



CHAPTER 04 CIVIL ENGINEERING

Ballinlee Wind Farm

Ballinlee Green Energy Limited

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Contents

4. Civil Engineering	4-1
4.1 Introduction	4-1
4.2 Site Entrances	4-2
4.3 Internal Wind Farm Access Tracks.....	4-4
4.4 Wind Turbines.....	4-6
4.4.1 Turbine Locations	4-6
4.4.2 Turbine Hardstands	4-7
4.4.3 Turbine Foundation	4-8
4.5 Internal Collector Circuit.....	4-10
4.6 External Grid Connection.....	4-12
4.7 Substation Compound and Buildings	4-13
4.8 Permanent Meteorological Mast	4-14
4.9 Temporary Construction Compounds	4-16
4.10 Borrow Pits.....	4-17
4.11 Deposition Areas.....	4-18
4.11.1 Temporary Deposition Areas.....	4-18
4.11.2 Permanent Deposition Areas.....	4-20
4.12 Construction Material Volumes.....	4-21
4.13 Aggregate and Concrete Haul Route	4-22
4.14 Turbine Delivery Route	4-24
4.15 Gas Network Ireland Transmission Pipeline	4-25
4.16 Substation Compound Water Design	4-26
4.16.1 Surface Water	4-26
4.16.1.1 Surface Water Network.....	4-26
4.16.1.2 Surface Water Treatment.....	4-26
4.16.1.3 Surface Water Attenuation	4-28
4.16.1.4 Surface Water Discharge Control	4-29

4.16.1.5	Surface Water Outfall	4-30
4.16.2	Wastewater.....	4-31
4.16.2.1	Wastewater Network	4-31
4.16.2.2	Wastewater Holding Tank	4-31
4.16.3	Potable Water	4-32
4.16.3.1	Potable Water Network.....	4-32
4.16.3.2	Rainwater Harvesting Tank.....	4-32
4.17	Wind Farm Surface Water Design	4-33
4.17.1	Surface Water Network	4-33
4.17.2	Surface Water Treatment.....	4-34
4.17.3	Surface Water Attenuation.....	4-36
4.17.4	Major Watercourse Crossing.....	4-36
4.17.5	Minor Watercourse / Surface Water Drain Crossing	4-38
4.17.6	Land Drain Removal.....	4-40
4.18	Decommissioning and Restoration.....	4-41
4.18.1	Wind Farm	4-41
4.18.2	Grid Connection.....	4-42
4.19	References	4-43

Tables

Table 4-1: Excavation and Material Volumes	4-21
Table 4-2: Distances from wind farm to aggregate quarries and concrete batch plants	4-23

Figures

Figure 4-1: Map of proposed wind farm site entrances.....	4-2
Figure 4-2: Map of proposed location of wind turbines	4-6
Figure 4-3: Extract from planning drawings showing turbine hardstand area	4-7
Figure 4-4: Map of proposed internal collector circuits.....	4-10

Figure 4-5: Extract from planning drawings showing external grid connection	4-12
Figure 4-6: Extract from planning drawings showing IPP & SS compound	4-13
Figure 4-7: Extract from planning drawings showing permanent meteorological mast	4-14
Figure 4-8: Map of proposed temporary construction compounds	4-16
Figure 4-9: Map showing the location of the proposed borrow pits	4-18
Figure 4-10: Map of proposed temporary deposition areas	4-19
Figure 4-11: Map of proposed permanent deposition areas	4-20
Figure 4-12: Map of the aggregate and concrete quarries	4-22
Figure 4-13: Map of proposed turbine delivery route	4-24
Figure 4-14: Extract from the planning drawings showing the Tullovin Temp Access track	4-25
Figure 4-15: Map showing access tracks crossing GNI transmission pipeline	4-25
Figure 4-16: Extract from the planning drawings showing the location of the Morningstar River clear span crossing	4-37

Plates

Plate 4-1: Typical example of a Wind farm proposed site entrance	4-3
Plate 4-2: Example of a typical Wind farm finished wind turbine hardstand area	4-8
Plate 4-3: Example of a typical reinforced wind turbine foundation	4-9
Plate 4-4: Example of a typical wind farm internal collector circuit joint bay	4-11
Plate 4-5: Example of a typical substation building and compound	4-14
Plate 4-6: Example of a typical Meteorological Mast on a wind farm	4-15
Plate 4-7: Example of a typical temporary construction compound on a wind farm	4-17
Plate 4-8: Typical proprietary treatment device used on wind farm substation compounds	4-27
Plate 4-9: Typical attenuation feature constructed for wind farm substation compounds	4-28
Plate 4-10: Typical discharge control device used within wind farms	4-30
Plate 4-11: Typical outfall structure used within wind farms	4-31
Plate 4-12: Typical wastewater holding tank used on wind farms	4-32
Plate 4-13: Typical rainwater harvesting tank used on wind farms	4-33
Plate 4-14: Typical conveyance swale feature used within wind farms	4-34

Plate 4-15: Typical treatment feature used within wind farms	4-35
Plate 4-16: Typical clear span crossing used on wind farms	4-38
Plate 4-17: Example of a clear span pre-cast concrete box culvert over a watercourse/drain.....	4-39
Plate 4-18: Example of a concrete pipe culvert for a watercourse/drain crossing	4-40

Appendices

Appendix 4A – BFA Preferred Grid Route Option Assessment Report
Appendix 4B – Material Volume Calculations
Appendix 4C – Met Éireann Rainfall Data
Appendix 4D – Proprietary Treatment Device
Appendix 4E – Permanent Surface Water Calculations
Appendix 4F – UK SuDS Greenfield Discharge Rates & Attenuation Storage Volume
Appendix 4G – InfoDrainage Discharge Quick Storage Estimate & Runoff Rate Calculator
Appendix 4H – InfoDrainage Model and Simulation Results
Appendix 4I – Wastewater Holding Tank Calculations
Appendix 4J – Rainwater Harvesting Tank Calculations
Appendix 4K – Temporary Surface Water Calculations
Appendix 4L – Gas Pipeline Electrical Interference Assessment

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4. Civil Engineering

4.1 Introduction

This chapter provides additional information to **Volume II, Chapter 02** Description of the Proposed Development of this EIAR on the civil engineering design rationale, standards, specifications and process of the various elements of the proposed development. All drawings to the appropriate scale as required by the Planning and Development Regulations 2001 (as amended) can be found in the planning pack accompanying the planning application. This chapter should be read in conjunction with the Planning Drawings, Surface Water Management Plan (SWMP), Grid Connection Route Report (GCRR) and the Turbine Delivery Route Report (TDRR).

Surface water principals and controls applied to the proposed development, including requirement, function and maintenance are included in the SWMP. The GCRR includes details on the initial and preliminary design as well as construction methodologies for the grid connection. Turbine delivery route details on the pinch points, transport vehicles and swept path analysis information is included in the TDRR.

The purpose of this Civil Engineering chapter is to provide additional information in relation to design of the following items:

- Site Entrances.
- Internal Wind Farm Access tracks.
- Wind Turbine Foundation and Hardstand Infrastructure.
- Internal Collector Circuit.
- External Grid Connection.
- Substation Compound and Buildings.
- Permanent Meteorological Mast.
- Temporary Construction Compound.
- Deposition Areas.
- Borrow Pits.
- Construction Material Volumes.
- Aggregate and Concrete Haul Route.
- Turbine Delivery Route.
- Transmission Gas pipeline.
- Compound Three Waters Design.
- Wind Farm Surface Water Design.
- Decommissioning and Restoration.

4.2 Site Entrances

In total there are Nine (9 No.) entrances proposed for this development, the entrance numbers and entrance locations are shown in **Figure 4-1**.

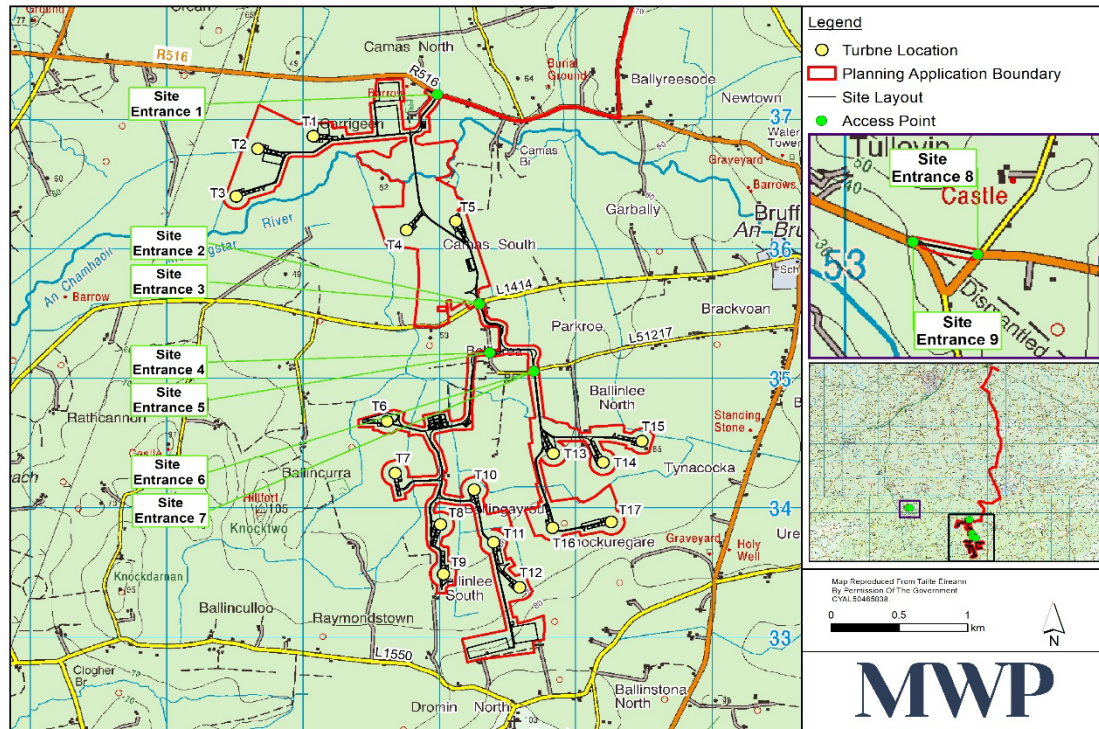


Figure 4-1: Map of proposed wind farm site entrances

Entrances One (1) Two (2) Three (3) Four (4) Five (5) Six (6) and Seven (7) will be used for the operational stage and construction stage. Entrances One (1) and Two (2) will serve the five wind turbines located to the south of the regional road R-516 and the north of the local road L-1414. Entrance Five (5) will provide access to the new on-site 110kV substation, a new Meteorological mast, and seven turbines located to the south of the L-1414 and the north of the L-1550. Entrance Seven (7) will provide access to five turbines south of the L-51217. Entrance Eight (8) and Nine (9) are part of the turbine delivery route, avoiding the Tullovin bridge, and both are off the R-516. These entrances (8 & 9) are required for the construction stage and will be reinstated to their pre-construction state following the delivery of the wind turbine components. Over the lifetime of the proposed development, these entrances and track will only be called into service to accommodate delivery of replacement turbine components requiring abnormal loads (e.g., blade, nacelle, tower), in the unlikely event that it would be required.

