

Surface Water Management Plan

Proposed Sheskin South
Wind Farm Development





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1.

INTRODUCTION

This Surface Water Management Plan (SWMP) is intended, as an accompanying document to the Construction and Environmental Management Plan (CEMP), to compile the proposed surface water drainage control and treatment measures, set out in the Environmental Impact Assessment Report (EIAR), and the proposed surface water monitoring programme, set out in the CEMP, in a single document.

This document has been prepared by Edward Ryan and reviewed by Eoin McCarthy of MKO. Edward is an Environmental Scientist with a B.Sc. (Hons) in Environmental Science from the University of Limerick and a M.Sc (hons) in Environmental Systems from Atlantic Technological University (previously called GMIT). Edward has over 3 years of consultancy experience in the environmental sector. Eoin is a Senior Environmental Scientist, with over 11 years of experience in private consultancy. Eoin holds a B.Sc. (Hons) in Environmental Science from NUI, Galway.

This document has also benefited from input by Henning Moe of CDM Smith. Henning is the author of the Water chapter of the EIAR and also designed the proposed drainage plan for the Sheskin South Wind Farm development that was submitted as part of the planning application. He is a registered professional geologist (P. Geo.) with the Institute of Geologists of Ireland and has more than 30 years of practical experience conducting hydrological and hydrogeological site investigations in Ireland and around the world. He has worked on several projects for EPA related to the implementation of the European Union Water Framework (WFD) Directive and is experienced with the preparation of hydrology and hydrogeology chapters of EIARs, including proposed developments that involve forestry pressures and peat bogs, and which are characterised by artificial drainage networks and water quality impacts. This SWMP has been divided into three sections, as listed below, and draws and expands on information already provided in Chapter 4 and Chapter 9 of the submitted EIAR and Section 4.2 of the CEMP (Appendix 4-4 of the EIAR).

- Surface Water Drainage Design
- Surface Water Drainage Management
- Surface Water Monitoring Programme

2.

SURFACE WATER DRAINAGE DESIGN

The drainage design for the Proposed Development has been prepared by CDM Smith, and by Senior Hydrogeologist, Henning Moe. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones of 50m around rivers and streams, respectively, have been used to inform the layout of the Proposed Development.

A copy of the drainage design drawing which is included in Appendix A of this document.

2.1

Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Development. Turbine locations have been selected to avoid natural watercourses. Up to 7 no. new watercourse crossings and 9 no. existing watercourse crossing upgrades will be required as part of the Proposed Development.

There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from natural watercourse and lakes. Buffer zones around the existing natural drainage features have informed the layout of the Proposed Development and are indicated on the drainage design drawings.

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 must be blocked, the blocking will only take place after the proposed Wind Farm drainage system to handle the same water has been put in place.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial 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. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

2.2

Drainage Design Principles

Drainage water from any works areas of the site of the Proposed Development will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. 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 and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that must be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

The proposed wind farm drainage process flow is presented in Figure 2-1 below.

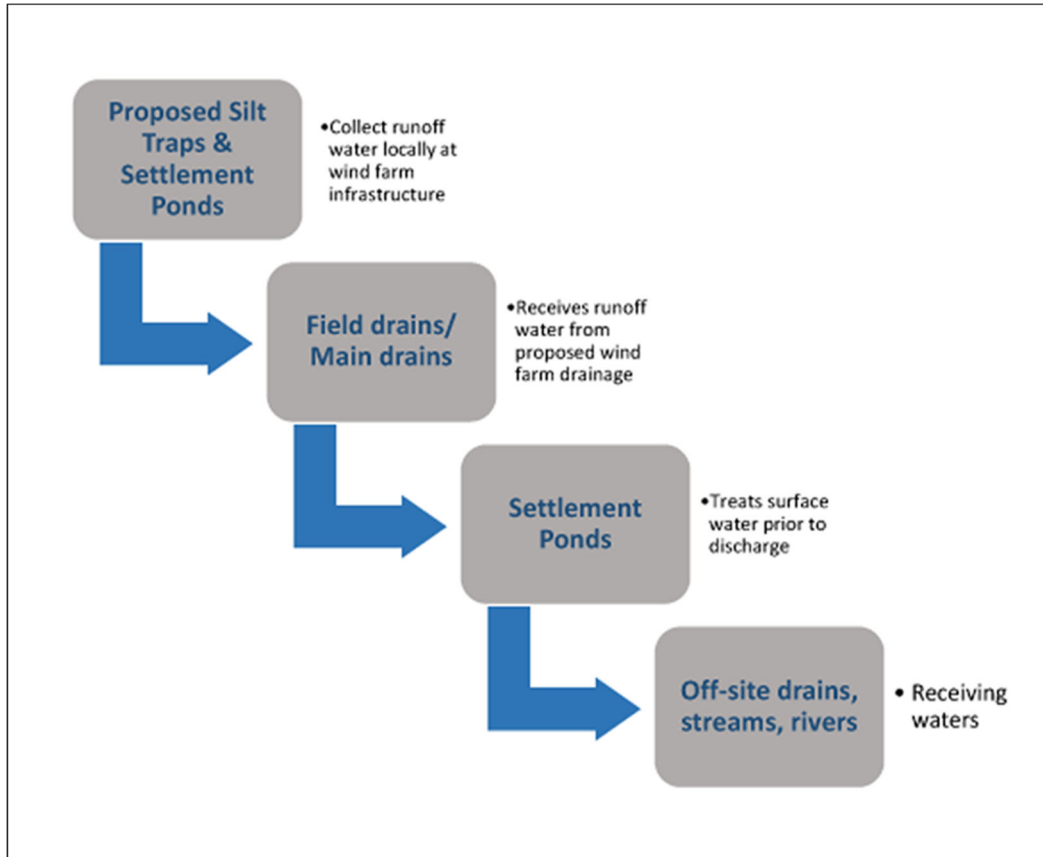


Figure 2-1 Proposed Wind Farm Drainage Process Flow

Comprehensive surface water mitigation and controls are outlined below to ensure protection of all downstream receiving waters. Mitigation measures will ensure that surface runoff from the developed areas of the site will be of a high quality and will therefore not impact on the quality of downstream surface water bodies. Any introduced drainage works at the site will mimic the existing hydrological regime thereby avoiding changes to flow volumes leaving the site.

2.3 Best Practice Guidance

The drainage design has been prepared based on experience of the project team of other renewable energy sites in peat-dominated environments, and in accordance with a number of best practice guidance documents.

There is no one guidance document that deals with drainage management and water quality controls for wind farms and other renewable energy developments. However, a selection of good practice approaches have been adopted in preparation of this drainage design, and these are taken from the various best practice guidance documents listed below. These relate to infrastructure and operational works on forested sites, forest road design, water quality controls for linear projects, forestry road drainage and management of geotechnical risks. To achieve best practice in terms of water protection

through construction management all drainage management is prepared in accordance with guidance contained in the following:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Forest Service (2017): Forestry Standards Manual - Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the design, construction and management of forest roads;
- MacCulloch (2006): Guidelines for risk management of peat slips on the construction of low volume low cost roads over peat (Frank MacCulloch Forestry Civil Engineering Forestry Commission, Scotland);
- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (September 1996);
- Eastern Regional Fisheries Board: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works Adjacent to Waters;
- Scottish Natural Heritage, 2010: Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA Report No. C648 (2006): CIRIA (Construction Industry Research and Information Association) guidance on ‘Control of Water Pollution from Linear Construction Projects’;
- CIRIA Report Number C532 (2001): Control of water pollution from construction sites - Guidance for consultants and contractors.; and,
- Control of water pollution from linear construction projects -Technical guidance. CIRIA C648 London, 2006.

2.4

Drainage System

The early establishment of the drainage measures outlined in Section 2.5, below, will manage the risk of impacts on watercourses on and adjacent to the site during construction. In addition, construction operations will adopt best working practices. The development of the site will need to be phased accordingly (as set out in Section 4.8 of Chapter 4 of the EIAR). 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 capacity to respond to an early phase incoming flow during the construction phase.

The implementation of a Scheduling of Works Operating Record (SOWOR) prior to commencement will provide a series of pre-commencement triggers which set out specific conditions which will be met before the commencement of works in particularly sensitive areas. These pre-commencement triggers will apply to the installation of any drainage infrastructure. An example of a SOWOR, that will be developed by the Environmental Clerk of Works (ECoW) and is included in Appendix B.

The detailed drainage measures proposed 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 hard standing construction. Drains will be excavated, and settlement ponds constructed to eliminate any suspended solids within surface water running off the site.

2.5 Surface Water Drainage Measures

2.5.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope clean water runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains will be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water to infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains will have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting of conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains will be maintained in localised areas along the roadway with culverts under the roadway, which will allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains, and culverts may be left in situ following construction.

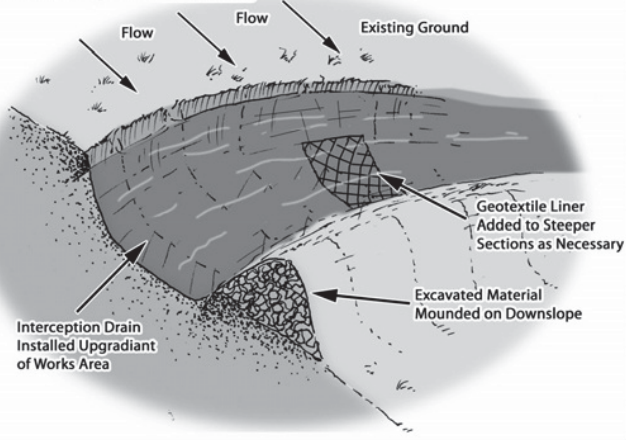
The velocity of flow in the interceptor will be controlled by check dams (see Section 2.5.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 2.5.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader. An illustration of the type of interceptor drain is shown in Figure 2-2.

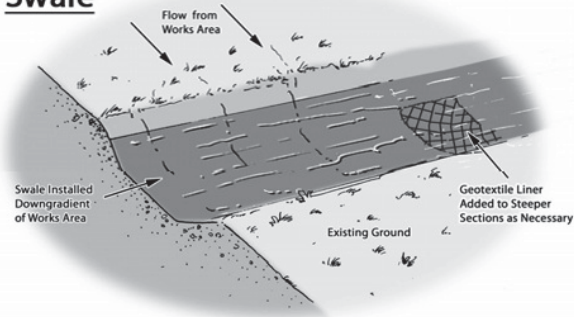
2.5.2 Swales

Drainage swales (or collector drains) are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any potentially sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above.

