 to 240 dB re 1 μPa)
- Sub-Bottom Profilers (SBP) (0.2 to 14 kHz chirp, 2 to 7 kHz pinger; 200 to 240 chirp dB re 1 μPa, 200 to 235 pinger (both) dB re 1 μPa)
- Ultra-High Resolution Seismic (UHRS) (0.05 to 4 kHz; 170 to 200 dB re 1 μPa)
- Magnetometer.

3.5.2.3 The geotechnical site investigation is anticipated to include the following activities which are commonly undertaken as best practice for offshore wind farms:

- Boreholes
- Cone penetration tests (CPTs)
- Vibrocores.

3.5.3 Unexploded Ordnance clearance

3.5.3.1 It is possible that UXO may be encountered during the construction of offshore infrastructure. This poses a health and safety risk where it coincides with the planned location of infrastructure and associated vessel activity and therefore it is necessary to survey for, and manage, potential UXO (pUXO). In order to identify UXO, detailed surveys of the location where infrastructure will be located are required. This work cannot be conducted before a consent application is submitted because the detailed design work needed to confirm the location of infrastructure is reliant upon the pre-construction site investigation surveys outlined in paragraph 3.5.2.1. In addition, the survey for identification of pUXO must be undertaken within approximately one year ahead of the start of construction as UXO surveys are only valid for one year due to the potential for hydrodynamics to uncover UXO that may not be detected in pre-application surveys. The Applicant commissioned a study to establish the potential for UXO presence at the Mona Offshore Wind Project. Based on the results of this study and a conservative estimate, the design envelope for UXO clearance is described in Table 3.2. Furthermore, a range of UXO sizes is predicted with the Net Explosive Quantity (NEQ) ranging between 25 kg to 907 kg, with 130 kg being the most likely maximum.

Table 3.2: UXO across the Mona Array Area and Mona Offshore Cable Corridor and Access Areas.

Parameter	UXO
Potential UXO as constraints to operations	3,183
Potential UXO requiring inspection	310
Percentage Potential UXO to Confirmed UXO	7.5%
Total UXO predicted to require clearance	22

3.5.3.2 The Mona Offshore Wind Project will submit a UXO clearance method statement, confirmation of UXO for clearance and confirmation that clearance does not coincide with archaeology/sensitive seabed features to the regulator pre-construction once UXO surveys are complete, all of which are secured within the DCO and expected to be secured with the standalone NRW marine licence.

Methodology

3.5.3.3 UXO targets identified during the pre-construction site investigation surveys will be investigated to determine if they are UXO. If they are classified as a UXO, they can either be cleared or avoided. UXO may be avoided through micrositing of infrastructure, cleared through *in-situ* clearance or recovery of the UXO for disposal at an alternate location. The method of clearance will depend on factors such as the condition of the UXO and will be subject to the UXO clearance contractors' safety assessment.

3.5.3.4 There are a number of methodologies that may be used to clear UXO targets, including detonation of the UXO using an explosive counter-charge placed next to the UXO on the seabed (referred to as a 'high order' technique) or methods that neutralise the UXO to be safe without detonation (referred to as 'low order' techniques). These low order techniques include 'deflagration' which involves the use of a small charge to 'burn out' the explosive material without detonation.

3.5.3.5 The use of the low order techniques is dependent on the condition of the UXO and individual circumstances. Furthermore, the Applicant will not know what condition a UXO is in until it is investigated through the pre-construction site investigation surveys. Therefore, whilst the use of low order techniques is a potentially viable solution for clearance of UXO, it is not possible to make a commitment to using them at this stage as it will not be known whether it is a feasible option.

3.5.4 Site preparation activities

Boulder clearance and out of service cables

3.5.4.1 Boulder clearance is commonly required during site preparation for installation of offshore wind farm infrastructure. Boulders would pose the risk of damage and exposure to cables as well as an obstruction risk to the foundation and cable installation equipment. Therefore, boulders may be picked up one by one and moved to the side of the Mona Offshore Cable Corridor and Access Areas or removed using a plow where boulders will be pushed out of the way. All boulders will remain in the marine environment.

3.5.4.2 The pre-application site-specific geophysical surveys have identified that boulder clearance may be required in the vicinity of the foundation locations, along the inter-array cables, interconnector cables and offshore export cables. Boulder clearance would occur within the footprint of other installation activities therefore the footprint is not presented to prevent double counting of the seabed footprint parameters.

3.5.4.3 If the final location of the Mona Offshore Wind Project infrastructure crosses any out of service cables, these will be removed where feasible. Any cable removal will be undertaken in consultation with the asset owner and in accordance with the International Cable Protection Committee (ICPC) guidelines (2011). Where feasible, cables will be retrieved to a vessel deck, where one end will be cut, the cable will be pulled past the crossing point, and then cut again before being pulled to the surface where it will be removed from site by the vessel.

Sandwave clearance for cables, and sandwave clearance and/or seabed preparation for foundations

3.5.4.4 In some areas within the Mona Array Area and along the Mona Offshore Cable Corridor and Access Areas, existing sandwaves and similar bedforms may need to be removed before cables and foundations are installed. Many of the cable installation tools require a stable, flat seabed surface in order to perform as it may not be possible to bury the cable up or down a slope over a certain angle. In addition, the cables must be buried to a depth where they can be expected to stay buried for the duration of the lifetime of the Mona Offshore Wind Project. Sandwaves are generally mobile in nature therefore cables must be buried beneath the level where natural sandwave movement could uncover them. Wind turbine foundations need to be placed in level, pre-prepared areas of seabed. This can only be achieved by removing the existing sandwaves and similar bedforms before installation takes place.

3.5.4.5 Site-specific geophysical data from the Mona Array Area and bathymetry data were used to identify sandwaves and it was determined that up to 50% of the inter-array cables, 60% of the interconnector cables and 20% of the total length of the offshore export cables would require sandwave clearance. Site-specific geophysical data from the Mona Array Area and bathymetry data identified that up to 50% of foundation locations may require sandwave clearance. UXO and boulder clearance will also be required. These activities are discussed earlier in this section. Additional seabed preparation may be required for gravity base foundations, including dredging of the soft sediments. If dredging is required, it would be carried out by dredging vessels using suction hoppers (dredging ships able to suck sand, clay, silt and gravel) or similar.

3.5.4.6 The MDS for sandwave clearance and seabed preparation in the Mona Array Area is summarised in Table 3.3~~Table 3.3~~. The MDS for sandwave clearance and seabed preparation for foundations is based on the four-legged suction bucket foundation option as they have the greatest seabed preparation requirements (foundation options are further described in section 3.5.8).

3.5.4.7 The MDS for sandwave clearance in the Mona Offshore Cable Corridor and Access Areas is summarised in Table 3.4~~Table 3.4~~. It should be noted that boulder clearance will occur over the same location as the sandwave clearance. The corridor width for boulder clearance is less than is required for sandwave clearance therefore boulder clearance represents repeat disturbance to the seabed.

3.5.4.8 The MDS for sandwave clearance width (and therefore associated sandwave clearance area) has been reduced from the 104 m proposed at PEIR to 80 m for both the inter-array and interconnector cables, and from the 104 m proposed at PEIR to 40 m for the offshore export cables. In addition, the percentage of the export cable length requiring sandwave clearance has been reduced from 70% as presented in the PEIR to 20%. The reduction in the sandwave clearance reduces potential impacts on several receptors associated with the following chapters:

- Volume 2, Chapter 1: Physical processes of the Environmental Statement
- Volume 2, Chapter 2: Benthic subtidal and intertidal ecology of the Environmental Statement
- Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement
- Volume 2, Chapter 9: Marine archaeology of the Environmental Statement
- Volume 2, Chapter 10: Other sea users of the Environmental Statement.

3.5.4.9 It is expected that material subject to seabed preparation activities will be deposited in the vicinity of where it was were removed. A dredging and disposal site characterisation for the disposal of seabed preparation material has been presented in the Mona Array Site Characterisation Report (Document Reference J19) and the Mona Offshore Cable Corridor Site Characterisation Report (Document Reference J20) submitted with the application for consent. The dredging site will be within either the Mona Array Area or the Mona Offshore Cable Corridor and Access Areas.

Table 3.3: Maximum design parameters for sandwave clearance and seabed preparation within the Mona Array Area.

Parameter	Maximum design parameters
Maximum sandwave clearance impact width – inter-array and interconnector (m)	80
Maximum sandwave clearance: Inter-array cables (m^3)	4,188,876
Maximum sandwave clearance: Interconnector cables (m^3)	432,000
Maximum sandwave clearance and seabed preparation: Foundations (m^3)	8,416,621
Maximum sandwave clearance and seabed preparation: Total in Mona Array Area (sum of the inter-array cable + interconnector cables + foundations) (m^3)	13,037,497 (4,188,876 + 432,000 + 8,416,621)

Table 3.4: Maximum design parameters for sandwave clearance in the Mona Offshore Cable Corridor and Access Areas.

Parameter	Maximum design parameters
Maximum sandwave clearance impact width per circuit (m)	40
Maximum length of offshore export cables affected by sandwaves (m)	72,000
Maximum sandwave clearance – total (m^3)	1,504,000

3.5.5 Wind turbines

Design

3.5.5.1 The Mona Offshore Wind Project will consist of up to 96 wind turbines, with the final number of wind turbines dependent on the capacity of the individual wind turbines used, and environmental and engineering survey results. Wind turbines with a range of generating capacities are being considered and are differentiated in the EIA as scenario 1 and 2 (Table 3.5). These two scenarios represent the largest possible difference of wind turbine numbers, between the minimum possible amount and the maximum possible amount. The final total of wind turbines could also be between these values. These scenarios have been chosen as they represent the scenario with the smallest, most numerous wind turbines (scenario 1), and the scenario with the largest, least numerous wind turbines (scenario 2). However, the physical parameters which form the basis of the MDS, such as maximum tip height or rotor diameter, will dictate the wind turbines that are ultimately installed, rather than these be limited by the maximum power ratings of individual turbines. The wind turbines will follow the traditional wind turbine design with a horizontal rotor axis with three blades connected to the nacelle of the wind turbine. The nacelle will be supported by a tower structure which is fixed to the transition piece and foundation. An illustration of this design can be seen in Figure 3.3 and a picture of an offshore wind turbine at the EnBW Hohe See Offshore Wind Farm is shown in Figure 3.4.

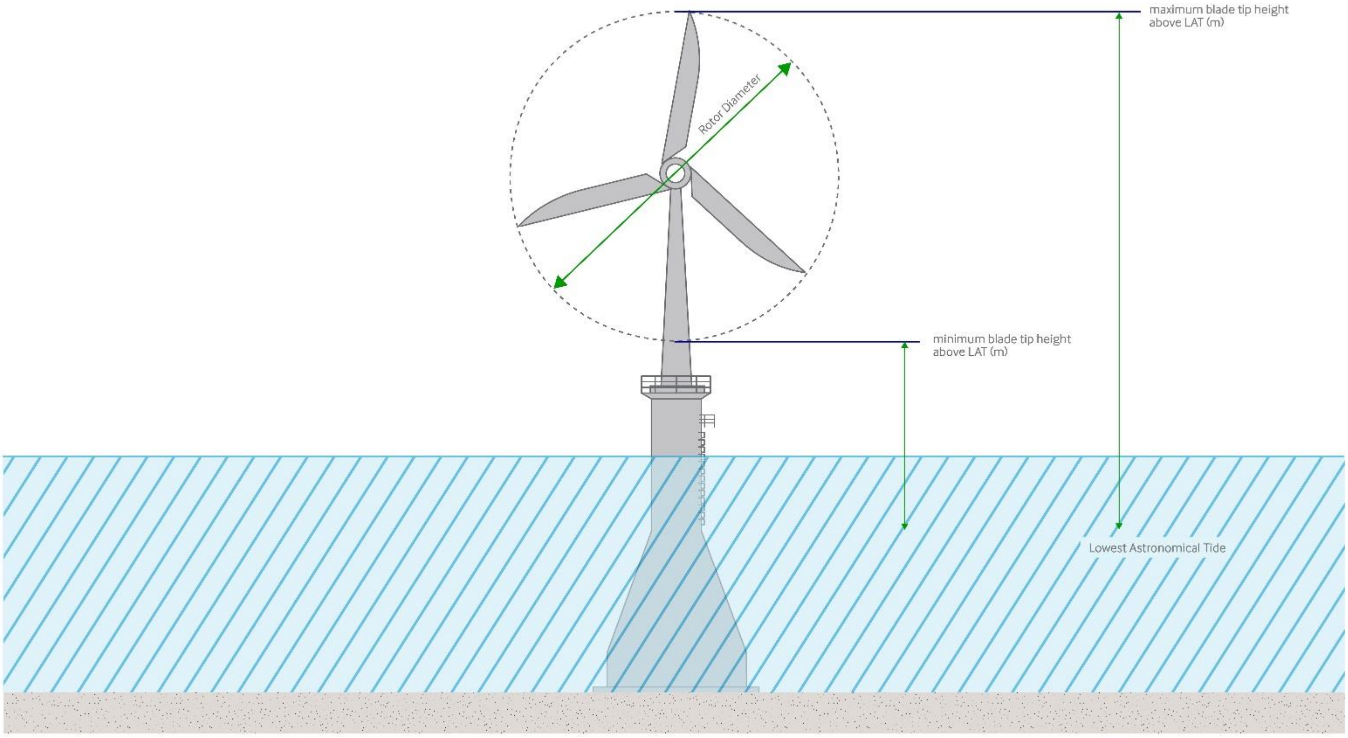

Figure 3.3: Schematic of an offshore wind turbine.

Figure 3.4: A picture of a wind turbine at the EnBW Hohe See Offshore wind farm in the German North Sea.

3.5.5.2 The MDS for wind turbines presented in Table 3.5 shows the scenarios being considered.

Table 3.5: Maximum design parameters: wind turbines.

Parameter	Scenario 1	Scenario 2
Maximum number of turbines	96	68
Minimum height of lowest blade tip above Lowest Astronomical Tide (LAT) (m)	34	34
Maximum blade tip height above LAT (m)	293	364
Maximum rotor blade diameter (m)	250	320

3.5.5.3 The maximum blade tip height has been increased from 324 m proposed in the PEIR. The increase in the maximum blade tip height increases potential impacts on several receptors associated with the following chapters:

- Volume 2, Chapter 5: Offshore Ornithology of the Environmental Statement
- Volume 2, Chapter 8: Seascape and visual resources of the Environmental Statement
- Volume 3, Chapter 3: Aviation and radar of the Environmental Statement.

3.5.5.4 Although, when considered alongside the reduction in the Mona Array Area and the reduced number of wind turbines, this increase in maximum blade tip height does not increase the significance of any potential effects.

Installation

3.5.5.5 Generally, wind turbines are installed using the following process:

1. Wind turbine components may be collected from a port in the UK, Europe or elsewhere and loaded onto barges or dedicated transport vessels at port and transported to the Mona Array Area. Generally, blades, nacelles and towers for a number of wind turbines are loaded separately onto the vessel
2. Wind turbine components will be installed onto the existing foundations by an installation vessel. Each wind turbine will be assembled on site. The exact methodology for the assembly is dependent on the wind turbine type and installation contractor and will be defined in the pre-construction phase. Jack-Up Vessels (JUVs) are often used to ensure a stable platform for installation vessels when on site. JUVs are assumed to have up to six legs with an area of 350 m^2 per foot.

3.5.5.6 The total duration for wind turbine installation is expected to be a maximum of nine months within a 24 month window.

3.5.5.7 Each installation vessel or barge may be assisted by a range of support vessels. These are typically smaller and may comprise of tugs, guard vessels, anchor handling vessels, or similar. These vessels will primarily shadow the same movements as the installation vessels they are supporting. For the purposes of the EIA, the assumptions in Table 3.6~~Table 3.6~~ have been made on the maximum number of installation and support vessels and the number of return trips to the Mona Array Area from port that are required throughout wind turbine installation. These numbers have been used to inform the assessment within Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement.

Table 3.6: Maximum design parameters for the wind turbines installation.

Vessel type	Maximum number of vessels on site at any one time	Maximum number of return trips per vessel type over the construction period
Installation and support vessels	4	76
Survey vessels	1	12
Crew Transfer Vessels (CTVs)	4	365
Helicopter support	2	365

3.5.6 Wind turbine and surface infrastructure layouts

3.5.6.1 The layout of the wind turbines will be developed to best utilise both the available wind resource and suitability of seabed conditions, while seeking to minimise potential environmental effects and impacts on other marine users (such as fisheries and shipping routes). The Mona Offshore Wind Project will be developed on the basis of the principles set out in Table 3.7.

- The minimum separation distance between offshore surface structures (wind turbines and OSPs) has increased from 1,000 m between rows of offshore surface structures and 875 m between each offshore surface structure in a row as presented in the PEIR to a minimum of 1,400 m both within and between rows.. The increase in the minimum separation distance, together with the reduction in the Mona Array Area (see section 3.3.1) and the reduction in the maximum number of turbines (see section 3.3.3), reduces potential impacts on several receptors including, but not limited to, those associated with the following chapters:
- Volume 2, Chapter 6: Commercial fisheries of the Environmental Statement
- Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement
- Volume 4, Chapter 3: Socio-economics of the Environmental Statement
- Volume 4, Chapter 4: Human health assessment of the Environmental Statement.

3.5.6.2 In order to inform the EIA, the Applicant has identified indicative layout scenarios which are presented in the relevant topic-specific chapters of the Environmental Statement. However, the final layout of the wind turbines and OSPs will be confirmed through the design plan submitted to NRW for approval in consultation with Maritime and Coastguard Agency (MCA) and Trinity House prior to commencement of construction offshore and secured within the deemed marine licence (dML) in the Draft DCO (Document Reference C1) submitted with the application for development consent and expected to be secured in the standalone NRW marine licence.

Table 3.7: Layout development principles.

Principle	Definition	How the principle is secured
Principle 1	All offshore surface structures (wind turbines and OSPs) will be located within the Mona Array Area. No blade overfly or structural overhang is permitted, therefore all wind turbines must be positioned at least half a rotor diameter inside the boundary of the Mona Array Area.	Location of offshore surface structures within the array area are secured in schedule 1, part 1 of the Draft DCO (Document Reference C1), within the dML in the Draft DCO (Document Reference C1) and expected to be secured within the standalone NRW marine licence.
Principle 2	There will be a minimum separation of 1,400 m within and between rows of offshore surface structures unless the requirements of Principles 5 and, or 6 are required to be applied.	The minimum separation distance of 1,400 m is secured as an offshore parameter in requirement 2 of Schedule 2 of the draft DCO, within the dML in the Draft DCO (Document Reference C1) and expected to be secured within the standalone NRW marine licence.
Principle 3	The final wind turbine layout will provide for two lines of orientation as a minimum.	Secured within the dML in the Draft DCO (Document Reference C1) and expected to be secured within the standalone NRW marine licence.
Principle 4	Search and Rescue (SAR) access lanes shall be allowed for and shall be a minimum of 500 m wide, measured from the perimeter of any offshore surface structure. In the case of wind turbines, SAR lanes will be measured from the blade tips that are transverse to the wind turbine. SAR lanes will cross the Mona Array Area on the same bearing until the edge of the Mona Array Area or until a Helicopter Refuge Area is reached in accordance with the recommendations for layouts in Marine Guidance Note (MGN) 654.	The minimum separation of 1,400m (Principle 2) will provide for sufficient room for SAR Access lanes. Development post-consent of a wind turbine layout in accordance with the recommendations for layout contained in MGN654 and its annexes is secured within the dML in the Draft DCO (Document Reference C1and expected to be secured within the standalone NRW marine licence.
Principle 5	For all offshore surface structure positions, the tolerance allowance will be ~~25~~5 m, centred on the nominal offshore surface structure position whilst still complying with Principle 4.	Secured within the dML in the Draft DCO (Document Reference C1) and expected to be secured within the standalone NRW marine licence.
Principle 6	For all offshore surface structures, the micrositing allowance will be ~~100~~50 m, centred on the nominal offshore surface structure position whilst still complying with Principle 4 and can be additive to the tolerance allowance of ~~25~~5 m in Principle 5.	Secured within the dML in Schedule 14 of the Draft DCO (Document Reference C1) and expected to be secured within the standalone NRW marine licence.
Principle 7	Packed boundaries are permitted, that is, wind turbines on the perimeter of the Mona Array Area maintain minimum spacing whilst internal spacing can be greater. The minimum spacing shall be compliant with Principle 2.	Not secured as MGN654 allows for layouts which include perimeter turbines with smaller spacing that internal turbines.
Principle 8	Where SAR access lanes are more than approximately 10 nm, a Helicopter Refuge Area perpendicular to the SAR Access Lanes will be included within the layout design as recommended in MGN654. The Helicopter Refuge Area shall be at least 1 nm (tip to tip) in width and allow access across the Mona Array Area as recommended in MGN654.	Development post-consent of a wind turbine layout in accordance with the recommendations for layout contained in MGN654 and its annexes is secured within the dML in the Draft DCO (Document Reference C1) and expected to be secured within the standalone NRW marine licence.