- Entrance No.1 off the R-516 Regional Road
- Entrance No.2 off the L-1414 Local Road
- Entrance No.3 off the L-1414 Local Road, opposite entrance No 2
- Entrance No.4 off the L-51217 Local Road, opposite entrance No 5
- Entrance No.5 off the L-51217 Local Road
- Entrance No.6 off the L-51217 Local Road, opposite entrance No 7

- Entrance No.7 off the L-51217 Local Road
- Entrance No. 8 off the R-516 Regional Road (temporary for construction phase)
- Entrance No. 9 off the R-516 Regional Road (temporary for construction phase)

The requirements for junction sight distance are set out in *Transport Infrastructure Ireland (TII) 'DN-GEO-03060: Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions)'*. Sight distance is measured from a point 2.4m from the near edge of the major road along the centre of the minor approach road. This distance is referred to as the 'x-distance'. The visibility distance along the major road is referred to as the 'y-distance' and is measured to the near edge of the major road in both directions. The required sight distance in the vertical plane is based on eye and object heights of 1.05m. The 'y-distance' requirement depends on the design speed of the major road. This is the 85th percentile speed which is the speed below which 85% of vehicles travel.

The mandatory speed limit on the regional road is 80Km/h and local roads are 60Km/h. Based on observations on site and *Transport Infrastructure Ireland (TII) -DN-GEO-03031 Rural Road Link Design table 9.1*, site distances of 160m for regional roads and 90m for local roads are required. This is not required for entrances 4 and 5, which are not on the public road. The splayed junctions with a 10m radius will be constructed to ensure the safety of the junction for regular construction traffic.

The sightline distance will be achieved by installing a timber post and rail fence and keeping an area outside the fence free of vegetation or other obstructions. The sight distance splays in both directions with the modifications in place are shown in **Volume II, Chapter 02** Description of the Proposed Development of this EIAR and on **Planning Drawing No. 22635-MWP-00-00-DR-C-5067 to 22635-MWP-00-00-DR-C-5069**. These improvements will remain in place permanently and will benefit users of the wind farm when exiting the site onto the public road. A photograph of a typical wind farm entrance with sightlines improved is shown in **Plate 4-1**.



Plate 4-1: Typical example of a Wind farm proposed site entrance

4.3 Internal Wind Farm Access Tracks

Internal access tracks are required to interconnect elements of the site and allow access to all wind turbines and wind farm infrastructure. The proposed wind farm will require approximately 10.8km of access tracks that will be constructed within the development site, the access track details are a combination of founded, floated and upgraded designs. 8.3km, will be new founded tracks and 0.5km of existing track will be upgraded. Finally, 2.0km of new floated tracks are required for the potential areas where depth to a solid base is excessive.

Design of the access tracks complies with the guidance in *COFORD, 2004, Forest Road Manual, Guidelines for the design, construction and management of forest roads* and *Forestry Civil Engineering and Scottish Natural Heritage - Floating Roads on Peat 2010*. All access tracks, founded/floated/upgraded, will have a running width of 5.5m along straight sections, with localised wider areas at bends to accommodate the efficient transport of the wind turbine components, larger splays will be required at the wind farm access points and at spur junctions for the large turbine component delivery trucks. The layout of the access tracks are shown in **Planning Drawing No. 22635-MWP-00-00-DR-C-5006 to 22635-MWP-00-00-DR-C-5020**.

The internal site access track design, constraints, objectives and rationale for the proposed wind farm development are outlined below.

The following constraints were considered in the alignment and location of the internal access track design within the site:

1. Neighbouring properties & dwellings (DoEHLG Guidelines) to meet noise requirements.
2. Existing Infrastructure, as outlined in **Volume II, Chapter 02** Description of the Proposed Development of this EIAR, maintain separation distances from road, rail, power, gas and other services. Except where connection and crossings are required.
3. Avoidance of hydrological areas, as outlined in **Volume II, Chapter 09** Water of this EIAR, except where water crossings and other minor works are required.
4. Avoidance of archaeological features, as outlined in **Volume II, Chapter 14** Cultural Heritage of this EIAR.
5. Minimisation of felling of existing forestry as outlined in **Volume II, Chapter 02** Description of the Proposed Development of this EIAR.
6. Avoidance of ecologically sensitive areas, as outlined in **Volume II, Chapter 06** Biodiversity of this EIAR.
7. Avoidance of geological features and areas, as outlined in **Volume II, Chapter 08** Land and Soils of this EIAR.
8. Site topography (OSI contour data) to avoid excess cut/fill, avoid steep slopes for turbine delivery vehicles.
9. Reduction of visual impact (DoEHLG Guidelines) access tracks, substation, turbines located to blend into existing landscape where possible i.e. access tracks along existing contours.

The following outlines the internal access track design rationale:

- The access track design was based on the necessity to deliver wind turbines with a blade length of 68.0m.
- Track gradients throughout most of the site are 8% or less which is sufficient for turbine delivery.
- The maximum camber and crossfall gradient on the access tracks is 2.5%.
- As turbines are normally grouped and linked in electrical circuits, consideration was given to cable circuit layouts in the internal access tracks route selection process. It is planned to run all cables under or

adjacent to the internal access tracks; it is important to ensure that access tracks facilitate efficient cabling.

- New sections of access tracks were selected minimising steep ground and utilising natural drainage features.
- Access track alignments were selected that will have adequate turning radii for delivery of turbines.
- Avoidance of stream crossings and water bodies, where possible.

The design of the site access track will depend on local geotechnical, topographical, and hydrological conditions. Founded, floated and upgraded access track construction methods will be employed to achieve an access track structure appropriate to the site conditions, for further details on the construction of the access tracks refer to Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**). The aggregate required for the construction of the internal access tracks, hardstands and substation compound will be sourced from local quarries and two on site borrow pits, details on material volumes for construction are in **Section 4.12**. The access tracks will be finished with a top layer of imported aggregate to give a clean hardwearing running surface for the delivery of turbines. Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5406** for further details.

Overall, the internal site layout design is an optimal one in terms of its minimal impact on the existing public road network in the vicinity of the site, low risk in terms of associated environmental impacts, the use of a well-developed drainage network and good access and connectivity to the public road network.

4.4 Wind Turbines

4.4.1 Turbine Locations

The wind farm consists of Seventeen (17 No.) turbines. **Figure 4-2** shows the proposed wind turbine locations.

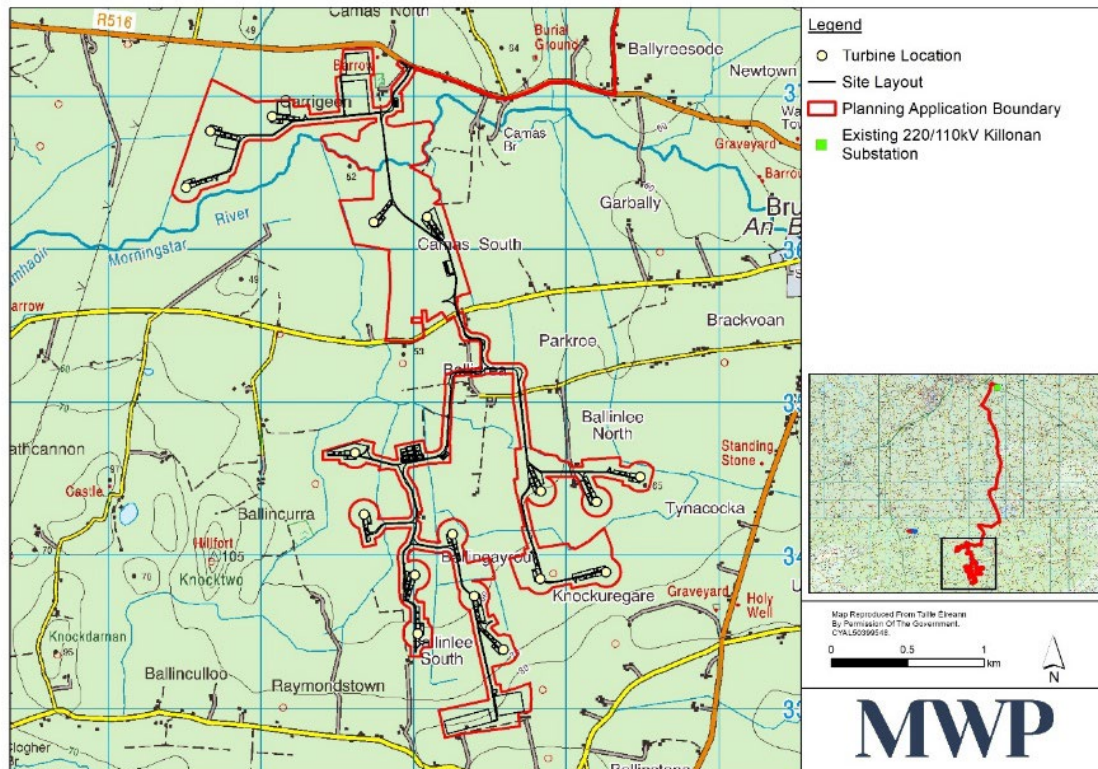


Figure 4-2: Map of proposed location of wind turbines

Topographically the nature of the site is relatively flat, based on the OSI map the maximum elevation is 79m AOD and the minimum is 49m AOD where infrastructure is to be developed. In engineering terms, the wind turbine locations have been selected to allow for a balance of cut and fill of the underlying strata at each location, accessibility for delivery of turbine components and sufficient space for the turbine hardstand.

The following constraints were considered in determining the location of the wind turbines within the site:

1. Neighbouring properties & dwellings (DoEHLG Guidelines) to meet noise, shadow flicker requirements.
2. Neighbouring Wind Energy Developments as outlined in **Volume II, Chapter 01** Introduction of this EIAR.
3. Existing Infrastructure, as outlined in **Volume II, Chapter 02** Description of the Proposed Development of this EIAR, maintain separation distances from road, rail, power, gas and other services. Except where connection and crossings are required.
4. Avoidance where possible of hydrological areas, as outlined in **Volume II, Chapter 09** Water of this EIAR..
5. Avoidance of archaeological features, as outlined in **Volume II, Chapter 14** Cultural Heritage of this EIAR.
6. Minimisation of felling of existing forestry as outlined in **Volume II, Chapter 02** Description of the Proposed Development of this EIAR, maintenance of ecological connectivity.

- #### 4.4.2 Turbine Hardstands

The wind turbine hardstand areas are generally rectangular in shape with additional temporary hardstand set down areas for turbine blades. The area of a single hardstand is approximately 80m long by 30m wide with depths varying depending on ground conditions and topography. Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5404** for further details.

The design of the turbine hardstand area is based on the specifications, standards and requirements provided by the turbine manufacturers. The hardstand areas are designed to facilitate the loads imposed by the main lifting crane during the turbine erection process. Refer to the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**) for further information on turbine hardstand area construction. A photograph of a typical completed wind turbine hardstand area is shown in **Plate 4-2**.



Plate 4-2: Example of a typical Wind farm finished wind turbine hardstand area

4.4.3 Turbine Foundation

The foundations of the Seventeen (17 No.) wind turbines will have a reinforced concrete base pad foundation with a central pedestal above the base, that will in turn support the wind turbine tower and be surrounded by a hardstand area.

Each turbine base will be constructed on suitable bearing stratum and will be constructed utilising a spread foundation, which is wide and shallow. A typical foundation will be approximately 27m in diameter and will generally be installed to a depth of approximately 3.5m below ground level. Approximately 1125m³ of concrete and 170 tonnes of steel will be used in the construction of each turbine base. Estimated material quantities required for the construction of the turbine bases are shown in **Section 4.12**. Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5403** for further details on the wind turbine foundations. The Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**) provides information on the construction of wind turbine foundations. A photograph of a typical wind turbine foundation, with reinforcing steel is shown in **Plate 4-3**.



Plate 4-3: Example of a typical reinforced wind turbine foundation

4.5 Internal Collector Circuit

The internal collector circuit, shown in **Figure 4-4**, illustrates the proposed circuits connecting the wind turbines to the substation compound. The circuits are between 20kV – 38kV and total 15.3Km, the circuits are defined as follows: Collector Circuit 1 (Pink) = 6.2Km, Collector Circuit 2 (Green) = 4.7Km and Collector Circuit 3 (Orange) = 4.4Km.