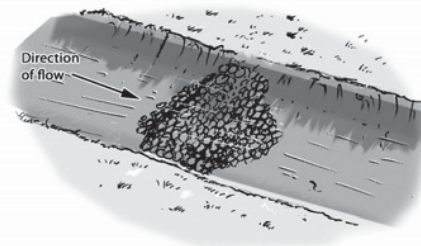
Interceptor Drain



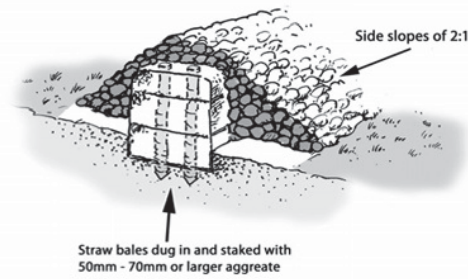
Swale



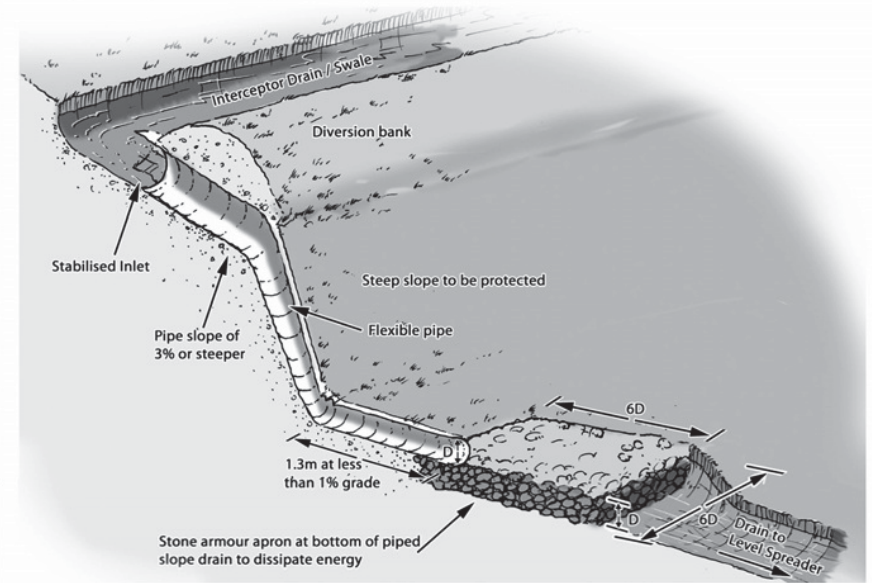
Check Dam (Stone Dam in Drain)



Check Dam (Straw Bale & Stone Dam - Cross Section)

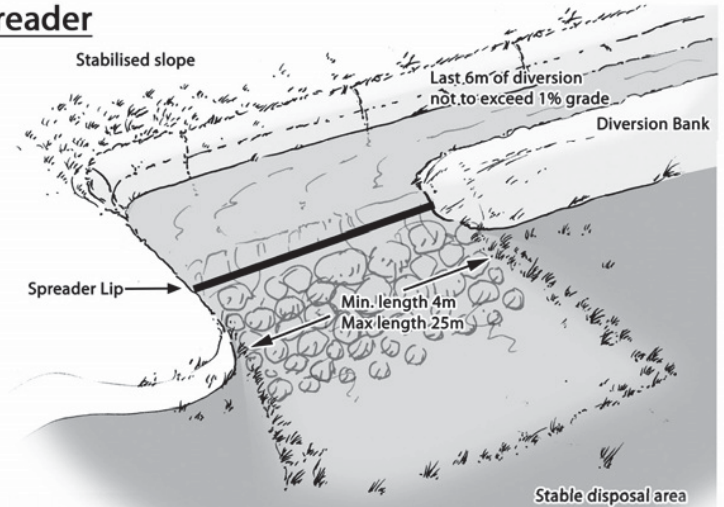


Slope Pipe Drain



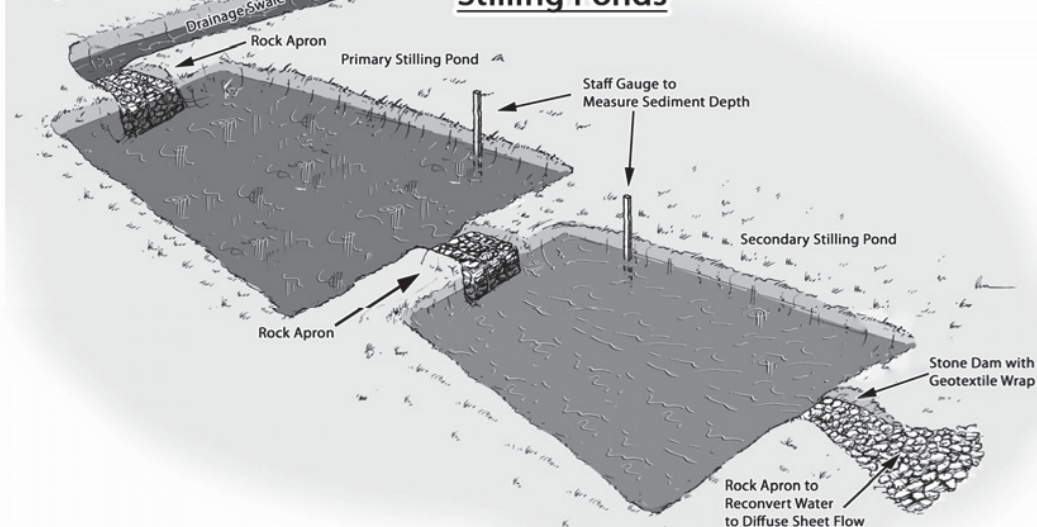
Drainage Design Measures

Level Spreader



Stilling Ponds

Stilling Ponds



Drawing Title	Drainage Design Measures	Drawing No.	Figure 2-2	Scale	NTS
Project Title	Sheskin South Wind Farm		Date	12.12.2022	
Drawn By	Eoin McCarthy	Checked By	Michael Watson	Project No.	201119
MKO Planning and Environmental Consultants Tuam Road, Galway Ireland, H91 VW84 +353 (0) 91 735611 email: info@mkofireland.ie Website: www.mkofireland.ie					

Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike. An illustration of the type of drainage swale is shown in Figure 2-2.

2.5.3 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 regular intervals along the drains to ensure flow in the swale is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

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 are being excavated.

The proposed check dams will be made up of straw bales (temporary use only) or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4-6 inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator.

The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to ensure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam. An illustration of the type of check dam is shown in Figure 2-2.

2.5.4 Level Spreader

A level spreader will be constructed at the end of each interceptor drain to convert concentrated clean water flows in the drain, into diffuse sheet flow on areas of vegetated ground. The level spreaders will be located downgradient of any proposed works areas in locations where they will not contribute further to water ingress to construction areas of the site.

The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain (see Section 2.5.5 below) will be used to transfer the water to a suitable location.

The spreader lip over which the water will spill will 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 or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area. An illustration of the type of level spreader is shown in Figure 2-2.

2.5.5 Piped Slope Drains

Piped slope drains will be used to convey surface runoff from diversion drains safely down slopes to flat areas without causing erosion. Once the runoff reaches the flat areas it will be reconverted to diffuse sheet flow. Level spreaders will only be established on slopes of less than 6% in grade. Piped slope drains will be used to transfer water away from areas where slopes are too steep to use level spreaders.

The piped slope drains will be semi-rigid corrugated pipes with a stabilised entrance and a rock apron at the outlet to trap sediment and dissipate the energy of the water. The base of drains leading into the top of the piped slope drain will be compacted and concavely formed to channel the water into the corrugated pipe. The entrance at the top of the pipe will be stabilised with sandbags if necessary. The pipe will be anchored in place by staking at approximately 3-4 metre intervals or by weighing down with compacted soil. The bottom of the pipe will be placed on a slope with a grade of less than 1% for a length of 1.5 metres, before outflowing onto a rock apron.

The rock apron at the outlet will consist of 6-inch stone to a depth equal to the diameter of the pipe, a length six times the diameter of the pipe. The width of the rock apron will be three times the diameter of the pipe where the pipe opens onto the apron and will fan out to six times the diameter of the pipe over its length.

Piped slope drains will only remain in place for the duration of the construction phase of the Proposed Development. On completion of the works, the pipes and rock aprons will be removed, and all channels backfilled with the material that was originally excavated from them.

Piped slope drains will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and blockages. Stake anchors or fill over the pipe will be checked for settlement, cracking and stability. Any seepage holes where pipe emerges from drain at the top of the pipe will be repaired promptly. An illustration of the type of piped slope drain is shown in Figure 2-2.

2.5.6 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.

2.5.7 Stilling Ponds

Stilling or settlement ponds will be used to attenuate runoff from works areas of the site of the Proposed Development during the construction phase and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling 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 stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed to the appropriate size at each required location as shown on the drainage design drawings included in Appendix A of this document. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The stilling ponds will reduce the velocity of flows in order to allow settlement of silt to occur. Water will flow out of the stilling 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.

Water will flow by gravity through the stilling pond system. The stilling ponds have been 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 settlement ponds are designed for 11hr and 24hr retention times used to settle out medium silt (0.006mm) and fine silt (0.004mm) respectively (EPA, 2006)¹. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the still pond when it exceeds 10% of pond capacity. Stilling ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. An illustration of the type of stilling pond is shown in Figure 2-2.

¹ Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006)

2.5.8 Siltbuster

A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas (e.g. borrow pit areas) or to filter water used during the cleaning of chutes of concrete delivery vehicles, if necessary prior to its discharge to stilling 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. Figure 2-3 below shows an illustrative diagram of a Silt buster unit.

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.

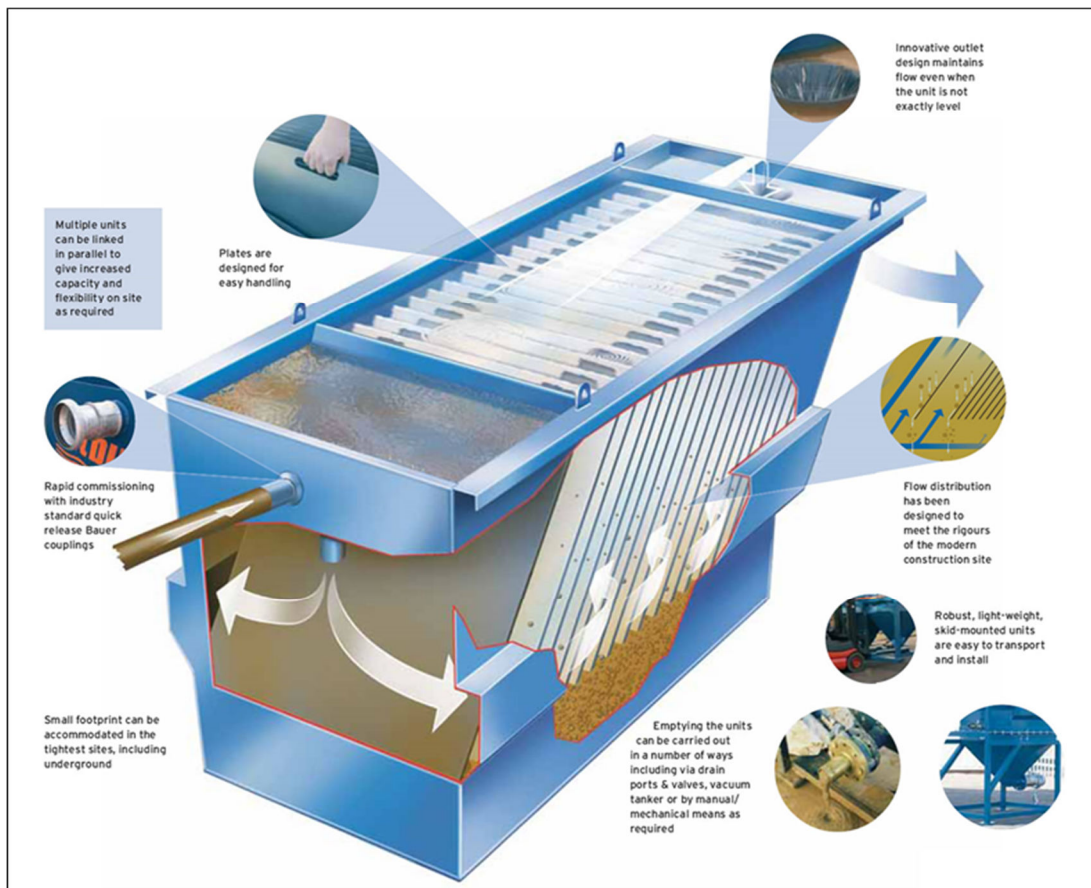


Figure 2-3 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb.50-settlement-unit/)

2.5.9 Silt Bags

Dewatering silt bags allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing any remaining silt contained in the potentially silt-laden water collected from works areas within the site.

Dewatering silt bags are an additional drainage measure that can be used downgradient of the stilling ponds at the end of the drainage swale channels and will be located, wherever it is deemed appropriate by the Project Hydrologist, throughout the site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of peaty silt into the stream.

The dewatering silt bag that will be used will be approximately 3 metres in width by 4.5 metres (see Plate 2-1 and Plate 2-2 below) in length and will be capable of trapping approximately four tonnes of silt. The dewatering silt bag, when full, will be removed from site by a waste contractor with the necessary waste collection permit, who will then transport the silt bag to an appropriate, fully licensed waste facility.



Plate 2-1 Silt Bag under inspection



Plate 2-2 Silt Bag with water being pumped through

2.5.10 Sedimats

Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure as shown in Plate 2-3 below.



Plate 2-3 Typical Sedimat Details (Source: <https://www.hy-tex.co.uk/>)

2.5.11 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

Culverts will be installed as part of the drainage system for the proposed wind farm development to manage drainage waters from works areas of the proposed development, 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 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 doesn't 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.

