Tab 5

Surface Water Management Plan

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BALLYNALACKEN WINDFARM PROJECT, CO. KILKENNY

SURFACE WATER MANAGEMENT PLAN

Prepared for:

ECOPOWER DEVELOPMENTS LTD

Prepared by:

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1. INTRODUCTION

1.1 BACKGROUND

This document presents a Surface Water Management Plan and pollution prevention measures for the construction and operation of the proposed Ballynalacken Wind Farm Project near Ballyragget, Co. Kilkenny. A site location map is shown as **Figure A**.

The following Surface Water Management Plan (SWMP) provides the water management framework for potential Contractors and Sub-contractors, and it incorporates the mitigating principles described in the accompanying Environmental Impact Assessment Report (EIAR) to ensure that work is carried out with minimal impact on the water environment and in accordance with the mitigation measures and commitments made in the EIAR.

This report also summarises the baseline geology and hydrology at the Ballynalacken Wind Farm Project site ('project site'), and then sets out the proposed appropriate drainage measures required for surface water management during the construction and operational phase of the proposed project.

Design, management and mitigation proposals are presented for the following:

- Drainage design criteria and drainage design philosophy;
- Construction Phase drainage; and,
- Operational Phase drainage

The SWMP also outlines proposed pollution prevention measures and surface water monitoring plan for the construction and operational phase of the proposed project.

The surface water drainage plan for the proposed Ballynalacken Wind Farm Project was developed by Hydro-Environmental Services, and for completeness the proposed drainage plan drawings for the project are included in **Appendix I** of this report.

1.2 SITE DESCRIPTION

The proposed Ballynalacken Wind Farm Project site ("project site") is located approximately 4.2km northwest of the town of Castlecomer and approximately 4.3km northeast of Ballyragget, entirely in County Kilkenny. The project site is located to the south of the Kilkenny-Laois County boundary.

The windfarm site generally consists of agricultural fields and coniferous forestry with the latter being more dominant on the southern section of the windfarm site. The proposed wind farm site is positioned in a linear arrangement along a narrow north-south trending topographic ridgeline where the ground slopes steadily to the east and west of the ridgeline. The steepest slopes are western facing. The elevation of the wind farm site ranges between approximately 250 to 315m OD with the highest point being centrally located.

The windfarm site can be accessed via several small local roads which branch northwards from the R694, which joins Castlecomer and Ballyragget to the south of the windfarm site. A public road runs along the top of the ridgeline immediately to the west of the windfarm site. This road crossroads near the mid-western boundary of the windfarm site. The public road running easterly from the crossroad junction divides the windfarm site into northern and southern portions. These public roads provide access to various areas of the project site (i.e. there are 9 no. site access points from local roads into the windfarm site, 1 no. entrance to the Tinnalintan Substation site and 1 no. entrance to the met mast site).

The northern portion of the wind farm site (which includes 6 no. of the proposed 12 no. turbines) is positioned largely along the eastern facing slope of the ridgeline, while the southern portion of the proposed windfarm site (which includes the remaining 6 no. turbines) is positioned on western/southwestern facing slopes. A control building is proposed at the windfarm site, with underground internal windfarm cabling connecting all turbines to the control building. The internal windfarm cabling is mainly routed under windfarm site roads with some sections under agricultural lands.

The proposed substation at Tinnalintan is located approximately 3.2km (as the crow flies) to the southwest of the windfarm control building. The proposed underground internal cable link, which will connect the windfarm control building to the Tinnalintan Substation runs south-westerly from the proposed windfarm control building at the windfarm site to the proposed substation, is 4km in length and is overlain by grassland, with sections under public road and private track.

The underground grid connection, which is 1.96km in length, and will connect the proposed Tinnalintan substation to the existing EirGrid Ballyragget 110kV substation north of Ballyragget town at Moatpark. The proposed Tinnalintan substation is located in gently undulating grassland surrounded by hedgerows where the ground elevation is mapped at approximately 75m OD. The proposed underground grid route is overlain by a mixture of private track and public roads.

The haul route works typically include provision of small hard-core areas and street furniture removal, between Exit 8 on the M9 Motorway, via the N78, Castlecomer town and the R694 regional road to the windfarm site entrances. Some road widening will also be required along the local roads at the windfarm site.

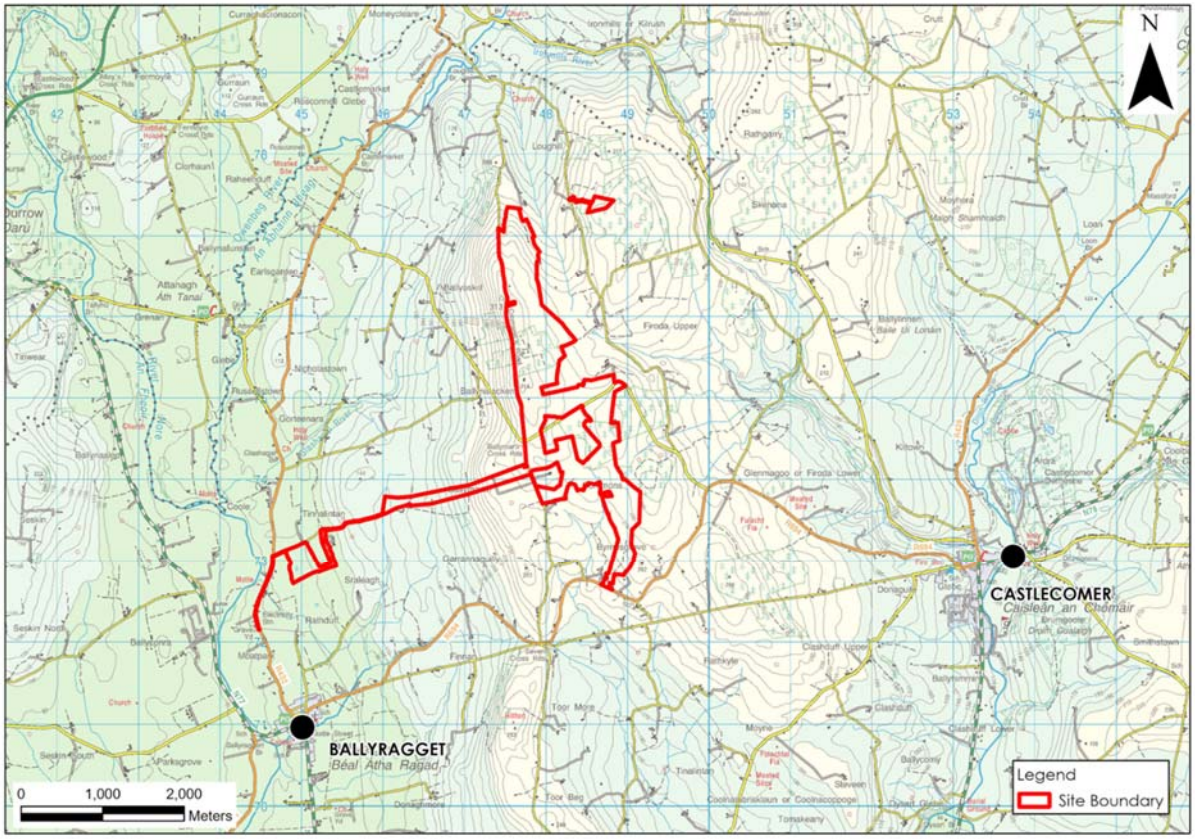


Figure A: Site Location Map

1.3 PROJECT DESCRIPTION

The Ballynalacken Windfarm Project comprises the following elements.

EIAR Nomenclature	Overview Description
Ballynalacken Windfarm	12 No. Wind Turbines and associated works including foundations and hardstanding areas, windfarm roads, electrical control building and internal underground cabling connecting the wind turbines to the control building.
Internal Cable Link	Underground cabling which will connect the Windfarm Control Building to the Tinnalintan Substation.
Tinnalintan Substation	110kV Electrical Substation and associated access road.
Ballynalacken Grid Connection	Underground Grid Connection from the Tinnalintan Substation to the existing EirGrid Ballyragget 110kV Substation and facilitating works in the EirGrid Substation.
Ancillary & Haul Route Works	Site entrances, 1 no. met mast, 1 no. telecoms relay pole, site drainage network, temporary construction compounds, 2 no. temporary borrow pits (which will also be used as spoil deposition areas), temporary works in private lands and along the public road corridor, public road widening works along the L5840, L5845 and L5846 local roads, landscaping and reinstatement works. Works/Activities along the Public Road to facilitate turbine delivery and access to the turbine sites (Haul Route Works & Activities).

1.4 OUTLINE OF THE SURFACE WATER MANAGEMENT PLAN

This document aims to set out the proposed procedures and operations to be utilised on the proposed project site to mitigate against any water related environmental effects. The mitigation and control measures outlined herein and the EIAR will be employed on-site during the construction phase and operational phase of the proposed project.

The main areas of water related concerns covered by this document are:

a) Pre-Construction, Construction Phase and Operational Phase drainage controls;
b) Earthworks (*i.e.* infrastructure & drainage) and surface water quality protection;
c) Temporary stockpiles water management and controls;
d) Permanent soil/subsoil storage areas (2 no. borrow pits to be backfilled);
e) Fuel usage, storage and management;
f) Tree felling drainage controls;
g) Working at or near existing streams / watercourses;
h) Wind farm, cable link and grid connection watercourse crossing works; and,
i) Water supply and on-site sanitation.

1.5 SWMP REPORT STATUS

The SWMP is considered a live document and will be modified over time as detailed contractor methods of work are developed. If the project is permitted an updated version of this document will be issued to all parties involved in the construction process when appropriate changes are deemed necessary.

2. EXISTING HYDROLOGICAL REGIME

2.1 INTRODUCTION

The existing geological and hydrological regime at the project site is described in Chapter 7 (Soils) and Chapter 8 (Water) of the Ballynalacken Windfarm Project EIAR 2024. A summary of geological and hydrological data is provided below in order to put the SWMP into perspective.

2.2 EXISTING GEOLOGICAL REGIME

The GSI subsoil mapping show that subsoils are largely absent on the northern portion of the wind farm site (i.e. mapped as "bedrock outcrop or subcrop") with more localised areas mapped as sandstone and shale tills (i.e. glacial tills).

On the southern portion of the wind farm site sandstone and shale tills are more dominant, while bedrock outcrop or subcrop is less extensive. Blanket peat is mapped in a localised depression on the south of the wind farm site where no wind farm infrastructure is proposed.

Based on the trial pit investigations, subsoil depths are shallowest on the northern portion of the wind farm site where bedrock was generally encountered between 1 and 2 meters below ground level (mbgl) and at most 3mbgl.

Subsoil depths are deeper on the southern portion of the wind farm site where most trial pits did not encountered bedrock at depths ranging from 2.3m to 4mbgl.

Trial pitting at the proposed substation encountered limestone tills (SILT/CLAY) over sand and gravel deposits down to 2mbgl.

2.3 EXISTING HYDROGEOLOGICAL REGIME

The proposed windfarm site is underlain by Westphalian Sandstones, Westphalian Shales and Namurian Sandstones and Shales which are overall poorly productive aquifers.

The Geological Survey of Ireland (GSI) classifies the Westphalian Sandstones as a Locally Important Aquifer – Bedrock which is Generally Moderately Productive (Lm) and the Westphalian Shales as a Poor Aquifer – Bedrock which is Generally Unproductive (Pu). Meanwhile the Namurian Sandstones and Shales are classed as being a Poor Aquifer – Bedrock which is Generally Unproductive except for Local Zones (PI).

The Tinnalintan Substation and Ballynalacken Grid Connection are mapped to be underlain by sand and gravels as well as Dinantian Pure Bedded Limestones, both of which are classified as Regionally Important. There are no GSI mapped karst features within 1km of the substation.

2.4 EXISTING HYDROLOGICAL REGIME

Regionally the project site is located in the River Nore regional surface water catchment within Hydrometric Area 15 of the Southeastern River Basin District. The River Nore flows in a southerly direction approximately 4 - 5km to the west of the proposed windfarm site and approximately 0.4km west of the proposed substation, and 0.2km west of the grid connection route along the regional road. The majority of the windfarm site however drains to the River Nore via the Dinin River (8 turbines) and via the Owveg (Owenbeg) River (4 turbines).

On a sub-catchment scale, the northern and western sections of the wind site including the internal cable link, grid connection and substation are located in the Nore_SC_060 sub-catchment, which includes the River Nore channel to the west and the furthest downstream reach of the Owveg River to the north.

The central section of the proposed wind farm site mainly drains easterly into the Dinin (North)_SC_010 sub-catchment, while the southern half of the wind farm site is located in the Nore_SC_080 sub-catchment. Both are mapped as sub-catchments of the Dinin River, which flows to the east and south of the windfarm site.

The downstream distance from the wind farm site to the 4 no. river sub-basins associated with the River Nore are as follows- Cloghnagh_010 (~16.2km), Castlecomer Stream_010 (~23.4km), Owveg (Nore)_040 (~10.5km) and Nore_120 (0.2km).

Sub-basins in which the haul route work are located include the Rathgarvan or Clifden_010 (HR1), Brownstown(Pococke)_010 (HR2, HR3, HR4, HR5), Nore_170 (HR6), Nore_160 (HR7), Dinin (Main Channel)_010 (HR8), Dinin (north)_040 (HR9), Castlecomer Stream_010 (HR10 and HR11), Nore_120 (HR12) and Cloghnagh_010 (HR13).

A summary of surface water catchments and project infrastructure is shown in **Table A** below.

Table A: Summary of Surface Water Catchments and Project Infrastructure

Sub-catchment	Local River Water Body (Sub-basin)	Proposed Infrastructure	Works Area (ha) in the sub-basin	% of works area in the sub-basin
Nore_SC_080 (Dinin River)	CLOGHNAGH_010	6 no. turbines (T1, T2, T3, T4, T5, T7), borrow pit no. 1, windfarm control building, windfarm site roads and drainage network, Internal Cable Link, construction compound no.1, road widening works, Haul route works (HR13) and watercourse works W1, and works at wet drainage channels (D1, D2, D3).	24.5	47%
	DININ (MAIN CHANNEL)_010	Haul route works (HR8)	1.3	2%
	NORE_160	Haul route works (HR7)	0.04	>1%
Dinin[North]_SC_010	CASTLECOMER STREAM_010	3 no. turbines (T6, T8, T9), borrow pit no.2, windfarm site roads and drainage network, construction compound no.1 and Haul route works (HR10, HR11)	7.2	14%
	DININ(NORTH)_040	Haul route works (HR9)	0	-
Nore_SC_060	OWVEG (NORE)_040	3 no. turbines (T10, T11, T12), met mast, windfarm site roads and drainage network, works at wet drainage channel D4 and road widening works	7.6	15%
	NORE_120	Internal Cable Link, Tinnalintan Substation, Ballynalacken Grid Connection, construction compounds no. 2 and 3, Haul route works (HR12), telecom relay pole, windfarm site roads and drainage network, road widening works and watercourse crossing works W2 and W3.	11.3	22%
Nore_SC_100	RATHGARVAN OR CLIFDEN_010	Haul route works (HR1)	0	-
	BROWNSTOWN(POCOCKE)_010	Haul route works (HR2, HR3, HR4, HR5)	0.09	>1%
	NORE_170	Haul Route Works HR6	0	-

2.5 PROJECT SITE EXISTING DRAINAGE FEATURES

Drainage within the project site is facilitated mainly by network of field drains and forestry drains with the former typically routed along hedgerows and field boundaries. These drains discharge to the local streams at the low points within the project site.

The majority of existing drainage features intercepted by the proposed project infrastructure are drains.

There are a total of 3 no. natural watercourse crossings (W1 to W3) within the Ballynalacken Windfarm Project site.