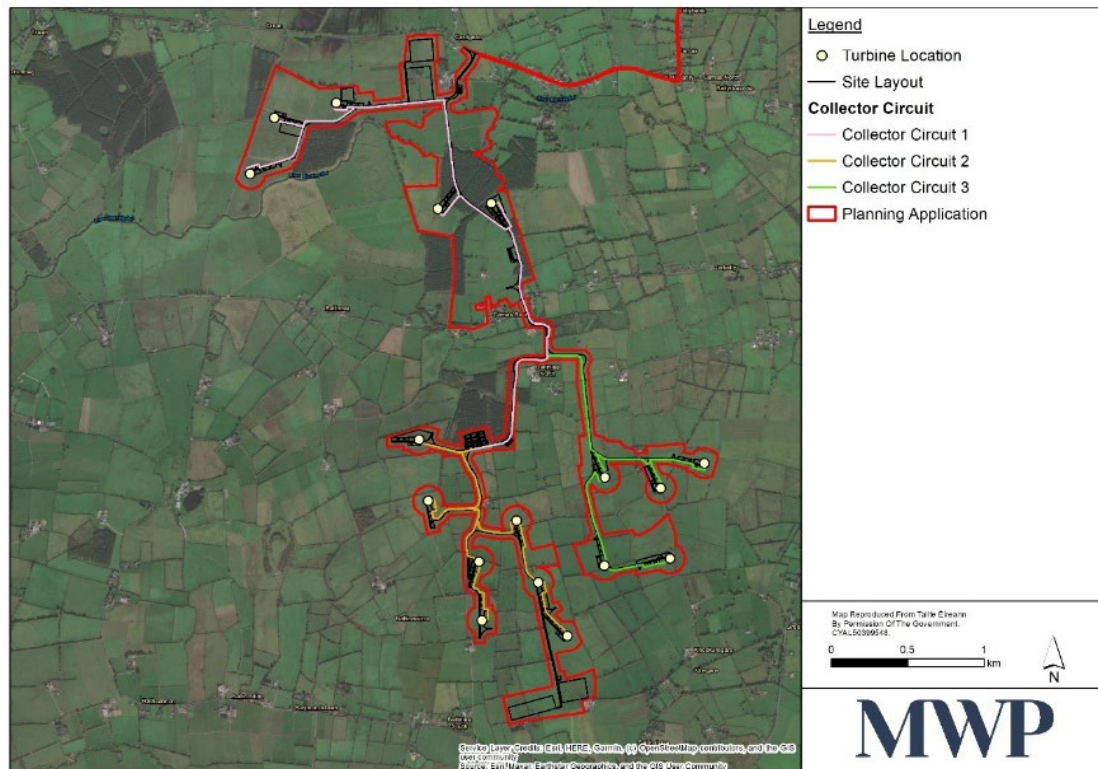


Figure 4-4: Map of proposed internal collector circuits

A network of underground cabling serving each turbine with electrical power and signal transmission will be installed within the site. The distribution system will electrically connect the wind turbines to the onsite substation. Cable jointing bays, (**Plate 4-4** is a typical example), will be required to allow cables to be jointed from the turbines to the onsite substation. Cabling on site is likely to consist of single or twin cable trenches for open ground sections and for trenches within internal access tracks. A cable marker post will be installed at intervals to identify the cable trench underneath. Post planning detailed design by an electrical engineer will determine the final configuration of the internal collector circuit. Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5006** to **22635-MWP-00-00-DR-C-5020** for further information on the layout of the internal collector circuit.

The design of the internal collector circuit follows best practise and is based on *International Electrotechnical Commission (IEC) Technical Specification 60502*. The typical build up for the internal site cable trenches will consist of selected excavated backfill on top of bedding material. The minimum cover depth over the ducts will be 750mm which is measured from the top of the cable duct to existing ground level. Where ducting is within internal access tracks; the cable trench will be backfilled with lean-mix concrete to protect ducting from being damaged by heavy axle loads that will pass above. The excavated material generated from the trenches will be reused as backfill

where possible or alternatively it will be deposited within the proposed on-site borrow pits as part of their reinstatement or the material deposition areas. Further details on the construction of the internal collector circuits are included in the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**) and design details in **Planning Drawing No. 22635-MWP-00-00-DR-C-5408**.



Plate 4-4: Example of a typical wind farm internal collector circuit joint bay

4.6 External Grid Connection

The grid connection route consists of an underground electrical cable from a new on-site 110kV electrical substation to be constructed in the wind farm site to the existing 220/110 kV Killonan substation 27.6km north of the main wind farm substation site. An extract from the planning drawings of the proposed 110kV grid connection cable route is outlined below in **Figure 4-5**. Approximately 3.2km of the external grid route will be within the wind farm site while the remaining 24.4km will be within public road carriageways. Refer to BFA Preferred Grid Route Option Assessment Report (EIAR **Volume III, Appendix 4A**) for further details on the selection of the external grid route on public roads.

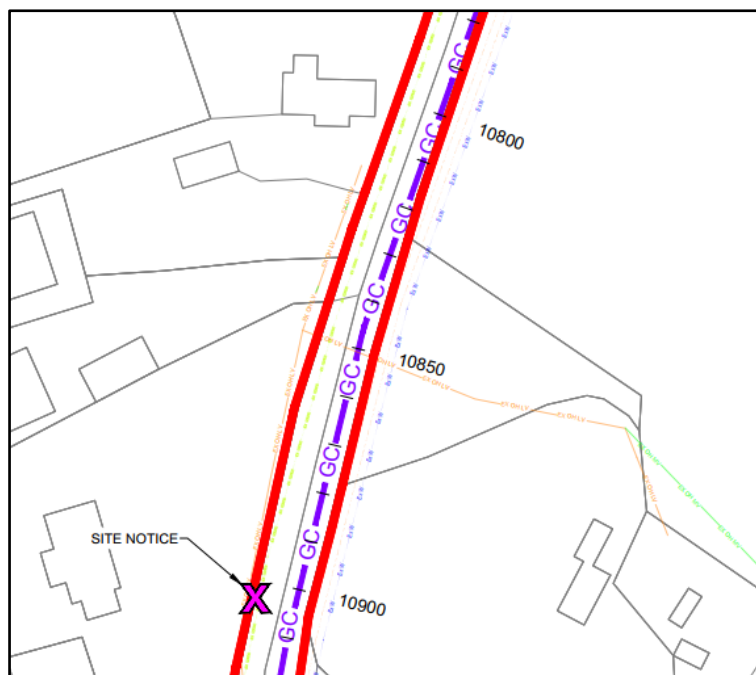


Figure 4-5: Extract from planning drawings showing external grid connection

The design of the external grid connection will comply with *EIRGRID Group - CDS-GFS-00-001-R0 110 kV - 220 kV and 400 kV Underground Cable Functional Specification General Requirements 2020* and *EIRGRID Group – XDN-CBL-STND-H-001 to 013 – 110kV Cable Standard drawings*. The excavated material generated from the trenches will be reused as backfill where possible or alternatively it will be deposited within the proposed on-site borrow pits as part of their reinstatement or the material deposition areas. Construction information on the external grid route is included in Grid Connection Route Report (EIAR **Volume III, Appendix 2D**) and Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

4.7 Substation Compound and Buildings

This section describes the design rationale, standards and specifications that were used for both the EirGrid (SS) and Independent Power Provider (IPP) substation buildings as well as the substation compound. An extract from the planning drawings of the SS & IPP locations are shown in **Figure 4-6**.

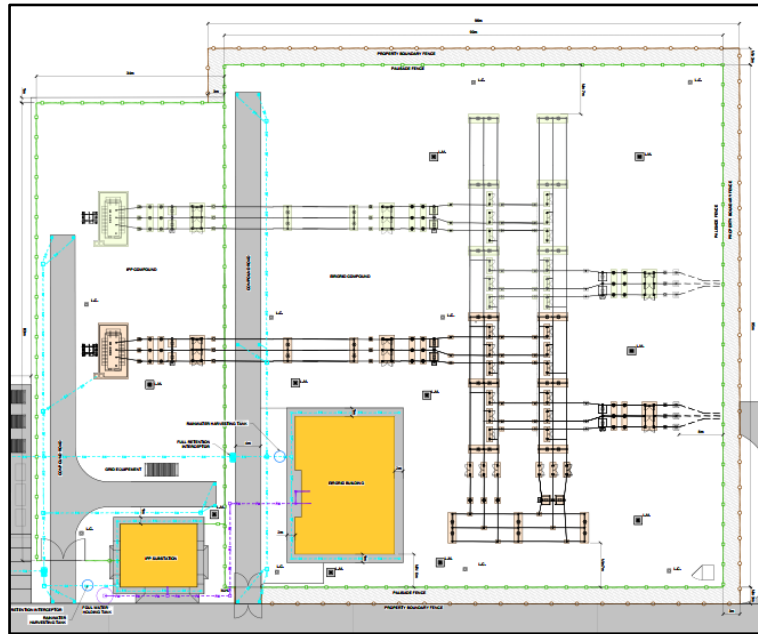


Figure 4-6: Extract from planning drawings showing IPP & SS compound

The location of the SS & IPP follow the same process and design constraints as in **Section 4.3** and **Section 4.4.1**. The location of the SS & IPP is shown on **Planning Drawing No. 22635-MWP-00-00-DR-C-5012**.

The following outlines the IPP & SS design rationale:

- Existing gradient across the compound is 0.72%.
- The cut/fill embankment slopes are 100%/45 degrees.
- Avoidance of stream crossings and water bodies, where possible.
- Location was selected minimising steep ground and natural drainage features.
- Location selected so that access would have adequate turning radii for delivery of components, and.
- Aerial photography, Ordnance Survey Ireland (OSI) contour data and LiDAR data were used to inform the platform design.

The IPP & SS design followed *EIRGRID Group - XDS-GFS-00-001-R4 - Functional Specification 110/220/400 kV Substation General Requirements 2019* and *EIRGRID Group – XDN-LAY-ELV-STND-H-001-R10 – 110kV AIS substation, 8 Bay 2024*. A typical 110kV AIS substation is shown in **Plate 4-5** and the details in terms of gate size, fence offset, wall thickness are fixed and are shown on Planning Drawing No. **22635-MWP-00-00-DR-C-5419** to **22635-MWP-00-00-DR-C-5429**.



Plate 4-5: Example of a typical substation building and compound

4.8 Permanent Meteorological Mast

A permanent meteorological mast is proposed for the site to monitor the wind regime while the wind farm is in operation. The mast will be located adjacent to the turbine access track at the southern side of the site, see **Figure 4-7**.

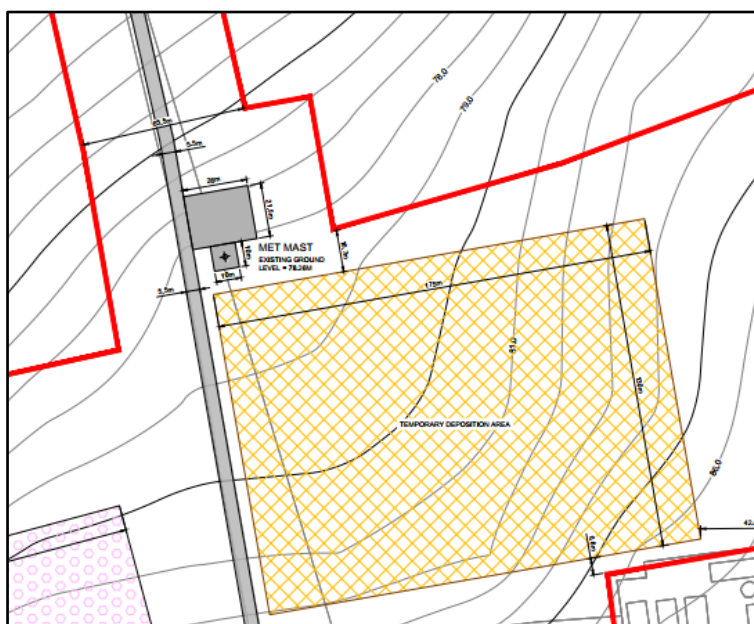


Figure 4-7: Extract from planning drawings showing permanent meteorological mast

The permanent meteorological mast is located north of borrow pit No.2 and temporary deposition area No.2. The location of the permanent meteorological mast is shown on **Planning Drawing No. 22635-MWP-00-00-DR-C-5017**. The permanent meteorological mast will be installed to a height of 92m which will be representative of the hub height of the turbines, the hardstand area will be surrounded by a galvanised steel palisade fence, 2.4m in height. Detailed design of the permanent meteorological mast will be completed post planning. **Plate 4-6** is an example of a wind farm met mast.