2.5.12 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a natural watercourse, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the proposed development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the detailed drainage design drawings included in Appendix A of this document.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series.

All silt fencing will be formed using Terrastop Premium or equivalent silt fence product.

Site fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it.

Site fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it. The silt fence details are shown below in Plate 2-4.



Plate 2-4 Typical Silt Fence Details

2.5.12.1 Hydrocarbon Interceptors

A hydrocarbon interceptor is a trap used to filter out hydrocarbons from surface water runoff. A suitably sized hydrocarbon interceptor will be installed wherever it is intended to store hydrocarbons and oils (i.e. construction compounds and substation compound) or where it is proposed to park vehicles during the construction and operational phases of the proposed development (i.e. construction compounds, substation compound and visitor car park).

3. SURFACE WATER DRAINAGE MANAGEMENT

The following sections set out the drainage management arrangements in terms of pre-construction, construction and operational phases of the Proposed Development.

3.1 Good Environmental Management During Construction

Timing of works can strongly influence the potential for damaging the freshwater environment. Construction during wetter periods of the year pose a significantly greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snowmelt events. Traditionally, wind farm construction undertaken during the drier summer months will result in significantly less erosion and siltation. Construction activities in the hydrological buffer zones shall be avoided during or after prolonged rainfall or an intense rainfall event and work will cease entirely near watercourses when it is evident that water quality could potentially be impacted. Given that this site has an established drainage network and existing watercourse crossing points, there will be no adverse impacts on watercourses.

3.2 Drainage Measure Implementation and Management

3.2.1 Pre-Construction Drainage

There is an existing drainage network across the site. There are two main natural watercourses (with multiple tributaries) which drain the proposed development site and there are numerous manmade drains that are in place predominately to drain the forestry plantations. This existing drainage system will continue to function as it is during the pre-construction phase.

However, prior to commencement of works in sub-catchments across the site, main drain inspections will be completed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis prior to the commencement of construction works across the site, as works in all areas will not commence simultaneously.

3.2.2 Construction Phase Drainage

The Project Hydrologist will attend the site to set out and assist with the implementation of the proposed drainage controls as outlined in Section 2.5 above and shown in the drainage design drawings included in Appendix A. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site.

The implementation of a SOWOR will continue through the construction phase of the project. The SOWOR provides a number of abandonment triggers which will ensure that site management are well informed as to the level of incident that will require the abandonment of works. The various triggers both pre-commencement and abandonment ensure best practice in terms of water quality management is maintained prior to commencement and during the various felling and construction phases.

Best practice and practical experience on other similar projects suggest that in addition to the drainage plans that are included in and as part of this application, there are additional site based decisions that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. The mechanisms for interaction between these are outlined within Section 4 of the CEMP.

In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined in Section 2.5 above and 3.3 below, and to ensure protection of all watercourses.

3.2.2.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above will be brought on-site in advance of any works commencing.

An adequate quantity of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

3.2.2.2 Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the development will also take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the threshold rainfall values, listed below, will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

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);
- >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;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall (listed above) and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

3.2.2.3 Reactive Site Drainage Management

The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat potentially silt-laden water from the works areas, will be monitored continuously by the ECoW on-site. The ECoW or project hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary following a confirmatory inspection by the project hydrologist, and the modifications will draw on the various features outlined above, in Section 2.5, in whatever combinations are deemed to be most appropriate to the situation on the ground at a particular time.

In the unlikely event that works are giving rise to siltation of watercourses, the ECoW or project hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures, as outlined in Section 2.5 above, will be installed in advance of works recommencing.

3.2.3 Operational Phase Drainage Management

The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described below:

- Some interceptor drains will be left in place, upgradient of the proposed 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.
- Swales/road side drains will remain in place to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;
- Check dams will be put in place at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, 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. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds, along with the entire drainage network, will be ongoing through the operational period.

In the operational phase of the wind farm, the reliance on the drainage system summarised above will become reduced as areas naturally revegetate. Once areas revegetate, this will result in a resumption of the natural drainage management that will have existed prior to any construction.

3.3

Activity Specific Drainage Control and Mitigation Measures

3.3.1

Keyhole Forestry Felling

As part of the proposed development, keyhole felling of forestry will be required within and around the development footprint to enable the construction of turbine bases, access roads and the other ancillary infrastructure. Felling is also required around turbine bases for the reduction of potential effects on bats (refer to Appendix 6-2 of this EIAR). A total of 80.5 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development in order to facilitate infrastructure construction and turbine erection.

The proposed methodology for the forestry felling activities is as follows:

Felling works will conform to current best practice Forest Service policies and strategic guidance documents as well as Coillte produced guidance documents, including the specific guidelines listed below, to ensure that the felling works provides minimal potential impacts to the receiving environment.

- ‘Standards for Felling and Reforestation’ (Department of Agriculture, Food and the Marine, 2019)
- ‘Forest Operations & Water Protection Guidelines’ (Coillte, 2009)
- ‘Methodology for Clear Felling Harvesting Operations’ (Coillte, 2009)
- ‘Forestry and Water Quality Guidelines’ (Forest Service, 2000)
- ‘Forestry Biodiversity Guidelines’ (Forest Service, 2000)
- ‘Forestry Protection Guidelines’ (Forest Service, 2002)
- ‘Forestry Harvesting and Environmental Guidelines’ (Forest Service, 2000)

The proposed methodology for the forestry felling activities is as follows:

- The extent of all necessary forestry felling areas will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected by the ECoW and contractor prior to any machinery being brought on site to commence the felling operation.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt/sediment traps (ie. check dam / silt fence) will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated.
- Sediment removed from traps will be carefully disposed of in the peat repository areas.
- Machine combinations (i.e. hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; however, the general proposed machine combination will comprise a harvester and a low-ground pressure harvester with a 14-tonne bunk capacity.
- Trees will be cut manually inside the 50m construction watercourse buffer and using machinery to extract whole trees only;
- Brush mats will be put in place to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur.

- Brush mat renewal will take place when they become heavily used and worn. Provision will be made for brush mats along all off-road routes, to protect the soil from compaction and rutting.
- No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Brush which has not been pushed into the soil may be moved to facilitate the creation of mats elsewhere within the site.
- Extraction routes, and hence brush mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone prior to removal off site to authorised saw mills.

3.3.1.1 Forestry Felling Drainage Management

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) shall be appointed to oversee the keyhole and extraction works. The ECoW shall be experienced and competent, and shall have the following functions and operate their record using a Schedule of Works Operation Record (SOWOR), as proposed in the planning application:

- Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works.
- Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).
- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix C (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements*.
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
 - Surface water samples shall be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
 - Sampling shall be taken from the stream / river bank, with no in-stream access permitted.
 - The following minimum analytical suite shall be used:
 - pH,
 - Electrical Conductivity,
 - Temperature
 - Total Suspended Solids, Biochemical Oxygen Demand, Total Phosphorus, Ortho-Phosphate, Total Nitrogen, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.
- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.
- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

3.3.2 Borrow Pit Drainage

While surface water will be contained in the borrow pits area, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit area will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to manage runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds and level spreader, which will receive the water from the single outlet.

3.3.3 Peat and Spoil Placement Area Drainage

During the initial placement of peat and subsoil at the placement areas, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the placement areas. ‘Siltbuster’ treatment trains will be employed if previous treatment is not to a high quality.

Drainage from the placement areas will ultimately be routed to an oversized swale and a stilling ponds designed for a 24 hour retention time, and for a 1 in 10 year return period, before being discharged to the on-site drains.

The placement areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised placement areas will no longer be a potential source of silt laden runoff

3.3.4 Cable Trench Drainage

Cable trenches will be developed in short sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Development, will be transported to one of the peat repository areas, the on-site borrow pit or used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 2.5.12, above, will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

3.3.5 Refuelling, Fuel and Hazardous Materials Storage

The following mitigation measures will be implemented to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling shall occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and

will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the wind farm. The 4x4 jeep 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. Only designated trained and competent operatives, with a permit to refuel, will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.

- Fuels volumes stored on site shall be minimised. The fuel storage areas, within the temporary construction compounds, will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical substation compound will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be developed (refer to Section 5 of the CEMP). Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.

3.3.6 Cement Based Products Control Measures

The following mitigation measures will be implemented to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Use weather forecasting to plan best days to avoid pouring concrete on days of heavy rainfall;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste (See Section 3.4 of the CEMP).

The 50m wide natural watercourse buffer zone and 20m existing artificial drainage buffer will be emplaced for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert construction. The buffer zone will:

- Prevent any cement based products accidentally entrained in the construction phase drainage system entering directly into watercourses, achieved in part by ending drain discharge outside the 50m buffer zone and allowing percolation across the vegetation of the buffer zone;
- Provide a buffer against accidental direct run-off to surface waters by any pollutants, or by pollutants entrained in surface water run-off.

3.4

Construction Phase Drainage Inspections and 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 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 ECoW and/or the Project Hydrologist. The ECoW 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.

Prior to the commencement of construction an inspection and maintenance plan for the on-site drainage system will be prepared by the ECoW in consultation with the Project Hydrologist. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

Any excess build-up of silt levels at check dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

The following periodic inspection regime will be implemented:

- Daily general visual inspections at pre-determined locations, as chosen by the Project Hydrologist and by ECoW;
- Weekly (existing & new drains) inspections of all drainage measures by the ECoW and/or the site Construction Manager;
- Inspection to include all elements of drainage systems and all water quality 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 shall be noted and corrective action shall be implemented. High risk locations such as settlement ponds will be inspected daily. 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 ECoW as follows:
 - >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 site inspections of the drainage measures by the Project Hydrologist during construction phase; and,
- Quarterly site inspections of the drainage measures by the Project Hydrologist after construction for a period of one year following the construction phase.
- A written record will be maintained or available on-site of all construction phase monitoring undertaken.

The abandonment triggers as set out in the SOWOR will be adopted as part of drainage inspections to ensure that any of the conditions prescribed under any abandonment trigger does not exist at the locations under inspection.

4.

SURFACE WATER QUALITY MONITORING

This section of the SWMP sets out the programme for water quality monitoring during the pre-construction, construction, commissioning and operational phases of the wind farm development.

The surface water quality monitoring programme combines the use of laboratory analysis, water quality monitoring instrumentation and visual inspection to develop a comprehensive schedule of monitoring of all watercourse that exist both at the site and the surrounding area. The information collected by this schedule of water monitoring, particularly the continuous turbidity monitoring will inform the pre-commencement triggers in the SOWOR before works commence in an area. The turbidity monitors both upstream and downstream of the site will provide instant data on the quality of water in which they are deployed and will be equipped with an alarm system to alert site management if a peak in turbidity occurs as set out in the SOWOR.

The water monitoring programme was prepared in accordance with the following legislation:

- Planning and Development Acts 2000-2022
- Planning and Development Regulations, 2001 (as amended);
- S.I. No. 94 of 1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293 of 1988: Quality of Salmon Water Regulations, resulting from EU Directive 78/659/EEC on the Quality of Fresh Waters Needing Protection or Improvement in order to Support Fish Life;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000 water management in the EU has been directed by the Water Framework Directive (WFD). The key objectives of the WFD are that all water bodies in member states achieve (or retain) at least 'good' status by 2015. Water bodies comprise both surface and groundwater bodies, and the achievement of 'Good' status for these depends also on the achievement of 'good' status by dependent ecosystems. Phases of characterisation, risk assessment, monitoring and the design of programmes of measures to achieve the objectives of the WFD have either been completed or are ongoing. In 2015 it replaced a number of existing water related directives, which were successively being repealed, while implementation of other Directives (such as the Habitats Directive 92/43/EEC) form part of the achievement of implementation of the objectives of the WFD;
- S.I. No. 41 of 1999: Protection of Groundwater Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249 of 1989: Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (repealed by 2000/60/EC in 2007);
- S.I. No. 439 of 2000: Quality of Water intended for Human Consumption Regulations and S.I. No. 278 of 2007 European Communities (Drinking Water No. 2) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009;

- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010; and,
- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

This water monitoring programme will be the subject of independent review by the supervising hydrologist who will provide the necessary guidance on the monitoring requirements. The water monitoring programme is outlined in the following sections.