W1 at a 1st order stream within the Ballynalacken Windfarm site within the Cloghnagh (Dinin) catchment and will involve the construction of a new crossing structure and access road over the watercourse. Wet drainage features (D1, D2 and D3) also occur within the windfarm site in the Cloghnagh catchment. W2 and W3 on the Rathduff_15 stream within the Nore_120 sub-basin; W2 involves installing cables in the public road above an existing culvert over a 1st order headwater stream, Rathduff_15, along the Internal Cable Link route, and W3 is a crossing point of the grid connection further down the Rathduff_15 stream which it is classed as a 2nd order watercourse at the W3 crossing point. The crossing point at W3 is at an existing bridge crossing over the Rathduff_15 stream on the regional road, and the cables will be either installed in the deck of the bridge or by directional drilling under the bridge. All works from W2 and W3 will be from the public road corridor..

Other watercourses which occur downstream of the main construction works at the wind farm include the Kilcronan stream which drains into the Owveg River, and the Castlecomer Stream which drains into the Dinan River. These watercourses are 209m and 358m downstream of the works respectively, a new crossing over a wet drainage feature (D4) occurs within the windfarm site, upstream of the Kilcronan stream.

A site drainage map is attached as **Figure 1** below.

2.6 FLOOD RISK MAPPING

A site-specific flood risk assessment was prepared as part of the EIAR (refer to **Appendix 8.3** of the EIAR Water Chapter).

To identify those areas as being at risk of flooding, OPW's Past Flood Event mapping (www.floodinfo.ie) were consulted. No recurring or historic flood incidents are recorded within the proposed project site or immediately downstream.

Catchment Flood Risk Assessment and Management (CFRAM)[1] River Flood Extent mapping has been completed for the main channel of the River Nore in the area of the project site with low, medium and high probabilities, however no CFRAM fluvial mapping extents encroach upon the project site.

National Indicative Fluvial Mapping (NIFM) (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme. For the present-day or future scenarios, no medium (1 in 100) and low probability (1 in 1,000) fluvial flood zones are mapped within the project site.

NIFM fluvial flood zones are mapped further downstream of the project site within the Owveg(Nore)_040, Castlecomer Stream_010, and Cloghnagh_010 river sub basins.

2.7 SURFACE WATER ABSTRACTIONS

Ballyragget public water supply uses an abstraction near the River Nore, which is located 1.5km downstream of the nearest Project works (the nearest Project works being the Ballynalacken Grid Connection works at the existing EirGrid Ballyragget 110kV Substation in Moatpark). The source of the raw water source is an infiltration gallery adjacent to the River Nore. Raw water is pumped from the infiltration gallery to a collection chamber/pump sump beside the Water Treatment Plant. There is no direct surface water abstraction from the River Nore itself.

[1] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

Further downstream, the Kilkenny City Public Water Supply comprises a surface water abstraction point from the Nore River at Troyswood which is located approximately 17km downstream of the Project site.

3. SURFACE WATER & SITE DRAINAGE MANAGEMENT

3.1 DRAINAGE DESIGN CRITERIA

The main design criteria for project drainage plans are shown below. These criteria were incorporated into the design of the drainage plan as shown in **Appendix I**.

- Minimise any change to the surface water and groundwater conditions within the project site;
- Avoid sensitive areas where possible by employing hydrological constraints (*i.e.* buffer zones);
- Using a SUDS philosophy where physically possible, to replicate the natural drainage of the wind farm site;
- Minimise sediment loads in the runoff, with particular attention being given to the construction phase of the project;
- Maintain runoff rates and volumes at Greenfield rates for a range of storm events (to be incorporated into final detailed design); and,
- Avoid high flow velocities internally within new drain networks and at outfall locations to prevent erosion.

3.2 DRAINAGE PHILOSOPHY

As a standard and best practice approach, surface water runoff attenuation and drainage management are key elements in terms of mitigation against impacts on surface water bodies.

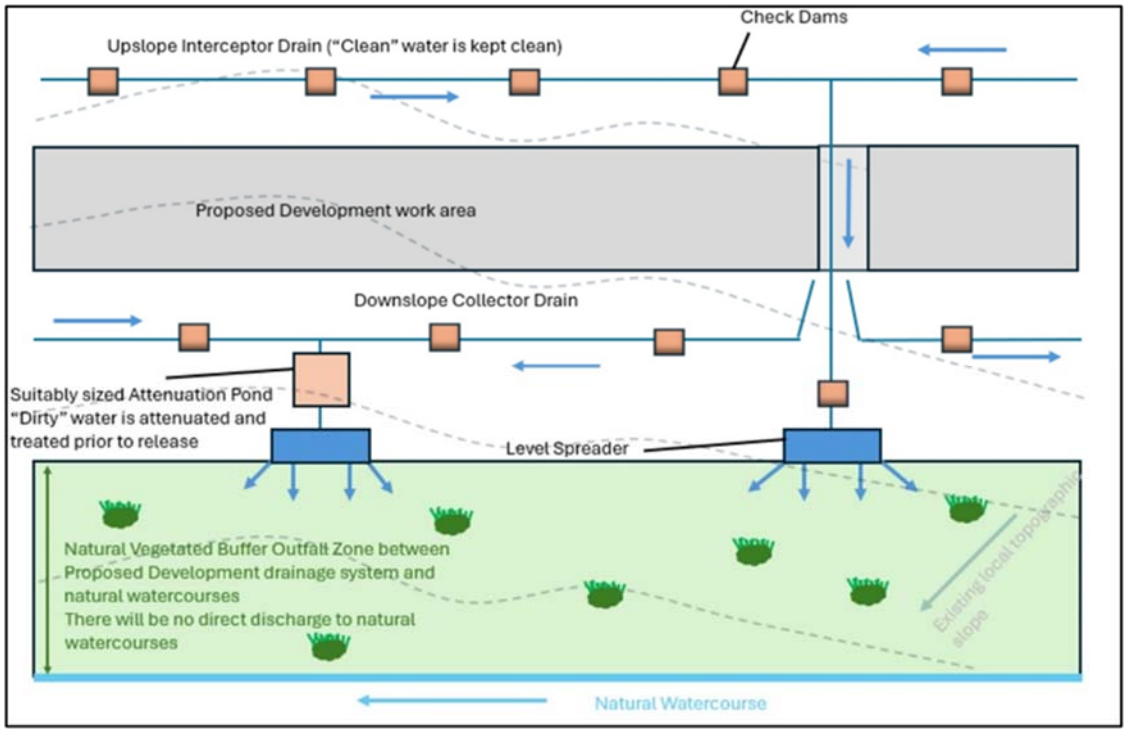
Two distinct methods will be employed in the management of construction surface water runoff. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas. The second method involves collecting any drainage waters from works areas within the project site, that might carry silt or sediment, and nutrients, and to route them towards settlement ponds or provide in-line sediment controls prior to controlled diffuse release over vegetated natural surfaces within the project site. There will be no direct discharge to surface waters or drains; and where possible all release of wind farm site drainage should be done outside of hydrological buffer zones.

A schematic of this approach is presented in **Figure B** below, and this system of drainage control is shown in more detail on the drainage plan (**Appendix I**). During the construction phase all runoff from works areas (i.e., dirty water) will be attenuated and treated to a high quality prior to being released.

Where artificial drains are currently in place in the vicinity of proposed works areas, these drains may have to be diverted around the proposed works areas to minimise the amount of water in the vicinity of works areas. Where it may not be possible to divert artificial drains around proposed work areas, the drains will be blocked to ensure sediment laden water from the works areas has no direct route to other watercourses. Where drains have to be blocked, the blocking will only take place after the new drainage system to handle the same water has been put in place.

Existing drains in the vicinity of the construction works area will be maintained in their present location where possible. If it is expected that these drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains.

Figure B: Schematic of Drainage Management



3.3 PRE-CONSTRUCTION DRAINAGE MANAGEMENT

An existing drainage network emerges within the project site which typically comprise field drains (typically routed along hedgerows and field boundaries) and forestry drains, with road drains alongside most sections of local roads immediately adjacent to the windfarm site. There are a small number of natural headwater streams and wet drainage channels within the project site (refer to Section 2.5 above).

The drainage regime within the project site will continue to function as it is during the pre-construction phase.

Prior to commencement of works, inspections will be competed to ensure drains and watercourses are free from debris and blockages that may impede drainage. It will also be required to complete these inspections as the construction works develop across the project site to ensure they remain in their original pre-construction condition.

3.4 PROXIMITY TO STREAMS / NATURAL WATERCOURSES

There are only a small number of natural headwater streams and wet drainage features within the project site (refer to Section 2.5 above).

As outlined in the EIAR a key pollution prevention measure during the construction phase is the avoidance of ecologically sensitive natural water features. A self-imposed 50m wide natural water feature buffer (i.e., streams) is proposed in the EIAR for surface water protection.

All of the key areas of the proposed project infrastructure are generally away from the 50m delineated buffer zones with the exception of 3 no. proposed watercourse crossings (W1, W2 and W3). The proposed 3 no. watercourse crossings are located on small headwater 1st order or 2nd order streams.

3.5 WIND FARM CONSTRUCTION PHASE SURFACE WATER DRAINAGE MANGEMENT

The early establishment of temporary drainage facilities will reduce the risk of pollution problems during construction. In addition, construction operations will adopt best working practices. The development of the wind farm site will need to be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other drainage features as each development phase progresses. They will therefore need to be designed with sufficient flexibility to respond to an early phase of limited incoming flow during the construction phase.

Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hardstanding construction. Drains will be excavated and settlement ponds constructed to eliminate any suspended solids within surface water running off the project site.

The drainage plan presented in **Appendix I** will be further developed and refined by the design and build contractor with oversight from the supervising project engineer and specialist contractor, and can be refined with detailed turbine by turbine inspection of existing drainage details, and agreement with the site foreman with regards to locations and directions of proposed outfalls, settlement ponds and level spreader locations.

Construction Drainage Action Points:

- Establish drainage and runoff controls before starting site clearance groundworks and earthworks;
- Minimising the area of exposed ground;
- Retain as much vegetation as possible;
- Delay clearing and topsoil stripping of each phase of work until ready to proceed;
- Establish vegetation as soon as practical on all areas where soil has been exposed, or all exposed surfaces should be sealed with excavator to ensure no erosion can occur;
- Close and backfill trenches as soon as practically possible;
- Through consultation with the Construction Manager/Site Supervisor, the site Environmental Manager should draw up a Schedule for surface water quality monitoring, which will be finalised prior to the start of construction; and,
- Where monitoring parameters are found to exceed the standards laid down, the Environmental Manager should initiate and report on corrective action(s). This may necessitate the alteration of the environmental control measures and in turn the relevant construction method statement(s).

Measures to control surface water runoff during the construction phase of the proposed project are as follows:

Access Roads

- Interceptor drains will be placed on the up-gradient side of the road/turbine/hardstanding excavations to divert clean runoff away from the section to be excavated;
- Use of in-line erosion and velocity control measures such as check dams, sand bags, oyster bags, flow limiters, weirs, baffles, silt fences, filter fabrics, and collection sumps should be used;
- Collector drains will be placed on the down-gradient side of the section to be excavated to collect any potential dirty excavation runoff and keep it away from clean surface water runoff; and,
- Settlement ponds and sediment traps along with proprietary settlement systems such as Siltbuster will be installed to treat dirty construction water runoff prior to controlled release onto the natural vegetation surfaces.

Turbine Bases, Substation & Site Compound area

- Installation of interceptor drains up-gradient and around the excavation to intercept clean surface runoff and divert it around and away from the works; surface water runoff may also be diverted around the excavation by silt fences, sand bags or similar laid on the surface of the ground;
- The base of the excavation will be constructed level, and water will be gathered in a temporary sump and pumped at a low flow rate into either a temporary settlement pond or swale type feature for treatment prior to controlled release onto the natural vegetation surface; and;
- The use of a proprietary settlement system such as Siltbuster may be required to treat dirty construction water where additional treatment is required.

Soil/Subsoil Storage areas

- During the initial placement of soil and subsoil, silt fences and biodegradable geogrids will be used to control surface water runoff from the storage areas;
- An interceptor drain will be installed upslope of the storage area. This drain will divert any surface water away from the storage area and hence preventing erosion and water ponding in the storage area;
- A collector drain will be installed down slope of the storage area to collect runoff and divert it towards settlement ponds;
- Where possible, the vegetation layer shall be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the soil. This will reduce runoff velocities by encouraging diffuse flow and prevent erosion by a having a natural "cap" over the exposed soils and subsoil; and,
- The vegetation layer can be hydro-seeded to encourage further stabilisation if required.

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in **Table B** below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls. A more detailed description of the key components of the SuDs drainage system is provided in **Table B** below.

Table B: Summary of SuDs Drainage Control & their Application

Management Type	Description of SuDs drainage control method	Applicable Works Area
Avoidance Controls:	• Application of 50m buffer zones to natural watercourses where possible; • Using small working areas; • Working in appropriate weather and suspending certain work activities in advance of forecasted heavy rain.	Construction work areas where sediment is being generated.
Source Controls:	• Use of upstream interceptor drains and downstream collector drains, vee-drains, diversion drains, flumes and culvert pipes.	Construction work areas where sediment is being generated.
	• Using small working areas; • Covering stockpiles; • Weathering off / sealing stockpiles and promoting vegetation growth.	Stockpile/overburden storage areas
In-Line Controls:	• Interceptor drains, vee-drains, oversized swales/collector drains; • Erosion and velocity control measures such as: o sand bags; o oyster bags filled with gravel; o filter fabrics; o flow limiters; o weirs or baffles; o and/or other similar/equivalent or appropriate systems. • Silt fences, filter fabrics; • Collection sumps, temporary sumps, pumping systems; • Attenuation lagoons; • Sediment traps, settlement ponds.	Interceptor and collection drainage systems
Water Treatment Controls:	• Temporary sumps; • Attenuation ponds; • Temporary storage lagoons; • Sediment traps, Settlement ponds, silt bags; • Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.	Surface water treatment locations
Outfall Controls:	• Level spreaders; • Buffered outfalls; • Vegetation filters; • Silt bags; • Flow limiters and weirs.	Drainage run outfalls and overland discharge points

Silt fences:

- Silt fences will be emplaced along drains and parallel to access roads edges as required, down-gradient of all new roads, turbine locations, construction compounds and at stream / watercourse crossings. Silt

fences are effective at removing heavy settleable solids. This will act to prevent entry of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff to nearby water courses (Cloghnagh, Ballymartin_15, Kilcronan, and Rathduff_15 streams). Silt fencing will also be placed downslope of the construction works area at the junction widening works (HR12 and HR13) as well as at the blade transfer area (HR8).

- Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They should remain in place throughout the entire construction phase. Silt fence material should be Terra Stop Premium or equivalent, as per the specifications provided at: http://www.hy-tex.co.uk/index.php/products/geotextiles/terrastop-premium-silt-fence.

- Double silt fences will be placed where work is required within the hydrological buffer zones (i.e. watercourse and wet drain crossings W1 – W3, and D1 to D4).

Check Dams:

- The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at 20 – 30m regular intervals to ensure flow is non-erosive;

- Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains and swales are being excavated; and,

- Check dams will be constructed from a 4/40 mm non-friable crushed rock. Check dams are relatively simple and cost effective to construct.

Swales:

- Swales are shallow drains that can be used to intercept and collect run off from construction areas of the site during the construction and operational phase. A swale is an excavated drainage channel located along the down-gradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to settlement ponds for attenuation and treatment; and,

- Swales will be installed in advance of any main construction works commencing. All swales and ponds will be kept shallow so that they pose no health and safety risk to plant or personnel. Maximum depth of standing water should be limited to 0.3 m within the swales.