Principle	Definition	How the principle is secured
Principle 9	Wind turbines will be laid out in rows with a roughly north to south orientation.	Secured within the outline fisheries liaison and co-existence plan (FLCP) submitted with the application (document reference: J13). The dML in the Draft DCO (Document Reference C1) secures submission if a FLCP in accordance with the outline FLCP (Document Reference J13) prior to commencement of offshore construction. The need for a FLCP is also expected to be secured within the standalone NRW marine licence.

3.5.7 Offshore Substation Platforms

3.5.7.1 The OSPs will contain the equipment required to transform electricity generated at the wind turbines to a higher voltage for transportation onshore. They may also house auxiliary equipment and facilities for operating, maintaining and controlling the substation. They are likely to have one or more decks, a helicopter platform, cranes and communication antenna (Figure 3.5).

3.5.7.2 OSPs may have electric vessel charging equipment (e.g. for electric SOVs or CTVs). Up to two OSPs would have up to two charging cables each. With the aid of a remotely operated telescopic crane or a similar device, electric vessels would collect a power cable messenger line and then move a safe distance from the OSPs before fully deploying and connecting the charging cable to commence charging operations.

Figure 3.5: OSP at the EnBW Hohe See Offshore Wind Farm in the German North Sea.

3.5.7.3 Up to four separate OSPs will be required, and they will all be located within the Mona Array Area. The exact locations will be determined during the post-consent detailed design phase. Locations will take into account the ground conditions and the most efficient cable routing, amongst other considerations. They will follow the layout principles set out in Table 3.7. The OSPs once commissioned will be subject to regular operations and maintenance visits.

3.5.7.4 The maximum design parameters for the OSPs are presented in Table 3.8 and a schematic of an OSP is presented in Figure 3.6.

Table 3.8: Maximum design parameters for the OSPs.

Parameter	Maximum design parameters
Maximum number of OSPs	4
Topside – maximum main structure length (m)	80
Topside – maximum main structure width (m)	60
Topside – maximum height (excluding helideck or lightning protection) (LAT) (m)	70
Maximum height of lightning protection and ancillary structures (LAT) (m)	95
Topside – maximum area (m^2) (length x width)	4,800 (80 x 60)

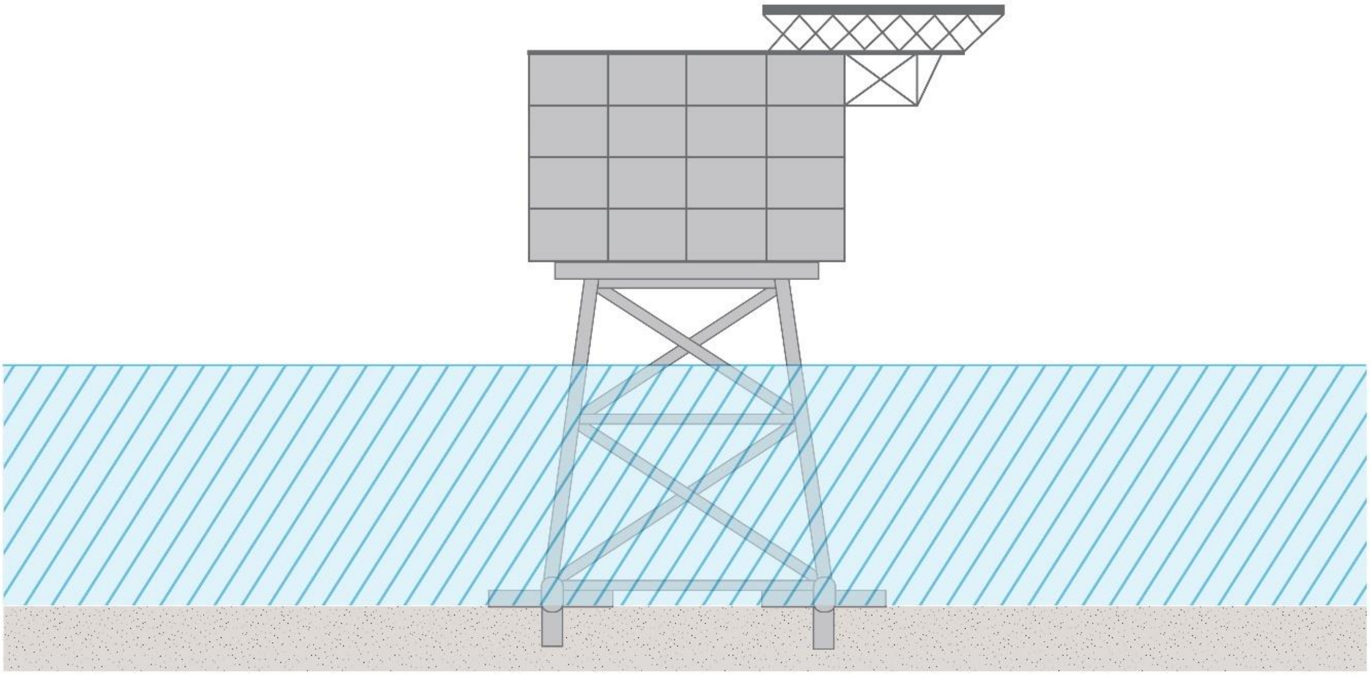

Figure 3.6: Schematic of an OSP.

Installation

3.5.7.5 OSPs are generally constructed by installing the foundation structure, then the topside will be lifted from a transport vessel/barge or floated over onto the foundation. The foundation and topside may be transported on the same transport vessel/barge, or separately. The vessel requirements for OSP installation are presented in Table 3.9.

Table 3.9: Maximum design parameters for the OSP installation.

Parameter	Maximum number of vessels on site at any one time	Maximum number of return trips per vessel type over the construction period
Primary installation and support vessels	9	45
Tug/anchor handlers	2	10
Survey vessels	1	3
Seabed preparation vessels	1	2
CTVs	2	40
Scour protection installation vessels	1	1
Helicopters	2	365

3.5.8 Foundations for wind turbines and OSPs

3.5.8.1 The wind turbines and OSPs will be attached to the seabed by foundation structures. The Applicant requires flexibility in foundation choice to ensure that anticipated changes in available technology can be accommodated within the Mona Offshore Wind Project final design. The foundation types that are being considered for the Mona Offshore Wind Project are shown in Table 3.10~~Table 3.10~~.

3.5.8.2 The PEIR included monopiles as a design option for turbines and OSPs, however monopiles have now been removed from the design envelope. The removal of the monopile foundations will reduce the potential impacts on several receptors associated with the following chapters:

- Volume 2, Chapter 3: Fish and shellfish of the Environmental Statement
- Volume 2, Chapter 4: Marine mammals of the Environmental Statement
- Volume 5, Annex 3.1: Underwater sound technical report of the Environmental Statement.

3.5.8.3 The foundations will be fabricated offsite, stored at a suitable port facility and transported to site by sea (see paragraph 3.5.5.5 *et seq*.). Specialist vessels transport and install foundations. Scour protection (typically rock) may be required on the seabed and will be installed before and/or after foundation installation (see paragraph 3.5.8.21 *et seq*.).

Table 3.10: Foundation options for wind turbines and OSPs.

	Wind turbines	OSPs
Maximum number of structures	96	4
Pin piled three-legged Jacket	Yes	Yes
Pin piled four-legged Jacket	Yes	Yes
Pin piled six-legged Jacket	No	Yes
Suction bucket three-legged Jacket	Yes	Yes
Suction bucket four-legged Jacket	Yes	Yes
Suction bucket six-legged Jacket	No	Yes
Gravity base	Yes	Yes

Piled jacket foundations

Design

3.5.8.4 Piled jacket foundations are formed of a steel lattice construction which is secured to the seabed by driven and/or drilled pin piles attached to the jacket feet. The transition piece and foundation structure are fabricated as an integrated part of the jacket. The Mona Offshore Wind Project may use either six-legged (for OSPs only), four-legged or three-legged piled jacket foundations. An example of a pin piled jacket is shown in Figure 3.7.

3.5.8.5 As the seabed in some sections of the Mona Array Area may be unsuitable for piling to be used as the installation technique, if piled jacket foundations are used for the Mona Offshore Wind Project, a maximum of 64 of the maximum number (96) of wind turbines would be installed using piled jackets. The remainder would be installed using suction bucket jackets or gravity base foundations.

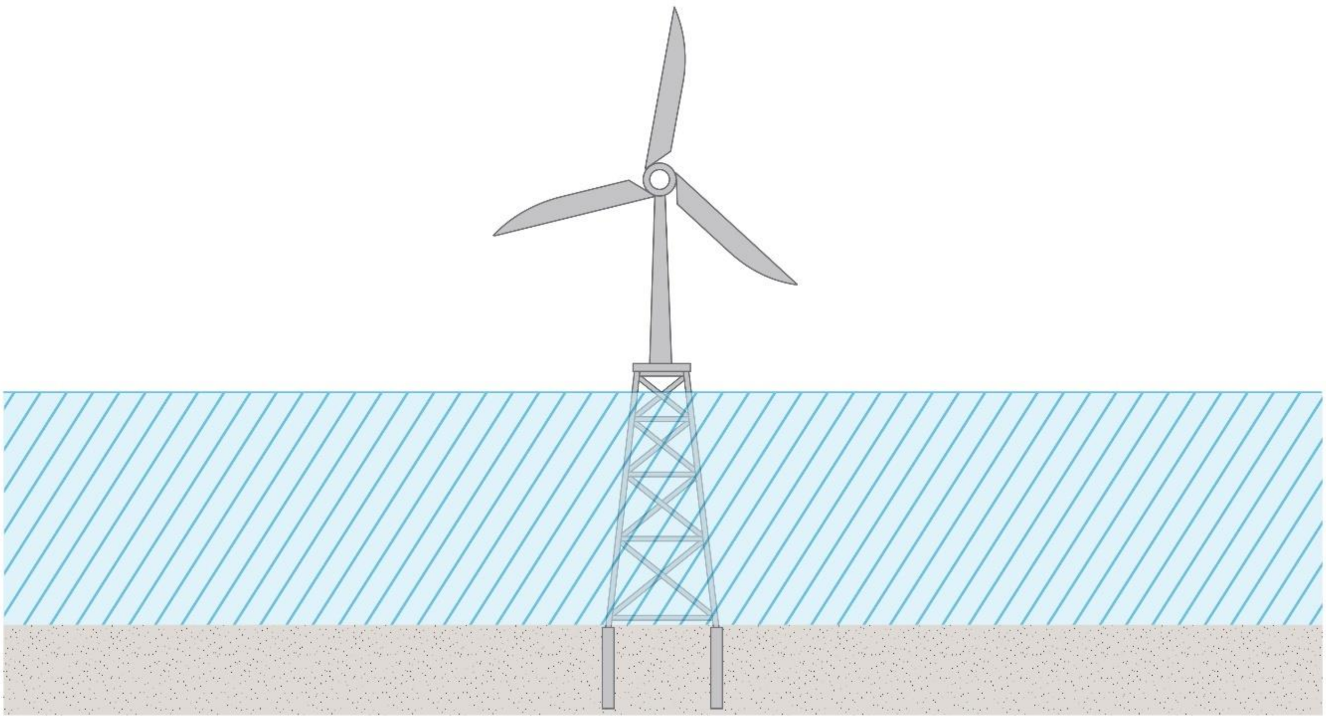

Figure 3.7: Schematic of a pin pile jacket foundation.

3.5.8.6 The maximum design parameters for jacket foundations with pin piles are shown in Table 3.11 and Table 3.12.

Table 3.11: Maximum design parameters for jacket foundations with pin piles - wind turbines.

Parameter	Maximum design parameter
Maximum number of jacket foundations	64 of a total of 96 foundation locations, with the other 32 installed using suction bucket jackets or gravity base foundations
Maximum number of legs per foundation	4
Maximum number of piles per leg	1
Maximum separation of adjacent legs at seabed level (m)	50
Maximum separation of adjacent legs at LAT (m)	40
Maximum leg diameter (m)	5
Maximum pin pile diameter (m)	5.5
Maximum embedment depth (below seabed) (m)	75
Maximum hammer energy (kJ)	4,400 at a maximum of 16 foundation locations, with all other wind turbine foundation piling locations limited to a maximum hammer energy of 3,000 kJ
Maximum seabed area – per foundation (m^2)	85
Maximum seabed area – scour protection per foundation (m^2)	6,188
Maximum seabed area – total foundations and scour protection for all foundations with jacket foundations with pin piles (m^2)	284,360
Maximum scour protection volume for all foundations with jacket foundations with pin piles (m^3)	701,272
Maximum total drill arisings for all foundations with jacket foundations with pin piles (m^3)	174,892

Table 3.12: Maximum design parameters for jacket foundations with pin piles - OSPs.

Parameter	Maximum design parameter
Maximum number of jacket foundations	4
Maximum number of legs per foundation	6
Maximum number of piles per leg	3
Maximum separation of adjacent legs at seabed level (m)	70
Maximum separation of adjacent legs at LAT (m)	50
Maximum leg diameter (m)	5
Maximum pin pile diameter (m)	5.5
Maximum embedment depth (below seabed) (m)	75

Parameter	Maximum design parameter
Maximum hammer energy (kJ)	4,400
Maximum seabed area – per foundation (m^2)	428
Maximum seabed area – scour protection per foundation (m^2)	8,406
Maximum seabed area – total foundations and scour protection for all foundations with jacket foundations with pin piles (m^2)	10,745
Maximum scour protection volume for all foundations with jacket foundations with pin piles (m^3)	25,731
Maximum total drill arisings for all foundations with jacket foundations with pin piles (m^3)	37,926

Installation of piled jacket foundations

3.5.8.7 The pin piles are driven and/or drilled into the seabed, relying on the frictional and end bearing properties of the seabed for support. Up to two vessels may be piling and two other vesselsor drilling simultaneously, with concurrent piling being undertaken at a maximum distance of 15 km between locations. Drill arisings will be disposed of in the vicinity of the source (Included within the offshore construction method statement that is secured within the deemed marine licence in the draft DCO and expected to be secured within the standalone NRW marine licence). The maximum duration for wind turbine foundation installation across the Mona Array Area would be 12 months within a 24 month window. The modelled piling scenario (see Volume 5, Annex 3.1: Underwater sound technical report of the Environmental Statement) for pin piles assumes a maximum 6.5 hour duration per pile.

3.5.8.8 The maximum hammer energy for the Mona Offshore Wind Project is 4,400 kJ for pin piles. The hammer energy may only be raised to 4,400 kJ at a maximum of 16 foundation locations, with all other piling locations being limited to a maximum hammer energy of 3,000 kJ, an approach informed by pre-application geophysical and geotechnical surveys and studies. Although a maximum hammer energy of 4,400 kJ is considered as the MDS, the actual energy used when piling is likely to be significantly lower for the majority of the time. The hammer energy will only be raised to 4,400 kJ when absolutely necessary. Hammer energies will start at 320 kJ for the soft start phase and gradually increase to the optimum energy level required to install the pile, which is typically less that the maximum hammer energy.

3.5.8.9 Owing to the removal of monopiles from the foundation options, the maximum hammer energy has been reduced from 5,500 kJ presented in the PEIR. The change in maximum hammer energy will influence the potential impacts on several receptors associated with the following chapters:

- Volume 2, Chapter 3: Fish and shellfish of the Environmental Statement
- Volume 2, Chapter 4: Marine mammals of the Environmental Statement
- Volume 5, Annex 3.1: Underwater sound technical report of the Environmental Statement.

3.5.8.10 The pin piles may be installed before or after the jacket is installed on the seabed. If they are installed first, a piling template is positioned onto the seabed to guide the pin-piles to the required locations. The piles are then installed through the template, which is recovered to the installation vessel. If the pin piles are installed after the jacket has been placed on the seabed then a piling template is not required. The transition piece may include ancillary components (e.g. boat landing facilities, ladders and a crane) as well as the connection to the wind turbine tower.

3.5.8.11 The details of the vessel movements and numbers of trips required are presented in Table 3.13.

3.5.8.12 The seabed preparation is described in section 3.5.3, the maximum design parameters for which are presented in Table 3.3~~Table 3.3~~.

Table 3.13: Vessel and helicopter requirements for gravity base, piled jacket and suction bucket jacket foundation installation.

Vessel type	Maximum number of vessels on site at any one time	Maximum number of return trips per vessel type over the construction period
Installation and support vessels	9	400
Tug/anchor handler	6	64
Guard vessels	1	50
Survey vessels	2	12
Seabed preparation vessels	2	12
CTVs	4	365
Scour protection installation vessels	2	40
Helicopters	3	365

Suction bucket jacket foundations

Design

3.5.8.13 Suction bucket jacket foundations are formed with a steel lattice construction fixed to the seabed by suction buckets installed below each leg of the jacket. The suction buckets are typically hollow steel cylinders, capped at the upper end, which are fitted underneath the legs of the jacket structure. The suction buckets do not require a hammer or drill for installation. The transition piece and foundation structure are fabricated as an integrated part of the jacket structure and are not installed separately offshore. An example of a suction bucket jacket is shown in Figure 3.8. The maximum design parameters for jacket foundations with suction buckets are presented in Table 3.14 and Table 3.15.

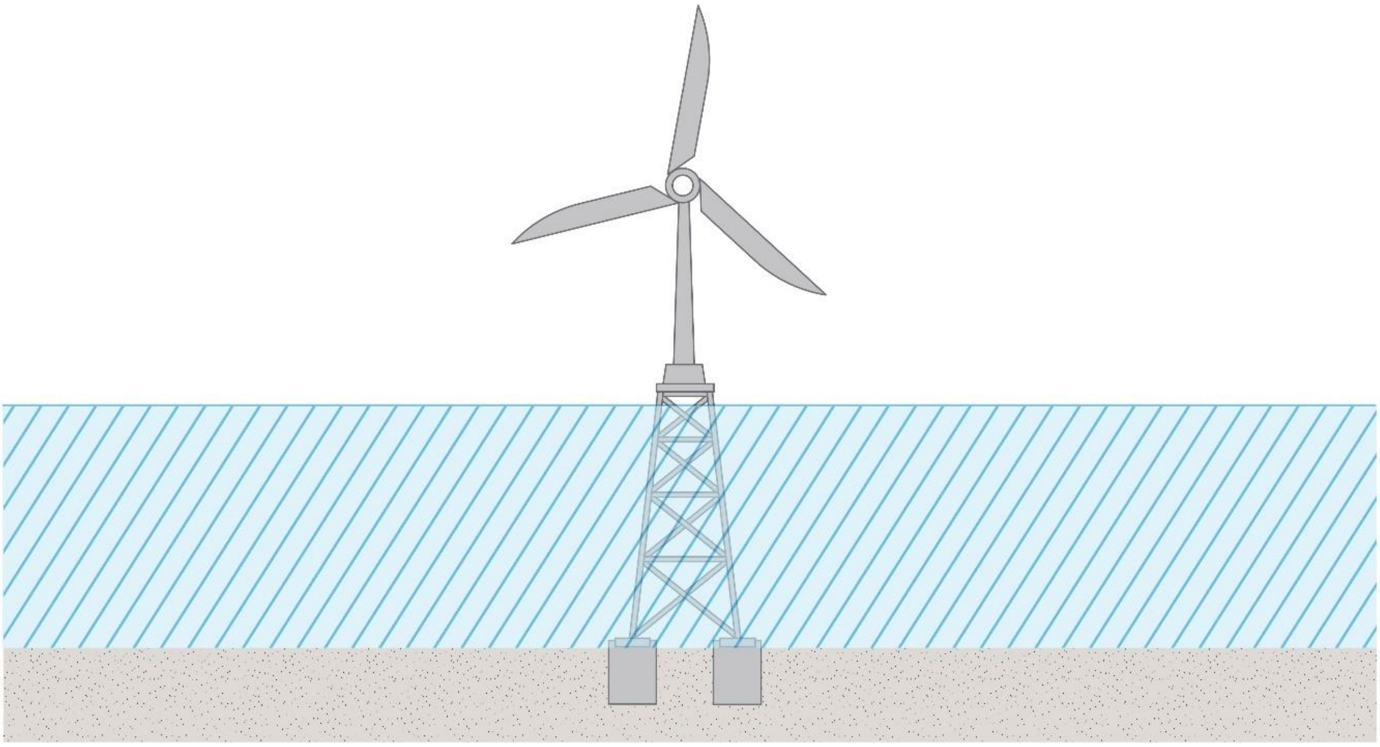

Figure 3.8: Schematic of a suction bucket jacket foundation.

Installation of a suction bucket jacket foundation

3.5.8.14 The suction bucket jacket will be transported to site by sea, as described in section 3.5.5. The suction bucket jacket foundation will then be lifted by the installation vessel using a crane and lowered towards the seabed in a controlled manner. When the steel bucket reaches the seabed, a suction pump system fitted on a trunk (which is itself fitted on the bucket lid) will be powered to suck water out of each bucket. The bucket will then be pressed down into the seabed by the resulting suction force. When the bucket has penetrated the seabed to the desired depth, the pump is turned off. A layer of grout is then injected through the grouting system fitted on or under the bucket to fill the air gap and ensure contact between the soil within the bucket, and the underside of the bucket lid itself.

3.5.8.15 The seabed preparation is described in section 3.5.3. The vessel movements for the installation are presented in Table 3.13.