4.1.1 **Pre-Construction Baseline Monitoring**

Water quality field testing and laboratory analysis will be undertaken prior to commencement of felling and construction at the site. The monitoring programme will be subject to agreement with Mayo County Council but will be based on the planning stage programme already outlined in the EIAR and CEMP and presented in this document.

Analysis will be for a range of parameters with relevant regulatory limits along with Environmental Quality Standard's (EQSs) and sampling will be undertaken for each stream that drains from the construction site.

Baseline sampling will be completed on at least two occasions and these will coincide with low flow and high flow stream conditions. The high flow sampling event will be undertaken after a period of sustained rainfall, and the low flow event will be undertaken after a dry spell.

There is an existing drainage network across the site and runoff drains relatively freely to local watercourses and streams. This existing drainage system will continue to function as it is during the pre-construction phase.

However, prior to commencement of works in sub-catchments across the site, main drain inspections will be completed to ensure ditches and streams are free from debris and blockages that may impede drainage. These inspections will be done on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

In addition, a broader baseline sampling programme is proposed to monitor for shifts in baseline conditions over the longer term, partly on the basis of potential cumulative effects on Sheskin River that may arise from other developments (Section 9.4.5 of Chapter 9 of the EIAR). The following sampling is proposed:

- Samples will be collected from three tributaries of Sheskin River flowing east out of Sheskin Forest before merging as the Sheskin River. This is necessary to be able to sample upgradient of infrastructure related to the Oweninny Phase 2 (OP2) wind farm (Chapter 9 of the EIAR) and differentiate any effects between the two developments.
- Samples will be collected on Sheskin River near or at an existing EPA monitoring station on Sheskin River just upstream of the confluence between the Sheskin and Oweninny Rivers. This is necessary to be able to detect and describe potential cumulative effects (if any) of OP2 operations on Sheskin River. OP2 extends the full length of Sheskin River east of Sheskin Forest.

The samples will be collected on a monthly schedule during construction and decommissioning, and on a monthly schedule during the operational phase. It is proposed to begin the monitoring three months ahead of the construction phase.

4.1.2 Construction Phase Monitoring

4.1.2.1 Daily Visual Inspections

Daily visual inspections of the installed drains and outfalls will be performed during the construction period to ensure suspended solids are not entering streams and rivers on site, to identify any obstructions to channels and to allow appropriate maintenance of the drainage regime. Should the suspended solids levels measured during construction, at the daily visual inspection locations, be higher than the baseline levels, the source will be identified, and additional mitigation measures implemented.

Inspection sheets and photographic records will be kept on site. Inspection points will include the in-situ field monitoring point locations, the laboratory analysis sampling points and continuous monitoring locations. Inspection points will depend on works being completed within the catchment upstream of the identified monitoring locations. Visual inspections will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period and data including photographs will be collected by visual inspections and independently assessed by the supervising hydrologist who will monitor and advise on the records being received.

Daily Visual Inspection locations will be chosen by the Project Hydrologist and ECoW, prior to the commencement of the construction phase, and a Daily Visual Check Sheet Template is included in Appendix C. Daily Visual Inspections are subject to change upon commencement of construction activity and works in progress within the catchment areas.

The following periodic inspection regime will be implemented:

- Daily general visual inspections of site operations and inspections of all watercourses within the site and in the surrounding area by the ECoW or a suitably qualified and competent person as delegated by the EcoW;
- Inspections to include all elements of drainage infrastructure to ensure the system is operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter shall be noted and corrective action shall be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as straw bales or oil absorbent materials need replacement;
- Event based inspections by the Environmental Clerk of Works as follows:
 - >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 site inspections by the Project Hydrologist/ Environmental Clerk of Works of the drainage measures during construction phase;
- Quarterly site inspections by the Project Hydrologist/ Environmental Clerk of Works of the drainage measures after construction for a period of one year following the construction phase; and,
- A written record will be maintained or available on-site within this Construction Environmental Management Plan (CEMP) which will be maintained on-site during the construction phase.

4.1.2.2 Continuous Monitoring

Continuous, in-situ, monitoring equipment will be installed where required at locations surrounding the wind farm site. The monitoring equipment will provide continuous readings for turbidity levels, flow rate and water depth in the watercourse. This equipment will be supplemented by daily visual monitoring at their locations as outlined in the Section 4.1.2.1 above.

The locations for continuous, in-situ monitoring will be determined by the Project Hydrologist.

4.1.2.3 Monthly Laboratory Analysis

Baseline laboratory analysis, at locations chosen by the Project Hydrologist, of a range of parameters with relevant regulatory limits and EQSs will be undertaken as per water monitoring programme for the overall windfarm development and each primary watercourse along the route. This will not be restricted to just these locations around the immediate wind farm site with further sampling points added as deemed necessary by the EcoW, in consultation with the Project Hydrologist and Site Manager, as the construction phase progresses.

4.1.2.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, specific electrical conductivity, temperature and turbidity) will be taken at the surface water monitoring locations, as per water monitoring programme for the overall wind farm development and each primary watercourse along the route and also at all installed sonde locations. These analyses will be carried out by either the EcoW or the Project Hydrologist. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The Project Hydrologist will monitor and advise on the readings collected by in-situ field monitoring.

4.1.2.5 Monitoring Parameters

The analytical determinants of the monitoring programme (including limits of detection and frequency of analysis) will be as per S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations and European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. The suite of determinants will include:

- pH (field measured)
- Electrical Conductivity (field measured)
- Temperature (field measured)
- Dissolved Oxygen (field measured)
- Alkalinity (pH measured)
- Total Phosphorus
- Chloride
- Nitrate
- Nitrite
- Total Nitrogen
- Ortho-Phosphate
- Total Ammonia as N
- Biochemical Oxygen Demand
- Total Suspended Solids
- True colour
- Dissolved organic carbon

4.1.3 Surface Water Monitoring Reporting

Visual inspection and monthly laboratory analysis results of water quality monitoring shall assist in determining requirements for any necessary improvements in drainage controls and pollution prevention measures implemented on site.

It will be the responsibility of the Environmental Clerk of Works to present the ongoing results of water quality and weather monitoring at or in advance of regular site meetings.

Reports on water quality will consider all field monitoring and visual inspections, and results of laboratory analysis completed for 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. Any proposed alteration to sampling frequency will be agreed with Mayo County Council in advance.

4.1.4 **Piezometer Water Level Measurements**

A network of up to 20 no. piezometers will be installed for monitoring of water levels in peat along the SAC boundaries, upslope of facilities that are closest to the SACs (e.g., turbines T2 and T17). The piezometers will be measured manually on a monthly interval and a select set of 6 no. standpipes along the SACs will be equipped with automatic data loggers for continuous water level measurement. The data will be periodically (quarterly) reviewed to assess trends in water level during the operational phase.

4.1.5 **Post Construction Monitoring**

4.1.5.1 **Surface Water Laboratory Analysis Sampling**

Surface water sampling for laboratory analysis for the range of parameters adopted during pre-commencement and construction phases will continue quarterly after construction is complete. The project hydrologist will monitor and advise on the readings received from the testing laboratory and monitoring will only cease once the hydrologist is satisfied that the chemical and biological monitoring results show that there is no adverse impact on the quality of surface water within the natural watercourses draining the site.

5. **COMPLIANCE AND REVIEW**

5.1 **Site Inspections and Auditing**

Field inspections and testing will only be carried out by an experienced Environmental Clerk of Works to ensure all correct protocols are carried out. The project hydrologist will also assist in compliance of testing and monitoring as required.

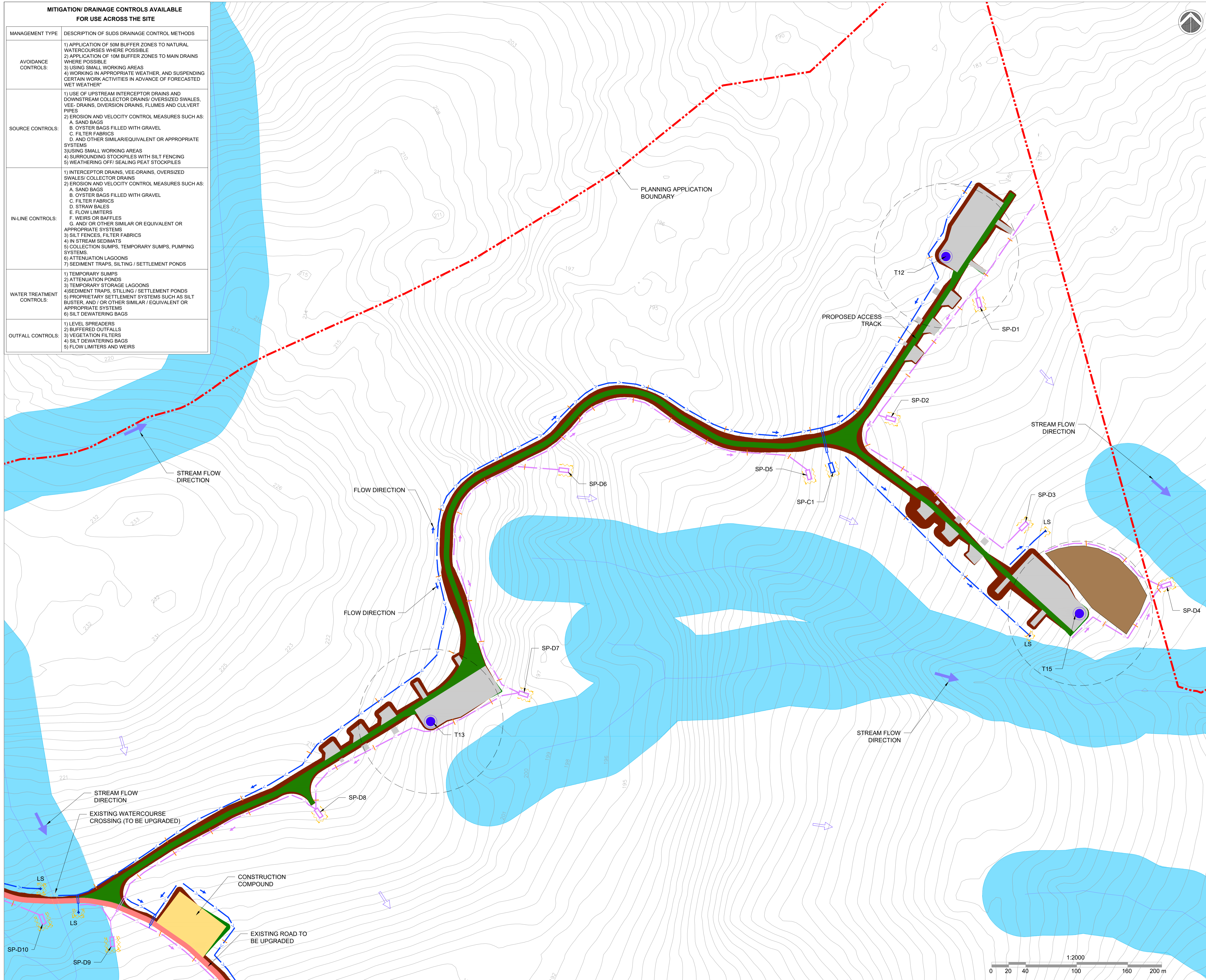
The SWMP will be reviewed in line with the CEMP and updated as required prior to commencement of construction to address any relevant planning conditions and mitigation measures, and also every six months thereafter during the construction phase of the project



APPENDIX A

**COPY OF DRAINAGE DESIGN
DRAWINGS**

MITIGATION/ DRAINAGE CONTROLS 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. STRAW BALES E. FLOW LIMITERS F. WEIRS OR BAFFLES G. AND/ OR OTHER SIMILAR OR EQUIVALENT OR APPROPRIATE SYSTEMS 3) SILT FENCES, FILTER FABRICS 4) IN STREAM SEDIMENTS 5) COLLECTION SUMPS, TEMPORARY SUMPS, PUMPING SYSTEMS 6) ATTENUATION LAGOONS 7) SEDIMENT TRAPS, SILTING / 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 SILT BUSTER, AND/ OR OTHER SIMILAR / EQUIVALENT OR APPROPRIATE SYSTEMS 6) SILT DEWATERING BAGS
OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