Settlement Ponds:

- Settlement ponds will be used to attenuate runoff from works areas of the wind farm site during the construction phase and will remain in place to handle runoff from road and hardstanding areas during the operational phase. The purpose of the settlement ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the settlement ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips down-gradient of any works areas;
- Settlement ponds will be constructed at each turbine location, soil/subsoil storage area(s), control building and substation compounds, site construction compounds and along sections of access road. The points at which water enters and exits the settlement ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the settlement pond system, and prevent erosion. The primary settlement pond will reduce the velocity of flows to less than 0.5 m/s to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary settlement pond will reduce the velocity of flows to less than 0.3 m/s. Water will flow out of the secondary settlement pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out; and,
- The settlement ponds are sized according to the size of the area they will be receiving water from and are large enough to accommodate a 10-year return rainfall event.

The proposed site drainage plan is shown in **Appendix I** of this report.

Level Spreaders:

- A level spreader will be constructed at the outfalls of interceptor drains and settlement ponds to convert concentrated flows into diffuse sheet flow on areas of existing vegetated ground;
- The level spreaders will distribute wind farm site drainage runoff onto vegetated surfaces where the discharge will emerge as diffuse flow. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion; and,
- The level spreader lip over which the water will spill should be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader.

Silt Bags

- Silt bags will also be emplaced within drains down-gradient of all construction areas. Silt bags are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment.

Siltbuster

- A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas, if necessary, prior to its discharge to settlement ponds or swales.
- Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites.
- The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile.
- The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.
- As described in Section EIAR 8.3.1.2.1 of the EIAR, the proposed Ballynalacken Windfarm Project includes additional treatment in the form of a water treatment train (such as Siltbuster) to be used in the Owveg River catchment (i.e. turbines T9 – T12). This is due to the short downstream distance to the Owveg River (which is a designated SAC) and the higher potential for cumulative effects in the Owveg River catchment.

Pre-emptive Site Drainage Management*:*

- The works programme for the initial construction stage of the project will also take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works should be scaled back or suspended will relate directly to the amount of rainfall forecast.
- Works will be suspended if forecasting suggests either of the following is likely to occur:
    - >10 mm/hr (*i.e.* high intensity local rainfall events); or
    - >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day); or,
    - >half monthly average rainfall in any 7 days.

- Prior to works being suspended the following control measures will be completed:
    - Secure all open excavations to prevent ingress of rainwater/runoff;
    - Provide temporary or emergency drainage in the form of diversion channels to prevent back-up of surface runoff; and,
    - Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

Timing of site construction works

Construction of the wind farm site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Construction of the drainage system during

this period will also ensure that attenuation features associated with the drainage system will be in place and operational for all subsequent construction works.

Post Construction Phase Drainage Decommission*:*
During the operational phase when silt laden runoff is no longer generated by construction/excavation activities, some SuDS features may not be necessary for long term surface water management.

- Temporary settlement ponds can be in-filled and the surrounding area fully reinstated post construction phase. Construction waste materials such as collected silt/sand material, gravel barriers, timber and sand bags etc will be disposed of at an appropriate waste disposal facility;
- Temporary sumps and silt traps along the access road will be in-filled with large open voided stone and covered over; and,
- Removal of geotextile material if used as sediment barriers at the inlet end of cross drainage pipes or as silt fences along surface water runoff routes.

3.6 WIND FARM OPERATIONAL PHASE DRAINAGE MANAGEMENT

The drainage system as outlined below will remain in place during the operational phase. The drainage system will be integrated with the existing site drainage where required.

- Interceptor drains (installed during construction) will be retained up-gradient of all proposed permanent infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Interceptor drains (installed during construction) will be retained downgradient of roads and turbine locations and will be used to collect runoff, from access roads and turbine hardstanding areas within the wind farm site and channel it to settlement ponds for sediment settling;
- On steep sections of access road, transverse drains ('grips') will be constructed where appropriate in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams should be constructed from a 4/40 mm non-friable crushed rock;
- Some settlement ponds, installed during construction, will be retained downstream of road sections and turbine locations, and will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses;
- Settlement ponds will remain in place until the site has stabilised in terms of re-vegetation of exposed ground; and,
- Maintenance of the operational phase drainage system is essential, and regular half-yearly clearance of any blockages or silt buildup will take place throughout the operational phase. Monthly ongoing inspections by site maintenance staff along with quarterly inspections by an independent consultant for a period of two years into the operational phase.
- Some maintenance works relating to site entrances, internal roads, junctions and hardstand areas will be required. These works would be of a minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.
- In addition to the permanent drainage outlined above, temporary check dams and silt fencing arrangements will be placed along sections of works areas where maintenance is being undertaken.
- Temporary blocking of forestry and land drains that intercept the works area will also be undertaken.

3.7 WIND FARM DECOMMISSIONING DRAINAGE MANAGEMENT

During decommissioning, it is intended to limit groundworks other than to rehabilitate, constructed areas such as turbine bases and hard standing areas. This will be done by covering with topsoil to encourage vegetation growth and reduce run-off and sedimentation.

The existing wind farm site roadways are likely to be kept and maintained following decommissioning of the wind farm infrastructure, as these will likely be of use for ongoing forestry works and by other participating landowners.

The electrical cabling connecting the site infrastructure to the on-site substation will be removed, while the ducting itself will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental impact, in terms of soil exposure, and thus on the possibility of the generation of suspended sediment which could enter nearby watercourses.

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site along their original delivery route. The turbine concrete bases will remain in the ground and backfilled.

Prior to the commencement of the decommissioning works the following key temporary drainage measures will be installed:

- All existing dry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using check dams/silt traps;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing drains that have surface water flows and also along existing roadside drains;
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone;
- All reinstated areas will be vegetated at the soonest opportunity to prevent potential sediment entrainment in runoff;
- Avoidance of instream works will be required during the decommissioning phase; and,
- No dewatering or diversion of surface water flows will be required.

3.8 WATERCOURSE CROSSINGS

There are 3 no. natural watercourse and 4 no. wet drainage channel crossings where works are required:

- W1, D3, D4: New bottomless pre-cast culverts for proposed wind farm access road,
- D1: New bottomless culvert and permanent diversion of 50m of the drainage channel at D1,
- D2: Extension of existing culvert;
- W2: Installing cables in the public road above an existing culvert over a 1st order headwater stream, Rathduff_15, along the Internal Cable Link route on a local public road.
- W3: Installing cables in the public road either in the deck above an existing bridge or by directional drilling under the bridge at the existing road crossing over a 2nd order headwater stream, along the Ballynalacken Grid Connection over the Rathduff_15 stream on the regional road.

A buffer zone will be maintained for all 7 no. crossing locations (W1 – W3, D1 – D4) where possible whereby all watercourses will be fenced off and construction works will be completed outside the fencing where possible. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the adjacent watercourse.

The purpose of the constraint zone is to:

- Avoid physical damage to surface water channels;
- Provide a buffer against hydraulic loading by additional surface water run-off;
- Avoid the entry of suspended sediment and associated nutrients into surface waters from the trench excavation;
- Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and,
- Provide a buffer against construction plant and materials entering any watercourse.

General Best Practice Pollution Prevention Measures will also include:

- Protection of the riparian zone watercourses by implementing a constraints zone around watercourse/wet drainage channel crossings, in which construction activity will be limited to the minimum, i.e. works solely in connection with duct laying or structure construction at the crossing point;
- No stockpiling of construction materials will take place within the constraints zone. No refuelling of machinery or overnight parking of machinery is permitted in this area (at least 100m separation distance from the 3 no. locations);
- No concrete truck chute cleaning is permitted in this area;
- Works within the constraints zone will not take place at periods of high rainfall or high stream/river flows, and works will be scaled back or suspended if heavy rain is forecast;
- Plant will travel slowly across bare ground at a maximum of 5km/hr;
- All machinery operations will take place away from the watercourse and ditch banks, apart from where crossings occur.
- Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility or designated soil storage area, as appropriate;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits shall be available in each item of plant required to complete the stream crossing; and,

- Silt fencing will be erected on ground sloping towards watercourses at the stream/river crossings if required.
- Double silt fences will be placed down-gradient of all construction areas inside the hydrological buffer zones (i.e., near stream crossings).
- Any roadside drains will be temporarily blocked using sandbags in the area where trenching works is taking place

3.9 CULVERT DESIGN

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected 100-year peak flows in the existing drain.

Some culverts may be installed to manage drainage waters from works areas of the proposed project, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water/drainage crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling does not occur above or below the culvert and water can continue to flow, as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4. POLLUTION PREVENTION & DRAINAGE CONTROL MEASURES

4.1 TEMPORARY MATERIAL STORAGE AREAS - DRAINAGE CONTROLS

For the protection of water quality, construction and drainage controls around temporary stockpiles at the wind farm site, and at the Tinnalintan Substation site should be implemented as follows:

- All areas for temporary stockpiling will be initially marked out on the ground, and an agreed preliminary drainage plan should be drawn up by the Project Geotechnical Engineer in consultation with the Site Construction Manager, Project Hydrologist;
- The preliminary drainage plan will be agreed on the ground with the Site Foreman, and, in the case of the wind farm site, pre drainage of the area will commence. Pre drainage will involve excavation of any required drainage ditches and surface water control ponds/swales;
- The marked temporary storage areas will also be surrounded on 3 sides with silt fencing, and the area will be filled by access through the open side;
- Once the temporary stockpile is filled to its intended area, silt fencing around the remaining edge will be installed.
- All exposed surfaces of temporary mineral soil and subsoil stockpiles will be sealed by smoothing the exposed surface with the back of an excavator bucket;
- Temporary management of runoff water during stockpile filling within the wind farm site may require pumping to a local settlement pond for sedimentation and water treatment prior to discharge;
- If there is no available local settlement pond, then a temporary settlement pond should be constructed and runoff from the temporary stockpile area should be routed to this settlement pond, and after treatment re-distribution locally across natural vegetated areas; and,
- Where required additional specialist treatment may be employed to ensure no deterioration in downstream water quality occurs.
- This is not relevant to the internal cable link route or grid connection route on private lands as the temporary stockpile will be reinstated within the trench generally within a short time frame *i.e.* <24 hours; This is also not relevant to the cable routes on public roads as all excavations will be removed immediately from the works areas and disposed of in accordance with the Waste Management Plan (i.e. in a licenced facility);

4.2 EXCAVATION DRAINAGE CONTROLS

There will be no significant requirement for groundwater dewatering during the excavation of turbine base foundations at the wind farm site or within excavations along the cable routes. As a worst case, minor seepages and localised surface water runoff may require management but this will only account for a minimal volume. Management of any water build-up and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate upstream interception drainage, to prevent upslope surface runoff from entering excavations at the turbine hardstanding/foundation areas, and at the windfarm control building and at Tinnalintan Substation compound will be put in place;
- If required, sump pumps will be employed to prevent build-up of water in the turbine base excavations at the wind farm site;
- The interception drainage will be discharged to the wind farm site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters.
- In the case of the grid route, interception drainage (if any) will be routed to existing roadside ditches and grass verges following treatment;
- Pumped water will only be discharged outside of the delineated 50m buffer zones;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit or equivalent;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase of the project. If high levels of seepage inflow occur, excavation work will immediately be stopped, and a geotechnical & hydrogeological assessment will be undertaken;

- Silt bags will be used to control discharges of pumped water into drainage swales at the wind farm site;
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be used at the windfarm site within the Owveg River catchment and can be mobilised on-site (wind farm site) at short notice for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur.
- Only designated trained and competent operatives will be authorised to refuel plant on site (wind farm site and all other Project works locations). Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations. Machinery will be refuelled off site at the beginning of each day during works along the grid route, refuelling on site will be minimised;
- Fuels storage bunds within the wind farm site will not be located in excavated areas, instead will only be located in a designated part of the construction compounds;
- Erosion from excavation areas at the wind farm site will be controlled by re-vegetation of exposed areas once backfilling is complete, and mounding and berms will also be employed to ensure runoff is controlled until vegetation is re-established following reinstatement of borrow pits areas;
- Erosion from excavation areas along the cable routes will not be an issue due to the temporal nature of the works, however control measures such as silt bags and fences will be put in place; and,
- Spill kits will be available to deal with any accidental spillage in and outside the excavation areas.

4.3 FUEL USAGE / STORAGE AND HAZARDOUS MATERIALS

Hydrocarbon Control Measures

Measures to control hydrocarbons at the project site are as follows:

- All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on the wind farm project site;
- On-site refuelling will occur at the windfarm using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer or truck will be re-filled off site and will be towed/driven around the wind farm site to where machinery are located. The 4x4 jeep/fuel truck will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Fuels stored on the wind farm site will be minimised. Any storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction, and located in a designated area of the construction site compounds;
- The electrical control building and substation compound will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- All plant used will be regularly inspected by the site Environmental Manager for leaks and fitness for purpose;
- Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area;
- Refuelling or Maintenance of vehicles will not take place within 100m of a watercourse;
- All spills and leaks will be reported directly to the Site Environmental Manager who in turn will report to the Construction Manager.

Hazardous Material Control Measures

Hazardous materials, such as hydrocarbons, may be used on site within the wind farm site and during the construction of the project. This section covers any substance that is regarded as potentially harmful. They are usually marked with one of the symbols shown below.

- All hazardous substances will be stored in a safe manner in such a way that they will not be at risk of spillage or damage, i.e. within a bunded storage area away from any vehicular traffic at a designated location within the site construction compounds;
- Chemicals stored on the wind farm project site will be minimised. This storage area if required will be bunded appropriately for the chemical storage volume (i.*e.,* 110 % of maximum volume);
- All material data sheets will be readily available on site and the Environmental Manager will keep copies of Material Safety Data Sheets for all hazardous substances centrally;
- Anywhere hazardous materials are to be used they will be specifically mentioned in the Method Statement along with information on how to handle the substance and how to deal with any accidents;
- Empty canisters or containers that contained hazardous substances will be disposed of in hazardous waste skips which will be provided at the site construction compounds and appropriately recorded on the waste register;
- Subcontractors must provide a copy of the Material Safety Data Sheets to the site Environmental Manager for all hazardous substances brought on site; and,
- The contents of any tank/container/drum will be clearly marked with the appropriate warning signage, and a notice displayed requiring that valves and trigger guns be locked when not in use.

Cement Based Products Control Measures

- Apart from very small volumes at the substation and control building (i.e. for block laying), no batching of wet-cement products will occur on the wind farm project site. In addition, wet cement will not be used during the construction of the grid connection, with semi-dry lean mix used as specified by EirGrid/ESBN standards;
- Ready-mixed supply of wet concrete products will be used for turbine foundations and for other foundations at the project site – i.e. foundations for the met mast, control buildings and as needed for structures at the substation compound. Watercourse crossing structures will utilize pre-cast concrete elements;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered to the wind farm site, only the chute will be cleaned, using the smallest volume of water possible (see reference to RCW wash unit below);
- No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water should be tanked and removed from the wind farm site to an appropriate waste facility;
- Weather forecasting will be used to plan dry days for pouring concrete;
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event; and,
- All concrete wash down at the site will be completed in a dedicated Roadside Concrete Washout (RCW) concrete wash unit (i.e. Siltbuster or similar). This unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility.

4.4 WATER SUPPLY AND ON-SITE SANITATION

All water used at the wind farm site will be as follows:

- Water supply for the site office and compound will be brought to site and removed after use from the site to be discharged at a suitable off-site licenced treatment location; and, no water will be sourced on the windfarm site.
- Water supply to the Tinnalintan Substation will be via a new supply from the existing Uisce Eireann network on the local public road.