The design of the permanent meteorological mast will be accordance with *International Electrotechnical Commission (IEC) 61400*, details can be found on **Planning Drawing No. 22635-MWP-00-00-DR-C-5405** while information on the construction of the permanent meteorological mast is located in Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).



Plate 4-6: Example of a typical Meteorological Mast on a wind farm

4.9 Temporary Construction Compounds

Three temporary construction compounds will be constructed early in the development to provide site offices and accommodation for staff and for the delivery of materials. Surface water management, bunding, waste management measures etc. will also be put in place at the outset. Site security will be put in place adjacent to the entrances and will be maintained throughout all phases of the construction work. The compounds will be in place for the duration of the construction stage and will be removed once commissioning is complete. **Figure 4-8** shows the proposed locations of the three temporary compounds.

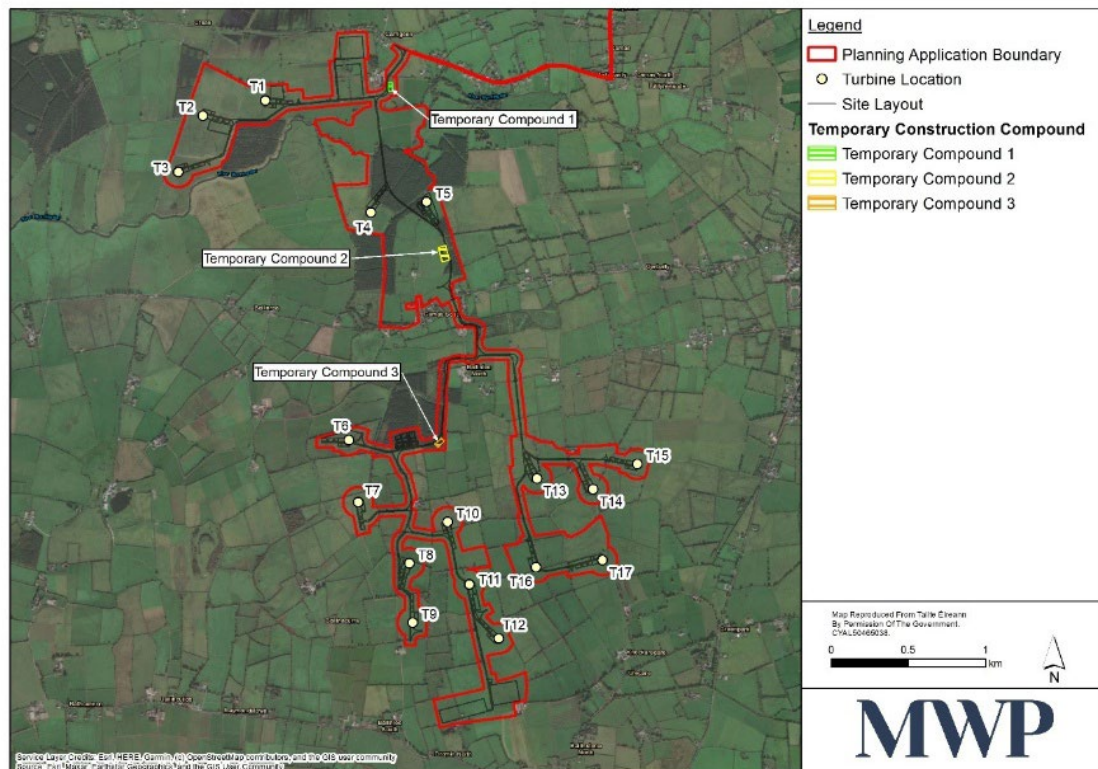


Figure 4-8: Map of proposed temporary construction compounds

The first compound will be located near the northern entrance to the wind farm, the second will be located to the south of Turbine 5, and the third will be located to the east of the Substation/IPP compound. Temporary Site Compound No.1 and No.3 will have dimensions of 55m x 25m as shown on **Planning Drawing No. 22635-MWP-00-00-DR-C-5413**. Temporary Site Compound No.2 will have dimensions of 95m x 50m as shown on **Planning Drawing No. 22635-MWP-00-00-DR-C-5414**.

The temporary construction compounds have been sized to meet the requirements of *HSE - Safety, Health and Welfare at Work (Construction) Regulations 2013 as amended Part 14 Construction Site Welfare Facilities*. **Plate 4-7** below is an example of a temporary construction compound while some of the functions are listed below:

1. A bunded containment area will be provided within the compounds for the storage of lubricants, oils, and site generators etc.
2. The compounds will be fenced and secured with locked gates.

3. During the construction stage, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction stage.
4. Upon completion of the construction stage, the compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.



Plate 4-7: Example of a typical temporary construction compound on a wind farm

4.10 Borrow Pits

The design of the wind farm includes two (2 No.) borrow pits. Borrow pit No 1 is located at the northern end of the wind farm site and no 2 at the southern end of the wind farm site as shown in **Figure 4-9**. The location of the borrow pits are also shown on **Planning Drawing No. 22635-MWP-00-00-DR-C-5008** and **22635-MWP-00-00-DR-C-5017**. The borrow pits will provide site won aggregate for the various infrastructure requirements. Site investigations were conducted to determine the depth below ground level to the rock strata layer. This was found to vary from 0.5m to 1.5m below ground level, refer to Trial Pit Logs (EIAR **Volume III, Appendix 8B**) for further information on the borrow pit site investigations.

The combined areas of the borrow pits is 60,700m². The topsoil layer, which has an average thickness of 0.3m, and mineral soil layer, which has an average thickness of 0.6m, above the rock layer will need to be excavated to facilitate the extraction of rock from the borrow pits. A rock layer of 2.350m is required which results in a minimum borrow pit depth of 3.250m. The rock layer produces, approximately, 142,650m³ of rock that will be processed into suitable site won aggregate. A 30% contingency factor was applied based on the desktop study of the geology and trial pits at the locations of the borrow pits. It has therefore been assumed that 70% of the rock excavated, when processed, will be suitable for use as aggregate on site. This results in 99,852m³ of usable site won aggregate.

Additional information on the borrow pits dimensions can be found on **Planning Drawing No. 22635-MWP-00-00-DR-C-5073** and **22635-MWP-00-00-DR-C-5074**. Further Information on the construction methodology of the borrow pits is located in Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).



Figure 4-9: Map showing the location of the proposed borrow pits

4.11 Deposition Areas

All excavated material, that isn't reused within the vicinity of the excavation will be transported to a deposition area within the wind farm site. Should any material be found to be contaminated, it will be transported offsite to an appropriately licenced facility. The deposition areas are either temporary or permanent. The description, details and design rationale of temporary and permanent deposition areas are discussed in **Section 4.11.1** and **Section 4.11.2**. Construction methodology and environmental management of the deposition areas is located in the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

4.11.1 Temporary Deposition Areas

The excavated overburden (topsoil and mineral soil) from the borrow pits will be temporarily stored at 1 of the 2 temporary deposition areas until the completion of the rock/aggregate extraction. The northern and southern temporary deposition areas are shown in **Figure 4-10**.



Figure 4-10: Map of proposed temporary deposition areas

Design details such as maximum storage height and embankment slope are incorporated into the design of the temporary deposition areas included in **Planning Drawing No. 22635-MWP-00-00-DR-C-5418**. The following principles will be adhered to when considering the temporary storage of excavated materials.

- Overburden (topsoil, mineral soil) storage will take place adjacent or within close proximity of each borrow pit.
- Preparation of the deposition area will involve the installation of silt fencing around the perimeter prior to the removal of the topsoil which will be transplanted to a suitable area and maintained for re-use during restoration operations.
- Material will be deposited, compacted in layers of 0.5m and will not exceed a total thickness of 1.5m.
- Material will only be deposited on slopes of less than 5 degrees to the horizontal and greater than 10m from the top of a cutting. The exact location of such areas will be confirmed on consultation with the geotechnical engineer.
- Upon commencement of the restoration phase, guidance from a suitably qualified environmental professional will be sought to confirm the methodology and programme. The material in the temporary deposition areas will be removed and placed in the borrow pits as part of their restoration.
- Once all material has been removed and reinstatement is complete the temporary deposition areas will be re-vegetated with the topsoil removed at the commencement of excavation operations.

The design of the deposition areas follows the processes in *Transport Infrastructure Ireland - CC-SPW-00600 – Earthworks 2024*. Additionally, any materials excavated during the construction stage shall in the first instance, be stored on site in an environmentally safe manner that will not result in the pollution of waters or located in ecologically sensitive habitats. It is proposed that the temporary deposition areas shall be removed, and material

utilised in the site reinstatement programme to infill any excavated borrow pit area which will then be mounded and capped with sod prior to the completion of works.

4.11.2 Permanent Deposition Areas

The wind farm includes nine (9 No.) permanent deposition areas in addition to the two (2 No.) temporary deposition areas. **Figure 4-11** shows the location of the deposition areas. The permanent deposition areas are proposed throughout the site in close proximity to areas where high quantities of excavated material are expected i.e. wind turbine foundations and the excavated material from other infrastructure.

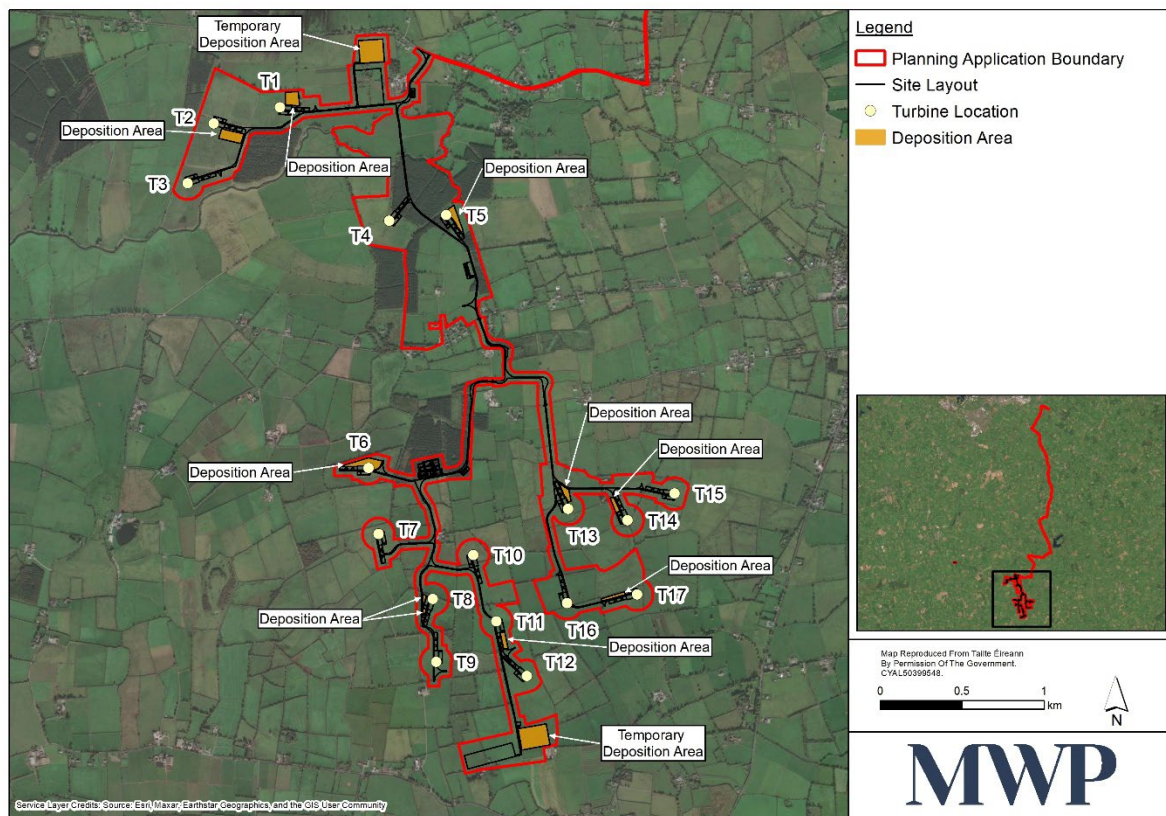


Figure 4-11: Map of proposed permanent deposition areas

The following principles will be adhered to when considering the storage of excavated materials.