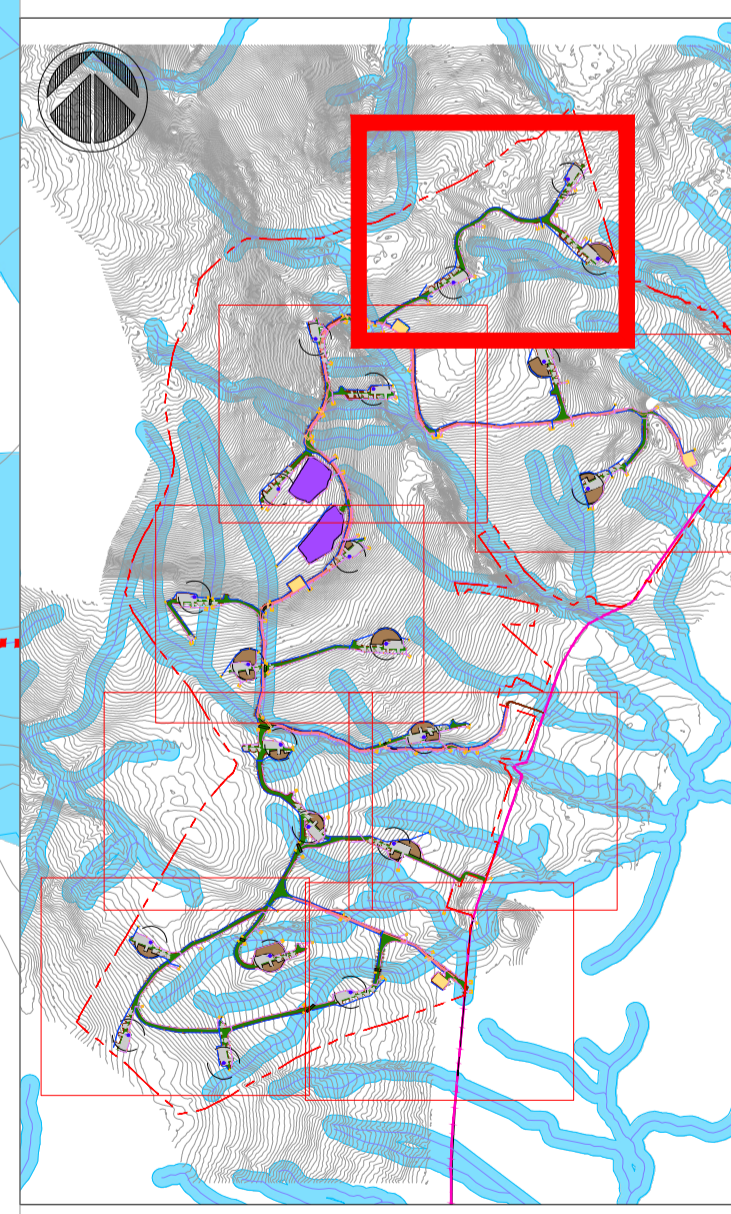


LEGEND :

- PROPOSED TURBINE
- PROPOSED MET MAST LOCATION
- HARDSTAND
- PROPOSED NEW ROADS
- EXISTING ROADS - UPGRADE PROPOSED
- PROPOSED CONSTRUCTION COMPOUND
- PEAT PLACEMENT AREAS
- EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
- PROPOSED BORROW PITS
- EXISTING STREAM WITH 50m BUFFER ZONE
- EXISTING CULVERT
- PROPOSED NEW WATERCOURSE CROSSING
- UPSLOPE INTERCEPTOR DRAIN
- SWALES / DOWNSLOPE INTERCEPTOR DRAIN
- STILLING POND - CLEAN WATER
- STILLING POND - DIRTY WATER
- UPSLOPE INTERCEPTOR DRAIN - CULVERT
- DOWNSLOPE INTERCEPTOR DRAIN - CULVERT
- + CHECK DAMS
- + SILT FENCES
- + DOUBLE SILT FENCES
- DIRECTION OF FLOW
- ▲ LS LEVEL SPREADER

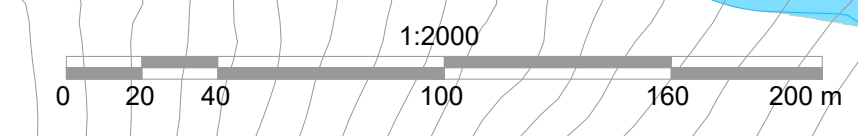
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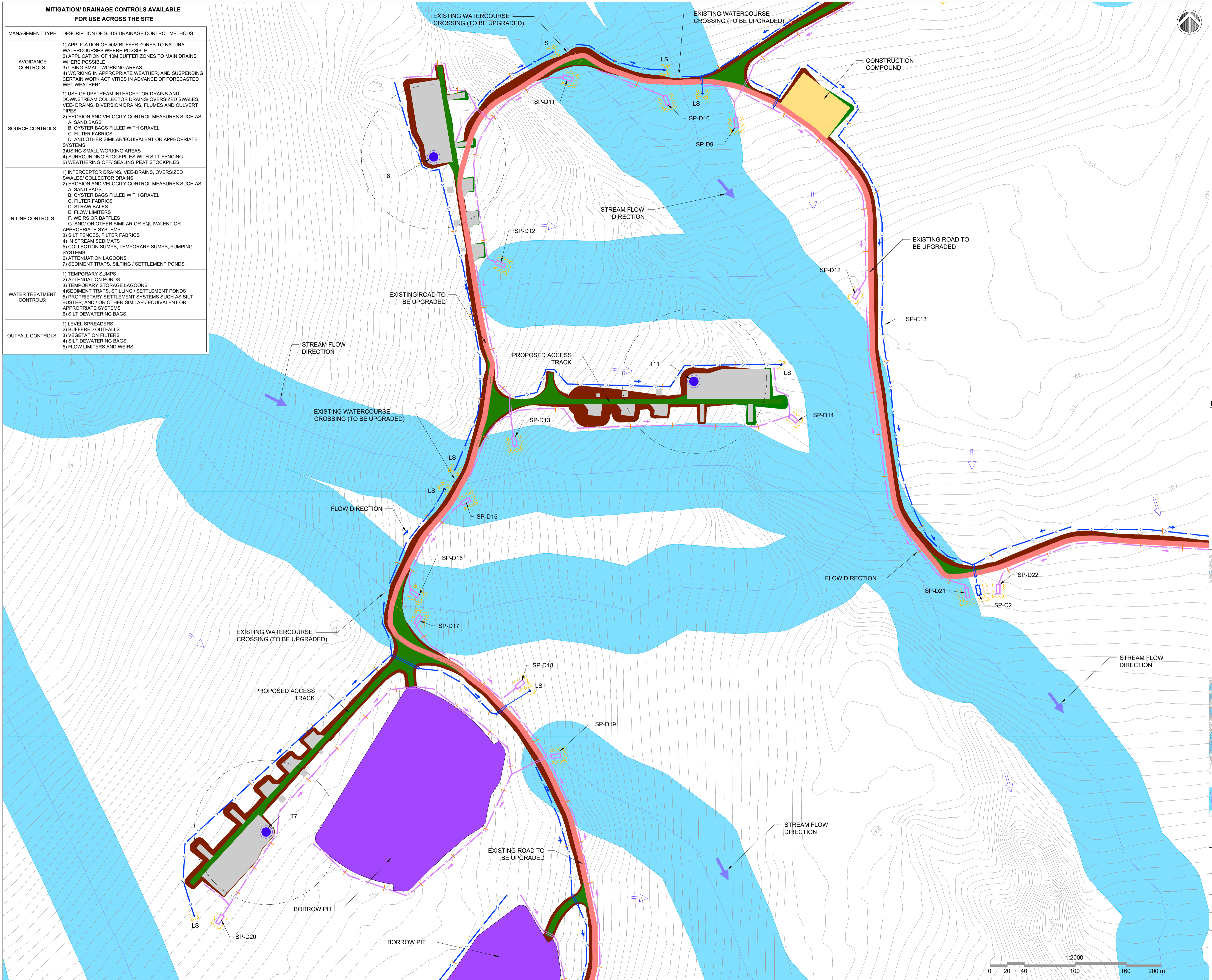


LOCATION PLAN
SCALE - NTS

Drawing Title: PROPOSED DRAINAGE LAYOUT	
SHEET 1 OF 8	
Project Title: SHESKIN SOUTH WIND FARM, Co. MAYO	
Drawn By: RP	Checked By: HM
Project No. 260761	Drawing No. FIG-1
Scale: 1:2000	Date: -



MITIGATION/ DRAINAGE CONTROLS 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. STRAW BALES E. FLOW LIMITERS F. WEIRS OR BAFFLES G. AND/ OR OTHER SIMILAR OR EQUIVALENT OR APPROPRIATE SYSTEMS 3) SILT FENCES, FILTER FABRICS 4) IN STREAM SEDIMENTS 5) COLLECTION SUMPS, TEMPORARY SUMPS, PUMPING SYSTEMS 6) ATTENUATION LAGOONS 7) SEDIMENT TRAPS, SILTING / 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 SILT BUSTER, AND / OR OTHER SIMILAR / EQUIVALENT OR APPROPRIATE SYSTEMS 6) SILT DEWATERING BAGS
OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

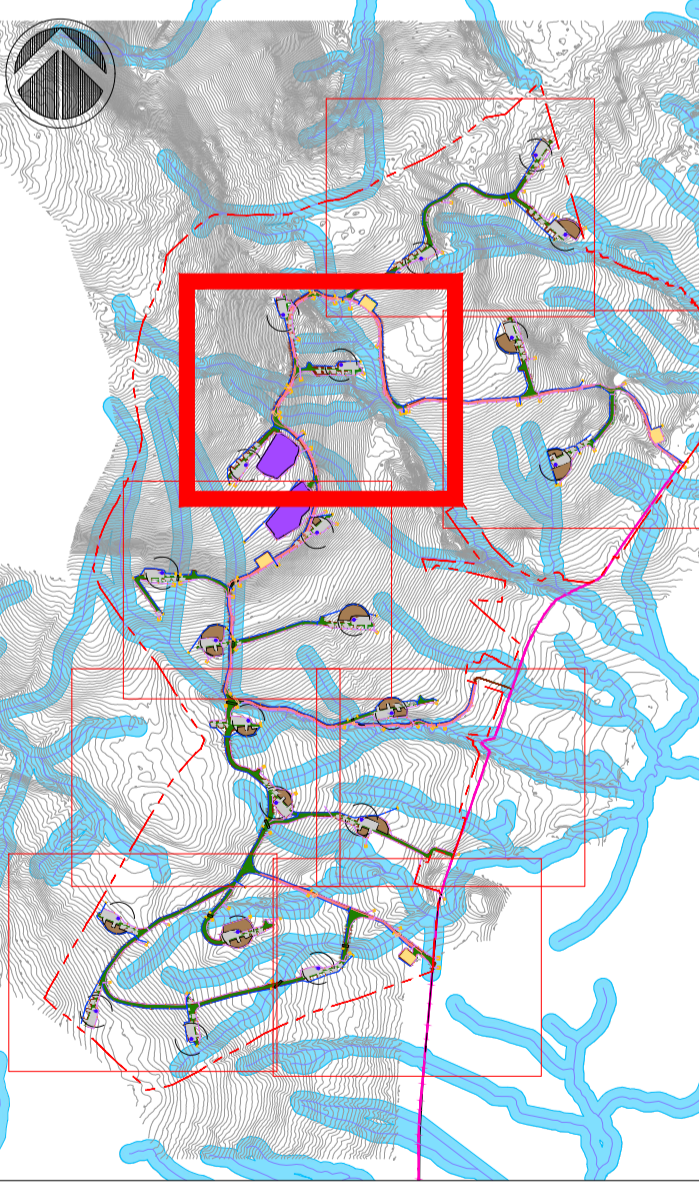


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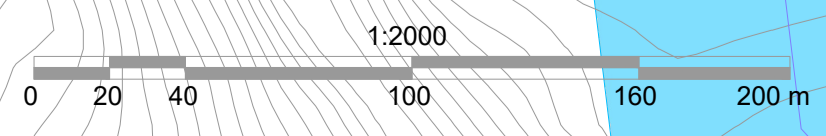
- PROPOSED TURBINE
- PROPOSED MET MAST LOCATION
- HARDSTAND
- PROPOSED NEW ROADS
- EXISTING ROADS - UPGRADE PROPOSED
- PROPOSED CONSTRUCTION COMPOUND
- PEAT PLACEMENT AREAS
- EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
- PROPOSED BORROW PITS
- EXISTING STREAM WITH 50m BUFFER ZONE
- EXISTING CULVERT
- PROPOSED NEW WATERCOURSE CROSSING
- UPSLOPE INTERCEPTOR DRAIN
- SWALES / DOWNSLOPE INTERCEPTOR DRAIN
- STILLING POND - CLEAN WATER
- STILLING POND - DIRTY WATER
- UPSLOPE INTERCEPTOR DRAIN - CULVERT
- DOWNSLOPE INTERCEPTOR DRAIN - CULVERT
- CHECK DAMS
- SILT FENCES
- DOUBLE SILT FENCES
- DIRECTION OF FLOW
- ▲ LS LEVEL SPREADER