All wastewater effluent generated throughout the construction phase of the project will be contained in Port-a-loos and disposed of appropriately by a licensed provider as follows:

- A self-contained port-a-loo with an integrated waste holding tank will be used, maintained by the providing contractor, and removed from the wind farm project site on completion of the construction works. Collected wastewater will be removed by tanker and disposed of at a suitable off-site licenced wastewater facility; and,
- No wastewater will be discharged to the wind farm site drainage network or to any downstream watercourse or along the cable routes or at any other remote works locations.

5. WATER MONITORING PLAN

5.1 DRAINAGE INSPECTION & MAINTENANCE

Drainage performance will form part of the civil works contract requirements. During the construction phase the effectiveness of drainage measures, designed to minimise runoff entering works areas and the capture and treatment of potentially silt-laden water from the works areas will be monitored periodically (daily, weekly, and event-based monitoring, *i.e.* after heavy rainfall events) by the site Environmental Manager and/or the Project Engineer. This will primarily involve inspection of the drainage system within the wind farm site, but also ongoing inspection of the efficacy of surface water treatment along the cable routes and at haul route works locations as works progress. The site Environmental Manager will respond to changing weather and drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained. Regular inspections of all existing and installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water within the system. Any excess build-up of silt levels at check dams, the settlement ponds, or any other drainage features within the wind farm site, or at silt fences/bags along the grid route, which may decrease the effectiveness of the drainage feature, will be removed.

The following periodic inspection regime will be completed and recorded:

- Daily general visual inspections by site Environmental Manager within the wind farm site and during the construction of the substation and underground cabling;
- Weekly (existing & new drains) inspections by site Construction Manager;
- All inspection to include all elements of drainage systems and all monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter should be noted and corrective action should be implemented. High risk locations such as settlement ponds will be inspected on a daily basis. Daily inspections checks will be completed on plant and equipment, and whether materials such as silt fencing or oil absorbent materials need replacement;
- Event based inspections by the site Environmental Manager as follows, after:
    - >10 mm/hr (*i.e.* high intensity localised rainfall event);
    - >25 mm in a 24 hour period (heavy frontal rainfall lasting most of the day); or,
    - Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week).
- Monthly inspections by the Project Hydrologist during construction phase.

5.2 SURFACE WATER QUALITY MONITORING

5.2.1 Field Monitoring

Field monitoring of water quality parameters and collection of samples within the project site will be undertaken by the site Environmental Manager. He/she will be appropriately trained on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used.

5.2.2 Sampling Locations

Surface water quality will be monitored during the construction phase and this monitoring will also extend into the post construction phase for the wind farm site. Grab sampling will be completed at monitoring points, which are proposed at the locations used in the pre-planning baseline assessments (refer to **Figure 2**).

The proposed locations of the surface water monitoring points will be agreed with Inland Fisheries Ireland and Kilkenny County Council in advance of the construction phase.

Coordination of the flow monitoring and continuous monitoring (maintenance and downloading and data management) will be undertaken by the site Environmental Manager.

5.2.3 Laboratory Analysis

Laboratory analysis of water samples will also be undertaken as part of the monitoring programme by an independent and appropriately certified laboratory.

Coordination of the laboratory sampling and analytical programme will be undertaken by the site Environmental Manager. Samples will be dispatched for analysis under chain of custody procedures. Laboratory analytical results will be sent to the site Environmental Manager who will relay data onto the Project Hydrologist and Project Ecologist for their independent review.

Interpretation and reporting of both the field and laboratory data will be the responsibility of the site Environmental Manager.

Proposed parameter suite for hydrochemistry analysis at the monitoring locations is shown in **Table C** below.

Table C: Proposed Parameter Suite for Surface Water Monitoring

• pH (field measured)	• Sulphate • Chloride
• Electrical Conductivity (field measured)	• Ammonia N • Nitrate • Nitrite
• Temperature (field measured)	• Total Petroleum Hydrocarbons
• Ortho-Phosphate	• Total Suspended Solids
• Biological Oxygen Demand	• Turbidity

5.2.4 Monitoring Frequency

Monitoring frequency will be specified and agreed with Inland Fisheries Ireland and Kilkenny County Council prior to commencement of construction.

As a minimum, the monitoring programme will include:

- Daily visual checks across the construction works area;
- Weekly sampling for suspended solids and turbidity in catchments where construction is on-going and monthly monitoring for all other parameters;
- Event based sampling, e.g. after heavy rainfall (at least 4 no. event-based monitoring rounds per year);
- Additional sampling in the event of trigger level exceedance, e.g. after heavy rainfall; and,
- Post construction sampling programme (monthly sampling for 3 months).

5.2.5 Surface Water Monitoring Reporting

Results of water quality monitoring shall assist in determining requirements for improvements in drainage and pollution prevention measures implemented at the wind farm site and during the works along the grid route.

It will be the responsibility of the site Environmental Manager to present the ongoing results of water quality and weather monitoring at regular site meetings. There will also be regular meetings between the Environmental Manager and construction staff which will include a look ahead for upcoming works and any required environmental management required to facilitate ongoing construction works.

Reports on water quality will consider all field monitoring and results of laboratory analysis completed that period. Reports will describe how the results compare with baseline data as well as previous reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed, whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented. The reports will be made available to Kilkenny County Council and Inland Fisheries Ireland on request.

5.3 COMPLIANCE AND EMERGENCY RESPONSE

5.3.1 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular water quality parameter have been exceeded. An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary. Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

5.3.2 Corrective Action Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Environmental Manager, as advised by the Environmental Clerk of Works. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Environmental Manager and the Environmental Clerk of Works will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

5.3.3 Emergency Response Procedure

In the unlikely event of a significant pollution occurrence in local surface waters relating to the works then the following protocol will be adopted:

- Water quality monitoring will be undertaken visually, and the Construction Manager will have informed the Environmental Manager of any observed issues;
- If the source is from the works, then the Environmental Manager will notify appropriate personnel in Kilkenny County Council, the EPA and Inland Fisheries Ireland.

Work will not continue again until the source of the pollution is identified and eliminated.

* * * * * * * * * * * * * * * * * * * *

FIGURES

Surface Water Management Plan

Figure 2 - Proposed Water Quality Monitoring Plan

Legend:

- Ballynalacken Windfarm Project
- Ballynalacken Windfarm Project (Haul Route Works)
- W2 Watercourse Crossing
- W2 Wet Drainage Channel Crossing
- Water Sampling Locations
- A6 Water Sampling Identification
- EPA Waterbodies

WFD River Sub Basins:

- Cloghnagh_010
- Castlecomer Stream_010
- Owveg(Nore)_040
- Nore_120
- Dinin(North)_040

Source: Environmental Protection Agency

BALLINAKILL
Baile na Coille

DURROW
Darú

BALLYRAGGET
Béal Átha Ragad

CASTLECOMER
Caisleán an Chomair

Owveg(Nore)_040

Nore_120

Dinin(North)_040

Castlecomer Stream_010

Cloghnagh_010

River Nore

Owveg River

Met Mast

Kilcronan

A1 A2 A3

B2 B3 B4 B5 B6 B7 B10

C1 C2 C3 C4 C5 C6 C7 C8

D1 D2 D3 D4

W1 W2 W3

HR8 HR9 HR10 HR11 HR12 HR13

Loughill

Ballyoskill

Castlemarket East

Ballynalacken 15

Nicholastown 15

Rathduff 15

Internal Cable Link

Ballynalacken Grid Connection

Tinnalintan Substation

Eirgrid Ballyragget Substation

Ballymartin 15

Sraleagh

Cloghnagh

Castlecomer Stream

Unnamed tributary

Dinin River

Damerstown West

N

Surface Water Management Plan

SWMP F.2 - Site Drainage Map

Legend:

- Ballynalacken Windfarm Project
- EPA waterbody, including direction of flow
- Drainage channel, including direction of glow
- Watercourse Crossing
- Wet Drainage Channel Crossing

WFD River Sub Basins:

- Cloghnagh_010
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Source: Environmental Protection Agency

T12
T11
T10
T9
T8
T7
T6
T5
T4
T3
T2
T1
D1
D2
D3
D4
W1
W2
W3
Kilcronan
Castlecomer Stream
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Cloghnagh
Cloghnagh
N

APPENDIX I: WIND FARM DRAINAGE PLANS

POLLUTION PREVENTION NOTES:

1. Site management proposals are intended to ensure protection against surface water and groundwater pollution, siltation and erosion.
2. Suitable drainage control measures should be in place at all times to prevent conveyance of significant volumes of silt to off site receiving watercourses.
3. Silty water can arise from dewatering excavations, erosion of exposed/disturbed ground, temporary stockpiles, plant and wheel wash, site roads/tracks, and disturbance of existing field drains and ditches.

Discharges

4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material is to be stored within any surface water buffer zone.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
8. Vegetation will NOT be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where deep excavations are proposed cut-off drains will be use to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of exposed ground and temporary stockpiles open at any one time will be minimised, as far as practicable.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, preferably on an impermeable surface and away from field drains / ditches and watercourses / waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Care will be taken when completing concrete works on site to ensure no discharges occur.
16. Concrete wash water, and waste concrete will be managed appropriately on site.

IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

STOP - work in the immediate area should be stopped and the source of the pollution identified.

CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

Drainage Notes:

1. Roadway surfacing design and construction to Engineer's Specification (i.e. by others).
2. Spare silt fencing/ or similar, to be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences/or similar or additional check dams at the problem areas. Mobile siltbuster system to be available on-site for use as required also.
3. SUDS system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of silt fencing/or similar approved method or additional check dams and silt fences to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures should be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
5. Interceptor swales / ditches to be used to collect upstream surface water flows. Regular cross drains / discharge to field ditches/drains will be required to transfer / discharge surface water in interceptor drains to suitable field drain outfall points.
6. Drainage swales / ditches to be excavated adjacent to the access tracks. Regular cross drains to be located along access tracks to prevent excessive volumes of water collecting in the swales / ditches. Locations of cross drains to be agreed with the Engineer on site. Surface water will not be allowed to discharge directly into existing watercourses.
7. Where possible, a buffer zone of >20m to any existing watercourse will be required where over land discharges are proposed from access track swales / ditches.
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams should be installed to reduce flow velocities and provide source control of silt containment. Where necessary these have been designated in conjunction with settlement ponds and silt traps, prior to discharge.
10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depends on catchment area served. Sample pond sizes shown on Drawing D501.
11. Silt fences to be used also around spoil heaps to mitigate silt runoff. Silt fences may be removed when suitable vegetation cover is established.
12. Silt fences to be provide along edge of existing watercourse where works comes within <15m of edge of any ditch / ephemeral channels.
13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer (peat 'sod' or 'scraw') from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation should be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20- 40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100m stone on the downhill face of the check dam and by wrapping in geotextile.
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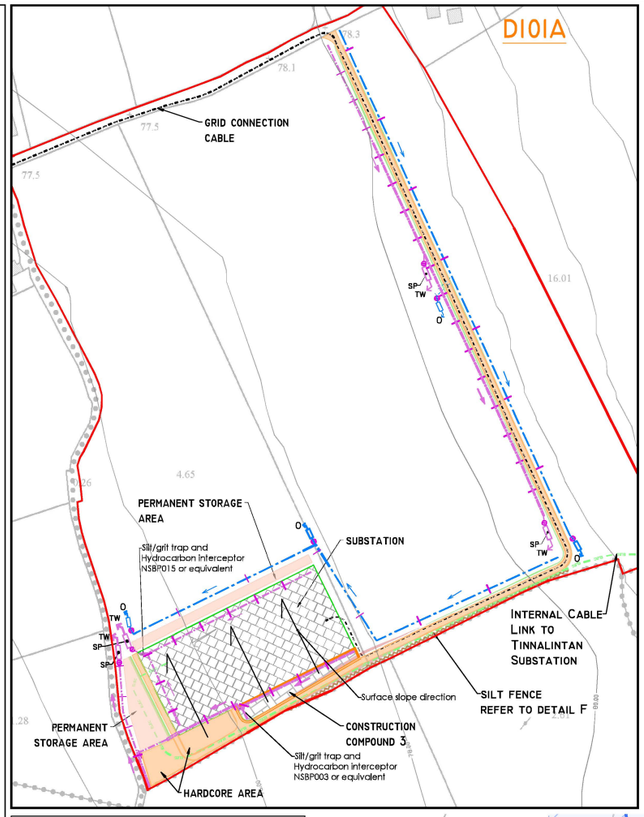
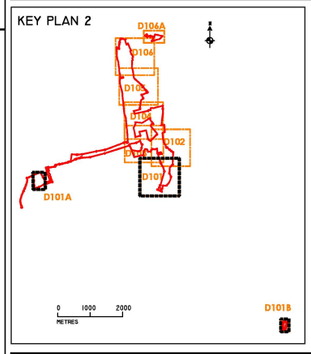
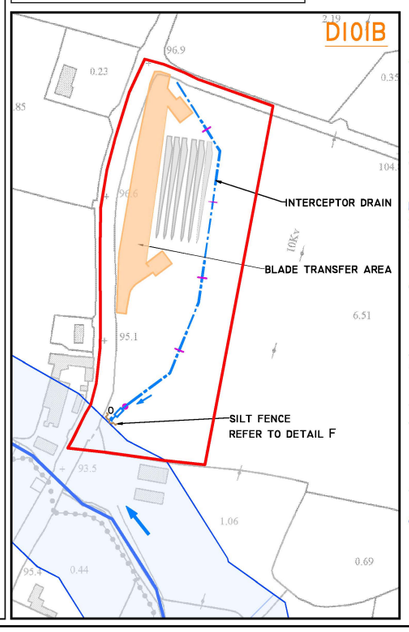
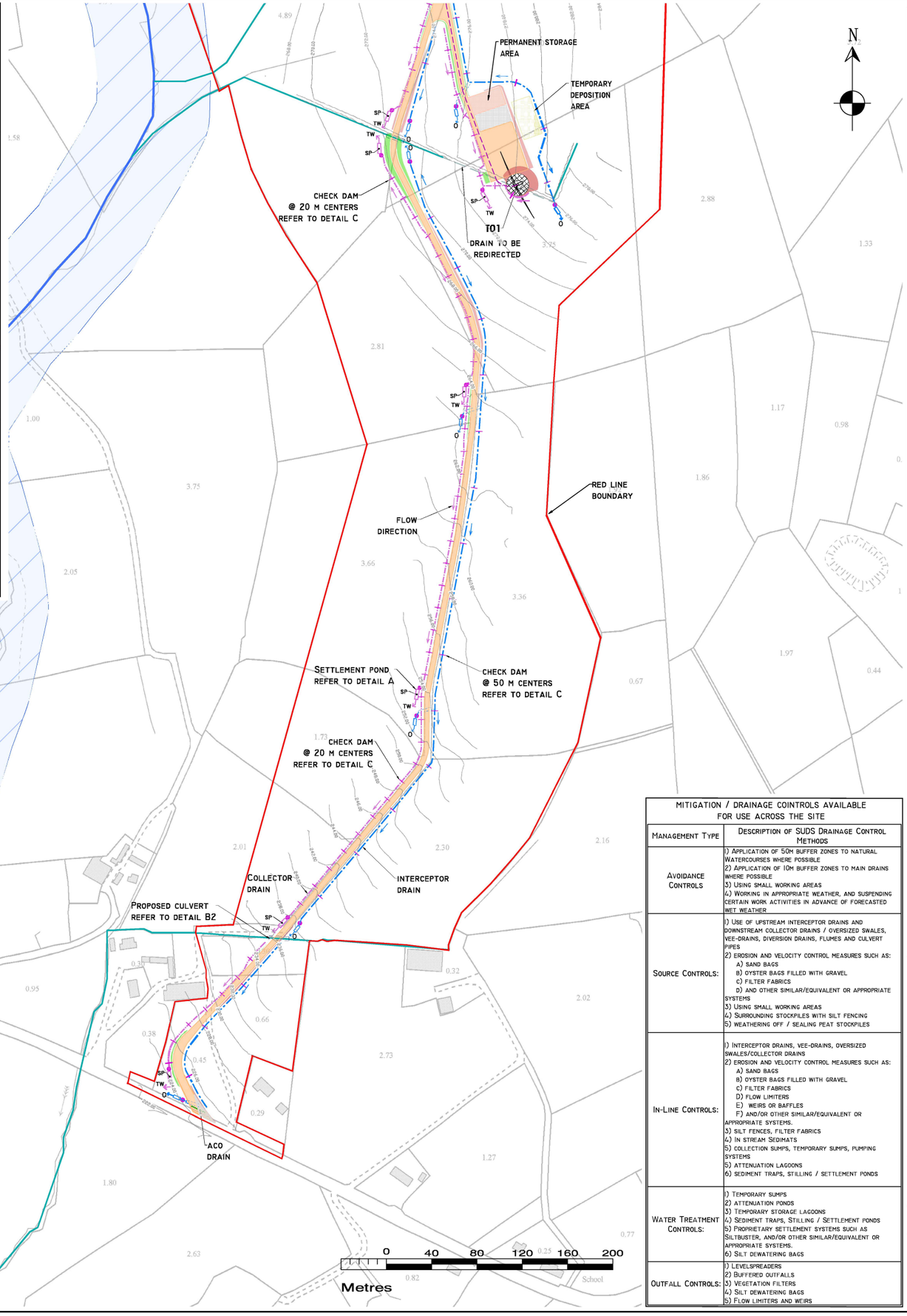
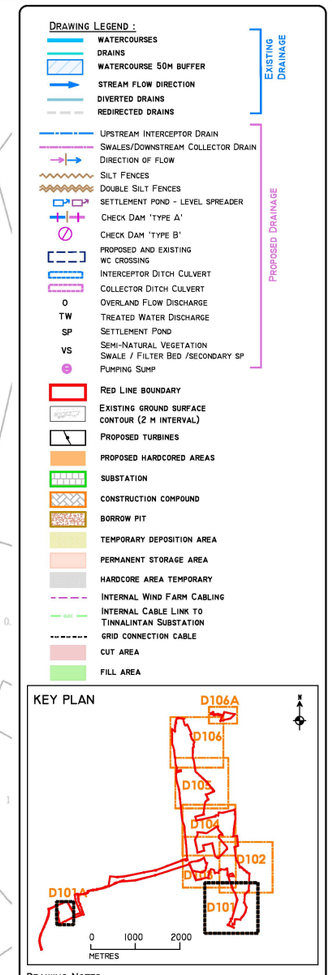
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil fuel should be stored within bunded containment structures.
20. Silt bags will be used on site at field drain discharge locations, as necessary.











MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) flow limiters E) weirs or baffles F) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
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Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

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Revisions

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ECOPOWER LTD.

Job:
Ballynalacken WF, Co. Kilkenny

Title:
PROPOSED DRAINAGE LAYOUT
SHEET 1 OF 6

Drawing No: D101

HES Reference No: P1562-0-0225-A1-D101-00J	
Sheet Size: A1	Project No.: P1562-0
Scale: 1:2,000 (A1)	Drawn By: GA
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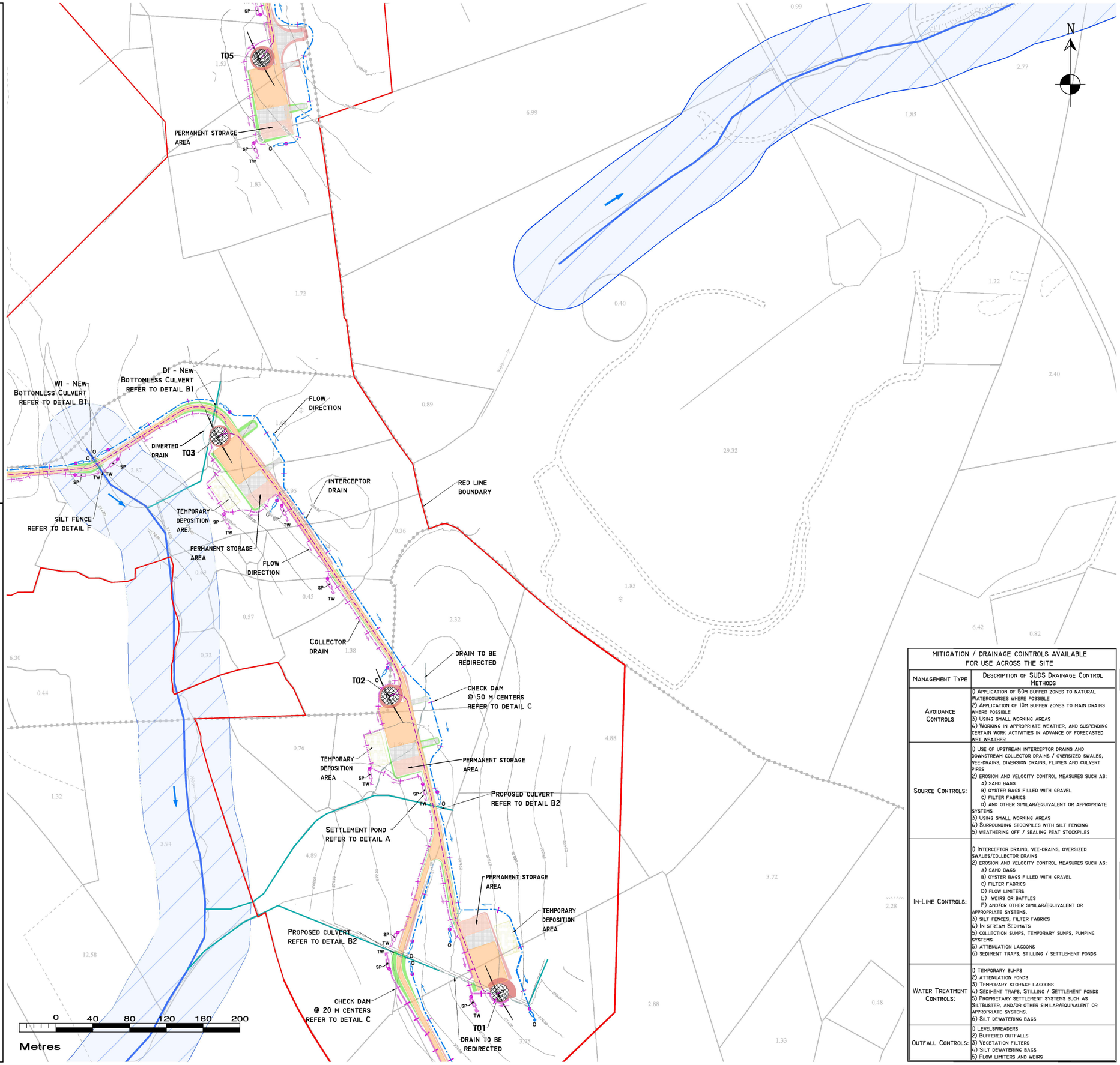
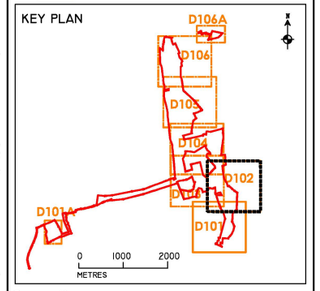


DRAWING LEGEND :

- Existing Drainage
  - Watercourses
  - Drains
  - Watercourse 50m buffer
  - Stream flow direction
  - Diverted drains
  - Redirected drains
- Proposed Drainage
  - Upstream Interceptor Drain
  - Swales/Downstream Collector Drain
  - Direction of flow
  - Silt Fences
  - Double Silt Fences
  - Settlement pond - level spreader
  - Check Dam 'type A'
  - Check Dam 'type B'
  - Proposed and existing wc crossing
  - Interceptor Ditch Culvert
  - Collector Ditch Culvert
  - O — Overland Flow Discharge
  - TW — Treated Water Discharge
  - SP — Settlement Pond
  - VS — Semi-Natural Vegetation Swale / Filter Bed /secondary sp
  - Pumping Sump
- Red Line Boundary
- Existing ground surface contour (2 m interval)
- Proposed turbines
- Proposed hardcored areas
- Substation
- Construction compound
- Borrow pit
- Temporary deposition area
- Permanent storage area
- Hardcore area temporary
- Internal Wind Farm Cabling
- Internal Cable Link to Tinnalintan Substation
- Grid connection cable
- Cut area
- Fill area

KEY PLAN



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Revisions

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Client: Ecopower Ltd.

Job: Ballynalacken WF, Co. Kilkenny

Title: Proposed Drainage Layout
sheet 2 of 6

Drawing No: DI02

HES Reference No: P1562-0-0225-A1-D102-00J	
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4. Suitable prevention measures should be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
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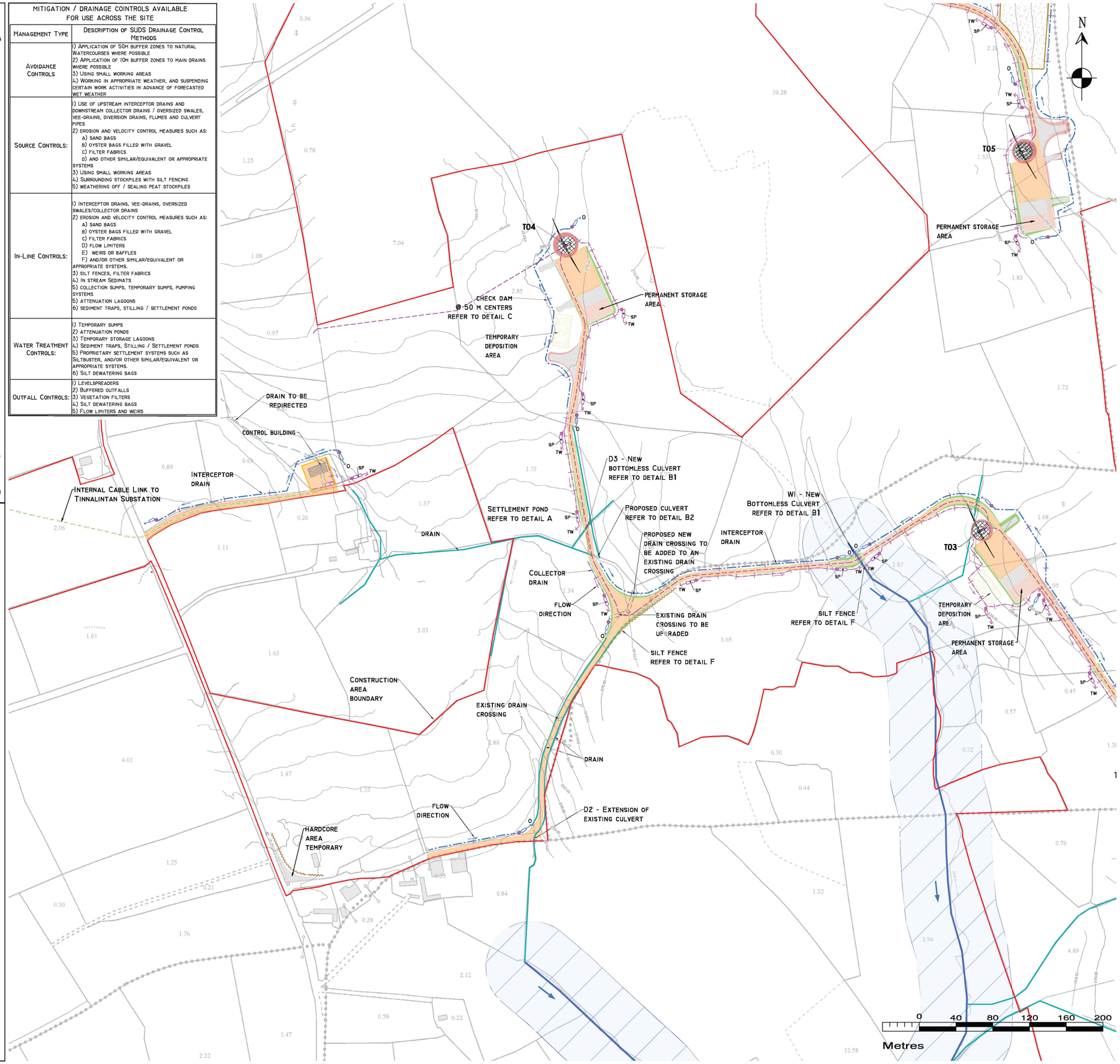
7. Where possible, a buffer zone of >20m to any existing watercourse will be required where over land discharges are proposed from access track swales / ditches.
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams should be installed to reduce flow velocities and provide source control of silt containment. Where necessary these have been designated in conjunction with settlement ponds and silt traps, prior to discharge.
10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depends on catchment area served. Sample pond sizes shown on Drawing D501.
11. Silt fences to be used also around spoil heaps to mitigate silt runoff. Silt fences may be removed when suitable vegetation cover is established.
12. Silt fences to be provide along edge of existing watercourse where works comes within <15m of edge of any ditch / ephemeral channels.
13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer (peat 'sod' or 'scraw') from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation should be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20- 40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100h stone on the downhill face of the check dam and by wrapping in geotextile.
16. Build up of silt levels at check dams to be removed and disposed of appropriately. Silt levels at check dams to be visually inspected as part of an ongoing drainage maintenance programme during the construction phase. Where check dams become clogged with silt or vegetation, stone check dam to be removed and replaced subsequent to the removal of silt.
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil fuel should be stored within bunded containment structures.
20. Silt bags will be used on site at field drain discharge locations, as necessary.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

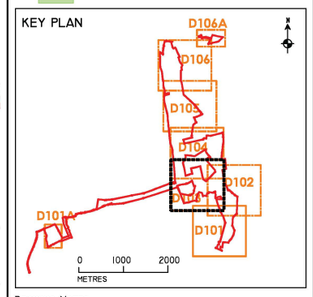
Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) flow limiters E) weirs or baffles F) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



DRAWING LEGEND :

- Existing Drainage: Watercourses; Drains; Watercourse 50m buffer; Stream flow direction; Diverted drains; Redirected drains
- Proposed Drainage: Upstream Interceptor Drain; Swales/Downstream Collector Drain; Direction of flow; Silt Fences; Double Silt Fences; Settlement pond - level spreader; Check Dam 'Type A'; Check Dam 'Type B'; Proposed and existing wc crossing; Interceptor Ditch Culvert; Collector Ditch Culvert; O Overland Flow Discharge; TW Treated Water Discharge; SP Settlement Pond; VS Semi-Natural Vegetation Swale / Filter Bed /secondary sp; Pumping Sump
- Red line boundary; Existing ground surface contour (2 m interval); Proposed turbines; Proposed hardcored areas; Substation; Construction compound; Borrow pit; Temporary deposition area; Permanent storage area; Hardcore area temporary; Internal wind farm cabling; Internal cable link to Tinnalintan Substation; Grid connection cable; Cut area; Fill area

KEY PLAN



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Date	Description	Chkd	Signed
Revisions			

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Client: Ecopower Ltd.

Job: Ballynalacken WF, Co. Kilkenny

Title: Proposed Drainage Layout Sheet 3 of 6

Drawing No: D103

HES Reference No: P1562-0-0225-A1-D103-00J	
Sheet Size: A1	Project No.: P1562-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/02/2025	Checked By: MG

POLLUTION PREVENTION NOTES:

1. Site management proposals are intended to ensure protection against surface water and groundwater pollution, siltation and erosion.
2. Suitable drainage control measures should be in place at all times to prevent conveyance of significant volumes of silt to off site receiving watercourses.
3. Silty water can arise from dewatering excavations, erosion of exposed/disturbed ground, temporary stockpiles, plant and wheel wash, site roads/tracks, and disturbance of existing field drains and ditches.