Table 3.14: Maximum design parameters for jacket foundations with suction buckets - wind turbines.

Parameter	Maximum design parameter
Maximum number of jacket foundations	96
Maximum number of legs per foundation	4
Maximum suction bucket diameter (m)	18
Maximum suction bucket depth (m)	25
Maximum separation of adjacent legs at seabed level (m)	50
Maximum separation of adjacent legs at LAT (m)	35

Parameter	Maximum design parameter
Maximum seabed area per foundation (m^2)	804
Maximum seabed area – scour protection per foundation (m^2)	10,012
Maximum seabed area – total foundations and scour protection for all foundations with suction bucket jackets (m^2)	735,488
Maximum scour protection volume for all foundations with suction bucket jackets (m^3)	1,701,998

Table 3.15: Maximum design parameters for jacket foundations with suction buckets - OSPs.

Parameter	Maximum design parameter
Maximum number of jacket foundations	4
Maximum number of legs per foundation	6
Maximum suction bucket diameter (m)	18
Maximum suction bucket depth (m)	25
Maximum separation of adjacent legs at seabed level (m)	70
Maximum separation of adjacent legs at LAT (m)	50
Maximum seabed area - per foundation (m^2)	1,527
Maximum seabed area – scour protection per foundation (m^2)	13,502
Maximum seabed area – total for all foundations and scour protection with suction bucket jackets (m^2)	24,964
Maximum scour protection volume for all foundations with suction bucket jackets (m^3)	56,252

Gravity base foundations

Design

3.5.8.16 Gravity base foundations are generally made of concrete with steel reinforcements, or steel alone, and consist of a base, a conical structure and a smaller cylindrical top (generally called the shaft) which can be made of steel and connected to the lower concrete conical structure. This shape provides support and stability to the wind turbine or OSP. If the scenario of one OSP is taken forward, a rectangular gravity base foundation may be used (Figure 3.10). The gravity base foundation would be ballast weighted built around a rectangular support structure with up to six legs and would only be used for one OSP. Gravity base foundations could also include skirts that embed into the seabed under the weight of the structure to improve the natural stability and scour resistance of the foundation. Ancillary structures (e.g. ladders) may be attached to the gravity base foundation or the transition piece and are usually made of steel but may be made of another metal. The main structure is filled with ballast, commonly sand, rock (such as olivine) or iron ore. Example of gravity base foundations are shown in Figure 3.9~~Figure 3.9~~ and Figure 3.10.

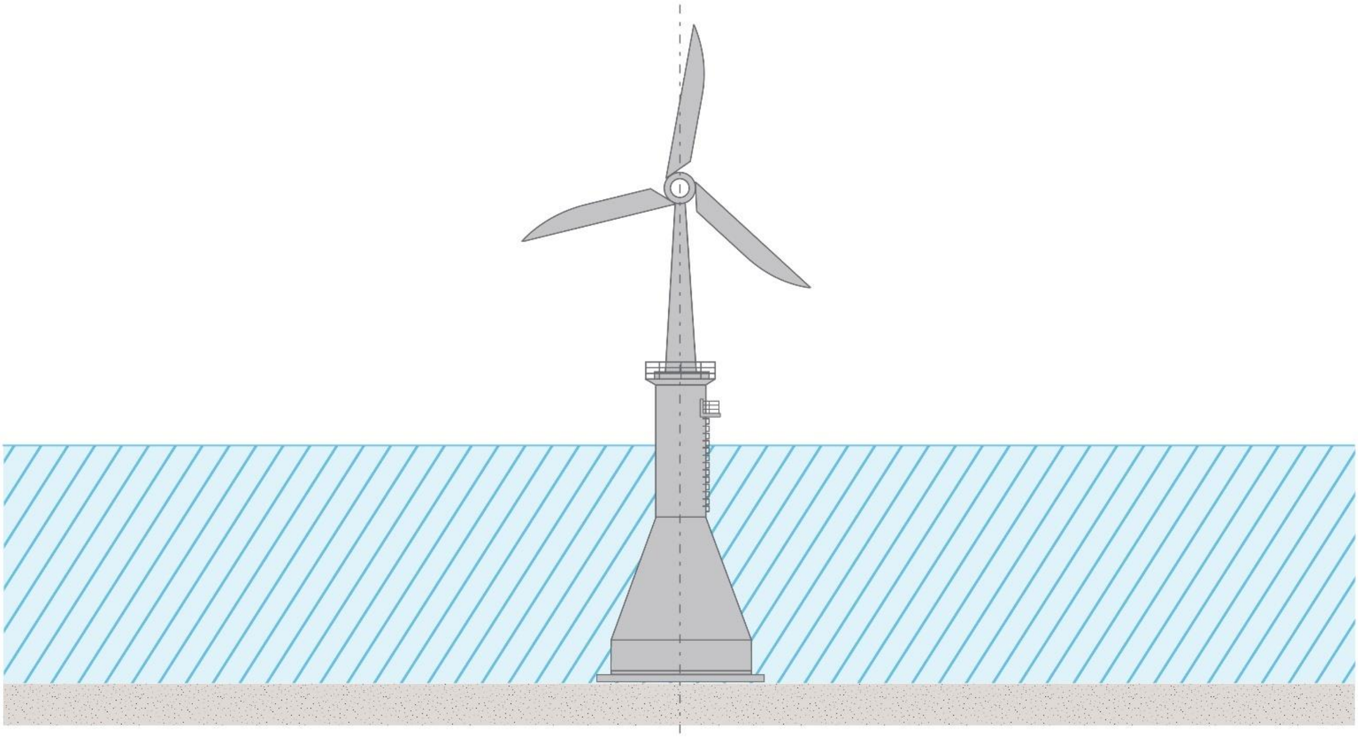

Figure 3.9: Schematic of a gravity base foundation.

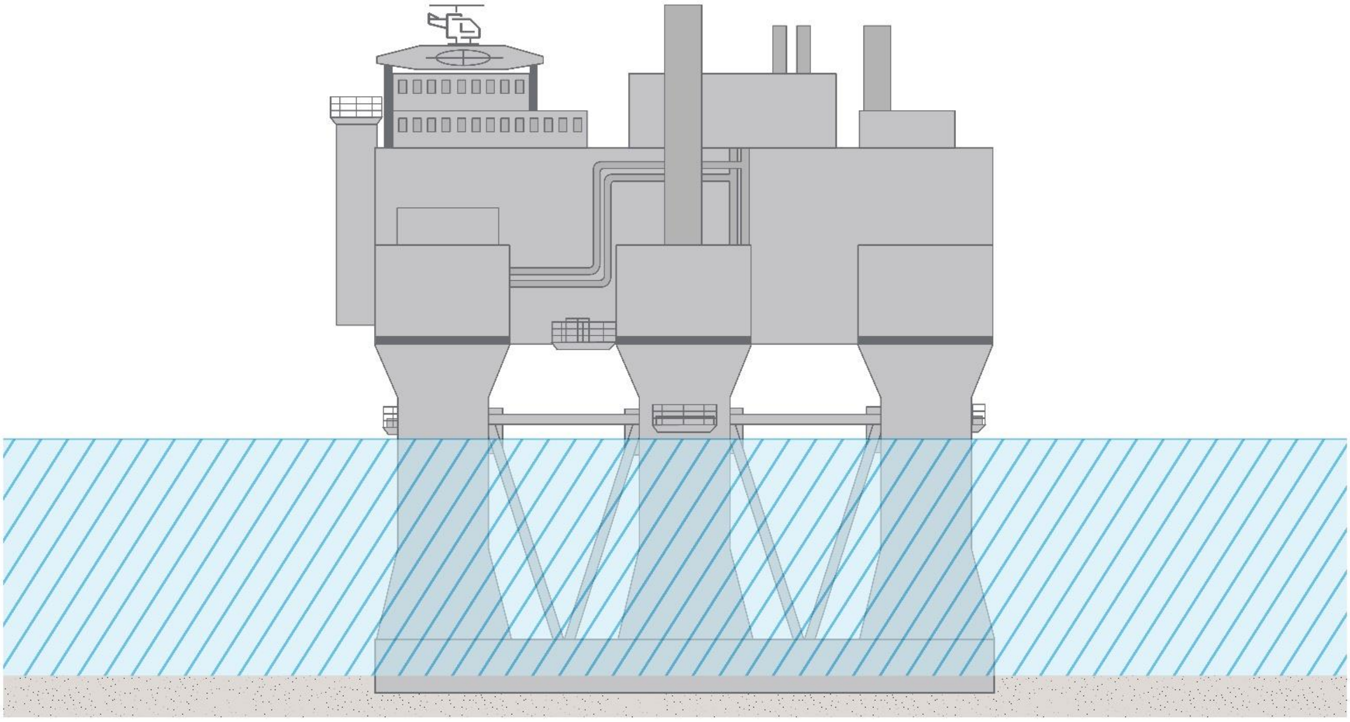

Figure 3.10: Schematic of a rectangular gravity base foundation (only used for the single OSP scenario).

3.5.8.17 The maximum design parameters for gravity base foundations for wind turbines are shown in Table 3.16, with the maximum design parameters for gravity base foundations for OSPs shown in Table 3.17. In some locations, the seabed will need to be strengthened for the installation of the gravity base foundations. This can be done either with piles (Figure 3.11) or suction buckets (Figure 3.12). These systems will be completely underneath and within the footprint of the foundation. Only a maximum of ten foundations may require ground strengthening.

Table 3.16: Maximum design parameters for gravity base foundations – wind turbines.

Parameter	Maximum design parameters
Maximum total number of structures (gravity base)	96
Maximum structural diameter at sea surface (m)	15
Maximum structural diameter at seabed (base slab) (m)	49
Maximum caisson diameter (m)	37
Maximum Transition Piece diameter (m)	15
Maximum number of piles per structure potentially requiring ground strengthening	15
Maximum pin pile diameter (m)	4
Maximum hammer energy (kJ)	3,000
Maximum number of suction buckets per gravity base structure, in the scenario where ground strengthening is required	6
Maximum suction bucket diameter (m)	15
Maximum suction bucket depth (m)	15
Maximum seabed area – per structure per foundation (m^2)	1,886
Maximum seabed area – scour protection per foundation (m^2)	5,665
Maximum seabed area – total foundations and scour protection for all foundations with gravity base foundations (m^2)	612,084
Maximum total scour protection volume for all foundations with gravity base foundations (m^3)	1,432,275

Table 3.17: Maximum design parameters for gravity base foundations – OSPs.

Parameter	Maximum design parameters
Maximum total number of structures (gravity base)	4
Maximum structural diameter at sea surface (for conical shape) (m)	20
Maximum structural diameter at seabed (base slab) (for conical shape) (m)	80
Maximum structural diameter at sea surface (for rectangular shape) (m)	80

Parameter	Maximum design parameters
Maximum structural diameter at seabed (base slab) (for rectangular shape) (m)	100
Maximum caisson diameter (m)	70
Maximum Transition Piece diameter (m)	20
Maximum number of piles per structure potentially requiring ground strengthening	15
Maximum pin pile diameter (m)	4
Maximum hammer energy (kJ)	3,000
Maximum number of suction buckets per structure potentially requiring ground strengthening	6
Maximum suction bucket diameter (m)	15
Maximum suction bucket depth (m)	15
Maximum number of suction buckets per structure requiring ground strengthening	6
Maximum seabed area – per structure per foundation (m^2)	5,027
Maximum seabed area – scour protection per foundation (m^2)	13,600
Maximum seabed area – total foundations and scour protection for all foundations with gravity base foundations (m^2)	24,941
Maximum total scour protection volume for all foundations with gravity base foundations (m^3)	58,361

Installation

3.5.8.18 Gravity base foundations can be either transported by a vessel or barge to site, or self-floated and being pulled by tugs. Lowering at location will be supported by self-flooding of the gravity base foundation with seawater, assisted by a suitable crane from a heavy lift vessel to the seabed. Seabed preparation might be necessary in terms of levelling and/or stabilising the upper soil layer, which is described in section 3.5.3. After the gravity base foundation is installed, it will be ballasted with a suitable material before finally the transition piece will be installed on top. The suitable material may include the following:

- Dredged sand from seabed preparation at gravity base foundation locations within the Mona Array Area
- Gravel
- Rock
- Crushed concrete
- Aggregate
- High density rocks such as olivine or iron ore.

3.5.8.19 The method to be used is dependent on the final gravity base design and the installation method would be confirmed following final design post-consent. The transition piece that is lifted on top of the gravity base may be either installed on site or installed prior to the transportation of the gravity base foundation.

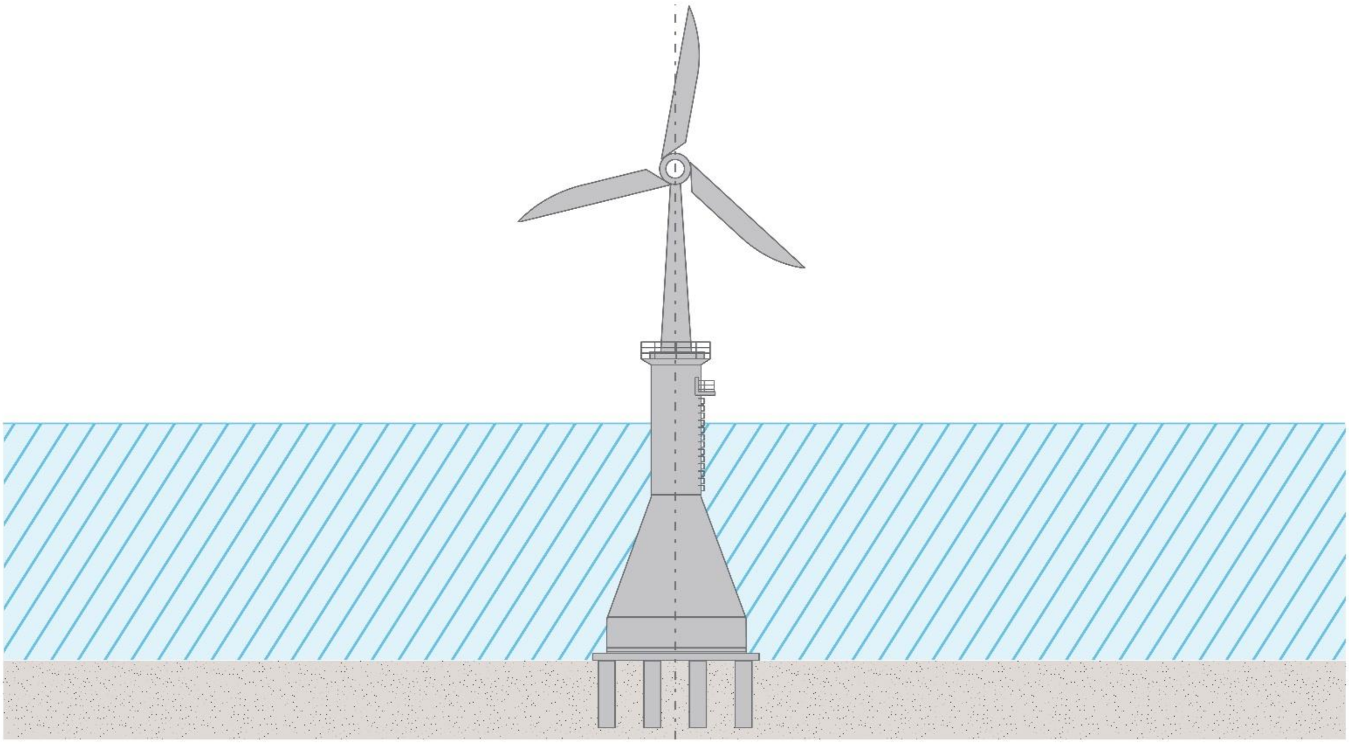

Figure 3.11: Schematic of a gravity base foundation with piled ground strengthening.

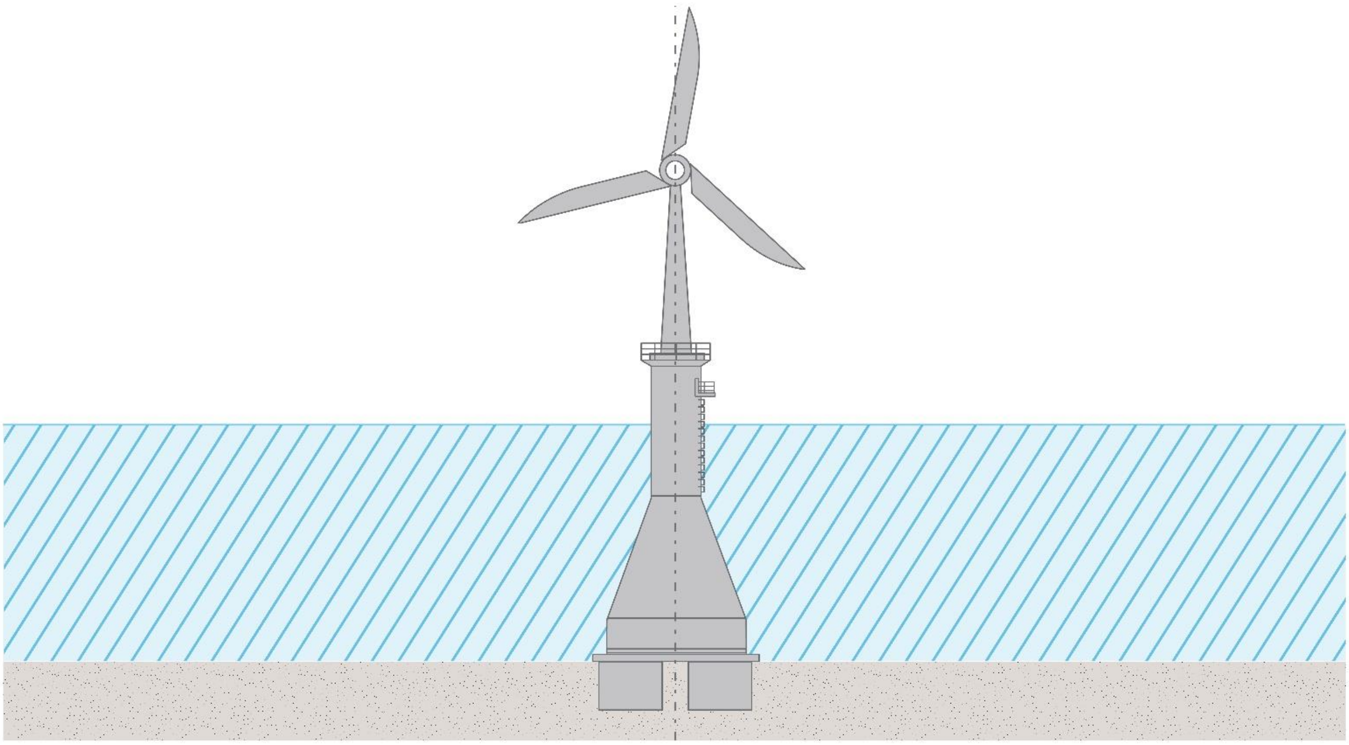

Figure 3.12: Schematic of a gravity base foundation with suction bucket ground strengthening.

3.5.8.20 The seabed preparation is described in section 3.5.3. The vessel movements for the installation are presented in Table 3.13.

Scour protection for foundations

3.5.8.21 Foundation structures for wind turbines and OSPs are at risk of seabed erosion and 'scour hole' formation due to natural hydrodynamic and sedimentary processes. The shape of the foundation structure is an important parameter influencing the potential depth of scour hole formation. Scour protection may be employed to mitigate scour around foundations. Several types of scour protection are under consideration, they are described below and presented in Figure 3.13:

- Rock: either layers of graded stones placed on and/or around structures to inhibit erosion or rock filled mesh fibre bags which adopt the shape of the seabed/structure as they are lowered on to it
- Concrete mattresses: several metres wide and long, cast of articulated concrete blocks which are linked by a polypropylene rope lattice which are placed on and/or around structures to stabilise the seabed and inhibit erosion
- Artificial fronds mattresses: mats typically several metres wide and long, composed of continuous lines of overlapping buoyant fronds made of either polypropylene or alternative materials that create a drag barrier which prevents sediment in their vicinity being transported away. The frond lines are secured to a polyester webbing mesh base that is itself secured to the seabed by a weighted perimeter or anchors pre-attached to the mesh base. Seabed Scour Control Systems (SSCS) Frond Mats installed in the North Sea in 1984 remain in place today and have required no maintenance since being deployed, as the mats are designed not to degrade with time (SSCS, 2022). The final design of these frond mattresses will be selected post-consent and consulted upon with NRW as part of the Offshore construction method statement secured within the deemed marine licence in the draft DCO and expected to be secured within the standalone NRW marine licence.