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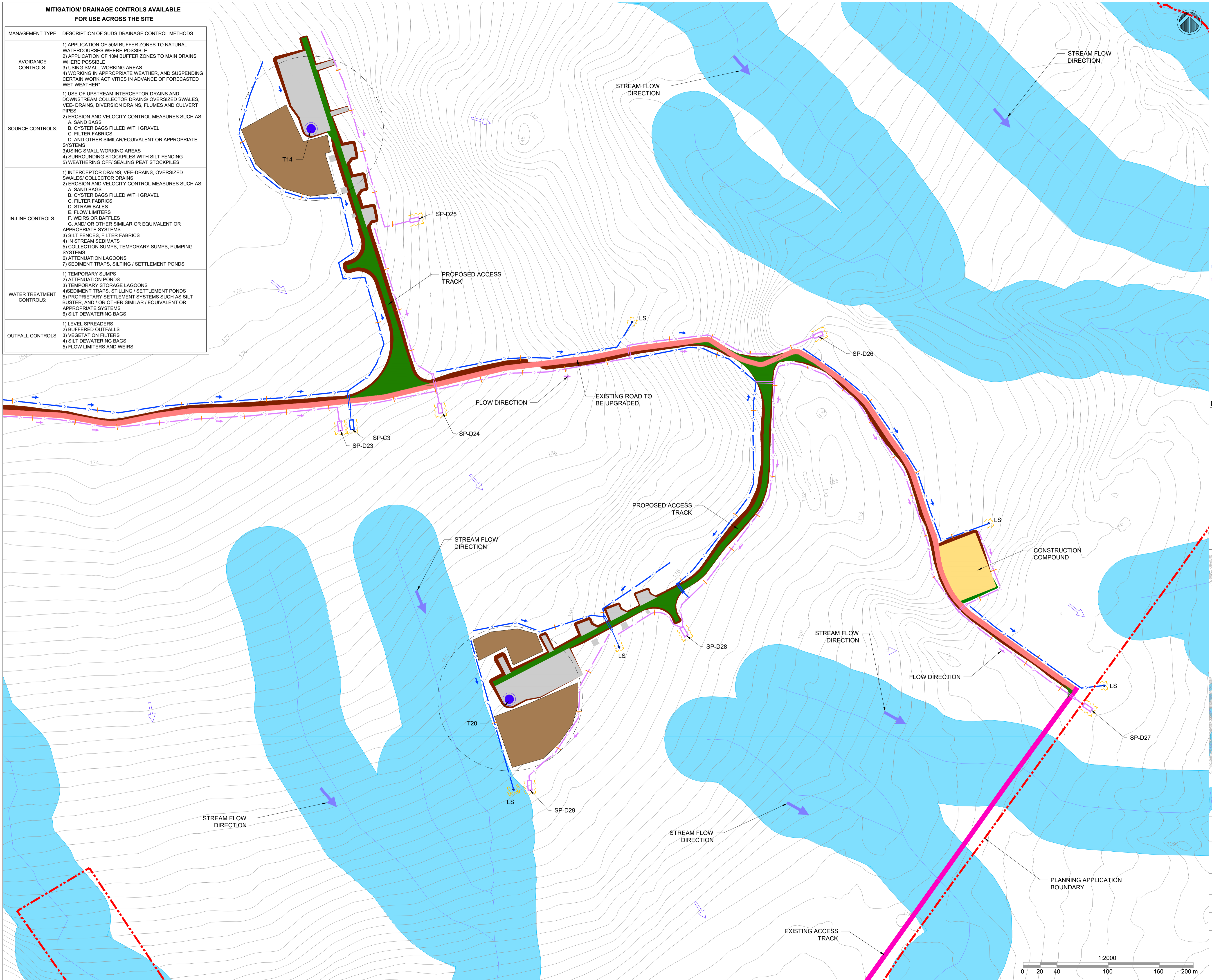


Drawing Title: PROPOSED DRAINAGE LAYOUT	
SHEET 2 OF 8	
Project Title: SHESKIN SOUTH WIND FARM, Co. MAYO	
Drawn By: RP	Checked By: HM
Project No. 260761	Drawing No. FIG-2
Scale 1:2000	Date -



MITIGATION/ DRAINAGE CONTROLS 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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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 SILT BUSTER, AND / OR OTHER SIMILAR / EQUIVALENT OR APPROPRIATE SYSTEMS 6) SILT DEWATERING BAGS
OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

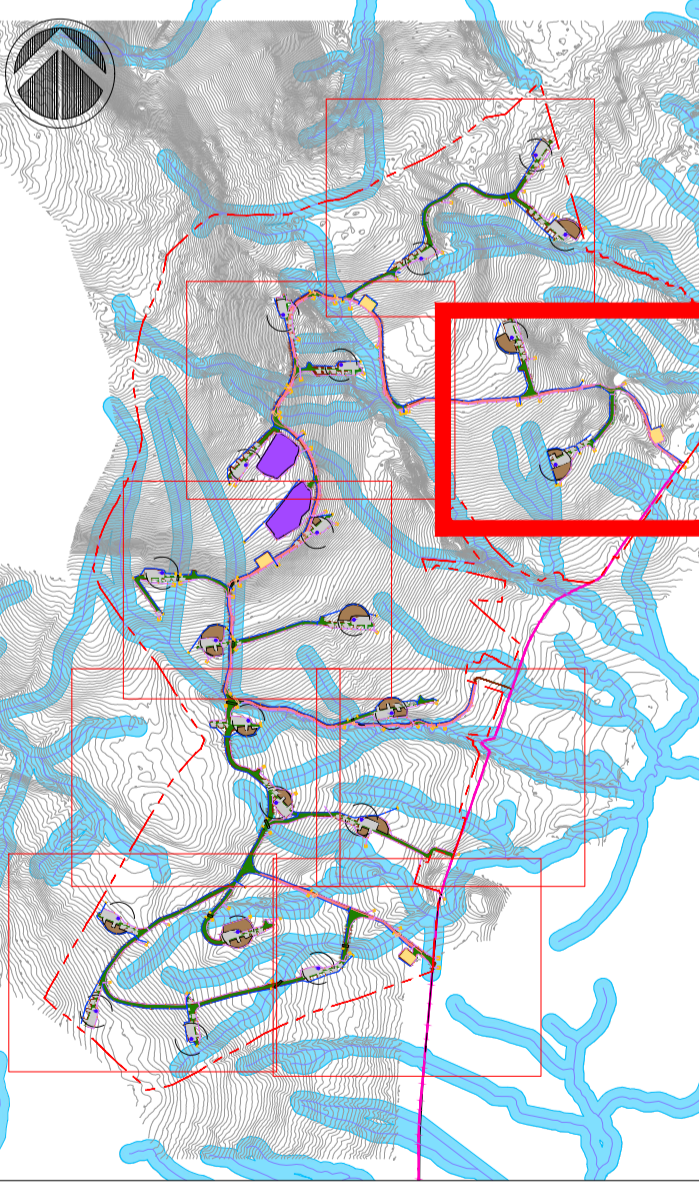


LEGEND :

- PROPOSED TURBINE
- PROPOSED MET MAST LOCATION
- HARDSTAND
- PROPOSED NEW ROADS
- EXISTING ROADS - UPGRADE PROPOSED
- PROPOSED CONSTRUCTION COMPOUND
- PEAT PLACEMENT AREAS
- EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
- PROPOSED BORROW PITS
- EXISTING STREAM WITH 50m BUFFER ZONE
- EXISTING CULVERT
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- UPSLOPE INTERCEPTOR DRAIN - CULVERT
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- + CHECK DAMS
- + SILT FENCES
- + DOUBLE SILT FENCES
- DIRECTION OF FLOW
- ▲ LS LEVEL SPREADER

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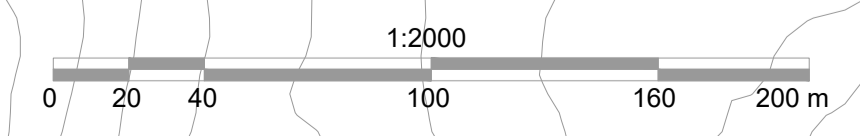
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Drawing Title:
PROPOSED DRAINAGE LAYOUT SHEET 3 OF 8

Project Title:
SHESKIN SOUTH WIND FARM, Co. MAYO

Drawn By: RP	Checked By: HM
Project No. 260761	Drawing No. FIG-3
Scale 1:2000	Date -

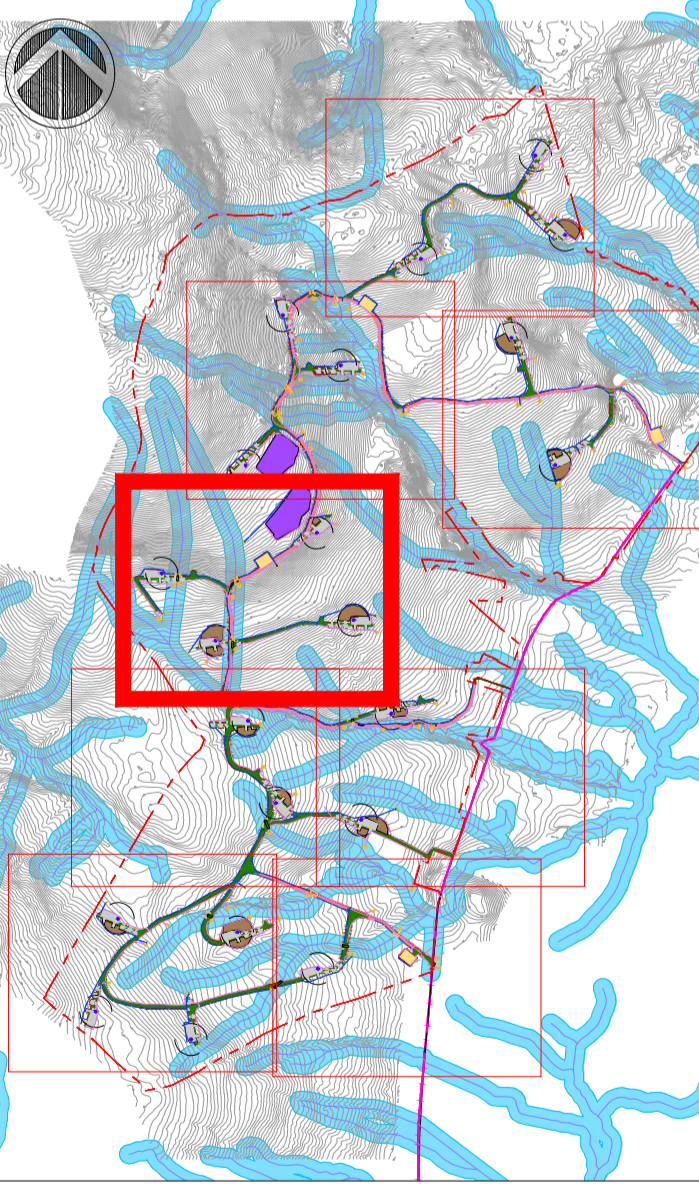


MITIGATION/ DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE	
MANAGEMENT TYPE	DESCRIPTION OF SUDS DRAINAGE CONTROL METHODS
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OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