- Excavated material storage will take place in the designated deposition areas.
- Preparation of the deposition area will involve the installation of silt fencing around the perimeter prior to the removal of the topsoil which will be transplanted to a suitable area and maintained for re-use during restoration operations.
- Material will be deposited in cells, compacted in layers of 0.5m and will not exceed a total thickness of 1.5m.
- Material will only be deposited on slopes of less than 5 degrees to the horizontal and greater than 10m from the top of a cutting. The exact location of such areas will be confirmed on consultation with the geotechnical engineer.
- Once reinstatement is complete the deposition areas will be re-vegetated.

Upon commencement of the restoration phase, works will be overseen by a suitably qualified environmental professional. As with the design of the temporary deposition areas, *Transport Infrastructure Ireland - CC-SPW-00600 – Earthworks 2024* was used for the design of the permanent deposition areas.

The proposed deposition areas will be subdivided into a series of cells. Silt fencing will be installed around the perimeter of the deposition areas. Each cell will be bunded by an embankment of engineered fill material capable of allowing a tracked excavator to move between the cells during deposition activities. The size of each cell will be dictated by the maximum working length of the excavators working the deposition area. Each cell will be bunded on all downslope sides, with additional silt fencing installed as required. The bund will be of adequate strength to retain the material stored within each cell. The bund and silt fencing will ensure sediment will not be released from the cells/deposition areas. Upon completion of each cell the surface of the deposited material will be profiled to a gradient not exceeding 5%.

Additional information relating to the construction methodology and environmental management of the deposition areas is located in the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

4.12 Construction Material Volumes

Material Volume Calculations (EIAR **Volume III, Appendix 4B**) includes details of the construction material volumes calculations, however **Table 4-1** provides a summary of the construction and excavated material volumes for the grid connection route and wind farm.

Table 4-1: Excavation and Material Volumes

Item	Unit	Quantity
Total Excavation Volume	m ³	321758
Excavated Material from the Wind Farm Site	m ³	296918
Excavated Material from the External Grid Route	m ³	24840
Total Aggregate Volume	m ³	167591
Imported Aggregate	m ³	67740
Site Won Aggregate	m ³	99852
Total Concrete Volume	m ³	35586
Total Reinforcement Volume	Tonnes	2882

4.13 Aggregate and Concrete Haul Route

Excluding the wind turbine component deliveries, the concrete and aggregate material deliveries are vital for the construction stage of the wind farm. A map of the concrete batching plants and quarries surrounding the wind farm site is shown in **Figure 4-12**, the concrete batching plants, quarries and associated routes are potential options at this stage of the project.

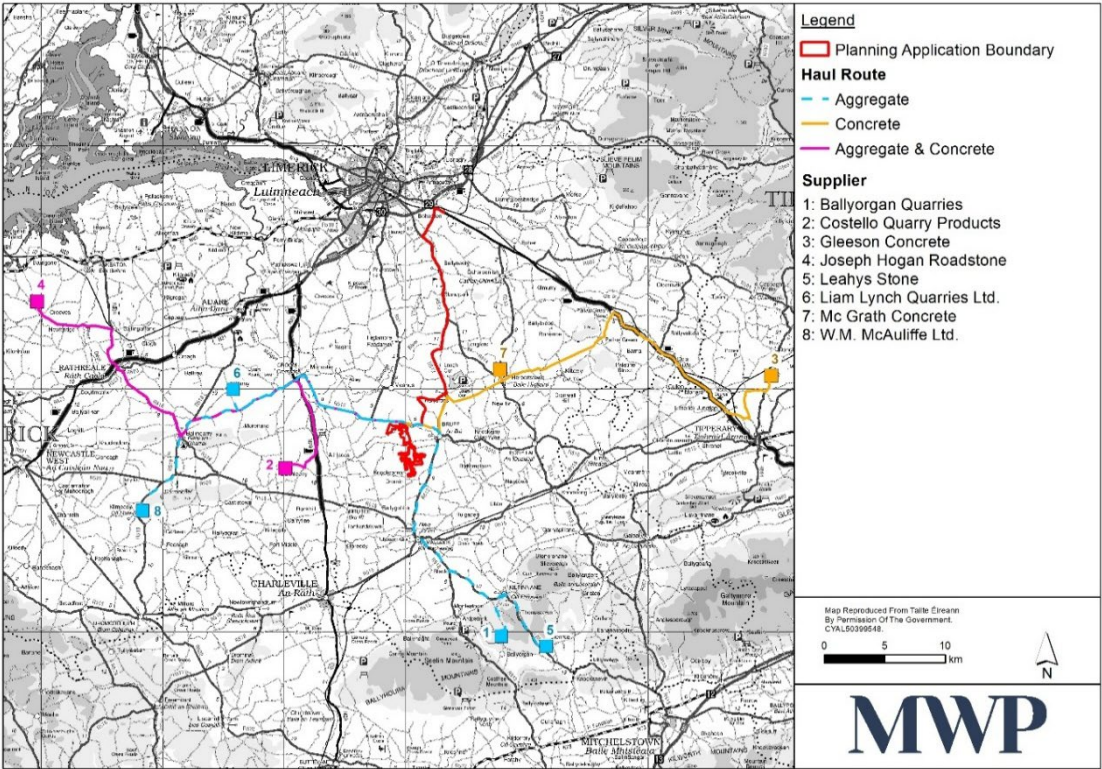


Figure 4-12: Map of the aggregate and concrete quarries

The material volumes illustrated above in **Section 4.12** provide the total volumes. Considering the volume of material and number of deliveries required, it is anticipated that 2 or more sources for concrete and aggregate will be required. **Table 4-2** provides additional information on the location of the concrete batching plants and quarries shown above.

Table 4-2: Distances from wind farm to aggregate quarries and concrete batch plants

Quarry Name	Address	Product Type	Distance from site (Km)	Co-ordinates (Lat/Long)	
McGrath Concrete Products Ltd	Ballinard, Co. Limerick	Concrete	12.5	52.52541381259566, 8.475756258526937	-
Liam Lynch Quarries Ltd	Kilfinny, Co. Limerick	Aggregate	19.0	52.51074067719904, 8.799939516197368	-
Costello Quarry Products	Coolruss, Bruree, Co. Limerick	Concrete & Aggregate	21.0	52.45064808350377, 8.73500700270491	-
Leahy's Stone	Ballynacourty, Kilfinane, Co. Limerick	Aggregate	24.0	52.32093714540462, 8.416940787371674	-
Ballyorgan Quarries	Ballyorgan, Co. Limerick	Aggregate	25.0	52.32893823579882, 8.471916760380546	-
W.M. McAuliffe Ltd.	Quarry, Kilmeedy, Co. Limerick	Aggregate	32.0	52.41853360605965, 8.90787161620183	-
Gleeson Concrete	Farnaclara, Donohill, Co. Tipperary	Concrete	44.0	52.523481433928, 8.14487247887865	-
Joseph Hogan Roadstone	Ballylin, Foynes, Co. Limerick	Concrete & Aggregate	39.0	52.57541182927034, 9.038467696437204	-

4.14 Turbine Delivery Route

The components for the 17 no. turbines will be delivered by marine freight to the Port of Foynes. The components for each turbine will be delivered in separate loads, some of which are abnormal in terms of their width and length. The components will be transported from the Port of Foynes to the site along the National, Regional and Local Road network. An overview of the proposed route is shown in **Figure 4-13**, refer to the Turbine Delivery Route Report (EIAR **Volume III, Appendix 2C**) for further details.

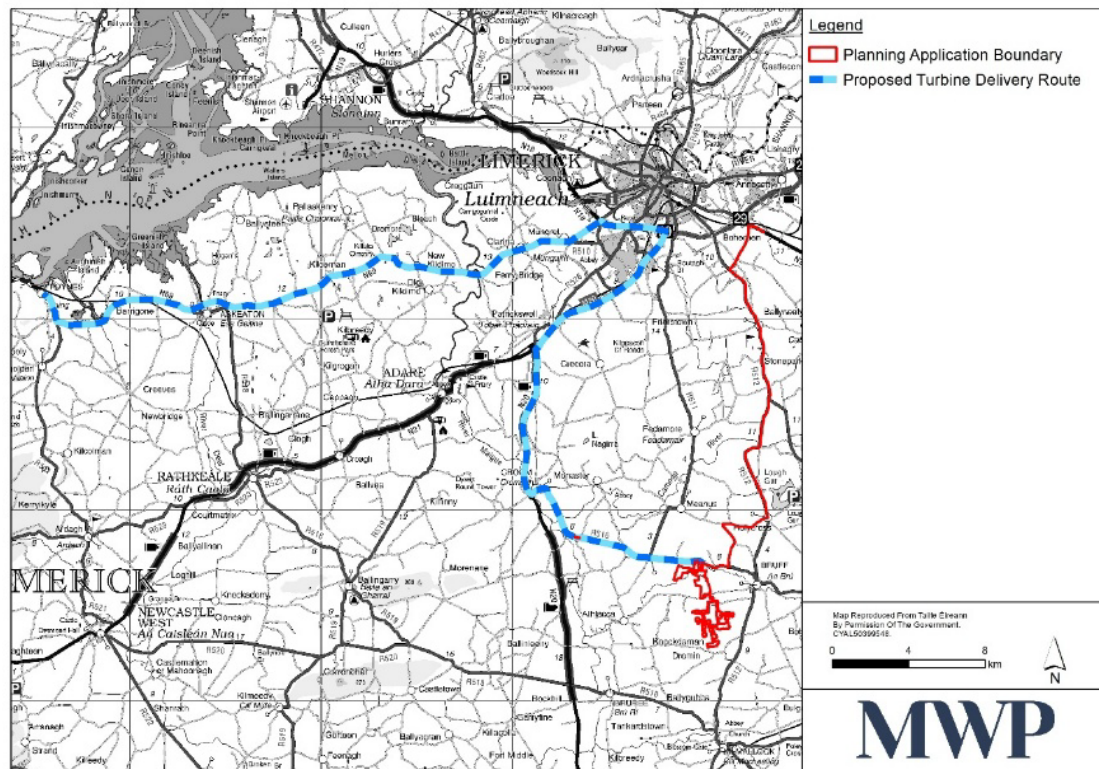


Figure 4-13: Map of proposed turbine delivery route

The delivery of turbine components to the proposed development will require temporary works on sections of the public road network along the delivery route including hedge or tree cutting, relocation of powerlines/poles, lampposts, signage and temporary local verge strengthening. Such works are temporary for the delivery of turbine components and are not included in the planning application boundary.