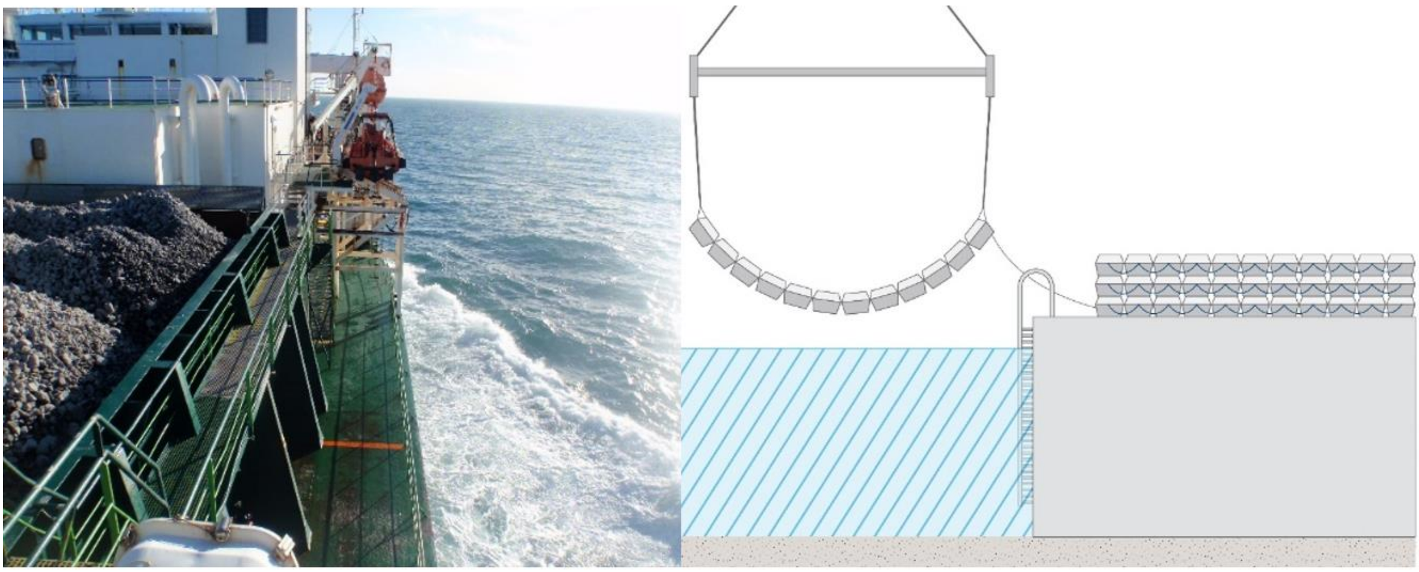

Figure 3.13: Illustrative scour protection types (Left: delivery of rock to EnBW's Hohe See offshore wind farm; Right: concrete mattresses).

3.5.8.22 The amount of scour protection required will vary for the different foundation types being considered for the Mona Offshore Wind Project. Scour protection parameters for the different foundations being considered are presented Table 3.11, Table 3.14 and Table 3.16.

3.5.8.23 The final choice and detailed design of the scour protection will be made after detailed design of the foundation structure, taking into account a range of aspects including geotechnical data, meteorological and oceanographic data, water depth, foundation type and maintenance strategy. The Draft DCO submitted with the application for consent secures the requirement to submit information on scour protection management and cable protection management including details of the need, type, sources, quantity and installation methods for scour protection and cable protection to the Licensing Authority prior to commencement of offshore construction.

3.5.9 Inter-array cables

3.5.9.1 Inter-array cables carry the electrical current produced by the wind turbines to an OSP. A small number of wind turbines will typically be grouped together on the same cable 'string' connecting those wind turbines to the OSP, and multiple cable 'strings' will connect back to each OSP.

Design

3.5.9.2 The maximum design parameters for inter-array cables are presented in Table 3.18.

Table 3.18: Maximum design parameters for inter-array cables.

Parameter	Maximum design parameters
Maximum cable diameter (mm)	300
Maximum total length of cable (km)	325
Maximum voltage (kV)	132

Installation

3.5.9.3 The inter-array cables will be buried below the seabed wherever possible and protected with a hard-protective layer (such as rock or concrete mattresses) where adequate burial is not achievable. Possible installation methods include ploughing, trenching and jetting whereby the seabed is opened and the cable laid within the trench. Pre-trenching or post-lay burial methods may be used, or alternatively the approach of simultaneous lay and burial using a tool towed behind the installation vessel. The installation method will be defined post consent based on a Cable Burial Risk Assessment (CBRA) (or similar) taking into account environmental and human considerations such as trawling and vessel anchors. Figure 3.14 shows an example of inter-array installation. Typically the cable will be buried between 0.5 to 6 m. A CBRA will inform cable burial depth, dependent on ground conditions as well as external risks. This assessment will be undertaken post-consent. The target burial depth, depending on the outcome of the CBRA, is 2 m. Details for cable specification, installation and monitoring will be set out in the offshore Construction method statement which is secured within the deemed marine licence in the draft DCO and expected to be secured within the standalone NRW marine licence.

3.5.9.4 The Applicant may also need to undertake seabed preparation within the Mona Array Area prior to installation of inter-array cables in order to level sandwaves and clear boulders on the inter-array cable routes. This is discussed in section 3.5.3.

3.5.9.5 Inter-array cables may be installed before wind turbine or OSP foundations are installed. In such cases, the inter-array cables will be installed to their final position up to a point close to the wind turbine or OSP locations. The cables will be cut, and their loose ends will be laid on the seabed with a standard cable recovery system and covered with cable protection material. At a later moment in time (not anticipated to mean more than maximum one year), those cable ends will be retrieved/uncovered and connected to the wind turbines and/or OSPs. This would only apply to a small proportion of the overall cable length and would be done within the overall footprint of seabed disturbance assessed for inter-array cables.

3.5.9.6 Inter-array cables will need to be protected where the route crosses obstacles such as exposed bedrock, pre-existing cables or pipelines that mean the cable cannot be buried. Cable protection methods include rock placement (rock protection), concrete mattresses, fronded mattresses and rock bags. Up to 10% of the total inter-array cable length may require protection due to ground conditions (this excludes cable protection due to cable crossings, the parameters for which are set out in Table 3.22). The maximum design parameters for inter-array cable installation are presented in Table 3.19. The cable protection methods being considered are described below. No more than 5% reduction in water depth (referenced to Chart Datum) will occur at any point on the cable route without prior written approval from the Licensing Authority. This commitment will be included in the offshore Construction method statement which is secured within the deemed marine licence in the draft DCO and expected to be secured within the standalone NRW marine licence.

Figure 3.14: Example of inter-array cable installation at the EnBW Hohe See Offshore Wind Farm construction site in the German North Sea.

Table 3.19: Maximum design parameters for inter-array cable installation-cable protection.

Parameter	Maximum design parameters
Installation methodology	Prelay plough, plough, trenching and jetting
Target burial depth (m)	2 (Dependent on CBRA [a])
Maximum width of seabed affected by installation per cable (m)	20
Maximum duration: total (months)	12 months during a 24 month period
Maximum seabed disturbance – total for installation (m^2)	6,500,000
Maximum height of cable protection (m)	3
Maximum width of cable protection (m)	10
Maximum percentage of route requiring protection (%)	10
Maximum cable protection area (m^2) (length of cable requiring protection x cable protection width)	325,000 (32.5 km x 10 m)
Maximum cable protection volume (m^3)	487,500
Maximum number of crossings	67
Maximum cable/pipe crossings: total impacted area (m^2) (footprint of each crossing x total number of crossings)	192,960 (2,880 m^2 x 67)
Cable/pipe crossings: maximum cable protection volume (m^3)	385,920

Mattress placements

3.5.9.7 Concrete mattresses are constructed using high strength concrete blocks and U.V. stabilised polypropylene rope. Mattresses provide protection from direct anchor strikes but are not able to protect from anchor drag. The mattresses are lowered to the seabed from an installation vessel and once the correct position is confirmed, a frame release mechanism is triggered and the mattress is deployed on the seabed. This single mattress installation is repeated for the length of cable that requires protection. The mattresses may be gradually layered in a stepped formation on top of each other dependant on expected scour. Mattresses with sloped edges would be deployed to reduce the potential for fishing gear to snag the edges of the mattresses.

3.5.9.8 Table 3.19 shows the details for the cable protection required for inter-array cables and Table 3.20 shows the envelope for vessel movements associated with inter-array cable installation.

Table 3.20: Maximum design parameters for inter-array cable installation vessel requirements.

Parameter	Maximum number of vessels on site at any one time	Maximum number of return trips per vessel type over the construction period
Cable lay and support vessels	7	56
Survey vessels	2	4
Seabed preparation vessels	5	5
CTVs	2	365
Cable protection installation vessels	2	2

3.5.10 Aids to navigation, colour, marking and lighting

3.5.10.1 The Mona Offshore Wind Project will be designed and constructed in accordance with relevant guidance from:

- Trinity House (2016) (Provision and Maintenance of Local Aids to Navigation Marking Offshore Renewable Energy Installations)
- Civil Aviation Authority (CAA) (2016) Civil Aviation Publication (CAP) 764 Policy and Guidelines on Wind Turbines
- Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) (2021) (Recommendation G1162 on the Marking of Man-Made Offshore Structures)
- MCA (2018) (Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for Search and Rescue and Emergency Response).

3.5.10.2 The Aids to navigation management plan will be submitted to NRW on consultation with Trinity House for approval prior to commencement of offshore construction. The Aids to navigation management plan is secured with the DCO and expected to be secured within the standalone NRW marine licence.

3.5.10.3 Appropriate lighting, in line with MCA (2018) guidance, will ensure the offshore structures are visible for search and rescue and emergency response procedures. In addition, Mona Offshore Wind Project lighting will conform to the following:

- Red, medium intensity aviation warning lights (of variable brightness between a maximum of 2000 candela (cd)) to a minimum of 10% of the maximum which would be 200 cd) will be located on either side of the nacelle of significant peripheral wind turbines. These lights will flash simultaneously with a Morse W flash pattern and will also include an infra-red (IR) component
- All aviation warning lights will flash synchronously throughout the Mona Array Area and be able to be switched on and off by means of twilight switches (which activate when ambient light falls below a pre-set level)
- Aviation warning lights will allow for reduction in lighting intensity at and below the horizon when visibility from every wind turbine is more than 5 km (to a minimum of 10% of the maximum (i.e. 200 cd))

- SAR lighting of each of the non-periphery turbines will be combi IR/200 cd steady red aviation hazard lights, individually switchable from the control centre at the request of the MCA (i.e. when conducting SAR operations in or around the Mona Array Area)
- All wind turbines will be fitted with a low intensity light for the purpose of helicopter winching (green hoist lamp). All wind turbines will also be fitted with suitable illumination (minimum one 5 cd light) for ID signs
- Marine navigational lights will be fitted at the platform level on Significant Peripheral Structures (SPS). These lights will be synchronized to display simultaneously an IALA 'special mark' characteristic, flashing yellow, with a range of not less than 5 nm.

3.5.10.4 The location of all infrastructure (including wind turbines, OSPs, and cables) will be communicated to the UK Hydrographic Office (UKHO) so that they can be incorporated into Admiralty Charts and the Notice to Mariners procedures. These locations will also be provided to the Defence Geographic Centre (DGC).

3.5.10.5 Appropriate lighting and marking will be included in the Aids to navigation management plan which is secured with the DCO and expected to be secured within the standalone NRW marine licence.

3.5.11 Safety zones

3.5.11.1 During construction and decommissioning, some restrictions on vessel movements within the Mona Array Area and the Mona Offshore Cable Corridor will be required to protect the health and safety of all users of the sea. The Applicant will apply for a 500 m safety zone around all infrastructure that is actively under construction. Safety zones of 50 m will be applied for vessels not associated with the Mona Offshore Wind Project around incomplete structures for which construction activity may be temporarily paused (and therefore the 500 m safety zone is no longer applicable) such as installed foundations without wind turbines or where construction works are completed but the Mona Offshore Wind Project has not yet been commissioned. The Applicant will also apply for rolling advisory exclusion zones of 500 m to be present around vessels installing inter-array cables, interconnector cables and offshore export cables, all of which are be outlined in the Safety zone statement (Document Reference J.6). Temporary restrictions to fishing activity and/or anchoring, will also be required in areas where full cable burial to target depth has not yet been achieved and/or surface-laid cable exists (prior to cover by external cable protection). In such areas of temporarily shallow buried/surface-laid cable, the restricted areas will be monitored by guard vessels.

3.5.11.2 During the operations and maintenance phase, the Applicant may apply for a 500 m safety zone for infrastructure undergoing major maintenance works (for example a blade replacement). Further information regarding the Safety Zones which the Applicant intends to apply for post consent will be outlined in the Safety zone statement (Document Reference J.6) (to be provided with the application for consent).

3.5.11.3 Guard vessels will be used during the construction and the operations and maintenance phases of the Mona Offshore Wind Project as necessary.

3.5.12 Ancillary works

3.5.12.1 Ancillary works will form part of the final design of the Mona Offshore Wind Project, however, the precise specifications and numbers of these will be determined at the detailed design phase. Ancillary works may include:

- Temporary landing places, moorings or other means of accommodating vessels in the construction and/or maintenance of the Mona Offshore Wind Project
- Buoys, beacons, fenders and other navigational warning or ship impact protection works.

3.5.12.2 Buoys would be required across the Mona Array Area and Mona Offshore Cable Corridor and Access Areas and could include:

- Up to 30 light buoys and marker buoys (cardinal buoys), although the final number will be determined by Maritime and Coastguard Agency (MCA)/Trinity House requirements
- Up to three LiDAR buoys
- Other buoys including waverider buoys, buoys for potential noise monitoring, wave measurement buoys, and mooring buoys for transportation vessels.

3.5.12.3 Each buoy would include a lantern suitable for use as a navigational aid.

3.5.12.4 These devices would be attached to the seabed using mooring devices such as common sinkers (small block of heavy material such as concrete and steel) or anchored by means of regular anchors. They could have one single mooring point or several points (usually up to three).

3.5.13 Transmission system

3.5.13.1 The transmission system is used to transport the electricity produced at the wind turbines to the UK National Grid. The electricity is transported from the offshore OSP's, through the offshore and onshore export cables and a number of onshore components. The transmission system is usually designed, paid for and constructed by the wind farm developer (the Applicant), but must be purchased by an Offshore Transmission Operator (OFTO) after the wind farm is constructed in a transaction overseen by the Office of Gas and Electricity Markets (Ofgem).

Circuit description

3.5.13.2 A circuit is an electrical system that allows the flow of electricity from one location to another. Generally, HVAC transmission systems require conductors as part of the electrical circuit to transport the electricity. Offshore, the three conductors of one circuit are usually combined into a single cable. Onshore these three conductors are usually housed within one cable per conductor (i.e. three cables per circuit).

The Mona Offshore Cable Corridor and Access Areas

3.5.13.3 The Mona Offshore Cable Corridor is the corridor between the Mona Array Area and the landfall up to MHWS, in which most of the length of the offshore export cables will be located (the export cables are linked to the OSPs and therefore are partially within the Mona Array Area also). The Mona Offshore Cable Corridor and Access Areas are defined as the same area, plus the area in which the intertidal access areas are located.

3.5.13.4 The Mona Offshore Cable Corridor and Access Areas can be seen in Figure 3.2, and the maximum design parameters for the Mona Offshore Cable Corridor and Access Areas are presented in Table 3.21. Although the Mona Offshore Cable Corridor and Access Areas have been identified, the exact route of the offshore export cables is yet to be determined and will be based upon geophysical and geotechnical survey information.

Offshore export cables

3.5.13.5 The offshore export cables are used for the transmission of electricity from the OSPs to the landfall and onwards to connect to the onshore National Grid substation. Up to four offshore export cables with a voltage of up to 275 kV will be required for the Mona Offshore Wind Project. Each offshore export cable will also house fibre optic cables for communication. Where possible, the cables will be buried below the seabed to landfall.

3.5.13.6 The Applicant requires flexibility in type, location, depth of burial and protection measures for the offshore export cables to ensure that anticipated physical and technical constraints and changes in available technology can be accommodated within the Mona Offshore Wind Project design.

Table 3.21: Maximum design parameters for the Mona Offshore Cable Corridor and Access Areas and offshore export cables.

Parameter	Maximum design parameters
Maximum number of circuits	4
Maximum voltage (kV)	275
Cable diameter (mm)	350
Maximum length of the Mona Offshore Cable Corridor (km)	90
Maximum width of the Mona Offshore Cable Corridor (km)	1.5
Maximum total length of offshore export cables (km)	360

Installation

3.5.13.7 The offshore export cable installation methodology, as well as the burial depth and any requirement for protection measures, will be defined by a detailed CBRA. The offshore export cables will be buried to a target depth of 1 m with a maximum burial depth of 3 m and a minimum burial depth of 0.5 m. The CBRA will be undertaken post-consent and will inform cable burial depth which will be dependent on ground conditions as well as external risks. The installation techniques being considered include pre-lay plough, plough, trenching, and jetting.

3.5.13.8 Offshore export cables may be installed before the OSPs foundations are installed. In such cases, the offshore export cables will be installed to their final position up to a point close to the OSP locations. The cables will be cut, and their loose ends will be laid on the seabed with a standard cable recovery system and covered with cable protection material. At a later moment in time (not anticipated to mean more than maximum one year), those cable ends will be retrieved/uncovered and connected to the OSPs. This would only apply to a small proportion of the overall cable length and would be done within the overall footprint of seabed disturbance as assessed for offshore export cables.

3.5.13.9 The offshore export cables will require protection where the cable crosses obstacles such as exposed bedrock, pre-existing cables or pipelines that mean the cable cannot be buried. Cable protection methods being considered include rock protection, concrete mattresses, fronded mattresses and rock bags. These are described further below. Cable protection within the Mona Offshore Cable Corridor and Access Areas will have a maximum height of 3 m and width of 10 m, with up to 20% of the total length of export cable requiring cable protection. Within the Menai Straights and Conwy Bay Special Area of Conservation (SAC), the Applicant commits to limit the maximum length of cable to 8.1 km and the maximum height of cable protection to 0.7 m. The percentage of export cable requiring cable protection will not exceed 10% of the total length (approximately 810 m). Additionally, no more than a 5% reduction in water depth (referenced to Chart Datum) will occur at any point along the export cables without prior written approval from the Licensing Authority in consultation with the MCA. These commitments will be included with the offshore construction method statement that is secured within the deemed marine licence in the draft DCO and expected to be secured within the standalone NRW marine licence. This is assessed in Volume 2, Chapter 2: Benthic subtidal and intertidal ecology and Volume 2, Chapter 1: Physical processes of the Environmental Statement.

3.5.13.10 The maximum design parameters for installation of up to four export cables are presented in Table 3.22. The vessel requirements for offshore export cable installation are presented in Table 3.23.

Rock placements

3.5.13.11 Initially small stones are placed over the cable as a covering layer. This provides protection from any impact from larger size rocks, which may then be placed on top of this smaller scale level. Rock placement is often achieved using a vessel with equipment such as a ‘fall pipe’ which allows installation of rock close to the seabed. The length of the rock protection is dependent on the length of cable which is either unburied or has not achieved target depth. For rock protection, the Applicant will use rock that is similar to the rock that occurs naturally in the area.

Mattress placements

3.5.13.12 Concrete mattresses are constructed using high strength concrete blocks and U.V. stabilised polypropylene rope. Mattresses provide protection from direct anchor strikes but are not able to protect from anchor drag. The mattresses are lowered to the seabed from an installation vessel and once the correct position is confirmed, a frame release mechanism is triggered and the mattress is deployed on the seabed. This single mattress installation is repeated for the length of cable that requires protection. The mattresses may be gradually layered in a stepped formation on top of each other dependant on expected scour. Mattresses with sloped edges would be deployed to reduce the potential for fishing gear to snag the edges of the mattresses.

Frond mattresses placements

3.5.13.13 Mats typically several metres wide and long, composed of continuous lines of overlapping buoyant polypropylene fronds that create a drag barrier which prevents sediment in their vicinity being transported away. The frond lines are secured to a polyester webbing mesh base that is itself secured to the seabed by a weighted perimeter or anchors pre-attached to the mesh base. Frond mattresses are installed following the same procedure as general mattress placement operations. The fronds floating in the water column, however, can impede the correct placement of additional mattresses. The fronds are designed with the aim to catch and trap sediment to form protective, localised sand berms. SSCS Frond Mats installed in the North Sea in 1984 remain in place today and have required no maintenance since being deployed, as the mats are designed not to degrade with time (SSCS, 2022). The final design of the frond mattresses will be selected post-consent and consulted upon with NRW through the offshore construction method statement that is secured within the deemed marine licence in the draft DCO and expected to be secured within the standalone NRW marine licence.

Rock bags

3.5.13.14 Prefilled rock bags consist of various sized rocks constrained within a rope or wire netting containment and can be placed above the cables with specialist installation beams. Rock bags are more suited for cable stability or trench/scour-related solutions. The number of rock bags required is dependent on the length of cable which requires protection.

Crossings

3.5.13.15 The Mona Offshore Cable Corridor and Access Areas crosses a number of existing assets, primarily interconnector cables in the Irish Sea. The design of these crossings will be confirmed in agreement with the asset owners, however it is likely that a berm of rock will be placed over the existing asset for protection. The offshore export cable will then be laid across this, at an angle as close to 90 degrees as possible. The offshore export cable will then be covered by a second post lay berm to ensure that the export cable remains protected and in place. The parameters for these crossings are presented in Table 3.22.

Table 3.22: Maximum design parameters for export cable installation and export cable protection.