LEGEND :	
	PROPOSED TURBINE
	PROPOSED MET MAST LOCATION
	HARDSTAND
	PROPOSED NEW ROADS
	EXISTING ROADS - UPGRADE PROPOSED
	PROPOSED CONSTRUCTION COMPOUND
	PEAT PLACEMENT AREAS
	EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
	PROPOSED BORROW PITS
	EXISTING STREAM WITH 50m BUFFER ZONE
	EXISTING CULVERT
	PROPOSED NEW WATERCOURSE CROSSING
	UPSLOPE INTERCEPTOR DRAIN
	SWALES / DOWNSLOPE INTERCEPTOR DRAIN
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	UPSLOPE INTERCEPTOR DRAIN - CULVERT
	DOWNSLOPE INTERCEPTOR DRAIN - CULVERT
	CHECK DAMS
	SILT FENCES
	DOUBLE SILT FENCES
	DIRECTION OF FLOW
	LEVEL SPREADER

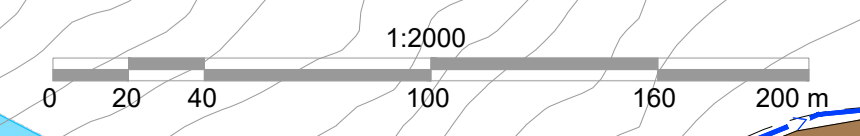
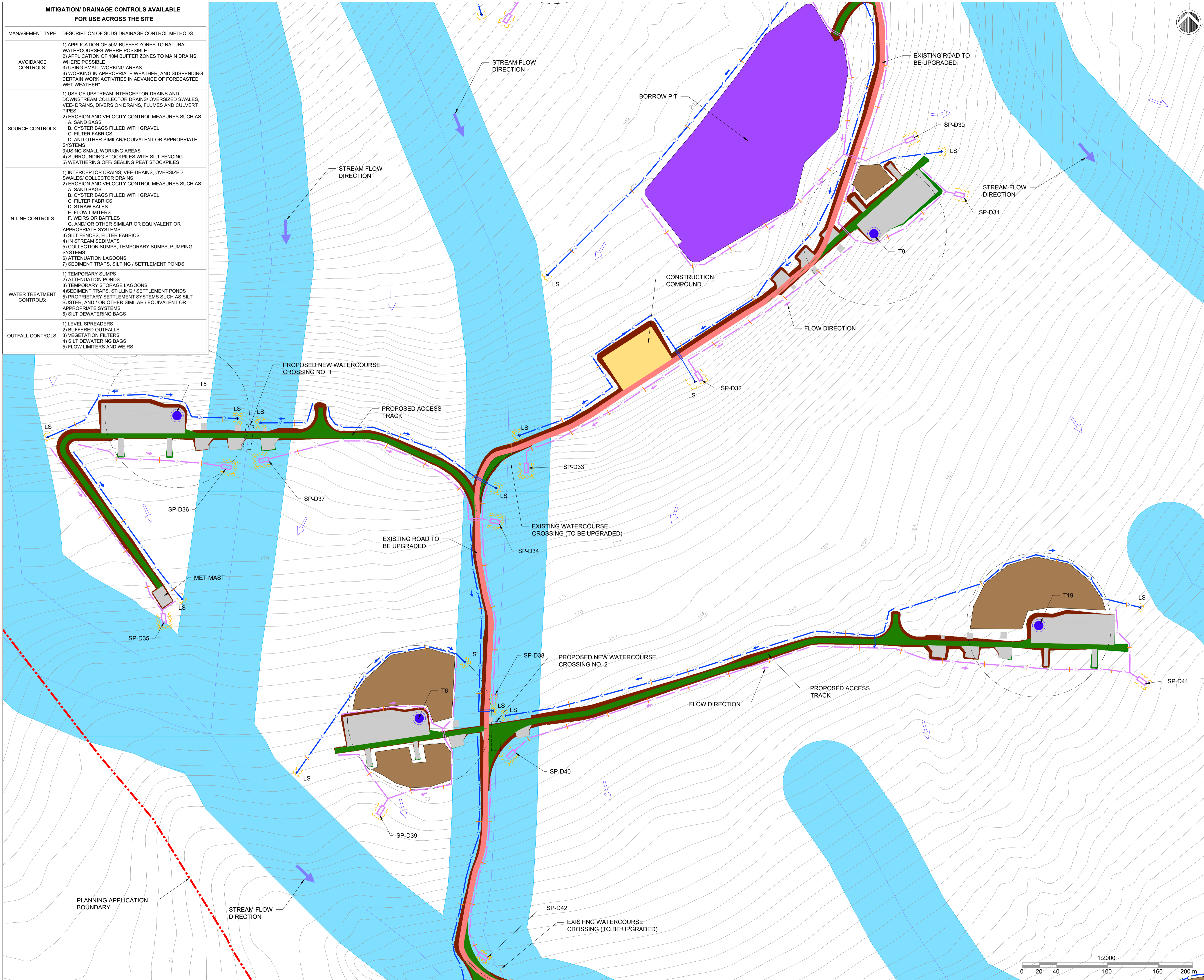
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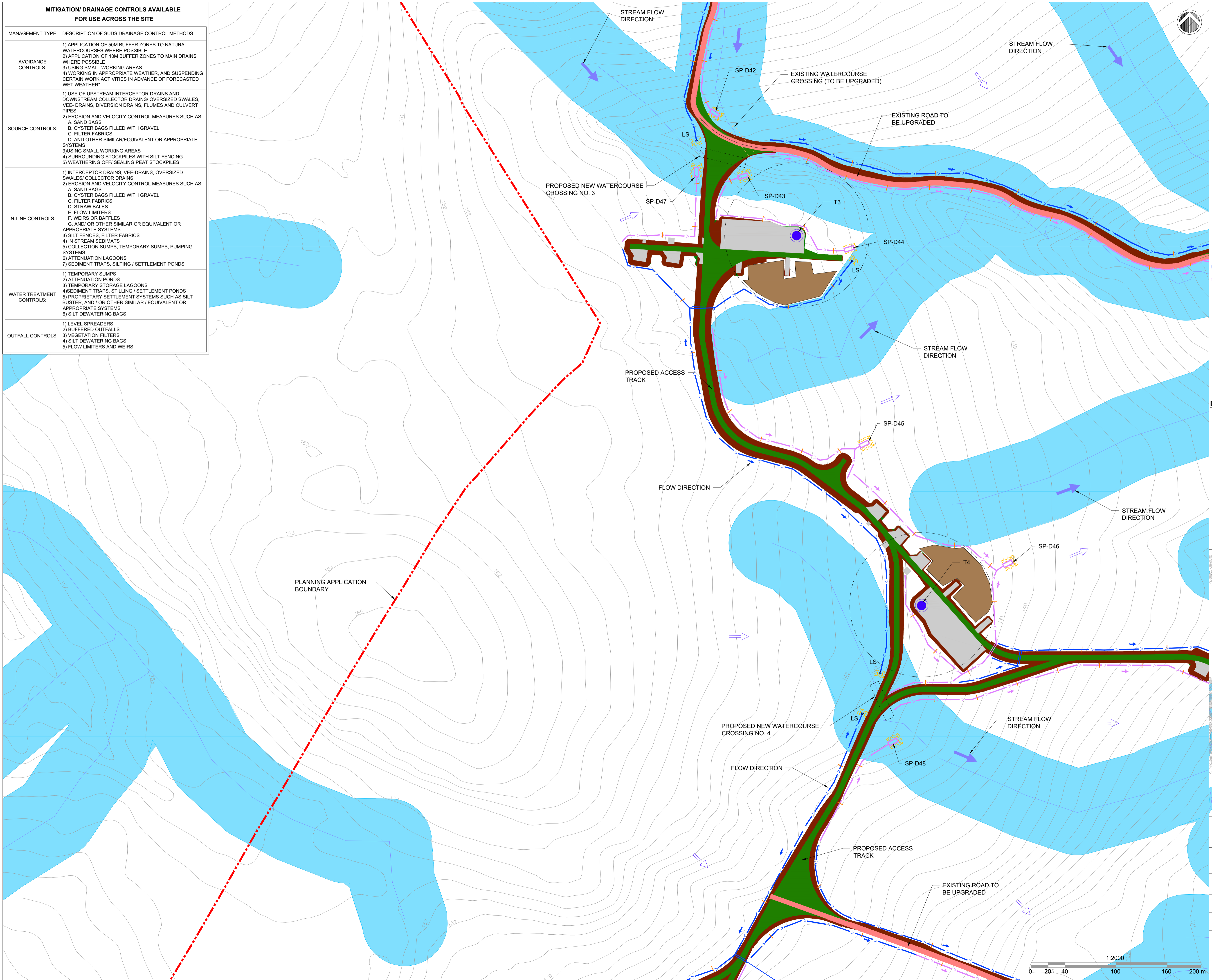


KEY PLAN
SCALE - NTS

Drawing Title: PROPOSED DRAINAGE LAYOUT SHEET 4 OF 8	
Project Title: SHESKIN SOUTH WIND FARM, Co. MAYO	
Drawn By: RP	Checked By: HM
Project No. 260761	Drawing No. FIG-4
Scale 1:2000	Date -



MITIGATION/ DRAINAGE CONTROLS 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. STRAW BALES E. FLOW LIMITERS F. WEIRS OR BAFFLES G. AND/ OR OTHER SIMILAR OR EQUIVALENT OR APPROPRIATE SYSTEMS 3) SILT FENCES, FILTER FABRICS 4) IN STREAM SEDIMENTS 5) COLLECTION SUMPS, TEMPORARY SUMPS, PUMPING SYSTEMS 6) ATTENUATION LAGOONS 7) SEDIMENT TRAPS, SILTING / 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 SILT BUSTER, AND / OR OTHER SIMILAR / EQUIVALENT OR APPROPRIATE SYSTEMS 6) SILT DEWATERING BAGS
OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

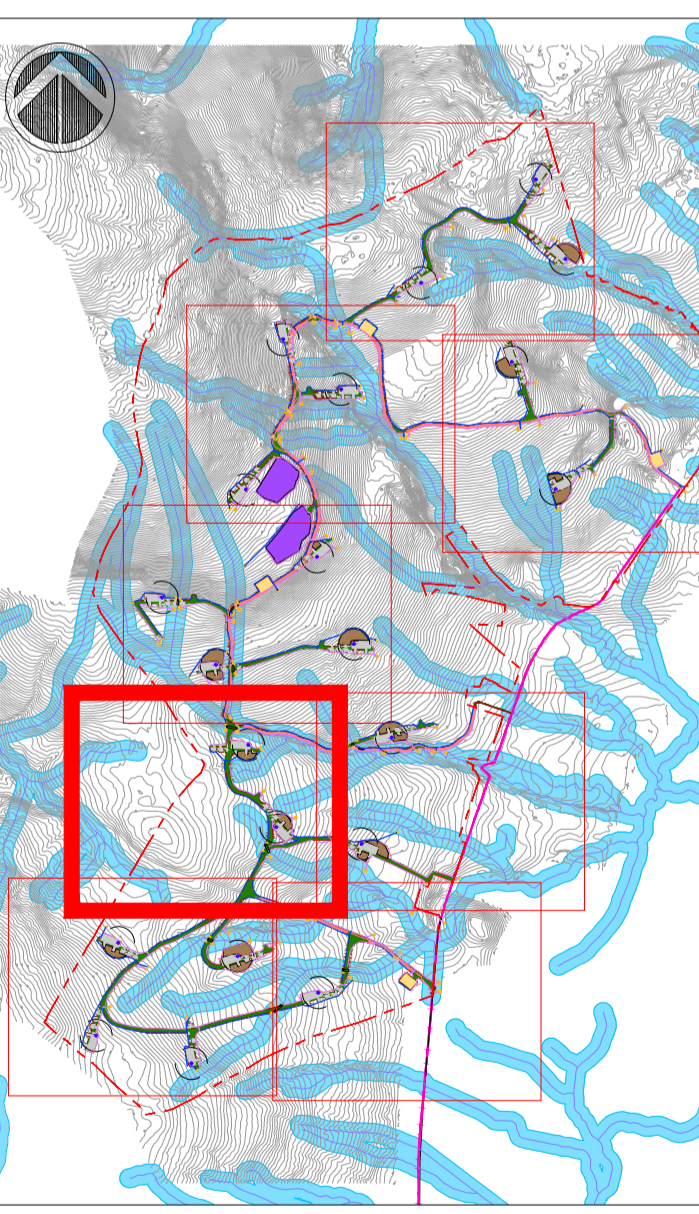


LEGEND :