One section of the delivery route at, Tullovin Bridge, will require the construction of a temporary access track as the swept path analysis highlighted vehicle manoeuvre difficulties at the bridge and the bends either side of the bridge. **Figure 4-14** is an extract from the **Planning Drawing No. 22635-MWP-00-00-DR-C-5072** showing the location of the proposed temporary access track. It is included in the Planning Boundary for the proposed wind farm development. The section of access track at Tullovin will be approximately 250m in length, and 5.5m wide and will either be constructed as a floated or founded design. Surface water controls will be implemented for the access track construction and operation. The surface water controls, and management principles are provided in the Surface Water Management Plan (EIAR **Volume III, Appendix 2E**) and the construction methodology of the access track is included in the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

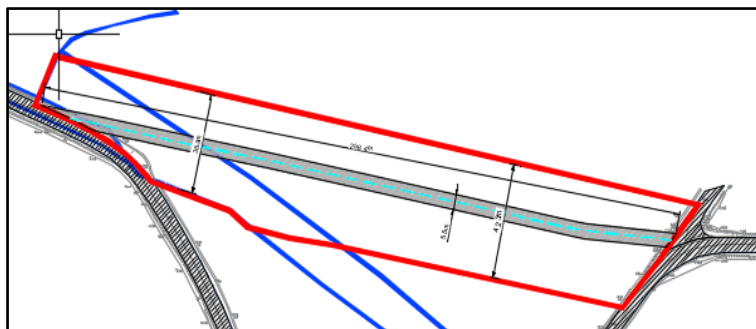


Figure 4-14: Extract from the planning drawings showing the Tullovin Temp Access track

4.15 Gas Network Ireland Transmission Pipeline

The access track layout crosses an existing Gas Network Ireland (GNI) transmission pipeline at three (3 No.) locations as shown in **Figure 4-15** below. GNI have been consulted during the design process of the wind farm in relation to the setback distance of the turbines from the transmission pipeline ($2 \times$ turbine tower height) and the requirements for protecting the pipeline. EIAR, **Volume III, Appendix 4L** contains an electrical interference assessment relating to potential interference from electrical cables to be installed as part of the proposed development and buried gas pipelines. Under both normal and fault conditions there are no safety risks to the pipeline, general public or livestock. Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5442** for details on the protection to the pipeline at the access track/cable crossings.

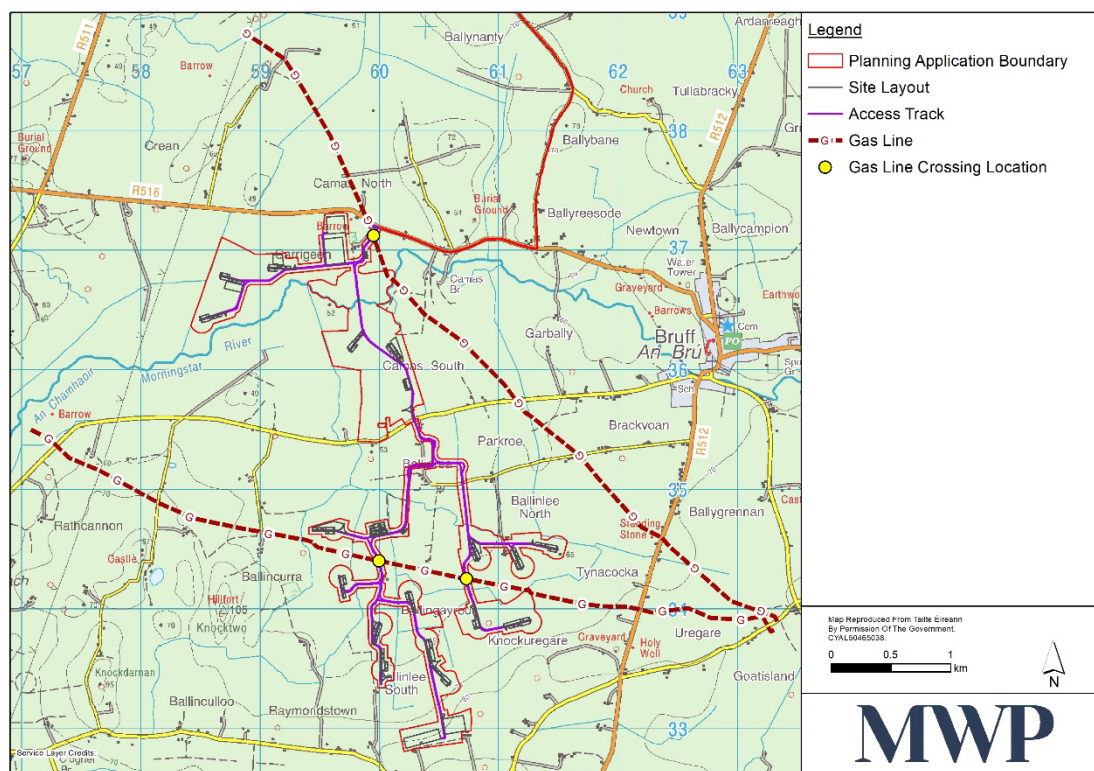


Figure 4-15: Map showing access tracks crossing GNI transmission pipeline

4.16 Substation Compound Water Design

4.16.1 Surface Water

Volume II, Chapter 09 Water of this EIAR provides information on the hydrology and hydrogeology on the existing watercourses and the established natural water network of the windfarm site. Also included in **Volume II, Chapter 09** Water of this EIAR is information regarding water quality and monitoring which is essential for the operational stage of the wind farm development.

The surface water management principles, the requirements and functionality of the surface water controls and details of the features and devices are provided in the Surface Water Management Plan (EIAR **Volume III, Appendix 2E**).

The following subsections under **Section 4.16.1** provide a brief introduction to the surface water controls and the design rationale, standards and specifications applied for each method of control. Autodesk InfoDrainage software was used to model the surface water network, run simulations and to produce a model output and simulation data report. Information regarding the construction of each of the surface water controls is provided in the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

Met Éireann Rainfall Data (EIAR **Volume III, Appendix 4C**) provides rainfall data which informed the surface water design.

4.16.1.1 Surface Water Network

The operational stage of the substation compound will utilise a closed conduit/piped surface water network for the IPP & EirGrid compounds. The surface water piped network varies from 100 – 225mm Dia uPVC. The IPP & EirGrid compounds surface water pipes are designed in accordance with *Department of Housing, Local Government and Heritage - Technical Guidance Document H – Drainage and Wastewater Disposal 2016*.

Permanent Surface Water Calculations (EIAR **Volume III, Appendix 4E**) includes the initial information for the surface water design, including substation coordinates, soil index determined from the soil survey maps as part of the *Natural Environment Research Council - Flood Studies Report (SOIL)*, standard annual average rainfall (SAAR), the catchment area, the surface water conduits and chamber details i.e. labels, dimensions and depths. InfoDrainage Model and Simulation Results (EIAR **Volume III, Appendix 4H**) details the surface water network modelling and simulation results.

Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5419** for further information on the layout of the IPP & SS compounds surface water network.

4.16.1.2 Surface Water Treatment

Contaminated runoff (hydrocarbons and sediment) from the IPP & EirGrid substation compound areas is principally due to movement of delivery vehicles, on-site traffic and general operations activities. A three-phase treatment system is proposed for the surface water from the IPP & EirGrid substation compounds. The three

stages of the treatment system each have a different function. **Plate 4-8** is an example of a proprietary treatment device typical used on wind farms substation compounds.



Plate 4-8: Typical proprietary treatment device used on wind farm substation compounds

The treatment system for the IPP & EirGrid compounds was designed in accordance with the following:

- Met Éireann Rainfall Data
- Runoff flow rate for the catchment area
- Klargester sizing table
- EPA silt trap guidelines
- CIRIA C753 The SuDS manual 2015

The treatment system consists of three (3) parts which are as follows:

- Wavin or similar product rainwater downpipe gullies and road gullies are the first part of the treatment system. These trap and remove sediment from the surface water runoff at the start of the surface water network.
- The secondary part of the treatment system is a propriety treatment device; the propriety treatment device removes sediment and hydrocarbons. A Klargester class 1 by-pass separator or similar approved product is proposed (see Proprietary Treatment Device (EIAR **Volume III, Appendix 4D**).
- The third part of the treatment system is the forebay contained within the detention basin. This feature removes any remaining sediment from the surface water runoff.

The selection of the treatment system devices and feature follows the guidelines established in *Limerick City and County Council - Surface Water/SuDS Specification 2022*. The design of the propriety treatment devices follows the manufacturers specifications and guidelines.

Refer to **Planning Drawing No. 22635-MWP-00-00-DR-C-5419** for information on the location of the IPP & SS compounds Klargester proprietary treatment device. Further information on the Klargester proprietary treatment device can be found in this EIAR, **Volume III, Appendix 4D**.

4.16.1.3 Surface Water Attenuation

The surface water runoff from the IPP & EirGrid compound areas is attenuated in a detention basin, two detention basins are proposed, one for the EirGrid compound & one for the IPP compound. Following the propriety treatment device, the surface water enters the detention basin via an inlet headwall, flows through the detention basin and exits via an outlet headwall. The surface water flows to a discharge control device contained within a manhole. **Plate 4-9** is an example of a typical attenuation feature used on wind farms.



Plate 4-9: Typical attenuation feature constructed for wind farm substation compounds

Attenuation for the IPP & EirGrid compounds was designed in accordance with the following:

- Met Éireann Rainfall Data
- CIRIA - C753 The SuDS Manual 2015
- Limerick City and County Council - Surface Water/SuDS Specification 2022
- EIRGRID Group – XDN-LAY-ELV-STND-H-001-R10 – 110kV AIS substation, 8 Bay 2024

The attenuation volumes for a 1% AEP (Annual Exceedance Probability) rainfall event required for the IPP and EirGrid compound are 30.0 m³ and 46.0 m³ respectively. To allow maintenance vehicles easy and safe access, both detention basins side slopes are 1:3.

The detention basin for the IPP compound has a maximum area of 190.0 m² and depth of 1.075 m. A freeboard of 0.400 m results in the maximum water depth of 0.675 m and volume of 39.1 m³ for a 1% AEP rainfall event.

The detention basin for the EirGrid compound has a maximum area of 223.0 m² and depth of 1.350 m. A freeboard of 0.400 m results in the maximum water depth of 0.950 m and volume of 54.7 m³ for a 1% AEP rainfall event.

Design of the attenuation basins for the IPP and EirGrid compounds included the following steps:

- Permanent Surface Water Calculations (EIAR **Volume III, Appendix 4E**) includes the initial information for the surface water design this includes coordinates, soil index determined from the soil survey maps as part of the *Natural Environment Research Council - Flood Studies Report* (SOIL), standard annual average rainfall (SAAR), the catchment area and the surface water detention basin details i.e. Max water level, Freeboard.
- UK SuDS Greenfield Discharge Rates & Attenuation Storage Volume (EIAR **Volume III, Appendix 4F**) includes the UK SuDS initial estimated attenuation volumes.
- InfoDrainage Discharge Quick Storage Estimate & Runoff Rate Calculator (EIAR, **Volume III, Appendix 4G**) is the initial calculations for the estimated attenuation volumes from InfoDrainage.
- InfoDrainage Model and Simulation Results (EIAR **Volume III, Appendix 4H**) shows the detention basin modelling and simulation results in the InfoDrainage report.