Discharges

4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material is to be stored within any surface water buffer zone.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
8. Vegetation will NOT be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where deep excavations are proposed cut-off drains will be use to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of exposed ground and temporary stockpiles open at any one time will be minimised, as far as practicable.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, preferably on an impermeable surface and away from field drains / ditches and watercourses / waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Care will be taken when completing concrete works on site to ensure no discharges occur.
16. Concrete wash water, and waste concrete will be managed appropriately on site.

IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

STOP - work in the immediate area should be stopped and the source of the pollution identified.

CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

DRAINAGE NOTES:

1. Roadway surfacing design and construction to Engineer's Specification (i.e. by others).
2. Spare silt fencing/ or similar, to be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences/or similar or additional check dams at the problem areas. Mobile siltbuster system to be available on-site for use as required also.
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MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
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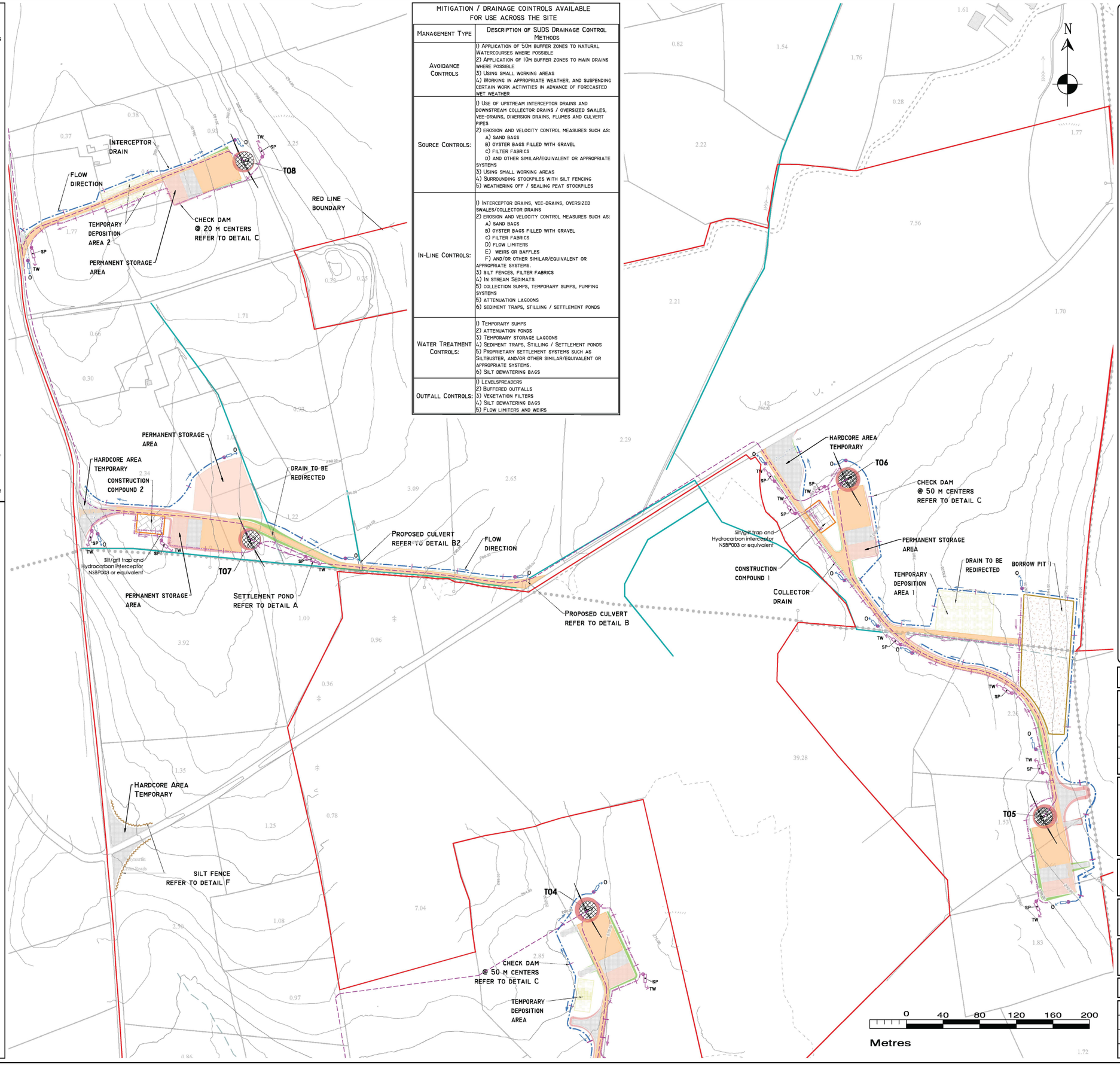

DRAWING LEGEND :

- Existing Drainage
  - Watercourses
  - Drains
  - Watercourse 50m buffer
  - Stream flow direction
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- Proposed Drainage
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- Substation
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- Borrow Pit
- Temporary Deposition Area
- Permanent Storage Area
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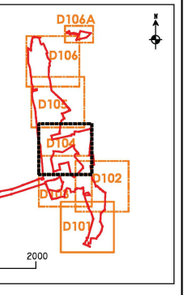
KEY PLAN



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Date	Description	Chkd	Signed
Revisions			

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web: www.hydroenvironmental.ie

Client: Ecopower Ltd.

Job: Ballynalacken WF, Co. Kilkenny

Title: Proposed Drainage Layout Sheet 4 of 6

Drawing No: DI04

HES Reference No: P1562-0-0225-A1-D104-00J	
Sheet Size: A1	Project No.: P1562-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/02/2025	Checked By: MG

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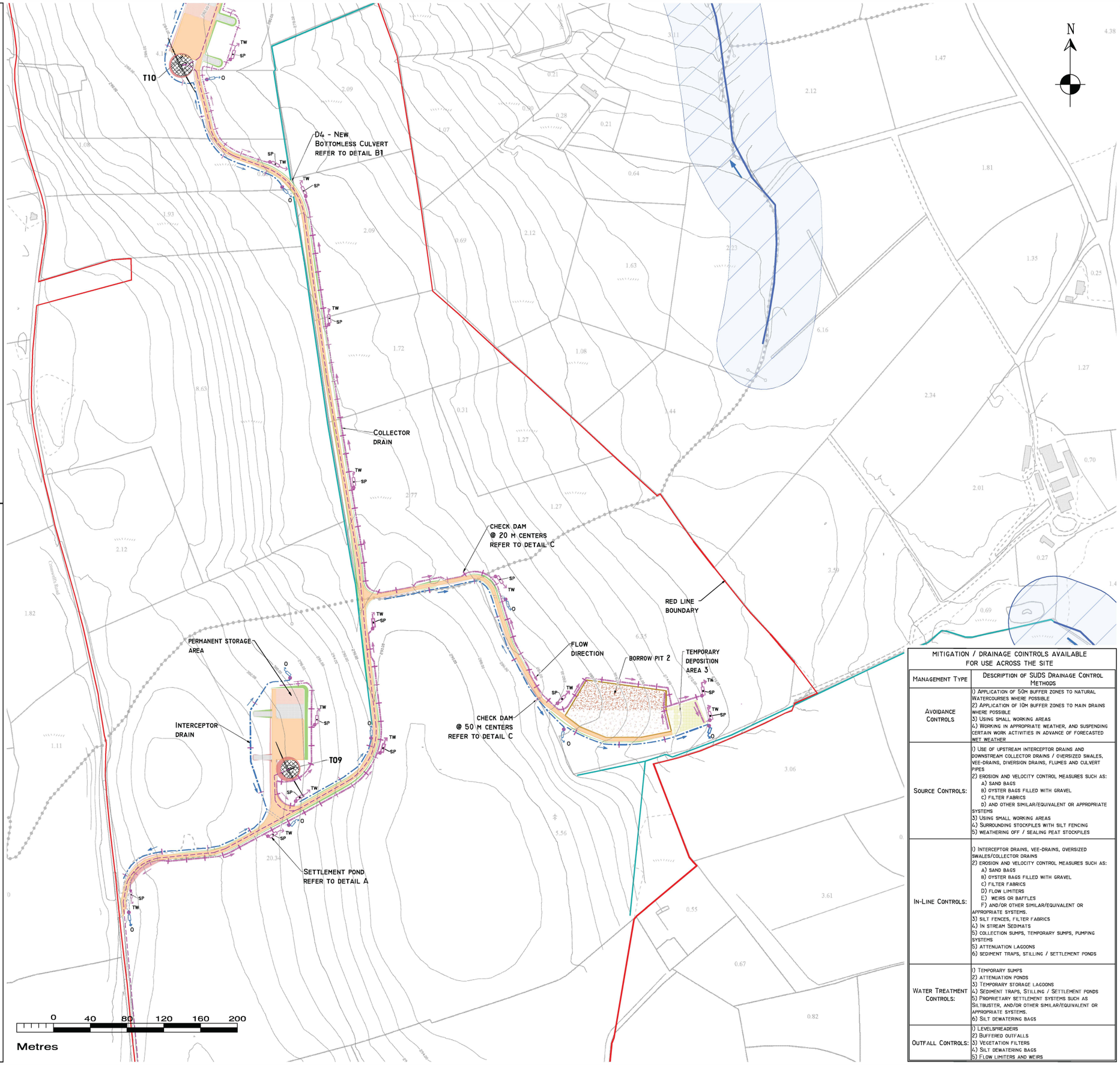

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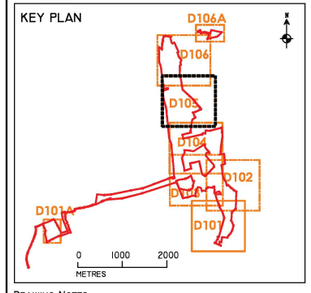

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Date	Description	Chkd	Signed

Revisions

HYDRO ENVIRONMENTAL SERVICES
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Client: Ecopower Ltd.

Job: Ballynalacken WF, Co. Kilkenny

Title: Proposed Drainage Layout
Sheet 5 of 6

Drawing No: D105

HES Reference No: P1562-0-0225-A1-D105-00J

Sheet Size: A1	Project No.: P1562-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/02/2025	Checked By: MG

POLLUTION PREVENTION NOTES:

1. Site management proposals are intended to ensure protection against surface water and groundwater pollution, siltation and erosion.
2. Suitable drainage control measures should be in place at all times to prevent conveyance of significant volumes of silt to off site receiving watercourses.
3. Silty water can arise from dewatering excavations, erosion of exposed/disturbed ground, temporary stockpiles, plant and wheel wash, site roads/tracks, and disturbance of existing field drains and ditches.

Discharges

4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material is to be stored within any surface water buffer zone.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
8. Vegetation will NOT be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where deep excavations are proposed cut-off drains will be use to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of exposed ground and temporary stockpiles open at any one time will be minimised, as far as practicable.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, preferably on an impermeable surface and away from field drains / ditches and watercourses / waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Care will be taken when completing concrete works on site to ensure no discharges occur.
16. Concrete wash water, and waste concrete will be managed appropriately on site.

IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO:

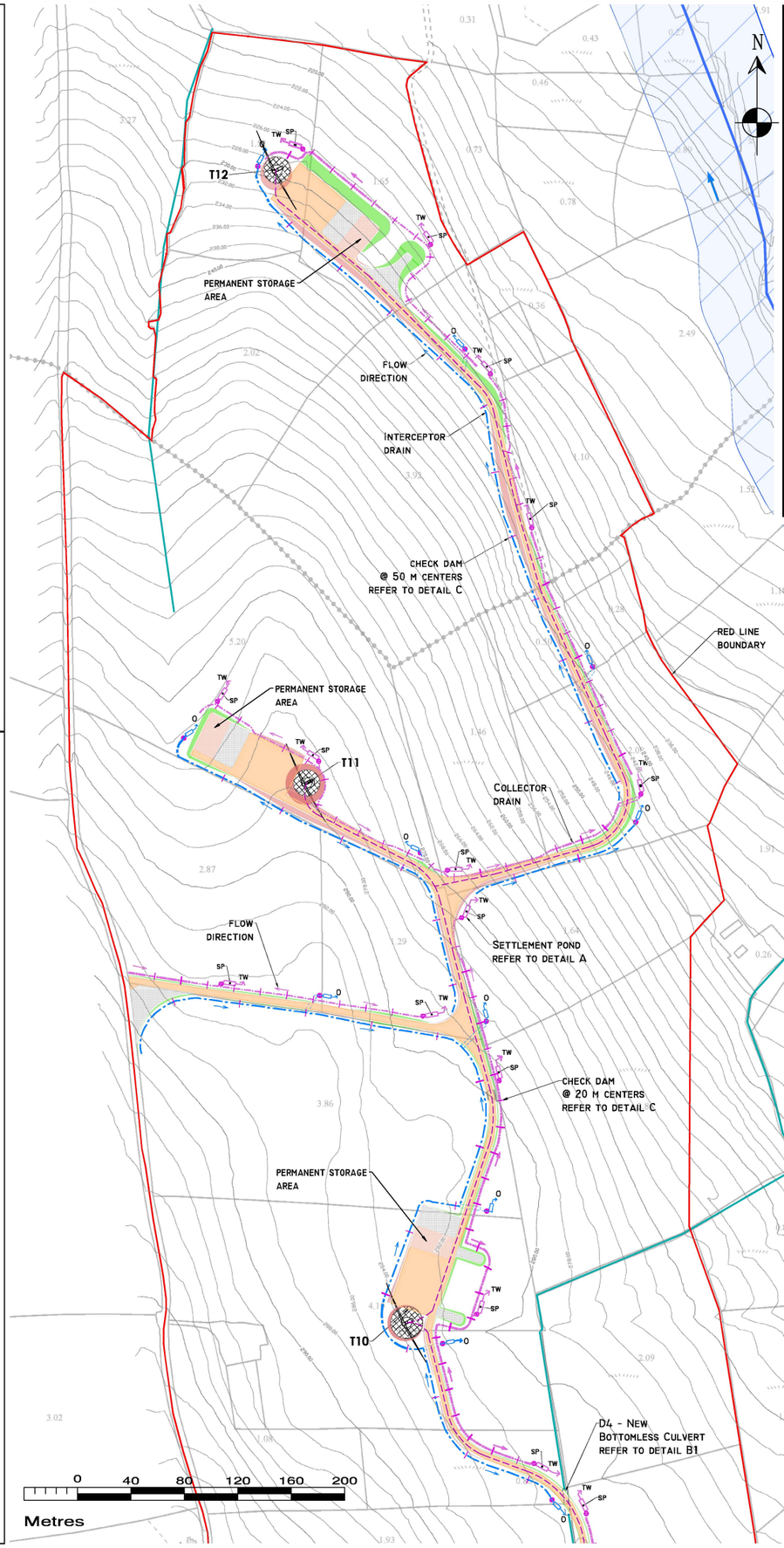
STOP - work in the immediate area should be stopped and the source of the pollution identified.