[a] Typically the cable will be buried between 0.5 to 3 m. A CBRA will inform cable burial depth, dependent on ground conditions as well as external risks. This assessment will be undertaken post-consent.

Parameter	Maximum design parameters
Installation methodology	Prelay plough, plough, trenching and jetting
Target burial depth	1 m. Dependent on CBRA [a]
Maximum width of seabed affected by installation per cable (m)	20
Maximum duration: total (months)	15 months in an 18 month period
Maximum seabed disturbance – total (m^2)	7,200,000
Maximum height of cable protection (m)	3
Maximum height of cable crossing (m)	3
Maximum height of cable protection on a crossing (m) (sum of the height of cable crossing + height of cable protection)	6 (3 + 3)
Maximum width of cable protection (m)	10
Maximum percentage of route requiring protection (%)	20

Parameter	Maximum design parameters
Maximum cable protection area (m^2) (20% of the total length of the export cables)	72,000 (20% of 360 km)
Maximum cable protection volume (m^3)	1,080,000
Maximum number of crossings	~~24~~14
Cable/pipe crossings: maximum total impacted area (m^2) (footprint of each crossing x total number of crossings)	144,000 (6,000 m^2 x 24)
Cable/pipe crossings: maximum cable protection volume (m^3)	108,000

3.5.13.16 The parameters for vessel movements associated with export cable installation are presented in Table 3.23.

Table 3.23: Maximum design parameters for export cables – vessel movements.

Parameter	Maximum number of vessels on site at any one time	Maximum number of return trips per vessel type over the construction period
Cable lay and support vessels	6	40
Guard vessels	1	18
Survey vessels	2	4
Seabed preparation vessels	4	24
CTVs	2	20
Cable protection installation vessels	2	20

Offshore interconnector cables

3.5.13.17 The Mona Offshore Wind Project will require cables to connect the OSPs to each other in order to provide redundancy in the case of cable failure. The interconnector cables will have a similar design and installation process to the offshore export cables and inter-array cables. The parameters for design and installation of the interconnector cables are presented in Table 3.24, Table 3.25 and Table 3.26.

Table 3.24: Maximum design parameters for interconnector cables.

Parameter	Maximum design parameters
Maximum number of cables	3
Maximum total cable length (km)	50
Maximum voltage (kV)	275

Table 3.25: Maximum design parameters for interconnector cable installation and interconnector cable protection.

[a] Typically the cable will be buried between 0.5 to 3 m. A CBRA will inform cable burial depth, dependent on ground conditions as well as external risks. This assessment will be undertaken post-consent.

Parameter	Maximum design parameters
Installation methodology	Prelay plough, plough, trenching and jetting
Target burial depth	1 m. Dependent on CBRA [a]
Maximum width of seabed affected by installation per cable (m)	20
Maximum duration: total (months)	4 months in an 18 month period
Maximum seabed disturbance – total (m^2)	1,200,000
Maximum height of cable protection (m)	3
Maximum width of cable protection (m)	10
Maximum percentage of route requiring protection (%)	20
Maximum cable protection area (m^2)	100,000
Maximum cable protection volume (m^3)	150,000
Maximum number of crossings	10
Cable/pipe crossings: maximum total impacted area (m^2) (length x width x number of crossings)	10,000 (50 m x 20 m x 10)
Cable/pipe crossings: maximum cable protection volume (m^3)	30,000

3.5.13.18 The parameters for vessel movements associated with interconnector cable installation are presented in Table 3.26.

Table 3.26: Maximum design parameters for interconnector cables - vessel requirements.

Parameter	Maximum number of vessels on site at any one time	Maximum number of return trips per vessel type over the construction period
Cable lay and support vessels	7	56
Survey vessels	2	4
Seabed preparation vessels	5	5
CTVs	2	365
Cable protection installation vessels	2	2

3.6 Landfall

3.6.1 Overview

3.6.1.1 The offshore export cables will make landfall in Llanddulas, North Wales. The offshore export cables will be brought under the intertidal area to a location above MHWS where they will be connected to the onshore export cables. The offshore export cables will be connected to the onshore export cables at the onshore Transition Joint Bays (TJBs) which will be located within the Landfall construction compound to the south of A547 (see Figure 3.15) within Work Area No. 10 as shown on the Onshore Works Plan (Document Reference B3).

3.6.1.2 Trenchless techniques will be used to construct the landfall. This commitment means that the export cables will be buried from seaward of MLWS up to the TJB. This method has been selected to avoid potential impacts from the installation of the export cables on the North Wales coastline. This includes avoiding direct physical disruption to the nearshore *Saballeria alveolata* and piddock habitats and avoiding the following onshore receptors:

- NRW coastal defences
- The former Llanddulas Beach landfill
- Wales Coast Path
- North Wales railway line
- A55 North Wales Expressway
- A547
- Gwrych Castle Grade II listed historic boundary wall.

3.6.1.3 The trenchless techniques will also avoid any construction works on Pensarn Beach: support activities, such as monitoring, may be required during the drilling of bores but no heavy construction plant will be required. The vehicles used for the support activities will be limited to 4 x 4s, a tractor and trailer and a JCB. They will be parked at the beach vehicle laydown area (see section 3.7.2.33) and will access the beach during low tide i.e. no vehicles will be routed across the shingle beach. Mobile welfare facilities will be brought to Beach Road for the workers undertaking support activities on Pensarn Beach. The welfare facilities will be parked in a designated area and removed at the end of each day i.e. they will not be parked overnight.

3.6.1.4 Geotechnical site investigations were undertaken in 2022 and 2023 to confirm the technical feasibility of trenchless techniques under the intertidal area. The investigations concluded that trenchless techniques could be used. Further details regarding the investigations are provided in the Outline Landfall Construction Method Statement (Document Reference J26.14).

3.6.1.5 Trenchless techniques include horizontal directional drilling (HDD), direct pipe, thrust bore and microtunnelling. The general principle of the technique involves drilling a bore underneath the surface of the intertidal area: then the duct is placed inside the bore and the export cable is pulled through. After the cable is installed the gap between duct and cable will be grouted. The selection of the preferred method to be used to construct the Landfall will be confirmed during detailed design together with the drill profile, drill depth below ground, bore diameter and duct material.

3.6.1.6 The trenchless technique will have entry pit landward of MHWS and an exit pit seaward of MLWS. The entry pit will be located within the Landfall compound and the exit pit may be located up to 1 km seaward MLWS however the exact locations will be confirmed as part of the detailed design.

3.6.1.7 Subject to the trenchless technique selected, ducts will either be transported by sea to the point of installation or the duct sections will be welded together and installed from the Landfall compound.

3.6.1.8 The maximum design parameters for trenchless techniques at the landfall are presented in Table 3.27Table 3.27 and are based on a maximum of four circuits.

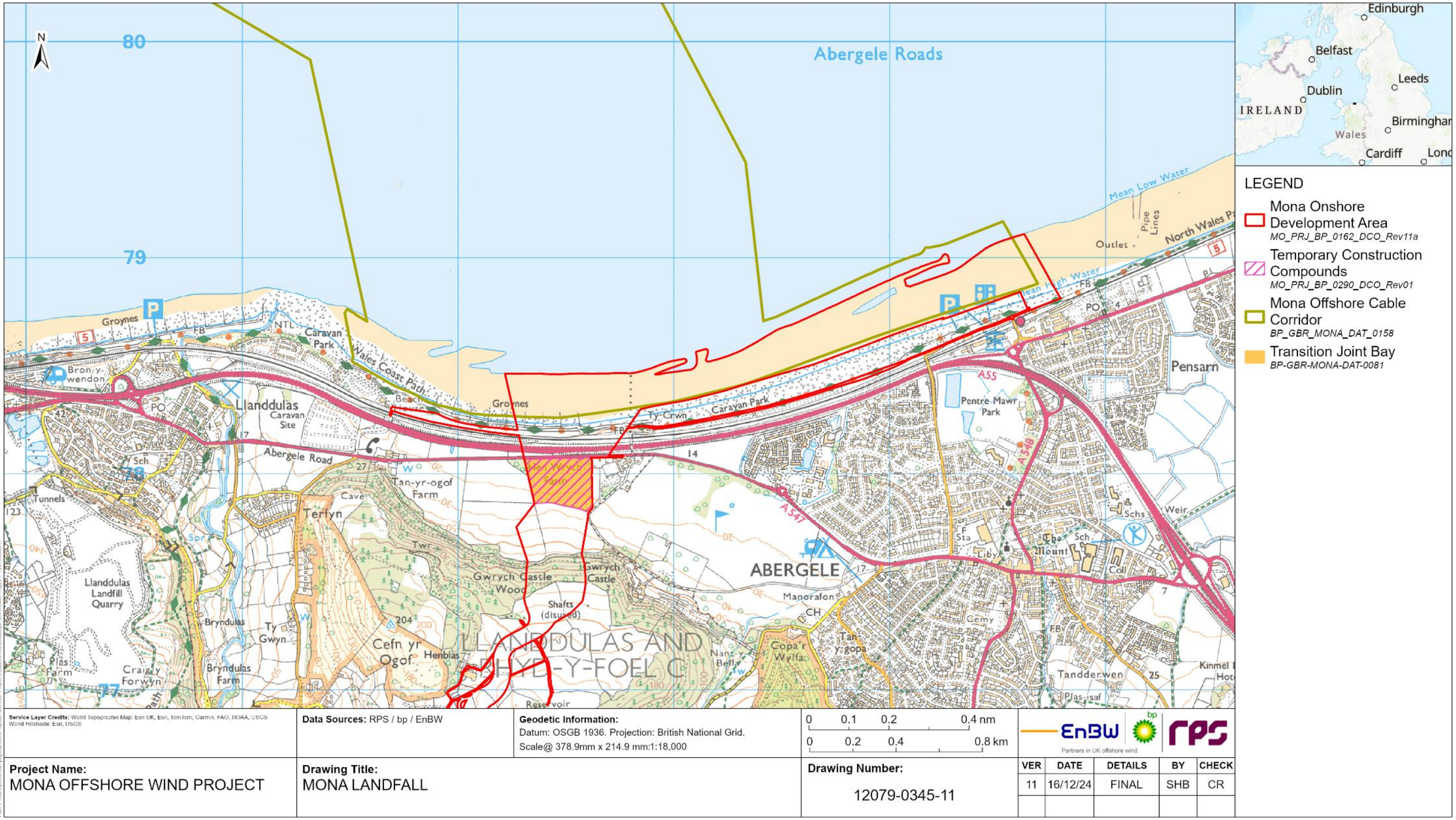

Figure 3.15: Mona Landfall.

Table 3.27: Maximum design parameters for trenchless techniques at the landfall.

Parameter	Maximum design parameters
Type of Trenchless Technique	HDD, thrust bore, direct pipe or microtunnelling
Maximum number of cable ducts	4
Maximum (internal) diameter of cable ducts (m)	1.2
Maximum length of cable ducts (km)	1.4
Maximum bore diameter (m)	1.65
Burial depth maximum landward of MHWS (m)	30
Burial depth minimum landward of MHWS (m)	5
Maximum number of punch outs	4
Burial depth maximum between MHWS and MLWS (m)	25
Maximum working compound (m)	200 x 150
Maximum Offshore Corridor width* (m) *corridor width tapers from mean low water to TJB (100 m)	200

3.6.1.9 The offshore export cables will be jointed to the onshore export cables at the TJBs. The TJBs will be located approximately 155 m above MHWS within the Landfall construction compound as shown on Figure 3.15.

3.6.1.10 The TJBs will be up to 4 m deep; each pit will measure up to 300 m^2 with spacing of up to 10 m between each pit. The TJBs will provide the location for the jointing of the offshore and onshore export cables; one TJB is required per export cable circuit. Dewatering will be required during the construction of the TJBs particularly during periods of wet weather. Dewatering will involve the use of a pump and generator; water from the dewatering activities will be discharged at a location and discharge rate agreed with NRW. Measures will be implemented to minimise noise impacts; these measures will be set out in the Construction Noise and Vibration Management Plan as part of the Code of Construction practice (CoCP) and secured through the DCO. An Outline Construction Noise and Vibration Management Plan is included in the DCO application (Document Reference J26.3).

3.6.1.11 Once the export cables have been jointed and tested, the TJBs will be backfilled and the land above reinstated. A link box will be provided for each TJB: (see paragraph 3.7.2.6 for further information). The maximum design parameters for the TJBs are presented in Table 3.28.

Table 3.28: Maximum design parameters for TJBs.

Parameter	Maximum design parameters
Maximum number of TJBs	4
Maximum TJB depth (m)	4
Maximum area of each TJB (m^2)	300
Maximum area of TJBs (m^2)	1,200
Maximum TJB construction compound (m)	~~200~~150 x 100

Programme

3.6.1.12 The timeframe for drilling the bores (using trenchless techniques) and installing the ducts will take up to nine months and maybe undertaken in two phases over a period of up to 24 months. The timeframe for the export cable pull in, TJB works and cable jointing will be up to 33 months.

3.6.1.13 Core construction hours for the Landfall construction will be:

- 07.00 to 19.00 Monday to Saturday
- No core working on Sundays or bank holidays
- Up to one hour before and after core working hours for mobilisation (i.e. staff and delivery arrivals)

3.6.1.14 Extended working hours may be required to maintain time critical activities; 24 hour working may be required for activities , such as the trenchless techniques and the export cable pull-in at Landfall l.

3.6.1.15 Refer to Section 3.8 for further detail as to how the construction programme for the Landfall fits into the wider project programme.

3.7 Onshore infrastructure

3.7.1 Overview

3.7.1.1 As set out in paragraph 3.3.1.1, the permanent onshore infrastructure for the Mona Offshore Wind Project includes the onshore export cables, the Onshore Substation (and its operational access road) and the Mona 400 kV Grid Connection Cables (see Figure 3.16).

3.7.1.2 The offshore export cables come onshore at the Landfall. The onshore export cables will provide a cable connection between the Transition Joint Bay and the Onshore Substation.

3.7.1.3 400kV Grid Connection Cables will connect the Onshore Substation to the National Grid Substation at Bodelwyddan.

3.7.1.4 The permanent onshore infrastructure will be located within the Mona Onshore Development Area together with mitigation areas and temporary construction facilities (such as access roads and construction compounds).

3.7.1.5 The proposed locations for the temporary construction facilities are shown on Figure 3.19. The location for the Onshore Substation is shown on Figure 3.20. Temporary and operational access to the Onshore Substation will be provided. The full extent of the operational access is shown on the Onshore Works Plans (Document Reference B3) and Figure 3.21. The operational access has been assessed in the relevant chapters of the Environmental Statement, however part of the operational access is not currently shown on the chapter figures. The Applicant intends to update these figures with the full extent of the operational access post-acceptance and prior to the examination of the DCO application for the Mona Offshore Wind Project.

3.7.1.6 The location of the Onshore Substation and the other permanent infrastructure has been informed by a site selection and route refinement process which is detailed in Volume 1, Chapter 4: Site selection and consideration of alternatives of the Environmental Statement. This process has considered a wide range of human, biological and physical constraints as well as technical and commercial factors.

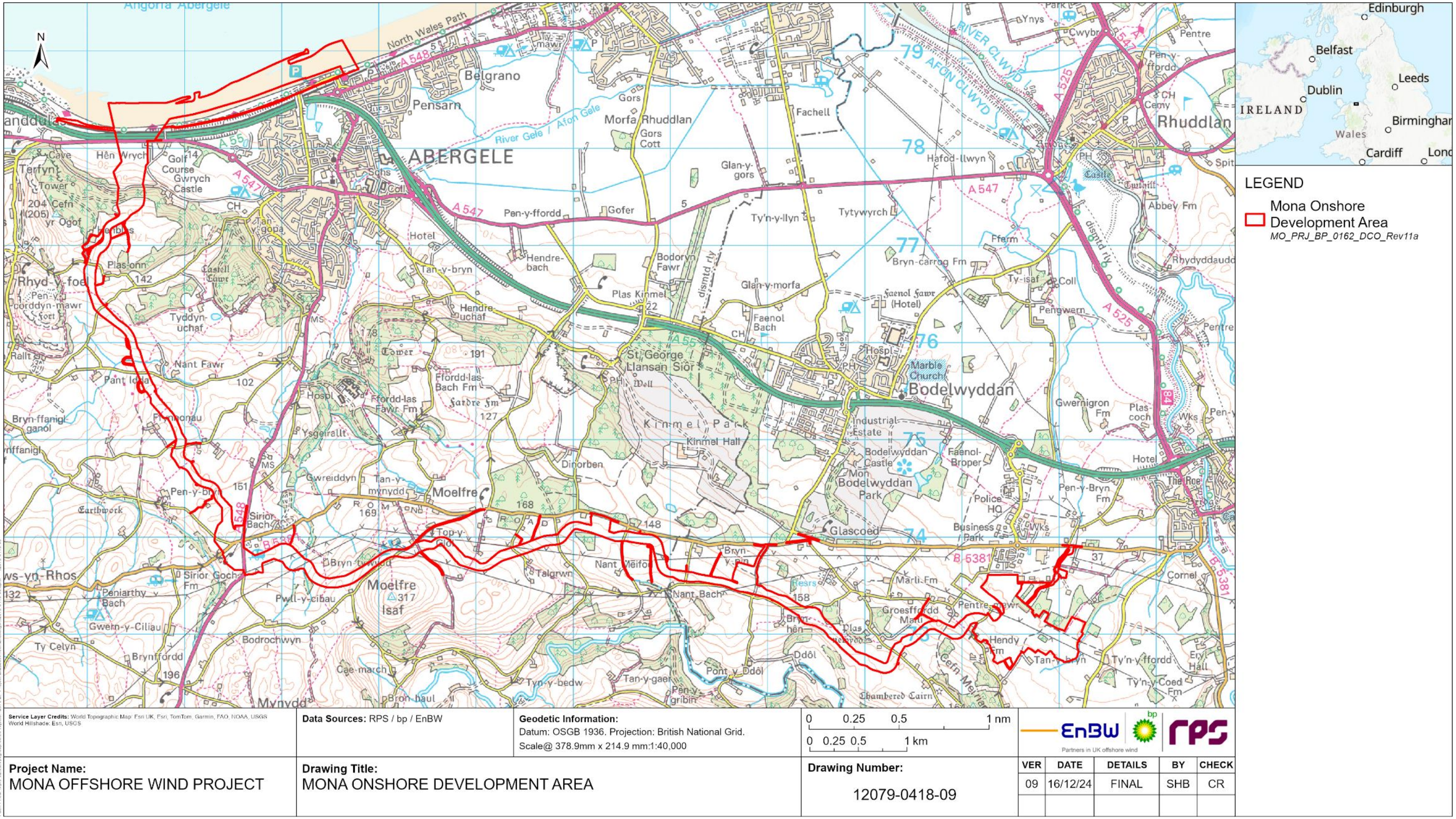

Figure 3.16: Mona Onshore Development Area.

3.7.2 Onshore export cables

Cable route design

3.7.2.1 The onshore export cables will transfer the electricity onwards to the Onshore Substation. The onshore export cables will be buried for their entire length; overhead lines are not proposed for the Mona Offshore Wind Project.

3.7.2.2 The operating voltage of the cables would be selected prior to construction but is likely to be either 220 kV or 275 kV. The number of cable circuits required will depend on the voltage selected (with higher voltages requiring fewer cable circuits). A 220 kV design will require up to four cable circuits, while a 275 kV design may require fewer cable circuits.

3.7.2.3 A maximum of four circuits has been assumed as the maximum design parameter for environmental assessment. Each cable circuit will consist of three cables, giving a total of up to 12 cables laid in trefoil formation or flat formation. In addition to the above, fibre-optic cables are likely to be required for communications and temperature sensing. This may include up to one communications and one temperature sensing fibre-optic cable per circuit.

3.7.2.4 The cables themselves consist of copper or aluminium conductors wrapped with various materials for insulation, protection, and sealing. Table 3.29 shows the MDS for the onshore export cables.

Table 3.29: Maximum design parameters for onshore export cables.

Note that the maximum voltage and maximum number of circuits/export cables would not occur together. The maximum number of cables relates to the 220 kV design option.

Parameter	Maximum design parameters
Maximum number of circuits	4
Maximum number of export cables	12
Maximum voltage (kV)	275
Maximum diameter of cable (mm)	200

Joint bays and link boxes

3.7.2.5 Joint Bays (JBs) and Link Boxes (LBs) will be required along the onshore cable route. JBs are typically concrete lined pits, that provide a clean and dry environment for jointing sections of cable together. Land above the JBs will be fully reinstated: JBs will only require access during the operations and maintenance phase in the event of a cable failure requiring replacement.

3.7.2.6 LBs are smaller pits compared to JBs, which house connections between the cable shielding, joints for fibre optic cables and other auxiliary equipment. LBs are typically located adjacent the JB locations; they comprise concrete chambers with a manhole cover set at ground level to provide access during the operations and maintenance phase. The MDS for JBs and LBs is presented in Table 3.30 and Table 3.31.

Table 3.30: Maximum design parameters for JBs.

Parameter	Maximum design parameters
Maximum number of JBs	80
Maximum distance between JBs (on one circuit) (m)	1,750
Minimum distance between JBs (on one circuit) (m)	750
Maximum area of each JB (m^2)	200
Maximum depth of JB (m)	2

Table 3.31: Maximum design parameters for LBs.