Refer to planning drawing **22635-MWP-00-00-DR-C-5419** for further information on the location of the IPP & SS compounds detention basin. Details of the detention basin are included in planning drawing **22635-MWP-00-00-DR-C-5443**

4.16.1.4 Surface Water Discharge Control

The surface water runoff from the IPP & EirGrid compound areas is restricted by a proprietary discharge control device hydrobrake or similar approved. Two hydrobrake's are proposed, one for the EirGrid compound Detention basin and one for the IPP compound Detention basin. At the discharge from the detention basin, the surface water enters the discharge control manhole. The proprietary discharge control device is installed at the outlet of the manhole. The proprietary discharge control device restricts the flow of the surface water runoff; **Plate 4-10** is an example of a proprietary discharge control device typically used on wind farms.



Plate 4-10: Typical discharge control device used within wind farms

Discharge for the IPP & EirGrid compounds was designed in accordance with the following:

- Met Éireann Rainfall Data
- CIRIA - C753 The SuDS Manual 2015
- Limerick City and County Council - Surface Water/SuDS Specification 2022
- EIRGRID Group – XDN-LAY-ELV-STND-H-001-R10 – 110kV AIS substation, 8 Bay 2024

The hydrobrake will limit the discharge from the detention basins. The surface water discharge rates, Q_{bar} and Q_{100} , for the IPP compound are Q_{bar} : 1.01 l/s & Q_{100} year: 1.97 l/s. The surface water discharge rates for the EirGrid compound are Q_{bar} : 2.63 l/s & Q_{100} year: 5.55 l/s.

Design of the discharge control of the IPP and EirGrid compound detention basins included the following:

- UK SuDS Greenfield Discharge Rates & Attenuation Storage Volume (EIAR **Volume III, Appendix 4F**) includes the UK SuDS initial calculations for the greenfield runoff rates.
- InfoDrainage Discharge Quick Storage Estimate & Runoff Rate Calculator (EIAR **Volume III, Appendix 4G**) is the initial calculations for the greenfield runoff rates from InfoDrainage.
- InfoDrainage Model and Simulation Results (EIAR **Volume III, Appendix 4H**) shows the discharge control modelling and simulation results in the InfoDrainage report.

Refer to planning drawings **22635-MWP-00-00-DR-C-5419** for further information on the location of the IPP & SS compounds manholes containing the hydrobrake's.

4.16.1.5 Surface Water Outfall

The surface water runoff from the IPP & EirGrid compound areas will outfall to an existing drainage ditch, downstream of the discharge control hydrobrake's. The surface water from the IPP & EirGrid compound areas

combine in a manhole before outfall to an existing surface water drain via a precast concrete headwall. **Plate 4-11** is an example of a precast concrete headwall with a galvanised grate.



Plate 4-11: Typical outfall structure used within wind farms

Refer to planning drawings **22635-MWP-00-00-DR-C-5419** for further information on the location surface water outfall from the IPP & SS compounds. Precast concrete headwall details are included in the planning drawing **22635-MWP-00-00-DR-C-5441**.

4.16.2 Wastewater

The following sections describe the design of the wastewater network and holding tank.

4.16.2.1 Wastewater Network

The operational stage of the wind farm and substation will utilise a closed piped wastewater network. The wastewater piped network for the IPP & EirGrid compounds are designed in accordance with *Department of Housing, Local Government and Heritage - Technical Guidance Document H – Drainage and Wastewater Disposal 2016*. Refer to planning drawing **22635-MWP-00-00-DR-C-5419** for further information on the layout of the IPP & EirGrid compounds wastewater network. The wastewater piped network varies from 40 – 150mm Dia uPVC.

4.16.2.2 Wastewater Holding Tank

Wastewater during the operational stage of the wind farm and substation will not discharge to an existing public closed piped network, instead wastewater will discharge and be collected in a new wastewater holding tank. **Plate 4-12** is an example of a holding tank typically used on wind farms.



Plate 4-12: Typical wastewater holding tank used on wind farms

Wastewater Holding Tank Calculations (EIAR **Volume III, Appendix 4I**) provides the preliminary design calculations for the wastewater holding tank. The design follows the specifications and guidelines set out in *Environmental Protection Agency - Code of practice Domestic Wastewater Treatment Systems (Population Equivalent ≤ 10) 2021*. For further information on the wastewater holding tank refer to the detail drawing in planning drawing **22635-MWP-00-00-DR-C-5428**.

4.16.3 Potable Water

The following sections describe the design of the potable water system:

4.16.3.1 Potable Water Network

The operational stage of the wind farm and substation will not utilise an existing watermain or treated rainwater system for potable water. Potable water will be provided from a third party and delivered to the IPP & EirGrid compound buildings in accordance with *Department of Housing, Local Government and Heritage - Technical Guidance Document G – Hygiene 2008*.

4.16.3.2 Rainwater Harvesting Tank

As above, the operational stage of the wind farm will not utilise an existing watermain, well or treated rainwater system for potable water. Surface water runoff from footpaths and roof areas will be collected in a rainwater harvesting tank and used as a greywater system. **Plate 4-13** is an example of a rainwater harvesting tank typically used on wind farms.



Plate 4-13: Typical rainwater harvesting tank used on wind farms

Rainwater Harvesting Tank Calculations (EIAR **Volume III, Appendix 4J**) provides the design calculations for the rainwater harvesting tank. The design follows the specifications and guidelines set out in *BS EN 16941-Part 1 Systems for Use Rainwater*. For further information on the rainwater harvesting tank refer to the detail drawing in planning drawings **22635-MWP-00-00-DR-C-5428**.

4.17 Wind Farm Surface Water Design

Volume II, Chapter 09 Water of this EIAR provides information on the hydrology and hydrogeology of the windfarm site, existing watercourses and the established natural water network. Also included in **Volume II, Chapter 09** Water of this EIAR is information regarding water quality and monitoring which is essential for the construction and operational stages of the wind farm development.

Although some surface water controls as part of the operational stage surface water management plan differ to the surface water controls as part of the construction stage, the principles are shared across both stages. The surface water principles, the requirements and functionality of the surface water controls and details of the features and devices are provided in the Surface Water Management Plan (EIAR **Volume III, Appendix 2E**).

The following sections provide a description of the surface water controls; design rationale, standards and specifications applied for each control element. Information regarding the construction of each control element is provided in the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

4.17.1 Surface Water Network

The construction stage of the wind farm will utilise a mix of open (swales/clear span culverts) and closed conduits (culverts/pipes) as part of the surface water network. Wind farm open surface water features are designed in

accordance with CIRIA - C753 *The SuDS Manual 2015* and Limerick City and County Council - *Surface Water/SuDS Specification 2022*. The closed surface water network varies from plastic (uPVC, HDPE) and concrete (RCRRJ) pipes to box/arch culverts. The open surface water network consists of clean conveyance/ attenuation and cut-off swales. **Plate 4-14** is an example of a conveyance/attenuation swale used within wind farms.

Refer to planning drawings **22635-MWP-00-00-DR-C-5052** to **22635-MWP-00-00-DR-C-5066** for further information on the layout of the wind farm surface water network.



Plate 4-14: Typical conveyance swale feature used within wind farms

4.17.2 Surface Water Treatment

Contaminated runoff (hydrocarbons and sediment) can be generated from the access tracks, borrow pit, deposition areas, met mast area, temporary construction compounds, substation site and turbine hard standing areas. The contaminated runoff is mainly due to excavation for the infrastructure, delivery vehicle movements and on-site traffic. Swales carrying construction site runoff will be diverted into sediment settlement ponds that reduce flow velocities, allowing sedimentation which reduces the sediment loading. **Plate 4-15** shows a typical modular approach to surface water treatment; the design of the sediment settlement ponds for the construction has adopted a similar approach for this wind farm. Refer to planning drawings **22635-MWP-00-00-DR-C-5052** to **22635-MWP-00-00-DR-C-5066** for further information on the location of the sediment settlement ponds within the wind farm surface water network.



Plate 4-15: Typical treatment feature used within wind farms

The sediment settlement ponds have been designed as a three-stage tiered system and this has been proven to work effectively on wind farm construction sites. The three-stage system also facilitates effective cleaning with minimal contamination of water exiting the pond.

The settlement ponds have been designed with regard to the following:

- Runoff flow rate for the modular catchment area.
- Met Éireann Extreme Rainfall Data (statistical rainfall intensity / duration table).
- Character of the impermeable areas (runoff coefficients); and
- Design particle size and density.

The treatment process of this feature consists of primary; secondary and tertiary treatment as follows:

- The primary treatment consists of a three-stage settlement pond with an over-topping weir at each stage. The sediment load of the surface water will be reduced as it passes through each stage. Generally, the first chamber removes the largest portion of the sediment load, while the remaining two chambers will remove remaining large particles from the sediment load. Several factors, including the flow rate, turbidity and particle sizes can influence the removal rate.
- Before the water is released onto the existing ground surface, it passes through a secondary treatment system in the form of a graded gravel filter bed that removes the remaining fine particles from the sediment load.
- The outflow from each interceptor is dispersed across a wide area of vegetation so that the velocity is minimised and the vegetation can filter out any residual sediment load from the surface water. This is

the final or tertiary stage of the treatment process. Existing rills and collector drains within the tertiary treatment area are blocked off to prevent concentration of the flow.

Temporary Surface Water Calculations (EIAR **Volume III, Appendix 4K**) shows the design calculations for the sediment settlement pond. The design follows the specifications and guidelines set out in *CIRIA - C753 The SuDS Manual 2015* and was developed in conjunction with Inland Fisheries Ireland personnel and local authority engineers. For further information on the sediment settlement pond, refer to planning drawing **22635-MWP-00-00-DR-C-5407**.

4.17.3 Surface Water Attenuation

The proposed wind farm is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is very small in the context of the catchment size and therefore represents a negligible increase in downstream flood risk. However, it is proposed to provide attenuation to limit the flow rate into the settlement ponds during high intensity storm events so that they do not become overloaded. This will also attenuate the flow to the downstream watercourses. The swales, mentioned above in **Section 4.17.1** are conveyance/attenuation swales and therefore serve a dual purpose, not only directing dirty water to the sediment settlement ponds but also providing attenuation storage for the surface water runoff. Refer to planning drawings **22635-MWP-00-00-DR-C-5052** to **22635-MWP-00-00-DR-C-5066** for further information on the location of the conveyance/attenuation swales within the wind farm surface water network.

The conveyance/attenuation swales will attenuate flows by creating check dams within the swale at regular intervals. To provide attenuation it is typical to space check dams at 100m intervals, but the distance can vary depending on the longitudinal slope of the swale, with steeper slopes requiring shorter intervals. An example of a conveyance/attenuation swale with check is shown above in **Plate 4-14**.

Temporary Surface Water Calculations (EIAR **Volume III, Appendix 4K**) shows the design calculations for the conveyance/attenuation swale. The design follows the specifications and guidelines set out in *CIRIA - C753 The SuDS Manual 2015*. For further information on conveyance/attenuation swales, refer to planning drawing **22635-MWP-00-00-DR-C-5407**.

4.17.4 Major Watercourse Crossing

There is one major watercourse crossing within the wind farm site crossing the Morningstar River between temporary construction compound No.1 and turbine No.4. **Figure 4-16** is an extract from planning drawing **22635-MWP-00-00-DR-C-5009**, showing the location of the crossing.