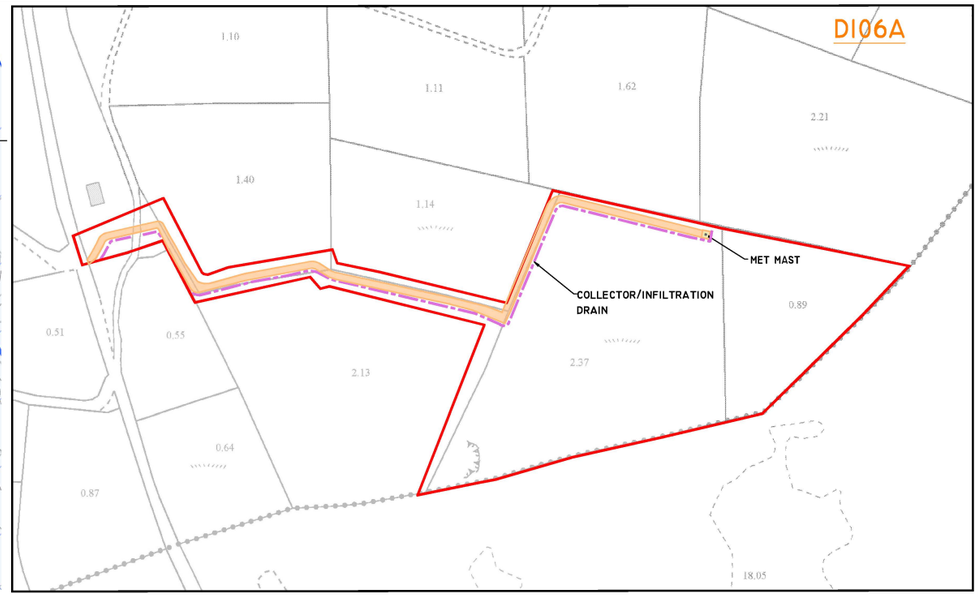
CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

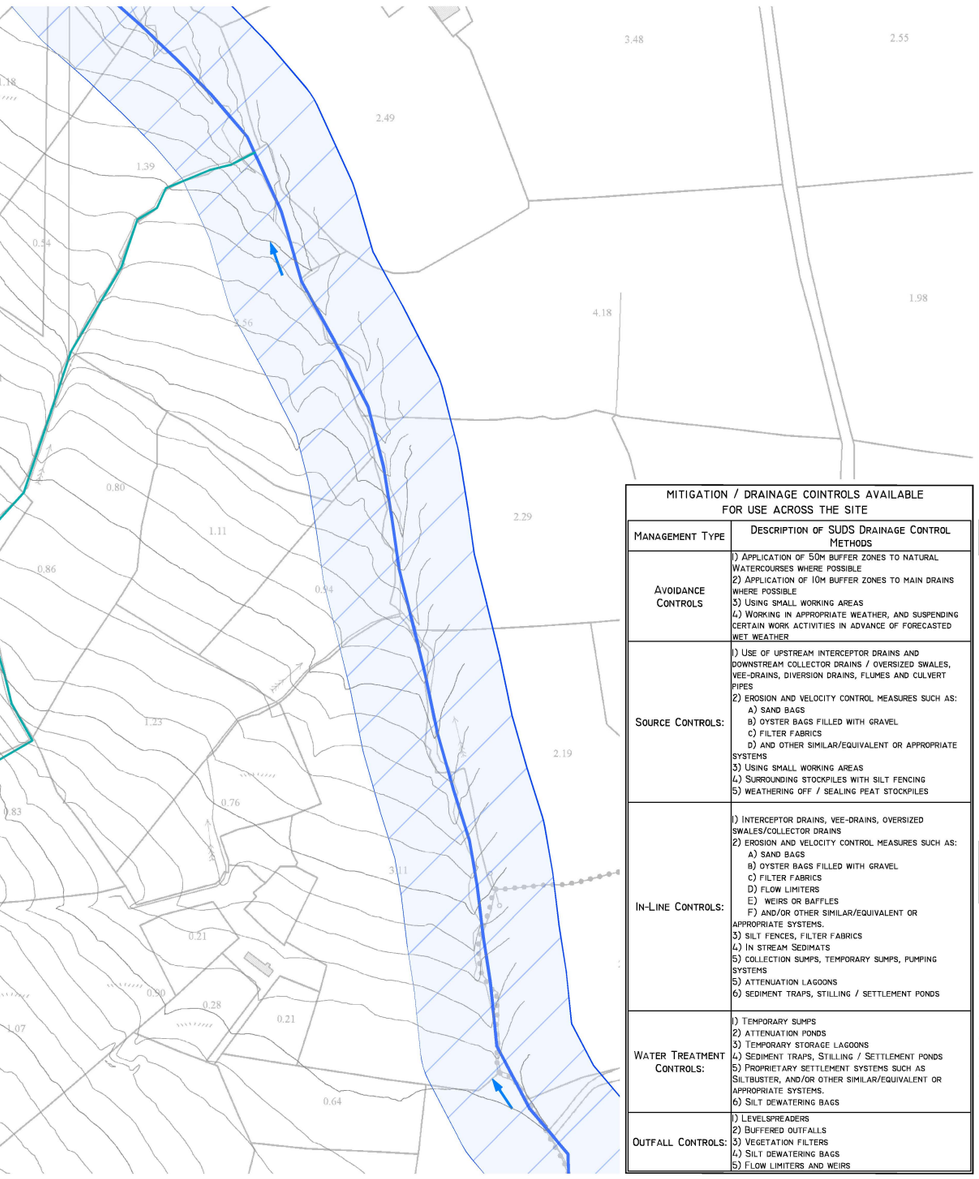
NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

DRAINAGE NOTES:

1. Roadway surfacing design and construction to Engineer's Specification (i.e. by others).
2. Spare silt fencing/ or similar, to be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences/or similar or additional check dams at the problem areas. Mobile siltbuster system to be available on-site for use as required also.
3. SUDS system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of silt fencing/or similar approved method or additional check dams and silt fences to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures should be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
5. Interceptor swales / ditches to be used to collect upstream surface water flows. Regular cross drains / discharge to field ditches/drains will be required to transfer / discharge surface water in interceptor drains to suitable field drain outfall points.
6. Drainage swales / ditches to be excavated adjacent to the access tracks. Regular cross drains to be located along access tracks to prevent excessive volumes of water collecting in the swales / ditches. Locations of cross drains to be agreed with the Engineer on site. Surface water will not be allowed to discharge directly into existing watercourses.
7. Where possible, a buffer zone of >20m to any existing watercourse will be required where over land discharges are proposed from access track swales / ditches.
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams should be installed to reduce flow velocities and provide source control of silt containment. Where necessary these have been designated in conjunction with settlement ponds and silt traps, prior to discharge.
10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depends on catchment area served. Sample pond sizes shown on Drawing D501.
11. Silt fences to be used also around spoil heaps to mitigate silt runoff. Silt fences may be removed when suitable vegetation cover is established.
12. Silt fences to be provide along edge of existing watercourse where works comes within <15m of edge of any ditch / ephemeral channels.
13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer (peat 'sod' or 'scraw') from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation should be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20- 40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100m stone on the downhill face of the check dam and by wrapping in geotextile.
16. Build up of silt levels at check dams to be removed and disposed of appropriately. Silt levels at check dams to be visually inspected as part of an ongoing drainage maintenance programme during the construction phase. Where check dams become clogged with silt or vegetation, stone check dam to be removed and replaced subsequent to the removal of silt.
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil fuel should be stored within bunded containment structures.
20. Silt bags will be used on site at field drain discharge locations, as necessary.







Drawing Legend :

- Watercourses
- Drains
- Watercourse 50m buffer
- Stream flow direction
- Diverted drains
- Redirected drains

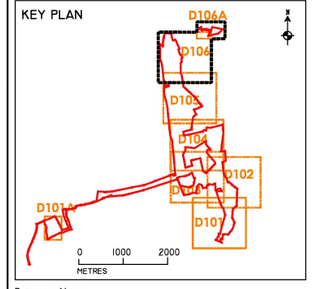
Existing Drainage

- Upstream Interceptor Drain
- Swales/Downstream Collector Drain
- Direction of flow
- Silt Fences
- Double Silt Fences
- Settlement pond - level spreader
- Check Dam 'type A'
- Check Dam 'type B'
- Proposed and existing wc crossing
- Interceptor Ditch Culvert
- Collector Ditch Culvert
- O Overland Flow Discharge
- TW Treated Water Discharge
- SP Settlement Pond
- VS Semi-Natural Vegetation Swale / Filter Bed /secondary sp
- Pumping Sump

Proposed Drainage

- Red Line Boundary
- Existing ground surface contour (2 m interval)
- Proposed Turbines
- Proposed hardcored areas
- Substation
- Construction Compound
- Borrow Pit
- Temporary Deposition Area
- Permanent Storage Area
- Hardcore Area Temporary
- Internal Wind Farm Cabling
- Internal Cable Link to Tinnalintan Substation
- Grid Connection Cable
- Cut Area
- Fill Area

KEY PLAN



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4. All dimensions are in metres.

MITIGATION / DRAINAGE COINTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural Watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) weathering off / sealing peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) erosion and velocity control measures such as: A) sand bags B) oyster bags filled with gravel C) filter fabrics D) flow limiters E) weirs or baffles F) and/or other similar/equivalent or appropriate systems. 3) silt fences, filter fabrics 4) In stream Sedimats 5) collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs

Date	Description	Chkd	Signed

Revisions

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Client: Ecopower Ltd.

Job: Ballynalacken WF, Co. Kilkenny

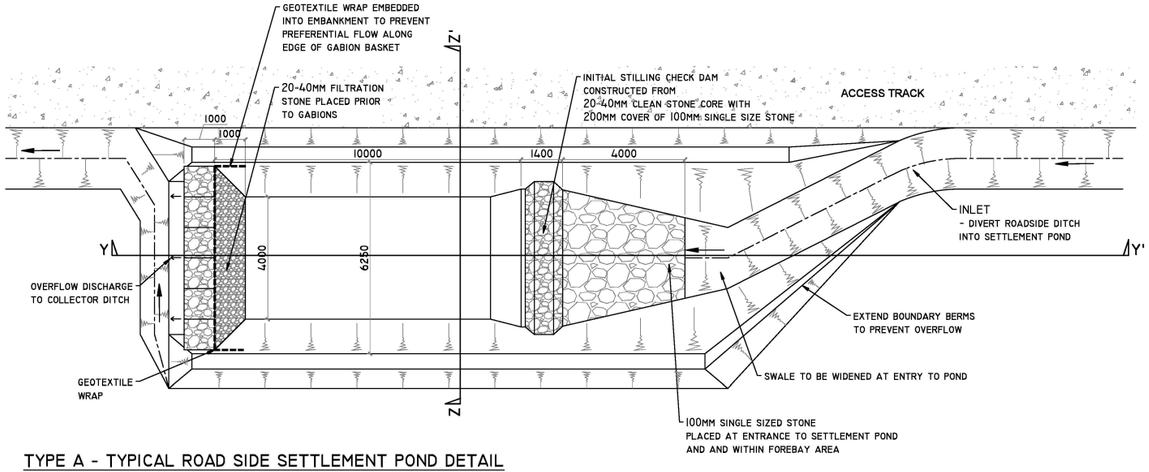
Title: Proposed Drainage Layout Sheet 6 of 6

Drawing No: DI06

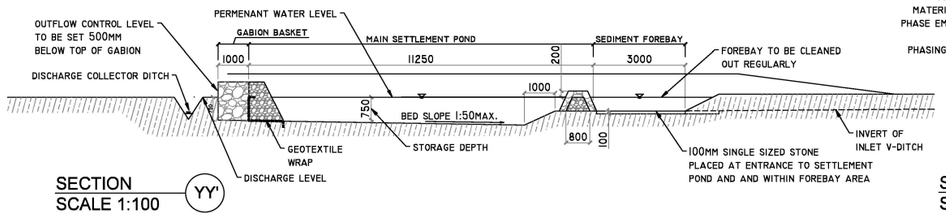
HES Reference No: P1562-0-0225-A1-D106-00J

Sheet Size: A1	Project No.: P1562-0
Scale: 1:2,000 (A1)	Drawn By: GA
Date: 26/02/2025	Checked By: MG

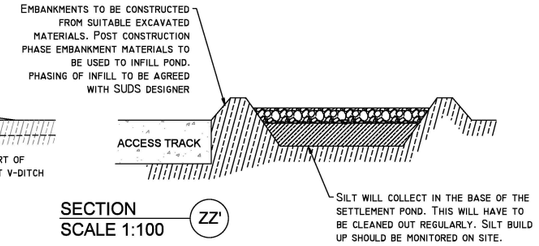
DETAIL AI



TYPE A - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:100 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)

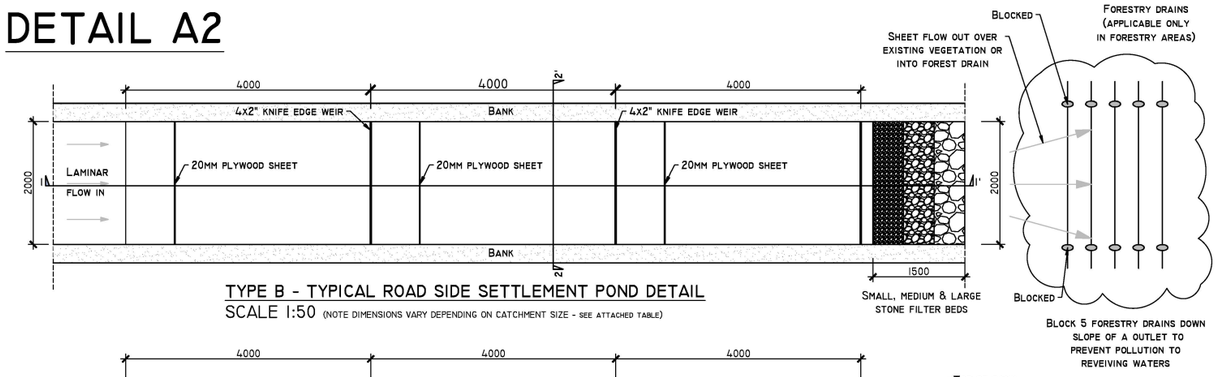


SECTION YY'
SCALE 1:100

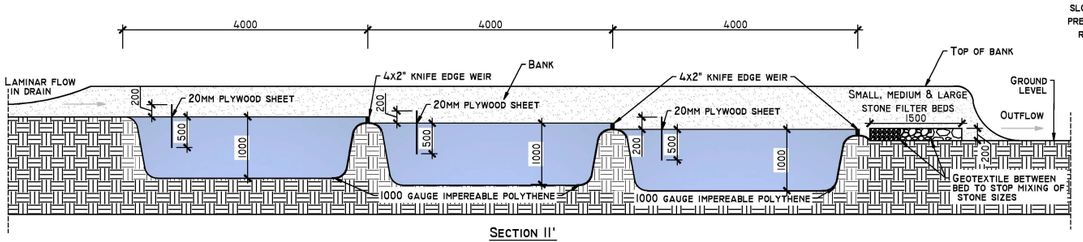


SECTION ZZ'
SCALE 1:100

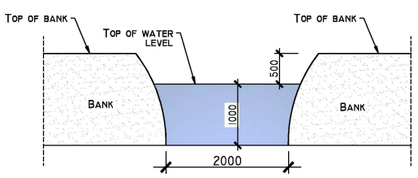
DETAIL A2



TYPE B - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:50 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)

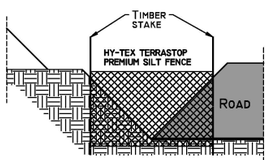


SECTION II'



SECTION 22'