Parameter	Maximum design parameters
Maximum number of LBs	80
Maximum distance between LBs (on one circuit) (m)	1,750
Minimum distance between LBs (on one circuit) (m)	750
Maximum area of each LB (m^2)	6
Maximum depth of LB (m)	1

Onshore export cable installation

Sequence of installation

3.7.2.7 Installation of the onshore export cables is likely to be undertaken in the following broad sequence:

1. Pre-commencement activities
   a. Completion of any required pre-construction surveys
   b. Installation of fencing within the construction areas
2. Site clearance, including vegetation clearance, where required
3. Topsoil strip and storage along the Onshore Cable Corridor
4. Establish and prepare temporary haul road along the Onshore Cable Corridor
5. Excavate cable trench, install cable duct, surround with cement bound sand, place marker tile and backfill with subsoil removed from the trench
6. Trenchless techniques will be used to install ducts under obstacles (as set out in Volume 5, Annex 4.3: Onshore crossing schedule of the Environmental Statement
7. Excavation of JBs and LBs (this may also be undertaken after the ducting is laid and the cable trench is reinstated)
8. Cable pulling into the as-laid cable ducts between JBs
9. Cable jointing and fibre splicing followed by backfill of joint bays/installation of inspection covers

10. Removal of the temporary haul road
11. Reinstatement of topsoil removed from the trench
12. Reinstatement to previous land use including field drainage
13. Removal of temporary fencing
14. Planting of any sections of replacement hedgerow.

Onshore site preparation works

3.7.2.8 Onshore site preparation works will be undertaken prior to the commencement of construction. These works comprise the following:

- Site clearance include vegetation clearance
- Demolition
- Early planting or landscaping works
- Archaeological investigations
- Environmental surveys such as
  - topographic surveys
  - ecology pre-construction surveys to inform protected species mitigation licences
- Ecological mitigation
- Investigations for the purpose of assessing ground conditions such as:
  - pre-entry soil surveys
  - drainage surveys
- Remedial work in respect of any contamination or other adverse ground conditions
- The diversion and laying of utilities and services
- Site security works
- The erection of any temporary means of enclosure; the type of fencing to be used will be dependent on the purpose of the fencing and would include:
  - Post and rope for arable land
  - Post and rail for fields with horses
  - Post mesh and wire/barbed wire for fields with cattle and sheep
  - Security fencing for construction compound
  - Tree protection fencing will be installed around the root protection zones of trees to be retained. Fencing will also be provided around other vegetation to be retained (e.g. hedgerows)
- The erection of any temporary hard standing
- The erection of welfare facilities
- Creation of site accesses
- Temporary display of site notices or advertisements,

3.7.2.9 Further details on fencing are provided in the Outline Construction Fencing Plan (Document Reference J26.5) of the Outline CoCP. A detailed Construction Fencing Plan will be agreed as part of the post-consent process through the discharge of DCO requirements.

3.7.2.10 Where required, site clearance will be undertaken under the supervision of the Ecological Clerk of Works (ECoW) and in accordance with the Outline CoCP (Document Reference J26).

Cable route installation

3.7.2.11 Open trenching will be the primary method used to install the onshore export cables. Where this is the case, the Mona Onshore Cable Corridor will include up to four cable trenches and a temporary haul road. The soil will be deposited back into the trench following the installation of the ducts..

3.7.2.12 The dimensions of the onshore export cable trenches are presented in Table 3.32.

Table 3.32: Maximum design parameters for onshore export cable installation.

Parameter	Maximum design parameters
Maximum trench width at base (m)	1.5
Maximum trench width at surface (m)	2.5
Maximum length of onshore export cable corridor (km)	15
Maximum width of onshore export cable easement - permanent (m)	30
Maximum width of onshore export cable corridor – permanent and temporary (m)	74
Maximum width of onshore export cable corridor (permanent and temporary) at trenchless technique crossings (m)	100
Target depth of trench(m)	1.8
Maximum trench depth of stabilised backfill (m)	0.6
Maximum total Installation duration (months)	33 months

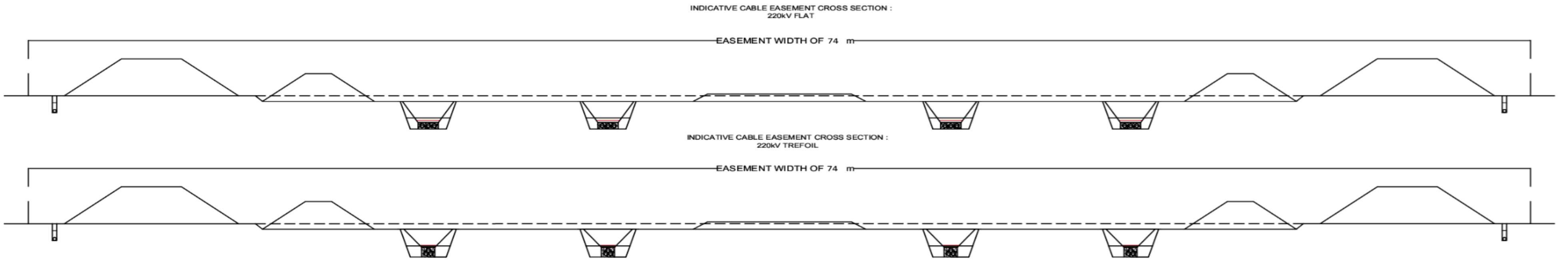

Figure 3.17: Indicative cross section of the Onshore Cable Corridor

3.7.2.13 An indicative cross section for the Onshore Cable Corridor is shown in Figure 3.17 and Figure 3.18~~Figure 3.18~~. The onshore export cables will be located within the Mona Onshore Development Area. The cables would route south from the Landfall and pass to the west of Abergele. They would then route southeast towards the A548 and B5381 junction and then northeast in the vicinity of the B5831 before turning east towards Bodelwyddan, south of the B5831.

3.7.2.14 The Mona Onshore Cable Corridor will be approximately 15 km in length. The target depth of the cable trenches will be approximately 1.8 m; the cables will be buried a minimum depth of 1.2 m to the top of the cable ducting. This target burial depth may be exceeded where the Onshore Cable Corridor is required to cross beneath features such as pipelines, land drains, highways or rivers, and may be shallower where adverse geological conditions are encountered (e.g. shallow rock). The Mona Onshore Cable Corridor will be up to 74 m wide (including the temporary construction width) to allow up to four cable circuits to be installed. In localised stretches of the Onshore Cable Corridor, the total width may be increased to 100 m (e.g. trenchless technique crossings).

3.7.2.15 In some cases, the width of the Onshore Cable Corridor may be reduced where constraints create a ‘pinch point’. The reduction in the width of the corridor would be achieved by applying a range of special engineering techniques that could include:

- Removing the spoil to a storage area further up or down the Onshore Cable Corridor (away from the reduced working width location), thereby negating the need to store spoil adjacent to the trenches.

3.7.2.16 Once installed, the cables will occupy a permanent easement approximately 30 m wide, although the easement may be wider where obstacles are encountered or where cables are installed using trenchless techniques.

3.7.2.17 The trenches will be excavated using mechanical excavators or trenchers in accordance with the measures set out in the Soil Management Plan. The Soil Management Plan appends the Code of Construction Practice (CoCP). The implementation of the CoCP will be secured as a requirement of the DCO.

3.7.2.18 Topsoil and subsoil excavated from the trenches will be temporarily stored in separate linear stockpiles adjacent to the excavation. The ducts will be laid in the open trench; hard protective tiles and marker tape will be installed above the cable ducts to indicate the presence of the cable to ensure the cable is not damaged by any third party. The ducts will be buried in a layer of cement bound sand that ensures a consistent structural and thermal environment for the onshore export cables. The trenches will be backfilled with the excavated subsoil and topsoil and the land reinstated in accordance with the Soil Management Plan.

3.7.2.19 Once the ducts are installed and the trenches backfilled, the cables will then be pulled through the ducts from the JBs.

3.7.2.20 The trenches may require de-watering to keep them free of standing water prior to the installation of the ducts and cement bound sand and prior to backfill with the excavated soil. This will require establishment of pumps; and generator.. In the event that dewatering is required, water from the dewatering activities will be discharged to a local drainage ditch or watercourse and/or discharged within the easement and allowed to infiltrate. De-watering activities and discharge will be undertaken in accordance with the Construction Surface Water and Drainage Management Plan, which forms part of the CoCP and agreed with NRW. Discharge of dewatering activities will also be agreed with the relevant landowner.

Figure 3.18: Example of an onshore export cable trench.

Crossings and trenchless techniques

3.7.2.21 Landward of the TJB, the route of the onshore export cables and Mona 400 kV Grid Connection Cables will cross existing infrastructure and obstacles such as highways, utilities and watercourses. The Mona Offshore Wind Project will aim to undertake all major crossings, such as public highways using trenchless technologies The locations of the crossings and the method that will be used are identified in Volume 5, Annex 4.3 Onshore crossing schedule of the Environmental Statement. Some of the obstacles crossed used trenchless techniques include:

- The woodland associated with the Gwyrch Castle estate
- Public highway crossings
- Hedgerows
- Ordinary watercourses
- Existing underground utilities.

3.7.2.22 For smaller less sensitive infrastructure it can be quicker and less disruptive to make the crossings using open cut techniques rather than undertaking the works required for trenchless techniques.

Watercourse crossings

3.7.2.23 In most cases, trenchless techniques will be used to pass beneath watercourses. However, open cut trenching may be used, where appropriate, such as for minor ditches or smaller watercourses that are frequently dry. Where this is the case, measures will be put in place to protect water quality and flow (where relevant). The design of the watercourse crossings will be in accordance with the Construction Method Statement and agreed with the relevant authority. An Outline Construction Method Statement is included in the DCO application (Document Reference J26.15).

Hedgerow crossings

3.7.2.24 Trenchless techniques have been proposed in many locations along on the Onshore Cable Corridor to avoid hedgerows and woodland. Where trenchless techniques are not proposed, trees and sections of hedgerow will be removed (as shown in Volume 7, Annex 6.6: Tree survey and arboriculture assessment of the Environmental Statement. In addition, hedgerow removal may be required for the construction of the haul road and to meet visibility requirements at access points.

3.7.2.25 In each case, the width of hedge or number of trees to be removed will be limited where practicable. Further details on hedgerow removal are presented in Volume 3, Chapter 3: Onshore ecology and Volume 7, Annex 6.6: Tree survey and arboriculture assessment of the Environmental Statement.

Road crossings

3.7.2.26 It is envisaged that all crossings of the public highway will be undertaken using trenchless techniques. This method of laying the onshore export cable means that no road closures will be required. Where the cable route crosses private accesses, access to properties and settlements will be retained.

3.7.2.27 There will be some locations whereby the haul road crosses the highway and where traffic management will be required. The traffic management methods to be used will depend on the location of the highway crossing, the nature and level of traffic on the highway link being crossed. Methods may include temporary shuttle working, crossings, or temporary single lane closures. Construction traffic will be managed in accordance with the Construction Traffic Management Plan. An Outline Construction Traffic Management Plan is included in the DCO application (Document Reference J26.13).

Utilities crossings

3.7.2.28 The Onshore Cable Corridor will cross a number of utilities including water infrastructure, gas pipelines and telecommunications. All crossings of these utilities will be undertaken using trenchless techniques and will be in-line with operators' design standards.

Drainage management

3.7.2.29 During construction, measures will be implemented to control surface water runoff, including measures to:

- Prevent flooding of the working area
- Prevent migration of water from the working area to adjoining land
- Ensure any runoff is treated appropriately.

3.7.2.30 Pre-construction drainage will be installed along the Onshore Cable Corridor, at the temporary construction compounds and Onshore Substation. Surface runoff will be managed in accordance with the Construction Surface Water and Drainage Management Plan. An Outline Construction Surface Water and Drainage Management Plan is included in the DCO application (Document Reference J26.6).

3.7.2.31 It is possible that existing field drainage could be affected by the onshore export cable installation works. To manage this, the contractor will develop a field drainage strategy in consultation with the landowners affected. It may be necessary to install additional field drainage on either side of the cable corridor to ensure the existing drainage of the land is maintained during and after construction. Any field drainage intercepted during the cable installation will either be reinstated following the installation of the cable or diverted to a secondary channel. Any works undertaken will be agreed with the appropriate stakeholders.

3.7.2.32 The installation of additional field drainage would typically use tracked machinery (e.g. small trenching machines).

Temporary construction compounds

3.7.2.33 Temporary construction compounds will be established within the Mona Onshore Development Area early in the construction programme. The proposed locations of the compounds are shown on Figure 3.19.

3.7.2.34 A main construction compound will be required within the Mona Onshore Development Area, to support the construction of the onshore export cables. This will operate as a central base for the onshore construction works and will house the central offices, welfare facilities, parking and stores, as well as acting as a staging post and secure storage for equipment and component deliveries.

3.7.2.35 Additional temporary construction compounds of various sizes will be required for laydown and storage of materials and plant, as well as space for small temporary offices, welfare facilities, security, parking and wheel washing facilities. These compounds will be smaller than the main construction compound and will be located within the Mona Onshore Development Area, taking into account environmental constraints.

3.7.2.36 Storage areas may also be required at various locations within the Mona Onshore Development Area. These will operate as areas where some limited additional storage may be required within the temporary corridor.

3.7.2.37 A working area for the trenchless technique will be required to contain the drilling rig, equipment and the drill entry and exit pit. These working areas will be located within the Mona Onshore Development Area either side of the haul road and within the 74 m temporary construction corridor.

3.7.2.38 The establishment of the construction compounds will follow the process set out in the Construction Method Statement that appends the CoCP. An Outline Construction Method Statement is included in the DCO application (Document Reference J26.15). Topsoil's will be stripped and stored, and areas of hard standing will be formed; tarmacked areas will be created for car parking and access points. Water, sewerage and electricity services will be supplied either via mains connection or mobile services such as bowsers, septic tanks and generators. Security fencing and lighting will be required at the compounds; task lighting may also be required during working hours in the winter months.

3.7.2.39 The maximum design parameters for construction compounds to support construction of the onshore export cable route are presented in Table 3.33.

Table 3.33: Maximum design parameters for temporary construction compounds and trenchless technique working areas.

Parameter	Maximum design parameters
Maximum primary compound size (m^2)	22,500
Maximum primary construction compound dimensions (length and width) (m)	150 x 150
Maximum number of primary compounds	1
Maximum secondary compound size (m^2)	15,000
Maximum secondary construction compound dimensions (length and width) (m)	150 x 100
Maximum number of secondary compounds	4
Maximum number of trenchless technique locations	45
Temporary working area for trenchless techniques (m^2)	2,500

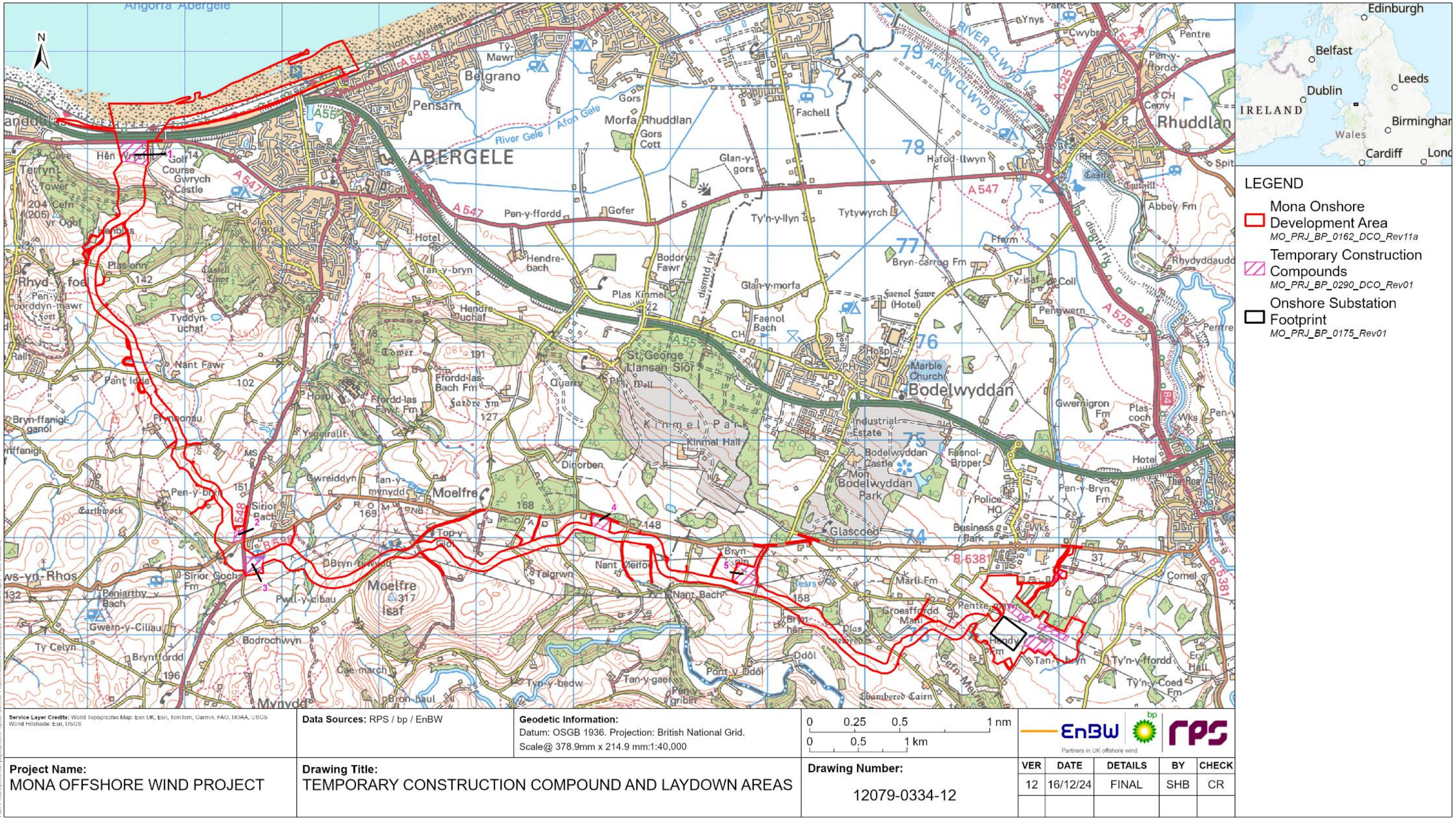

Figure 3.19: Temporary construction compound and laydown areas

Construction access points

3.7.2.40 Access points will be required from the public highway to the Mona Onshore Cable Corridor and construction compounds. Temporary access points off the highway will be installed to facilitate vehicle access from the highway to the Mona Onshore Cable Corridor and temporary construction compounds during construction. The access points will be constructed in line with the local authorities' requirements.

3.7.2.41 A temporary haul road will be installed within the Mona Onshore Cable Corridor to reduce the number of HGVs associated with the Mona Offshore Wind Project travelling on the public highway. The haul road will provide vehicle access from the temporary construction compounds to the Mona Onshore Cable Corridor; the haul road will also provide access within the easement. The haul road will be constructed early in the construction programme and will be used where needed throughout the installation of the onshore export cables and Mona 400 kV Grid Connection Cable. The haul road will be 6 m wide (excluding passing places).

3.7.2.42 The haul road will be made up of permeable gravel aggregate (on average 0.4 m in depth) with a geotextile or other type of protective matting.

Programme

3.7.2.43 The installation of the onshore export cables (see paragraph 3.7.2.7) is expected to take up to 33 months in total. Construction may be carried out by multiple teams at more than one location along the Mona Onshore Cable Corridor at the same time.

3.7.2.44 Core construction hours will be:

- 07.00 to 19.00 Monday to Saturday
- No core working on Sundays or bank holidays
- Up to one hour before and after core working hours for mobilisation (i.e. staff and delivery arrivals).

3.7.2.45 Extended working hours may be required to maintain time critical activities; 24 hour working may be required for activities, such as complex trenchless technique crossings and dewatering activities.

3.7.2.46 Refer to Section 3.8 for further detail as to how the construction programme for the onshore export cables fits into the wider project programme.

Restoration

3.7.2.47 Once the cable installation work is completed and commissioned, the haul road will be removed and the ground reinstated using stored topsoil. All temporary construction compounds and temporary fencing will be removed, field drainage and/or irrigation will be reinstated and the land will be restored to its original condition, where practicable. Consideration will be given to the early restoration of land and habitats within the Mona Onshore Cable Corridor.

3.7.2.48 Hedgerows will be replanted using locally sourced native species, where practicable. Suitably qualified and experienced contractors will be used to undertake the reinstatement, which will be based on restoring the hedge to match the remaining hedgerow at each location. Where appropriate, some enhancement (such as planting of additional suitable species) may be undertaken. Details of the proposed planting, its monitoring and aftercare will be set out in the Landscape and Ecology Management Plan as secured by the DCO. For further information on enhancement refer to the Biodiversity Benefit and Green Infrastructure Statement (Document Reference J7).