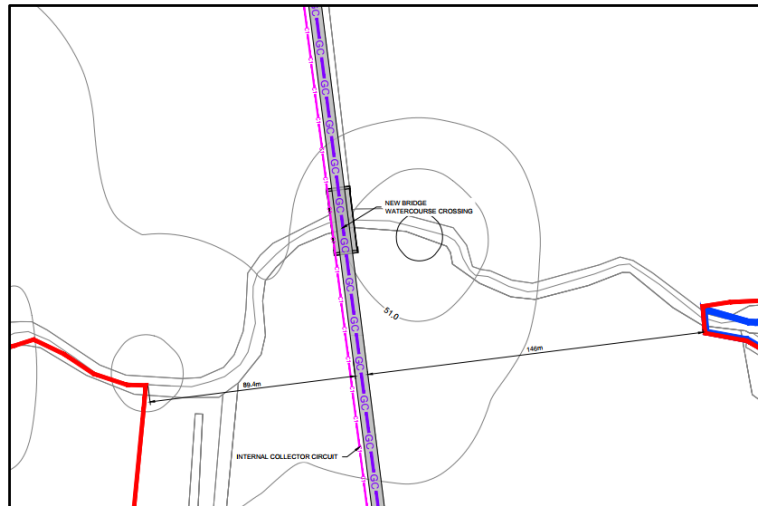


Figure 4-16: Extract from the planning drawings showing the location of the Morningstar River clear span crossing

The preliminary design for the crossing is a clear span pre-cast concrete bridge and is shown in planning drawing **22635-MWP-00-00-DR-C-5401**. The bridge span, deck level and abutment locations have been designed based on the information from the Flood Risk Assessment (EIAR **Volume III, Appendix 9B**). See also the Construction Environmental Management Plan (EIAR **Volume III, Appendix 2A**).

The design of a clear span pre-cast concrete bridge will ensure that:

- The existing channel profile within the watercourse is maintained.
- There are no in-stream works.
- Gradients within the watercourse are not altered.
- There is unrestricted passage for all size classes of fish by retaining the natural watercourse stream / riverbed.
- There are no blockages within the watercourse. The large size of a clear span bridge allows for the passage of debris in the event of flood flow conditions.
- The watercourse velocity is not changed.

Post planning detailed design of the bridge is required in consultation with a precast manufacture, Office of Public Works (Section 50), Inland Fisheries Ireland and the Environmental Protection Agency. **Plate 4-16** is an example of a typical clear span watercourse crossing used on wind farms.



Plate 4-16: Typical clear span crossing used on wind farms

4.17.5 Minor Watercourse / Surface Water Drain Crossing

Minor watercourse/surface water drain crossings will be needed where the crossing is unavoidable for an access track, turning head or wind turbine hardstand. All such crossings will be in accordance with this application and/or conditions attached to a grant of planning permission and agreed with the Office of Public Works and Inland Fisheries Ireland prior to construction. No work will take place within buffer zones of watercourses identified in **Volume II, Chapter 09** Water of this EIAR except for minor watercourse/surface water drain crossings and associated access track construction. The crossing can either be a clear span crossing or closed pipe culvert depending on the site restrictions. The site restrictions can be, but are not limited to, boundary encroachment, existing vegetation or proximity to protected structures/areas. Refer to planning drawing **22635-MWP-00-00-DR-C-5417** for further details.

The selection criteria for minor watercourse/surface water drain crossings within the site were:

- Avoid crossing watercourses or surface water drains at acute angles where possible.
- Avoid meanders at the crossing location.
- Cross where foundations could be constructed without excess excavation or in-stream works.
- Consider vertical alignment requirements.

There will be no in-stream works in EPA mapped watercourses. Clear span pre-cast concrete culverts are the preferred installation. Also, as spans increase the height can increase accordingly allowing significant light penetration under the culvert. The increase in height is complimentary to the vertical alignment requirements for access track design. An example of a permanent clear span pre-cast concrete box culvert watercourse/drain crossing is illustrated in **Plate 4-17**.

The design of a clear span crossings will ensure that:

- The existing channel profile within the watercourse/drain is maintained.
- Gradients within the watercourse/drain are not altered.

- There is unrestricted passage for all size classes of fish by retaining the natural bed of the watercourse/drain.
- There are no blockages within the watercourse/drain. The large size of a clear span culvert allows for the passage of debris in the event of flood flow conditions.
- The watercourse/drain velocity is not changed.
- The clear span of a culvert will ensure that the banks of the watercourse/drain are maintained during construction.



Plate 4-17: Example of a clear span pre-cast concrete box culvert over a watercourse/drain

The above design describes a crossing with no in-stream works. No in-stream works will be required in EPA mapped watercourses. Minor works will be required to existing land drains as part of culvert works including the installation of closed conduit, either pipe or box culverts, if the site conditions restrict the use of clear span pre-cast concrete culverts. If the appointed contractor proposes a closed conduit for crossings over land drains, that are periodically dry, all such crossings will be in accordance with the CEMP management plan and/or conditions attached to a grant of planning permission and agreed with the OPW and IFI prior to construction. **Plate 4-18** is an example of a closed conduit watercourse crossing.

The design of a closed conduit culvert crossings will ensure that:

- All crossings will be designed for a minimum 1 in 200-year return rainfall event.
- The invert of the pipe is submerged approximately 1/4 of its diameter below the original drainage bed.
- Where natural gradients allow, a nominal back fall in the pipe will be incorporated to prevent scour and promote the settling of natural material along the invert of the pipe.



Plate 4-18: Example of a concrete pipe culvert for a watercourse/drain crossing

4.17.6 Land Drain Removal

Existing land drains in some instances are required to be removed or infilled due to the location of access tracks, turning heads or wind turbine hardstand areas. As these land drains are not listed on the EPA watercourse GIS map, they do not have a watercourse buffer zone as identified in **Volume II, Chapter 09** Water of this EIAR. In these instances, a culvert is not practical, and removal is unavoidable. Disruption to the existing land drains will be mitigated by the construction of swales. The swales will be constructed first prior to the removal of the existing land drain. Surface water runoff that would have utilised the existing land drain being removed will be collected by the swale. The swales will convey surface water to, or in close proximity to, the same outfall point as the existing land drain that's being removed. The surface water swales will provide the same function as the land drains being replaced.

All land drains removed will be in accordance with this application and/or conditions attached to a grant of planning permission and agreed with the Office of Public Works and Inland Fisheries Ireland prior to construction. Further information on the locations of land drains to be removed is included in planning drawings **22635-MWP-00-00-DR-C-5052** to **22635-MWP-00-00-DR-C-5066**.

4.18 Decommissioning and Restoration

4.18.1 Wind Farm

The wind farm has been designed to have an operational life of 35 years and any further proposals for wind farm development at the site after this time will be subject to a new planning permission application. If planning permission is not sought after 35 years, the site will be decommissioned and reinstated with all wind turbines and towers removed. Removal of infrastructure will be undertaken in accordance with the Schedule of Environmental mitigation included in **Volume II, Chapter 19** Schedule of Mitigation of this EIAR and commitments arising from any conditions attached to a grant of permission, in conjunction with other landowner, regulatory requirements and best practice applicable at the time. The information below outlines the proposed decommissioning tasks based on current requirements and best practice. When the site is to be decommissioned, cranes of similar size to those used for construction will disassemble each turbine. The towers, blades and all components will then be removed. The turbines and monitoring mast will also be removed from site. It is likely that where possible, turbine components will be reused as they have a life well in excess of the wind farm proposal i.e., greater than 35 years. Wind farm components may also be recycled.

It is anticipated that internal underground cables connecting the proposed turbines to the proposed on-site substation will be cut back and left underground in order to minimise disruption from construction and the potential for environment effects. The cables will not be removed if an environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them *in situ*. The assessment will be carried out closer to the time to take into account environmental changes over the project life.

Upon decommissioning, turbine foundations will be covered with soil and reseeded. The substation will remain in place as part of the permanent electrical infrastructure. Hardstand areas will be remediated to match the existing landscape thus requiring reforestation or return to grassland by placing topsoil and grass seed. Access tracks will be left for use by the landowner.

Any structural materials suitable for recycling will be disposed of in an appropriate manner.

Prior to wind turbine removal, due consideration will be given to any potential impacts arising from these operations. Some of the potential issues include:

- Potential disturbance to the community, flora and fauna by the presence of personnel on-site, heavy goods vehicles and cranes.
- On-site temporary compound will be located appropriately.
- Time of year and time-scale (to be outside sensitive periods); and
- Access tracks (tracks may remain in use for the benefit of the landowner).

Prior to the decommissioning work, a plan will be drawn up to ensure the safety of the public and workforce and the use of best available techniques at the time.

Prior to the decommissioning work, a comprehensive reinstatement proposal, including the implementation of a program that details the removal of all structures and landscaping, will be submitted to the planning authority for approval. Wastes generated during the decommissioning phase will be taken off site and disposed of appropriately by a licensed waste operator.

4.18.2 Grid Connection

The grid cable will remain a permanent part of the national grid and therefore decommissioning is not foreseen. In the event of decommissioning, it will involve removing the cable from the ducting but leaving the ducting and associated supporting structure in place. The ducting will not be removed if the environmental assessment of the decommissioning operation demonstrates that this would do more harm than leaving them in situ. The assessment will be carried out closer to the time to consider environmental changes over the project life. The removal of the ducts would also cause some limited disruption to road users. Leaving the ducts in place would avoid disruption to road users without compromising the structure of the roadway.

The substation will remain in place and will previously have been taken in charge by the system operator, after the wind farm is connected to the national electricity grid.

4.19 References

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- COFORD, 2004, Forest Road Manual, Guidelines for the design, construction and management of forest roads.
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- Forestry Commission Scotland - Forests and Water Guidelines 4th Edition 2004
- Forests and Water - UK Forestry Standard Guidelines 2011
- Department of Housing, Local Government and Heritage - Wind Energy Development Guidelines 2019 DRAFT
- Wind Energy Ireland - Best Practice Guidelines for the Irish Wind Energy Industry 2012
- IWEA - health and safety guidelines for onshore wind industry on the island of Ireland 2011
- International Electrotechnical Commission Technical Specification 61400-28:2025
- Transport Infrastructure Ireland - CC-SPW-00600 – Earthworks 2024
- Natural Environment Research Council - Flood Studies Report 1975
- Met Éireann Extreme Rainfall Data, <https://www.met.ie/climate/available-data>.
- UK Sustainable Urban Drainage Systems, <https://www.uksuds.com/>
- Office of Public Works - Construction, Replacement or Alteration of Bridges and Culverts 2019
- Irish Government - Arterial Drainage Act – Section 50 1945
- International Electrotechnical Commission IEC 61400
- Inland Fisheries Ireland - Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters 2016
- Department of Housing, Local Government and Heritage - Technical Guidance Document H – Drainage and Wastewater Disposal 2016
- Department of Housing, Local Government and Heritage - Technical Guidance Document G – Hygiene 2008
- CIRIA - C753 The SuDS Manual 2015
- Limerick City and County Council - Surface Water/SuDS Specification 2022
- Environmental Protection Agency - Code of practice Domestic Wastewater Treatment Systems (Population Equivalent ≤ 10) 2021
- BS EN 16941-Part 1 Systems for Use Rainwater.
- HSE - Safety, Health and Welfare at Work (Construction) Regulations 2013 Part 14 Construction Site Welfare Facilities.

ESB Networks – 18150-SPEC-191213-AXT – functional specification for the installation of ducts and ancillary structures for 38kV underground power cables and associated communication cables for contestable projects 2021

ESB Networks – DOC-090217-CMY – 38kV MV & LV Civil & Ducting Standard 2017

EIRGRID Group - CDS-GFS-00-001-R0 110 kV - 220 kV and 400 kV Underground Cable Functional Specification General Requirements 2020

EIRGRID Group – XDN-CBL-STND-H-001 to 013 – 110kV Cable Standard drawings

EIRGRID Group - XDS-GFS-00-001-R4 - Functional Specification 110/220/400 kV Substation General Requirements 2019

EIRGRID Group – XDN-LAY-ELV-STND-H-001-R10 – 110kV AIS substation, 8 Bay 2024