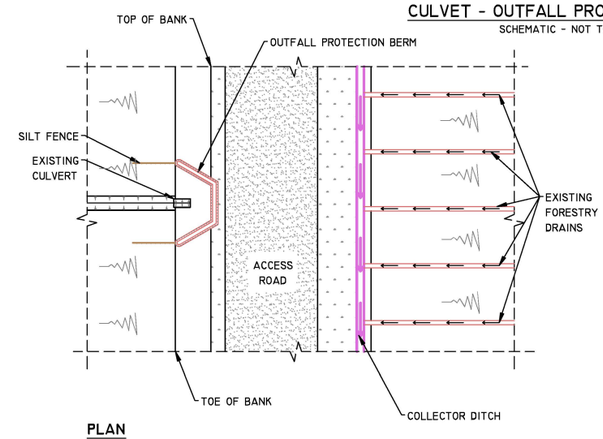
SEDIMENT FENCE/CHECK DAM DETAIL



POND SIZE W [M] X L [M] X D [M]			TRACK/HARDSTAND CATCHMENT SIZE (M^2)		
RETURN PERIOD	*10 YRS*	STORM DURATION	500	1000	2000
6HR RETENTION FOR COARSE SILT		6 HRS	2.5 X 7.5 X 1 M	3.5 X 12 X 1 M	6.0 X 19.8 X 1 M
11HR RETENTION FOR MEDIUM SILT		12 HRS	3.5 X 10.8 X 1 M	5 X 16.8 X 1 M	8.5 X 28.0 X 1 M
24HR RETENTION FOR FINE SILT		24 HRS	5 X 15.3 X 1 M	7.5 X 23.3 X1 M	12.5 X 38 X 1 M

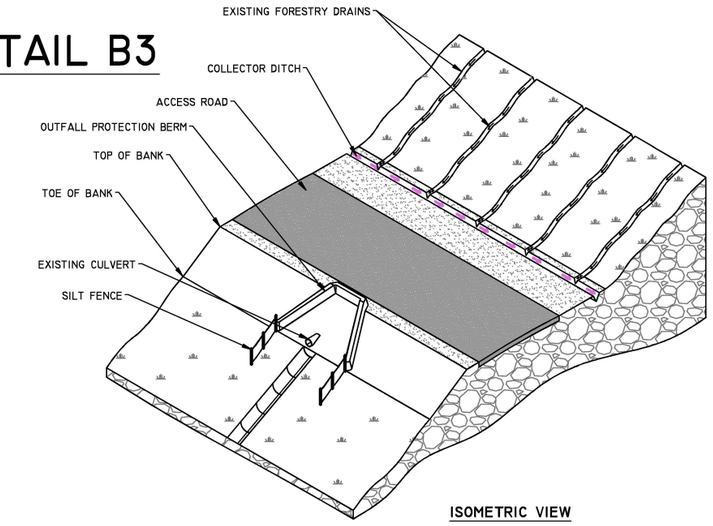
CULVET - OUTFALL PROTECTION DETAIL

SCHEMATIC - NOT TO SCALE



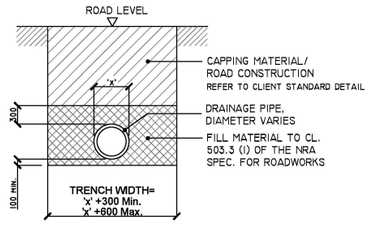
PLAN

DETAIL B3



ISOMETRIC VIEW

DETAIL B2



'TYPE B' CULVERT - DRAINAGE CROSSING BENEATH EXCAVATED ROAD

SCALE 1:50

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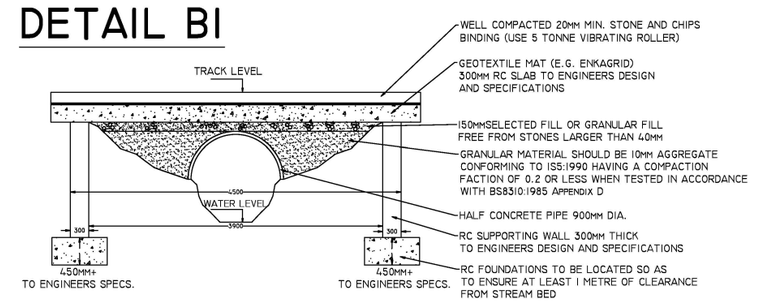
DETAIL BI



'TYPE A' TYPICAL SECTION OF STREAM BOTTOMLESS CULVERT THRU' ROAD (WHERE APPLICABLE)

SCALE 1:50

Date	Description	Chkd	Signed
24/02/25	Planning	MG	MG
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Client: ECOPOWER

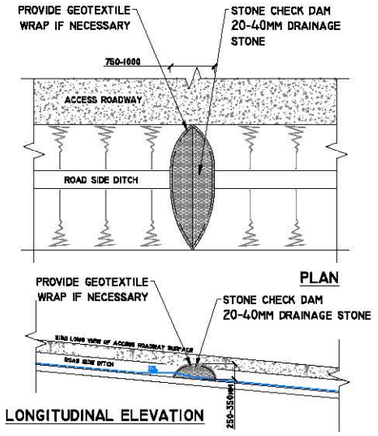
Job: BALLYNALACKEN WF, CO. KILKENNY

Title: DRAINAGE DETAILS I

Figure No: D501

Drawing No: P1562-0-0225-A1-D501-00C	
Sheet Size: A1	Project No.: P1562-0
Scale: as shown (A1)	Drawn By: MG/GA
Date: 24/02/2025	Checked By: MG

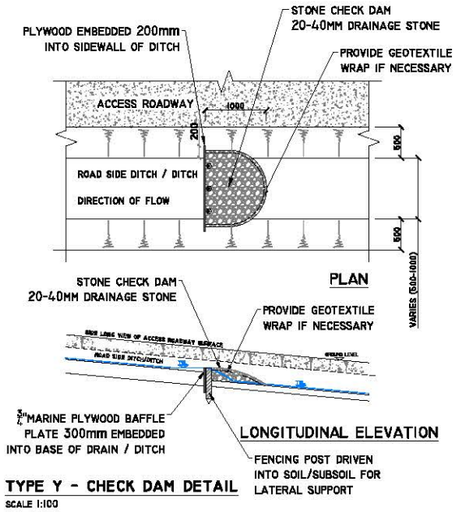
DETAIL C



TYPE X - CHECK DAM DETAIL

SCALE 1:50

DETAIL D



TYPE Y - CHECK DAM DETAIL

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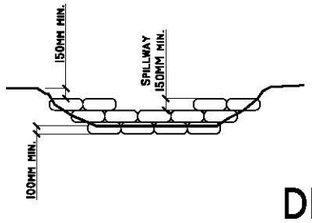
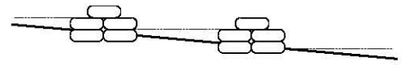
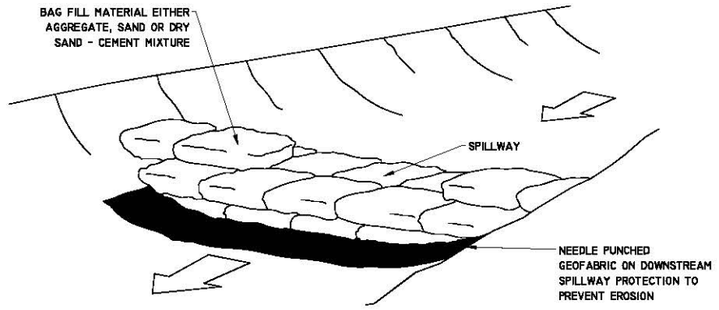




NOTE: SPACING OF CHECK DAMS ALONG CENTRELINE AND SCOUR PROTECTION BELOW EACH CHECK DAM

DETAIL C1



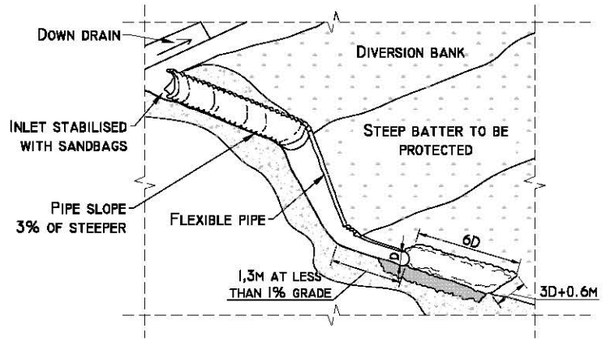
TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW
SAND FILLED BAG CONSTRUCTION

SCHEMATIC - NOT TO SCALE

DETAIL E

TYPICAL PIPE SPILLWAY DETAIL

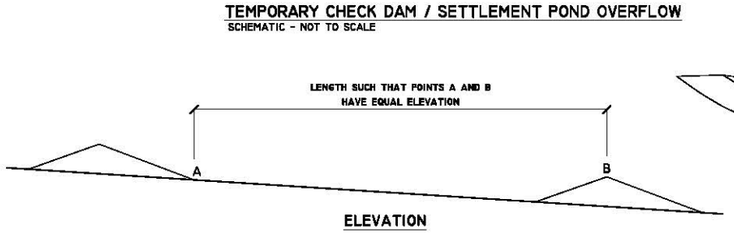
SCHEMATIC - NOT TO SCALE



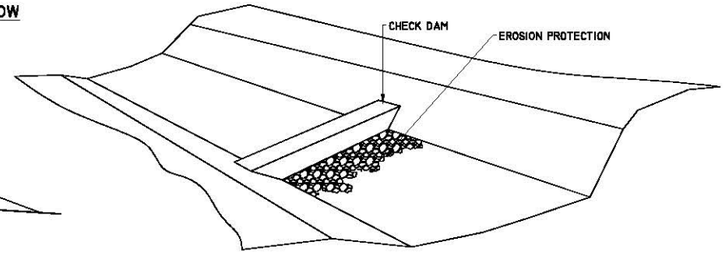
DETAIL C2

TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW

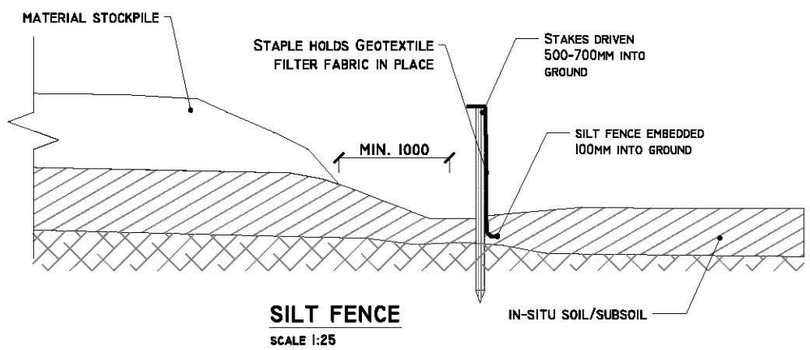
SCHEMATIC - NOT TO SCALE



ELEVATION



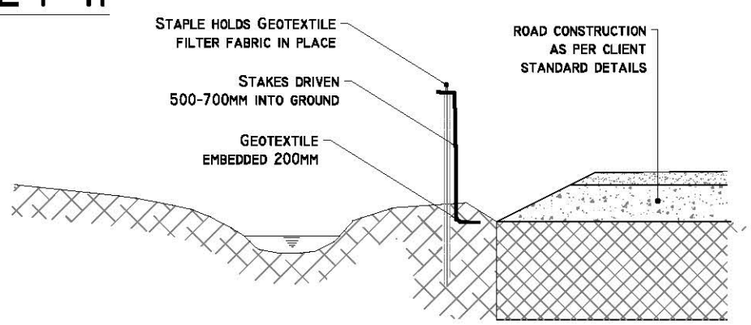
DETAIL F-I



SILT FENCE

SCALE 1:25

DETAIL F-II



SILT FENCE FOR WATERCOURSE PROTECTION

SCALE 1:25

Date	Description	Chkd	Signed
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Client: ECOPOWER

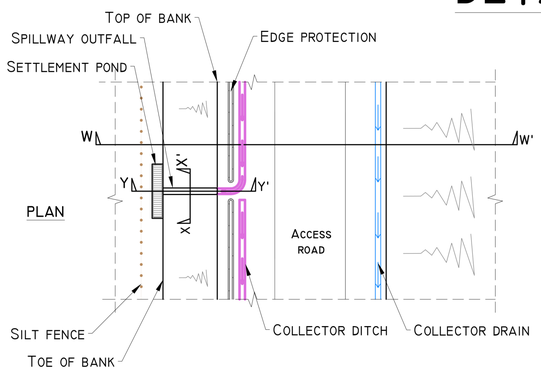
Job: BALLYNALACKEN WF, CO. KILKENNY

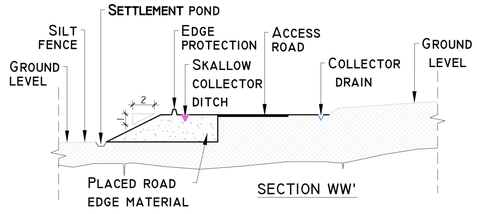
Title: DRAINAGE DETAILS 2

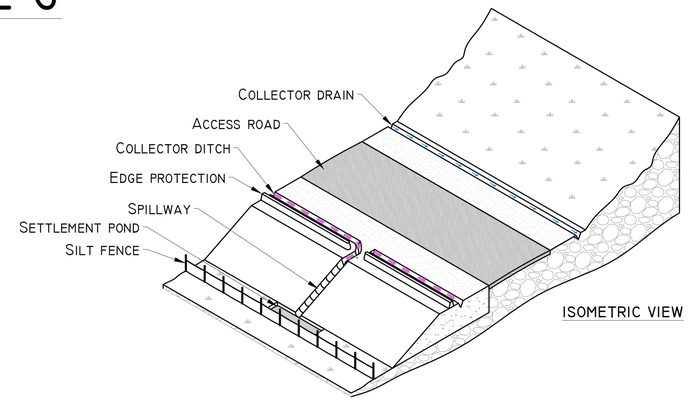
Figure No: D502

Drawing No: P1562-0-0225-A1-D502-008	
Sheet Size: A1	Project No.: P1562-0
Scale: as shown (A1)	Drawn By: MG/GA
Date: 24/02/2025	Checked By: MG

DETAIL G



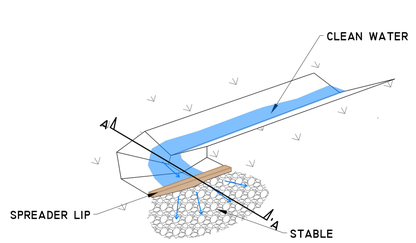




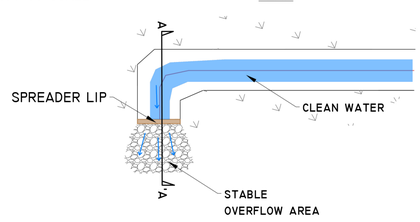
SPILLWAY OUTFALL PLAN
SCHEMATIC - NOT TO SCALE

DETAIL J-1

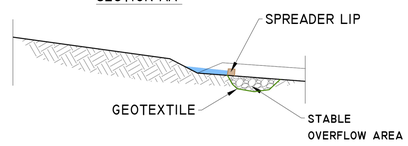
LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



PLAN

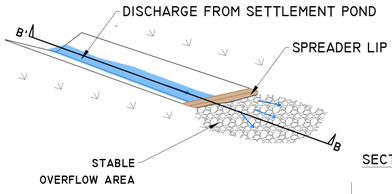


SECTION AA'

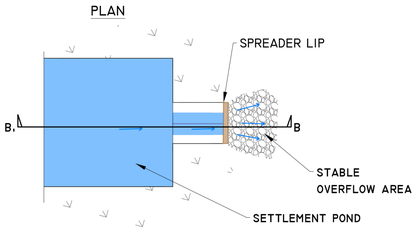


DETAIL J-2

LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



PLAN



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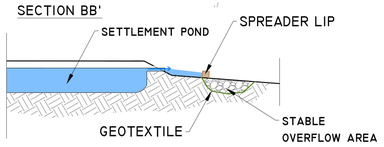

Date	Description	Chkd	Signed
24/02/25	Planning	MG	MG

Revisions

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Job: BALLYNALACKEN WF, CO. KILKENNY

Title: DRAINAGE DETAILS 3

Figure No: D503

Drawing No: P1562-0-0225-A1-D503-008	
Sheet Size: A1	Project No.: P1562-0
Scale: as shown (A1)	Drawn By: MG/GA
Date: 24/02/2025	Checked By: MG