3.7.3 Onshore substation

Location

3.7.3.1 The Mona Offshore Wind Project will connect to the Bodelwyddan National Grid Substation, located south of Rhyl, North Wales. The Onshore Substation is located immediately south of the Bodelwyddan National Grid Substation and the Bodelwyddan to Pentir 400 kV overhead lines. The site selection methodology for the onshore substation is described in Volume 1, Chapter 4: Site selection and consideration of alternatives of the Environmental Statement. The location of the Onshore Substation is shown in Figure 3.20.

Design

3.7.3.2 The Onshore Substation will employ Gas Insulated Switchgear (GIS). Illustrative layouts of the Onshore Substation have been prepared and have been informed by the Design Principles (Document Reference B3).

3.7.3.3 The Onshore Substation will contain the electrical components for transforming the power supplied from the offshore wind farm to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the national grid. The Onshore Substation will also house the auxiliary equipment and facilities for operating, maintaining and controlling the onshore substation. The Onshore Substation compound would contain electrical equipment including power transformers, switchgear, reactive compensation equipment, harmonic filters, cables, lightning protection masts, control buildings, communication masts, backup generators, fencing and other associated equipment, structures or buildings.

3.7.3.4 The main equipment will either be housed within a single or multiple buildings, in an open space or a combination of buildings and open space. There may also be some smaller buildings required to house components such as smaller equipment and control rooms. The maximum design parameters are presented in Table 3.34.

3.7.3.5 The Onshore Substation building substructures are likely to be composed of steel frame and cladding materials. The structural steelwork will be fabricated and prepared off site and delivered to site for assembly. The design of the Onshore Substation will be in accordance with the Design Principles (Document Reference B3) and is secured in the DCO.

3.7.3.6 An Outline LEMP accompanies the DCO application (Document Reference J22. The OLEMP includes an illustrative landscape and ecology strategy plan that identifies areas of landscape planting and habitat creation. A detailed LEMP will be prepared post consent (as secured in the DCO) and will be agreed with the relevant authorities.

3.7.3.7 During the operations and maintenance phase, drainage at the Onshore Substation will be managed using sustainable drainage measures. The measures will be designed in line with the SUDs Discharge Hierarchy (Sustainable Drainage System (SuDS) Manual (CIRIA 2015)) and will be set out in the Operational Drainage Management Plan. Preparation of the Operational Drainage Management Plan is secured in the DCO and will be agreed with the relevant local authority. An Outline Operational Drainage Management Strategy is included in the DCO application (Document Reference J 28).

Table 3.34: Maximum design parameters for the Onshore Substation.

Parameter	Maximum design parameters
Maximum substation footprint (m^2)	65,000
Maximum impermeable footprint (m^2)	42,000
Maximum main building height (m)	15
Main building - maximum lightning protection height (m)	30
Maximum duration of construction and installation (months)	33 months
Maximum duration of testing and commissioning (months)	10 months
Maximum number of main buildings	4
Maximum length of main building (m)	140
Maximum width of main building (m)	80
Maximum width of permanent access road and associated services (m)	15
Maximum width of construction road (m)	20
Maximum length of permanent access road (m)	800

Onshore Substation preparation works

Pre-construction surveys

3.7.3.8 Onshore site preparation works will be undertaken prior to the commencement of construction. These works comprise the following:

- Site clearance include vegetation clearance
- Demolition
- Early planting or landscaping works
- Archaeological investigations
- Environmental surveys such as
  - topographic surveys
  - ecology pre-construction surveys to inform protected species mitigation licences
- Ecological mitigation
  - Habitat enhancement works to prepare great crested newt (GCN) temporary receptor sites (Work Area 31)
  - Installation of GCN fencing
- Investigations for the purpose of assessing ground conditions such as:
  - pre-entry soil surveys
  - drainage surveys

- Remedial work in respect of any contamination or other adverse ground conditions
- The diversion and laying of utilities and services
- Site security works
- The erection of any temporary means of enclosure; the type of fencing to be used will be dependent on the purpose of the fencing and would include:
  - Post mesh and wire/barbed wire for fields with cattle and sheep
  - Fencing along the Onshore Substation construction access road
  - Security fencing for temporary construction compound
  - Tree protection fencing will be installed around the root protection zones of trees to be retained. Fencing will also be provided around other vegetation to be retained (e.g. hedgerows)
- The erection of any temporary hard standing
- The erection of welfare facilities
- Creation of site accesses
- Temporary display of site notices or advertisements,

3.7.3.9 Prior to the commencement of the Onshore Substation works, a number of pre-construction surveys and studies will be undertaken to inform the design teams when developing the final design, including:

- Archaeological pre-construction work
- Ecological pre-construction surveys
- Geotechnical investigations
- Drainage studies.

3.7.3.10 In addition to the pre-construction surveys listed above, habitat enhancement works will be undertaken to create temporary mitigation areas for Great Crested Newts (GCN). The temporary mitigation areas are located in Work Area 31 on the Onshore Works Plan (Document Reference B3).

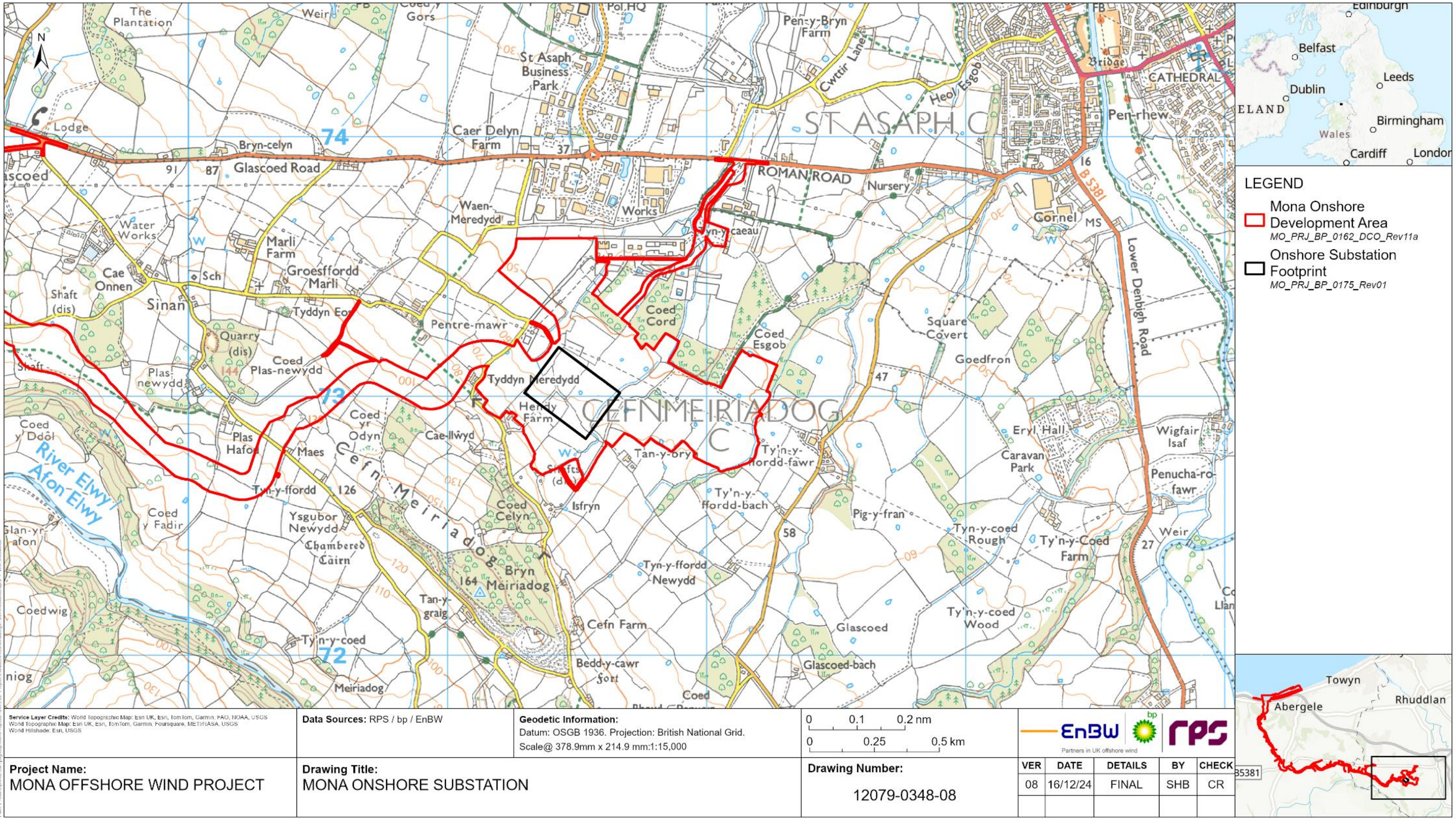

Figure 3.20: Onshore Substation.

3.7.3.11 On the completion of the habitat enhancement works to Work Areas 31 and the installation of the fencing, GCN, reptiles and mammals will be trapped and translocated to the temporary mitigation areas. Translocation will be undertaken by qualified and experience ecologists and managed by the ECoW.

3.7.3.12 Vegetation will be cleared along the Onshore Substation construction access road, temporary construction compounds and Onshore Substation footprint. Clearance will be undertaken under the supervision of the ECoW and in accordance with the CoCP, the LEMP (as secured in the DCO) and shown in Volume 7, Annex 6.6: Tree survey and arboriculture impact assessment of the Environmental Statement.

Construction

Temporary construction compounds

3.7.3.13 Temporary construction compounds will be established to support the construction of the Onshore Substation. The construction compounds will be located within the Mona Onshore Development Area and will provide offices, welfare facilities, soil and material storage, storage of plant and equipment and parking for construction staff. A laydown area will also be provided to facilitate the construction of the Onshore Substation construction access road and the temporary bell mouth from Glascoed Road. The location of the construction compounds and laydown areas are shown on Figure 3.19.

3.7.3.14 The establishment of the construction compounds will follow the process set out in the Construction Method Statement that appends the CoCP. An Outline Construction Method Statement is included in the DCO application (Document Reference J26.15). Topsoil's will be stripped and stored, and areas of hard standing will be formed; tarmacked areas will be created for car parking and access points. Water, sewerage and electricity services will be supplied either via mains connection or mobile services such as bowsers, septic tanks and generators. Security fencing and lighting will be required at the compounds; task lighting may also be required during working hours in the winter months.

3.7.3.15 On completion of the temporary bell mouth improvement works and the Onshore Substation construction access road, the laydown area will be removed and a gate house will be established to control construction vehicles entering and leaving the Onshore Substation works area.

Landscaping and screening

3.7.3.16 The site of the Onshore Substation benefits from substantial existing hedgerows and woodland blocks within the local area that provide a level of screening. However, the Applicant has committed to additional planting and earth modelling to further screen the Onshore Substation. An illustrative landscape and ecology strategy has been prepared that shows areas of landscape planting and ecology habitat creation (refer to the Outline LEMP (Document Reference J22). The landscape planting will comprise a mix of faster growing 'nurse' species and slower growing 'core' species. The core species will comprise a mix of preferred native, canopy species that will outlive the nurse species and characterise the woodland structure over the longer term. In locations where it is possible to achieve advanced planting, this will be undertaken to allow growth prior to completion of construction and commencement of operation.

3.7.3.17 Ponds and areas of scrub and wildflower meadow habitat will be created for GCN; enhancement of hedgerows will provide habitat and improve connectivity for dormice and species of bats. These areas are shown on the illustrative landscape and ecology strategy in the Outline LEMP (Document Reference J22).

Onshore substation construction access haul road

3.7.3.18 Construction access to the Onshore Substation will be provided from Glascoed Road. A dedicated construction access will be provided from Glascoed Road: the access will follow the alignment of the reinstated construction access road used by the Burbo Bank Extension Offshore Wind Project. The access road will extend south, running parallel with the access road for the National Grid Bodelwyddan Substation, and will connect to the temporary laydown area. Beyond the laydown area the construction access will use the proposed permanent access route, albeit that during construction, a temporary surface may be used. This access route will need to be installed early in the construction process. The route of the construction and permanent access roads are shown on Figure 3.21.

3.7.3.19 The construction access will be formed by stripping the topsoil along the route and placing geotextile and permeable hardcore aggregate (or equivalent) to create a hard surfaced. Areas of tarmac will be required, particularly at the bell mouth with Glascoed Road; necessary protection will be provided for underground services.

3.7.3.20 Dedicated access will be provided between the temporary construction compound and the Onshore Substation construction area. The route of the track will minimise the loss of habitats where possible.

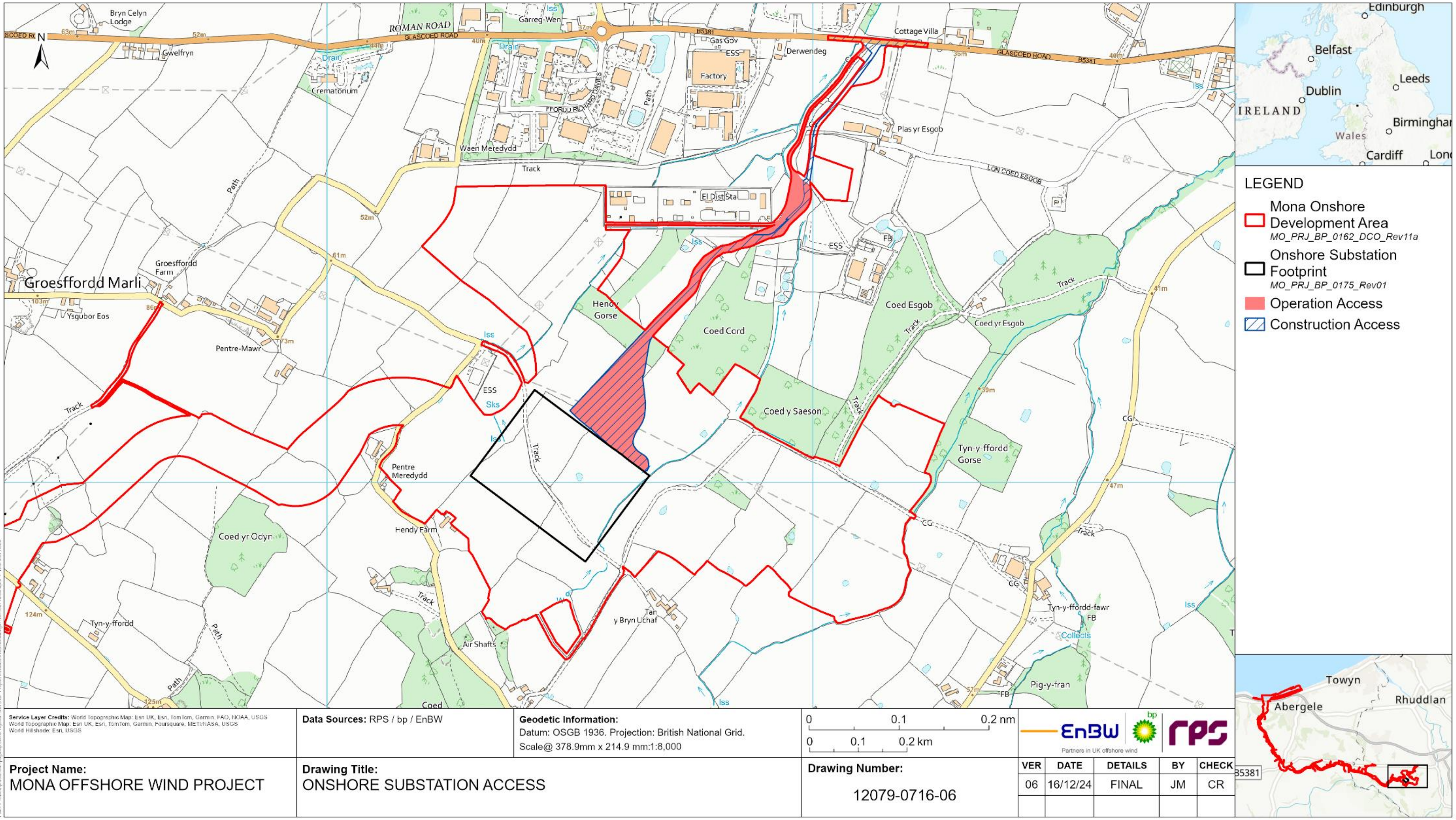

Figure 3.21: Onshore Substation access.

Grading and earthworks

3.7.3.21 Following site clearance, topsoil will be stripped from the Onshore Substation platform and the area will be graded to the required formation level. Earthworks will also be required for the excavation of the attenuation pond, the diversion of the ordinary watercourse and the earth modelling (see paragraph 3.7.3.27).

3.7.3.22 Material will be reused on site where possible subject to its suitability e.g. material from the excavation of the attenuation pond will be used as fill material for the Onshore Substation platform. ~~A cut/fill exercise has been undertaken and which has shown Figure 3.22.~~

3.7.3.23 Any soil exported would be transported by a licensed waste carrier to an appropriate waste management facility. Excavations of foundations and trenches would commence following the completion of grading.

Surface water drainage

Temporary drainage

3.7.3.24 Prior to the commencement of cut/fill operations, existing field drains will be diverted where intercepted; cut off ditches/drains will be provided to intercept field surface runoff where required. The design of the temporary drainage measures will be set out in the Construction Surface Water and Drainage Management Plan (as part of the CoCP) and agreed with the relevant authorities prior to construction. The key principles are set out in the Outline Construction Surface Water and Drainage Management Plan (Document Reference J26.6).

Operational drainage

3.7.3.25 Drainage from the Onshore Substation and the operational access road will be managed in accordance with the Operational Drainage Management Strategy that will be agreed with the relevant authority (as secured in the DCO). An Outline Operational Drainage Management Strategy is included in the DCO application (Document Reference J28). Based on current understanding and in line with the SuDS hierarchy it is anticipated that surface water run-off from the Mona Onshore Substation will be collected by perimeter drains and attenuated within an attenuation pond, prior to discharge to the nearby unnamed watercourse. Additional SuDS components will be incorporated as necessary (source control) and confirmed at the detailed design stage. The indicative location of the attenuation pond is shown in Figure 3.22. Appropriate drainage will be provided for the operational access road. The design will be set out in the Operational Drainage Management Strategy as secured in the DCO.

3.7.3.26 The rate of surface water runoff discharging into local watercourses will be no greater than existing rates for all events up to the 1% AEP (1 in 100 annual chance) plus 40% allowance for climate change.

3.7.3.27 The construction of the Onshore Substation will require the diversion of an un-named ordinary watercourse. The design of the diversion will be set out in the Operational Drainage Management Strategy and will be agreed with the relevant authority and secured in the DCO. An 8 m buffer will be provided between the diverted watercourse and the Onshore Substation platform. As a minimum, the diversion will use the same dimensions as the existing watercourse to ensure existing flow capacities are maintained.

3.7.3.28 Outside of the impermeable areas the site finishes would consist of stone chippings over an appropriate thickness of sub-base to provide suitable surface for plant maintenance and permeability.

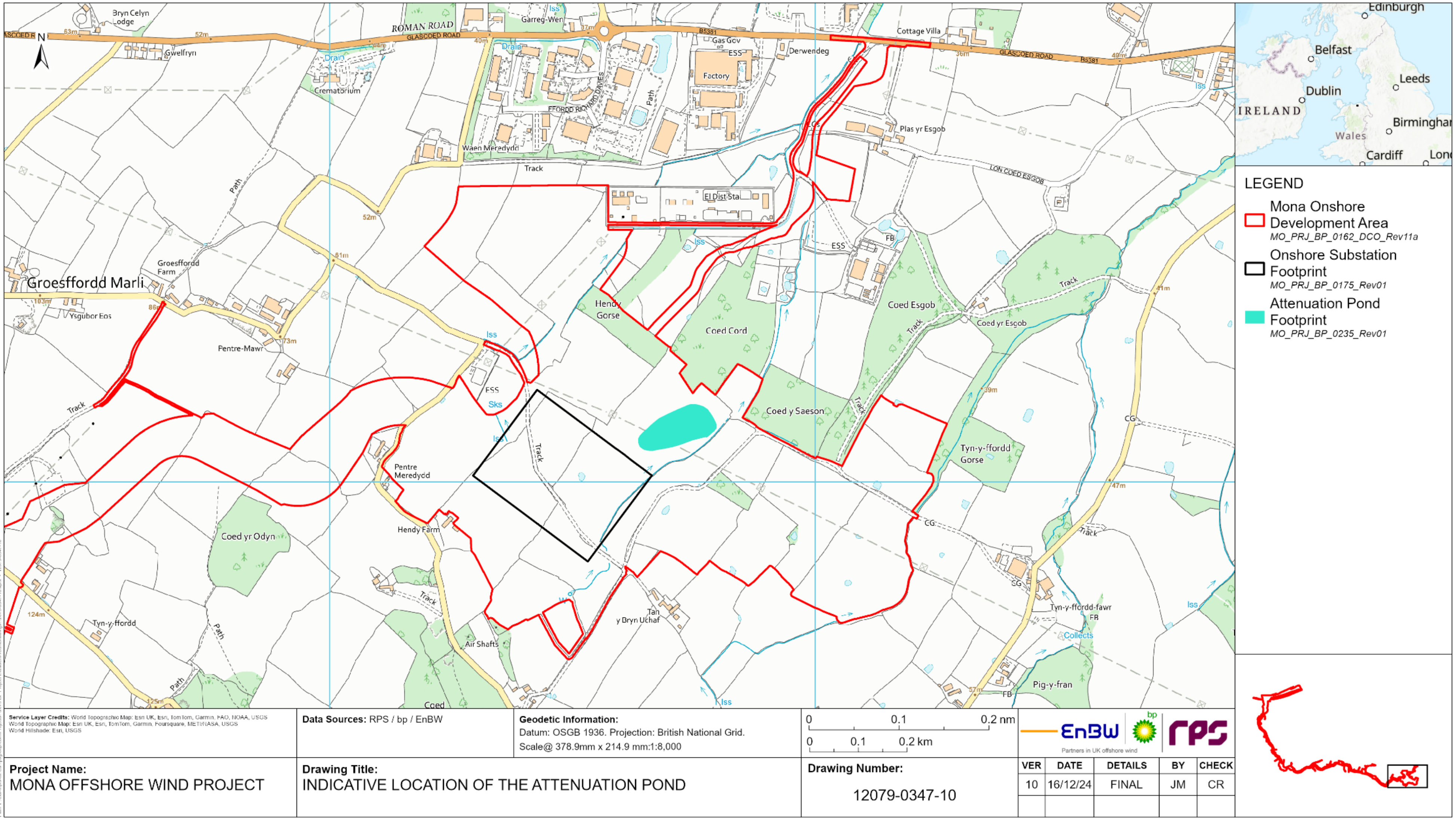

Figure 3.22: Indicative location of the attenuation pond.

Utilities

3.7.3.29 It is intended that both the Onshore Substation and the temporary construction compound welfare will be connected to the mains water and electricity during the construction phase. Foul drainage would be collected in either of the following ways:

- Mains connection discharge to a local authority sewer system, if available
- Septic tank located within the Onshore Substation location boundary or a packaged sewage treatment plant which can treat foul water.

3.7.3.30 The preferred method for controlling foul waste will be determined during detailed design and will depend on the availability and cost of a mains connection and the number of visiting hours staff that would attend site.

Lighting

3.7.3.31 As a maximum design scenario, it has been assumed that some periods of 24-hour construction may be required, for which task related flood lighting may be necessary. Details of construction lighting will be set out in the Artificial Light Emissions Plan as part of the CoCP. An Outline Artificial Light Emissions Plan is included in the DCO application (Document Reference J.26.10).

3.7.3.32 Operational lighting requirements at the onshore substation site may entail:

- Security lighting
- Car park lighting – as per standard car park lighting, possibly motion sensitive
- Repair/maintenance – task related flood lighting may be necessary

3.7.3.33 No additional lighting is proposed along the B5381 Glascoed Road or the operational access road. An operational lighting strategy will be secured as a requirement of the DCO.

Electrical connection

3.7.3.34 The electrical equipment will be installed and tested before being connected to the offshore wind farm and the Bodelwyddan National Grid substation. Once the construction of the Onshore Substation is complete the site will be secured and the supporting infrastructure finalised in readiness for hot commissioning phase and under strict rules of entry, the temporary construction areas will be demobilised and reinstated.

3.7.3.35 The maximum design parameters for the Onshore Substation construction compound are presented in Table 3.35.

Table 3.35: Maximum design parameters for substation construction compound.

Parameter	Maximum design parameters
Switchgear technology	GIS
Maximum temporary works for the Onshore Substation (m^2)	150,000

Programme

3.7.3.36 The Onshore Substation construction is expected to take up to 33 months in total (including site preparation activities and reinstatement). In addition, a period of approximately 10 months is anticipated for substation testing and commissioning.

3.7.3.37 Core construction hours will be:

- 07.00 to 19.00 Monday to Saturday
- No core working on Sundays or bank holidays
- Up to one hour before and after core working hours for mobilisation (i.e. staff and delivery arrivals)

3.7.3.38 Extended working hours may be required to maintain time critical activities; 24 hour working may be required for activities, such as trenchless techniques, maintenance of dewatering pumps and works required to complete concrete works.

3.7.3.39 Refer to Section 3.8 Construction programme for further detail as to how the construction programme for the Onshore Substation fits into the wider project programme.

Mona 400 kV Grid Connection cable

3.7.3.40 A further section of buried onshore export cabling is required to connect the Mona Onshore Substation with the National Grid substation at Bodelwyddan. This is referred to as the 'Mona 400 kV Gid Connection Cable' and will be located within the Mona Onshore Development Area

3.7.3.41 This section of cabling will be similar in design to the onshore export cabling, and will have a maximum of two circuits, with a total of six export cables, installed within a permanent easement. The parameters of this section of the onshore cable route are presented in Table 3.36. An indicative cross section of the 400 kV grid connection export cable trench is shown on Figure 3.23.

Table 3.36: MDS for the 400 kV grid connection export cable.

Parameter	Maximum design parameters
Maximum width of corridor (temporary and permanent) (m)	48
Maximum number of cables	6
Maximum number of cable trenches	2
Maximum cable route length (km)	1
Maximum voltage kV)	400
Maximum trench width at surface (m)	2.5
Maximum trench width at base (m)	1.5
Maximum trench depth (m)	1.8
Maximum number of HDD locations	3
Maximum number of JBs	2

Parameter	Maximum design parameters
Minimum distance between JBs (m)	500
Maximum number of LBs	2
Minimum distance between LBs (mm)	500

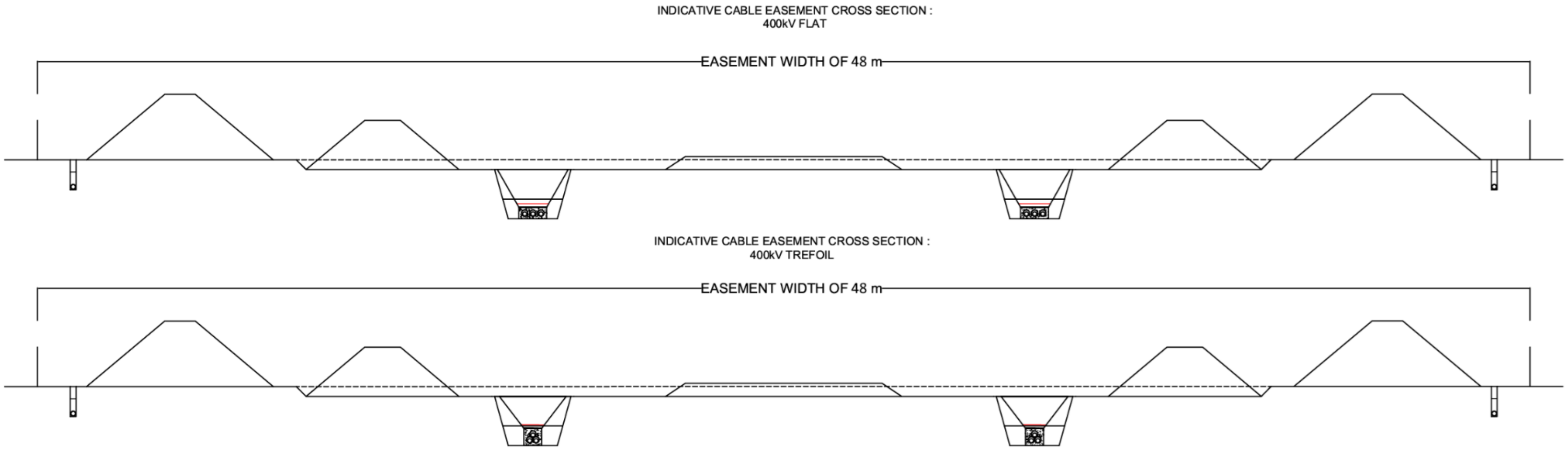

Figure 3.23: Indicative cross section of the 400 kV grid connection export cable trench.

Construction

3.7.3.42 Cable installation for the Mona 400 kV Grid Connection Cable will use the same techniques as described for the Mona Onshore Cable Corridor above (see Section 3.7.2).

3.7.4 Construction environmental management

3.7.4.1 The onshore elements of the Mona Offshore Wind Project will be constructed in an environmentally sensitive manner. They will meet the requirements of all relevant legislation, codes of practice and standards as identified in the topic chapters of this Environmental Statement and will limit the potential adverse effects on the local community and environment as far as reasonably practicable.

Code of Construction Practice

3.7.4.2 Construction will be undertaken in accordance with a CoCP. The CoCP will set out the key management measures that the Applicant will require its contractors to adopt and implement for all relevant construction activities for the onshore elements of the Mona Offshore Wind Project. Implementation of the CoCP will be secured through the DCO requirements. The CoCP will be based on the Outline CoCP (Document Reference J.26). These measures have been developed based on those identified during the EIA process and set out in the topic chapters of this Environmental Statement, and in consultation with relevant consultees. They include strategies and control measures for managing the potential environmental effects of construction and limiting disturbance from construction activities as far as reasonably practicable.

3.7.4.3 The Outline CoCP incorporates a series of environmental management plans and strategies to manage potential construction impacts, such as plans to relate to the management of soils, traffic, and waste.

Local community liaison

3.7.4.4 The Applicant will establish an approach for liaising with the local community and stakeholders during the construction process, which will build on the engagement undertaken throughout the EIA process. A project website, email address and phone number will remain in place.

3.7.4.5 A Communication Plan will be developed as part of the CoCP as secured in the DCO. The Communication Plan will ensure communication with the local community is appropriate, timely and easily understood. The Plan will include provision for a Community Liaison Officer throughout the construction phase, who will actively work with the local community to ensure the local community is kept up to date with progress and that any queries arising are dealt with appropriately. The plan will also include a procedure for dealing with enquiries or complaints from the public, local authorities or statutory consultees.

3.7.4.6 An Agricultural Liaison Officer will be provided as the main point of contact for landowners to provide project updates and to resolve any queries arising during the construction phase.

Traffic

3.7.4.7 Where the onshore cable route crosses public highways and private accesses, access to properties and settlements will be maintained.

3.7.4.8 Dust suppression measures will be implemented to minimise dust, mud and debris associated with the movement of construction vehicles, such as wheel washing. These measures will be implemented via the Dust Management Plan which appends the CoCP (as secured in DCO). An Outline Dust Management Plan is included in the DCO application (Document Reference J.26).

3.7.4.9 On completion of construction, temporary vehicle accesses will be removed and the area reinstated to its original condition as far as reasonably practicable.

3.8 Construction programme

~~3.8.1.1~~ A high-level indicative construction programme is presented in Table 3.37. The programme illustrates the likely window in which the construction of the major project elements will occur. It covers installation of the major components but does not include elements such as preliminary site preparation, and commissioning of the Mona Offshore Wind Project post-construction. Further details of where preliminary site preparation work will fit within the outline programme is discussed in sections 3.5.3 for offshore activities and 3.7.1 for onshore activities. Onshore and offshore construction is currently planned to commence in 2026.

Table 3.37: Indicative construction programme for the Mona Offshore Wind Project.

Activity (time in brackets is time taken for completion, ~~blue~~ colouring denotes window)	Pre-commencement				Year 1 of construction				Year 2 of construction				Year 3 of construction				Year 4 of construction			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Onshore																				
~~Onshore~~Onshore Site Preparation Works Onshore Substation (12 months)																				
Onshore Substation construction and installation (including restoration) (33 months)																				
Onshore Substation testing and commissioning (10 months)																				
Onshore Site Preparation Works Onshore Export Cables (6 months)																				
Onshore export cables construction and installation (including Mona 400 kV Grid Connection Cable Corridor) (33 months)																				
Landfall																				
Onshore Site Preparation Works Landfall trenchless install. (6 months)																				
Landfall trenchless installation (9 months)																				
Offshore																				
Site Investigation Surveys including UXO Surveys (6 months)																				
UXO Clearance (3 months)																				
Seabed preparation activities (9 months)																				
Foundation installation (12 months)																				
OSP installation and commissioning (9 months)																				
Offshore export cables installation (15 months)																				
Interconnector cables installation (4 months)																				
Inter-array cables seabed preparation (3 months)																				
Inter-array cables installation (12 months)																				
Wind turbine installation (9 months)																				
Wind turbine commissioning (9 months)																				

	Pre-commencement activities and onshore site preparation works
	Construction

3.9 Operations and maintenance phase

3.9.1 Offshore operations and maintenance activities

3.9.1.1 The overall operations and maintenance strategy will be finalised once the technical specifications of the Mona Offshore Wind Project are known, including wind turbine type and final layout. A single port or multiple ports could be used to support primary elements of operations and maintenance. The operations and maintenance requirements for the Mona Offshore Wind Project have been set out within an outline Offshore Operations and Maintenance Plan which has been submitted alongside the application for consent.

3.9.1.2 The general operations and maintenance strategy may rely on CTVs, service operation vessels, supply vessels, cable and remedial protection vessels and helicopters for the operations and maintenance services that will be performed at the Mona Offshore Wind Project. The maximum number of operations and maintenance vessels on site at any one time are presented in Table 3.38. The total operations and maintenance vessel and helicopter round trips per year for the Mona Offshore Wind Project are presented in Table 3.39~~Table 3.39~~.

3.9.1.3 Routine inspections of inter-array, interconnector and offshore export cables will be undertaken to ensure that the cables are buried to an adequate depth and not exposed. The integrity of the cables and cable protection systems will also be checked. It is expected that on average the cables will require up to one visit per year.

Table 3.38: Maximum design parameters for offshore operations and maintenance activities.

Parameter	Maximum number of vessels on site at any one time
CTVs	6
Jack-up vessels	3
Cable repair vessels	4
Other vessels (Service Operation Vessels (SOVs) or other)	4
Excavators or backhoe dredgers	4
Helicopters	8
Inspection drones	5

Table 3.39: Maximum design parameters for offshore operations and maintenance activities per year.

Parameter	Maximum number of return trips per vessel type per year
CTVs	730
Jack-up vessels	25
Cable repair vessels	8
Other vessels (SOVs or other)	78
Excavators or backhoe dredgers	8
Helicopters	730
Inspection drones	214

3.9.2 Onshore operations and maintenance activities

3.9.2.1 The onshore operations and maintenance requirements for the onshore export cables will involve infrequent on-site inspections and corrective maintenance activities at link pit locations along the onshore export cables. The onshore export cables will be continuously monitored remotely. Following completion of construction, access to the cable route would be from access points along the existing highway.

3.9.2.2 The Onshore Substation will be unmanned: the onshore infrastructure will be continuously monitored remotely, and there will be operations and maintenance staff visiting the onshore substation to undertake preventative and corrective works on a regular basis. Access to the Onshore Substation during the operations and maintenance phase will be via the existing National Grid access from Glascoed Road: a new operational access road will extend south to the Onshore Substation. Access will also be required to the 400kV grid connection within the National Grid Bodelwyddan Substation extension. This will be achieved using the National Grid access road. The full extent of the operational access (including the section to the National Grid Substation extension) is shown on the Onshore Works Plans (Document Reference B3) and Figure 3.21. The operational access has been assessed in the relevant chapters of the Environmental Statement, however the section of operational access to the National Grid Substation extension is not currently shown on the Figures. The Applicant intends to update these figures with the full extent of the operational access post-acceptance and prior to the examination of the DCO application for the Mona Offshore Wind Project.

3.9.2.3 It is not expected that the TJBs will need to be accessed during the operation of the Mona Offshore Wind Project however LBs will be provided with inspection covers to allow for access.

3.10 Security

3.10.1.1 The Mona Offshore Wind Project will be appropriately secured throughout all phases of development to ensure the safety and security of those working on the Mona Offshore Wind Project and the safety of the general public. Temporary construction compounds will be securely fenced, as will any ongoing construction work. The onshore export cables are buried and will not be readily accessible from the surface.

3.10.1.2 The offshore infrastructure is by nature inaccessible due to being situated offshore. The offshore assets are secured from entry from the public as all entry points are locked.

3.11 Quality, health, safety and environment

3.11.1.1 The Applicant has a strong focus on Health, Safety and Environment (HSE) and the HSE Policy, together with processes and procedures ensure that the Applicant's wind farms are safe by design and that this is verified.

3.11.1.2 All elements of the Mona Offshore Wind Project will be risk assessed according to the relevant best practice guidance as well as the Applicant's internal best practice. These risk assessments will then form the basis of the methods and safety mitigations put in place across the life of the Mona Offshore Wind Project. The Applicant has a focus on employee safety and its HSE policy ensures that the Applicant's wind farms are safe by design and that the processes and procedures are adhered to. There is a clearly defined safety culture in place in order to avoid incidents and accidents. There will be constant controls to ensure that the safety measures are observed and followed and the Applicant has built a safe workplace for its employees and contractors.

3.12 Waste management

3.12.1.1 Waste will be generated as a result of the Mona Offshore Wind Project, with most waste expected to be generated during the construction and decommissioning phases. In accordance with Government policy contained in National Policy Statement (NPS) EN-1 (Department for Energy Security and Net Zero, 2024), consideration will be given to the types and quantities of waste that will be generated.

3.12.1.2 Procedures for handling waste materials are set out in the Site Waste Management Plan (SWMP) which forms part of the Outline CoCP (Document Reference J26.9). A detailed SWMP will be prepared post consent\; it will describe quantities of likely waste type arising from the Mona Offshore Wind Project and how it will be managed (i.e. reuse, recycling, recovery or disposal). The SWMP will also describe the duty of care requirements and identify potential management facilities in the vicinity of the Mona Offshore Wind Project.

3.12.1.3 The SWMP will be updated as further detailed design information becomes available prior to construction. A Materials management plan in line with the Contaminated Land:

Applications in Real Environments (CL:AIRE) Definition of Waste: Code of Practice will also be prepared and agreed prior to commencement of earthworks.

3.13 Decommissioning phase

3.13.1 Overview

3.13.1.1 Section 105 of the Energy Act (2004) requires that the Mona Offshore Wind Project is decommissioned at the end of the operations and maintenance phase. This section summarises the assumptions that have been made regarding decommissioning in order to undertake an EIA on the decommissioning phase of the Mona Offshore Wind Project. No offshore decommissioning works will take place until a written decommissioning programme has been approved by the Secretary of State for the Department for Energy Security and Net Zero (formerly the Department for BEIS), a draft of which will be submitted prior to the construction of the Mona Offshore Wind Project. No onshore decommissioning works will take place until a written scheme of decommissioning (including a code of construction practice) has been agreed by the relevant planning authority at least six months before decommissioning works commence. The decommissioning programme/written scheme of decommissioning will be updated during the Mona Offshore Wind Project lifespan to take account of changing best practice and new technologies. The scope of the decommissioning works would be determined by the relevant legislation and guidance at the time of decommissioning.

3.13.1.2 At the end of the operational lifetime of the Mona Offshore Wind Project, it is anticipated that all structures above the seabed or ground level will be completely removed where feasible and practical. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment.

3.13.2 Offshore decommissioning

Wind turbines

3.13.2.1 Wind turbines will be removed by reversing the methods used to install them, as described in section 3.5.8.

Foundations

3.13.2.2 Piled foundations would likely be cut below the seabed at a level that means they will not create a hazard for fishing or shipping. At this time, it is not thought to be reasonably practicable to remove entire piles from the seabed, but best practice will be employed to ensure that the sections of pile that remain in the seabed are fully buried. The project position is that scour protection will preferably be left *in situ* but removal has been assessed as the MDS.

Offshore cables

3.13.2.3 All inter-array and interconnector cables may be retrieved and if retrieved will be disposed of onshore. In addition to this, offshore export cables may be retrieved up to the exit pits (below MHWS) for cables installed under the intertidal area, if retrieved they will be disposed of onshore.

3.13.2.4 The project position is that cable protection will preferably be left *in situ* but removal has been assessed as the MDS.

3.13.2.5 At this time, it is difficult to foresee what techniques will be used if cables are to be removed during decommissioning. However, it is not unlikely that equipment similar to that which is used to install the cables could be used to reverse the burial process and expose them. Therefore, the area of seabed impacted during the removal of the cables may be the same as the area impacted during the installation of the cables.

Mona intertidal area

3.13.2.6 It is expected that the export cable in the intertidal area will be left *in situ*. The cable ends will be cut, sealed and securely buried as a precautionary measure.

3.13.3 Onshore decommissioning

Onshore export cable

3.13.3.1 It is expected that the onshore export cables will be left *in situ* to minimise the environmental disturbance during wind farm decommissioning. The cable ends where the connect to the Onshore Substation will be cut, sealed and securely buried as a precautionary measure.

3.13.3.2 The structures of the LBs will be removed in line with the decommissioning plan. The cables connecting the LBs to the onshore export cables will be cut, sealed and securely buried.

Onshore substation

3.13.3.3 The expected operational life expectancy of the Onshore Substation is 50 years.. Decommissioning of the Onshore Substation will be reviewed in discussion with the transmission system operator and the regulator in the light of any other existing or proposed future use of the Onshore Substation. If complete decommissioning is required, then all of the electrical infrastructure will be removed and any waste arising disposed of in accordance with relevant regulations.

3.13.3.4 Foundations will be broken up and the site reinstated to agricultural use. The permanent access road and its associated services and drainage will also be removed.

3.14 References

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