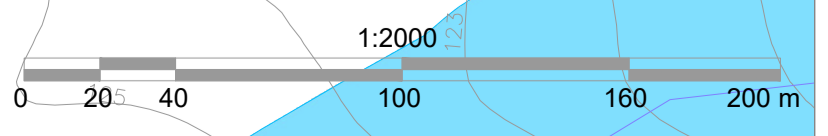
- PROPOSED TURBINE
- PROPOSED MET MAST LOCATION
- HARDSTAND
- PROPOSED NEW ROADS
- EXISTING ROADS - UPGRADE PROPOSED
- PROPOSED CONSTRUCTION COMPOUND
- PEAT PLACEMENT AREAS
- EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
- PROPOSED BORROW PITS
- EXISTING STREAM WITH 50m BUFFER ZONE
- EXISTING CULVERT
- PROPOSED NEW WATERCOURSE CROSSING
- UPSLOPE INTERCEPTOR DRAIN
- SWALES / DOWNSLOPE INTERCEPTOR DRAIN
- STILLING POND - CLEAN WATER
- STILLING POND - DIRTY WATER
- UPSLOPE INTERCEPTOR DRAIN - CULVERT
- DOWNSLOPE INTERCEPTOR DRAIN - CULVERT
- CHECK DAMS
- SILT FENCES
- DOUBLE SILT FENCES
- DIRECTION OF FLOW
- ▲ LS LEVEL SPREADER

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Drawing Title: PROPOSED DRAINAGE LAYOUT	
SHEET 5 OF 8	
Project Title: SHESKIN SOUTH WIND FARM, Co. MAYO	
Drawn By: RP	Checked By: HM
Project No. 260761	Drawing No. FIG-5
Scale 1:2000	Date -

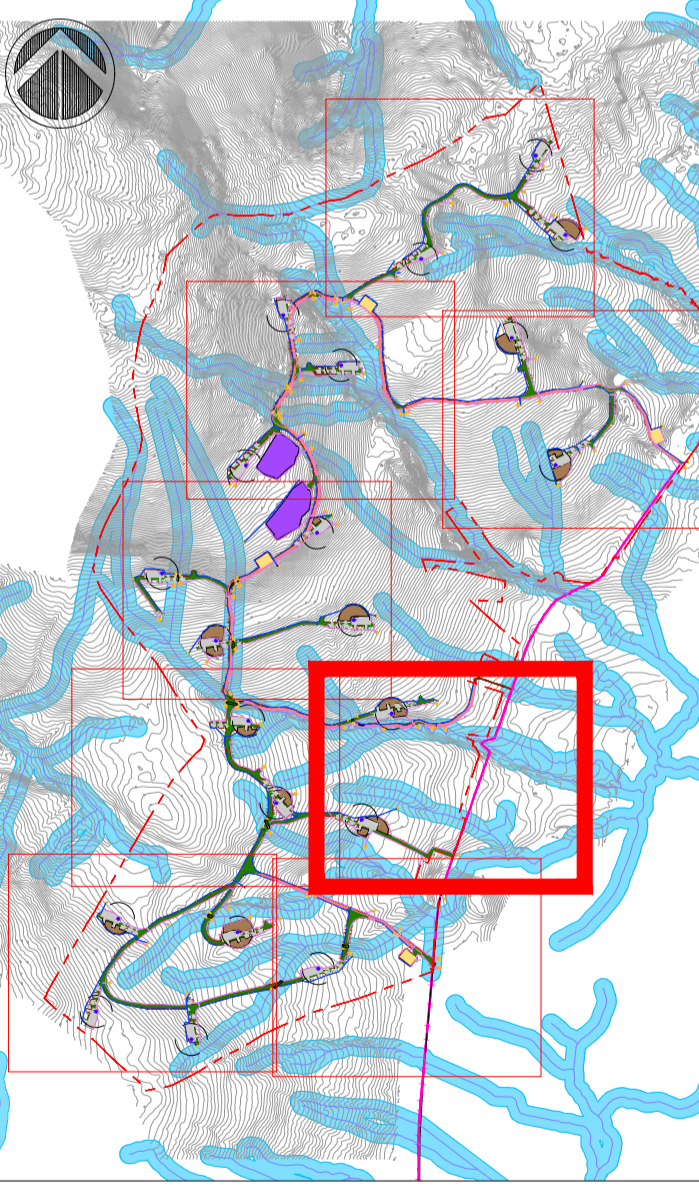




- LEGEND :**
- PROPOSED TURBINE
 - PROPOSED MET MAST LOCATION
 - HARDSTAND
 - PROPOSED NEW ROADS
 - EXISTING ROADS - UPGRADE PROPOSED
 - PROPOSED CONSTRUCTION COMPOUND
 - PEAT PLACEMENT AREAS
 - EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
 - PROPOSED BORROW PITS
 - EXISTING STREAM WITH 50m BUFFER ZONE
 - EXISTING CULVERT
 - PROPOSED NEW WATERCOURSE CROSSING
 - UPSLOPE INTERCEPTOR DRAIN
 - SWALES / DOWNSLOPE INTERCEPTOR DRAIN
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 - UPSLOPE INTERCEPTOR DRAIN - CULVERT
 - DOWNSLOPE INTERCEPTOR DRAIN - CULVERT
 - CHECK DAMS
 - SILT FENCES
 - DOUBLE SILT FENCES
 - DIRECTION OF FLOW
 - LEVEL SPREADER

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MITIGATION/ DRAINAGE CONTROLS 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. STRAW BALES E. FLOW LIMITERS F. WEIRS OR BAFFLES G. AND/ OR OTHER SIMILAR OR EQUIVALENT OR APPROPRIATE SYSTEMS 3) SILT FENCES, FILTER FABRICS 4) IN STREAM SEDIMENTS 5) COLLECTION SUMPS, TEMPORARY SUMPS, PUMPING SYSTEMS 6) ATTENUATION LAGOONS 7) SEDIMENT TRAPS, SILTING / 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 SILT BUSTER, AND / OR OTHER SIMILAR / EQUIVALENT OR APPROPRIATE SYSTEMS 6) SILT DEWATERING BAGS
OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

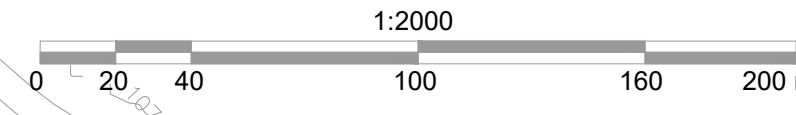
Drawing Title:
PROPOSED DRAINAGE LAYOUT
SHEET 6 OF 8

Project Title:
SHESKIN SOUTH WIND FARM, Co. MAYO

Drawn By: **RP** Checked By: **HM**

Project No: **260761** Drawing No: **FIG-6**

Scale: **1:2000** Date: -



MITIGATION/ DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

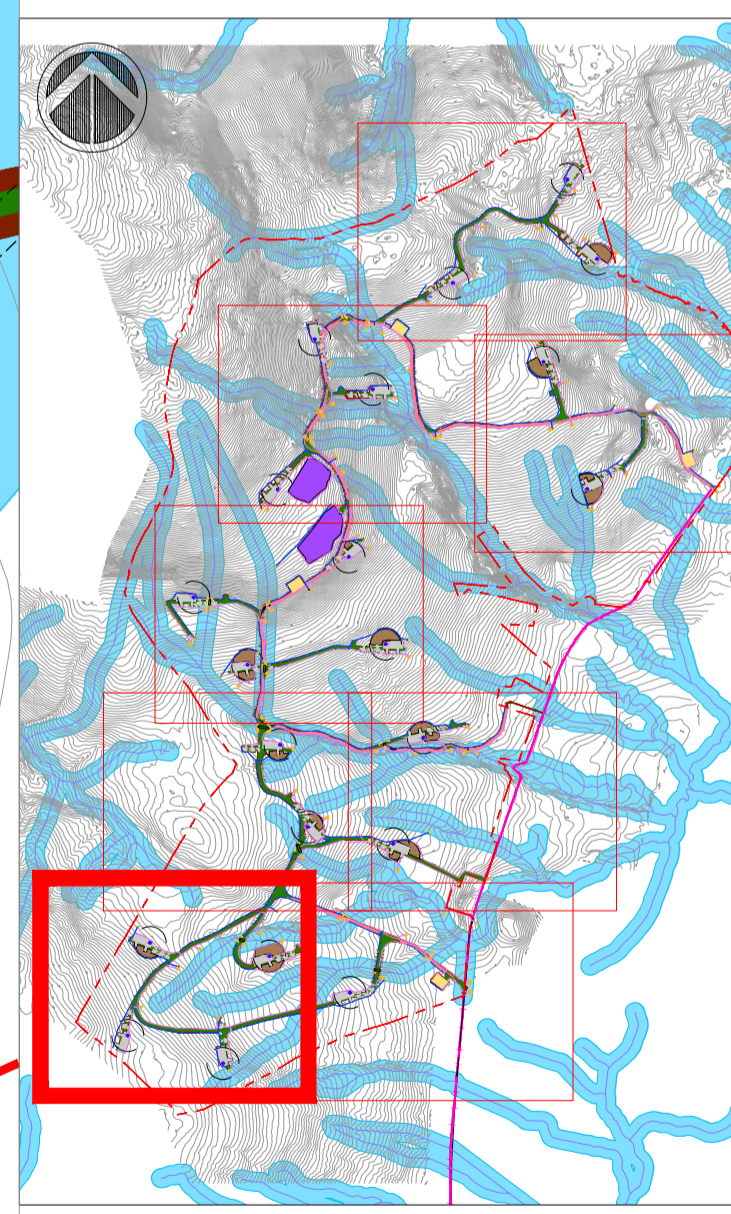
MANAGEMENT TYPE	DESCRIPTION OF SUDS DRAINAGE CONTROL METHODS
AVOIDANCE CONTROLS:	1) APPLICATION OF 50M BUFFER ZONES TO NATURAL WATERCOURSES WHERE POSSIBLE 2) APPLICATION OF 10M BUFFER ZONES TO MAIN DRAINS WHERE POSSIBLE 3) USING SMALL WORKING AREAS 4) WORKING IN APPROPRIATE WEATHER, AND SUSPENDING CERTAIN WORK ACTIVITIES IN ADVANCE OF FORECASTED WET WEATHER
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OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

LEGEND :

- PROPOSED TURBINE
- PROPOSED MET MAST LOCATION
- HARDSTAND
- PROPOSED NEW ROADS
- EXISTING ROADS - UPGRADE PROPOSED
- PROPOSED CONSTRUCTION COMPOUND
- PEAT PLACEMENT AREAS
- EXISTING ROADS - UPGRADE REQUIRED (NOT PROPOSED)
- PROPOSED BORROW PITS
- EXISTING STREAM WITH 50m BUFFER ZONE
- EXISTING CULVERT
- PROPOSED NEW WATERCOURSE CROSSING
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- CHECK DAMS
- SILT FENCES
- DOUBLE SILT FENCES
- DIRECTION OF FLOW
- ▲ LS LEVEL SPREADER

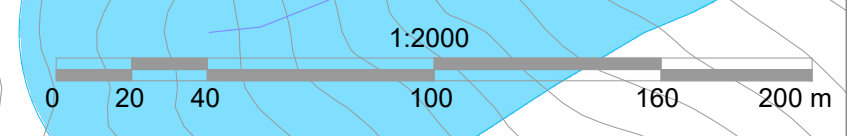
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KEY PLAN
SCALE - NTS

Drawing Title: PROPOSED DRAINAGE LAYOUT	
SHEET 7 OF 8	
Project Title: SHESKIN SOUTH WIND FARM, Co. MAYO	
Drawn By: RP	Checked By: HM
Project No. 260761	Drawing No. FIG-7
Scale 1:2000	Date -

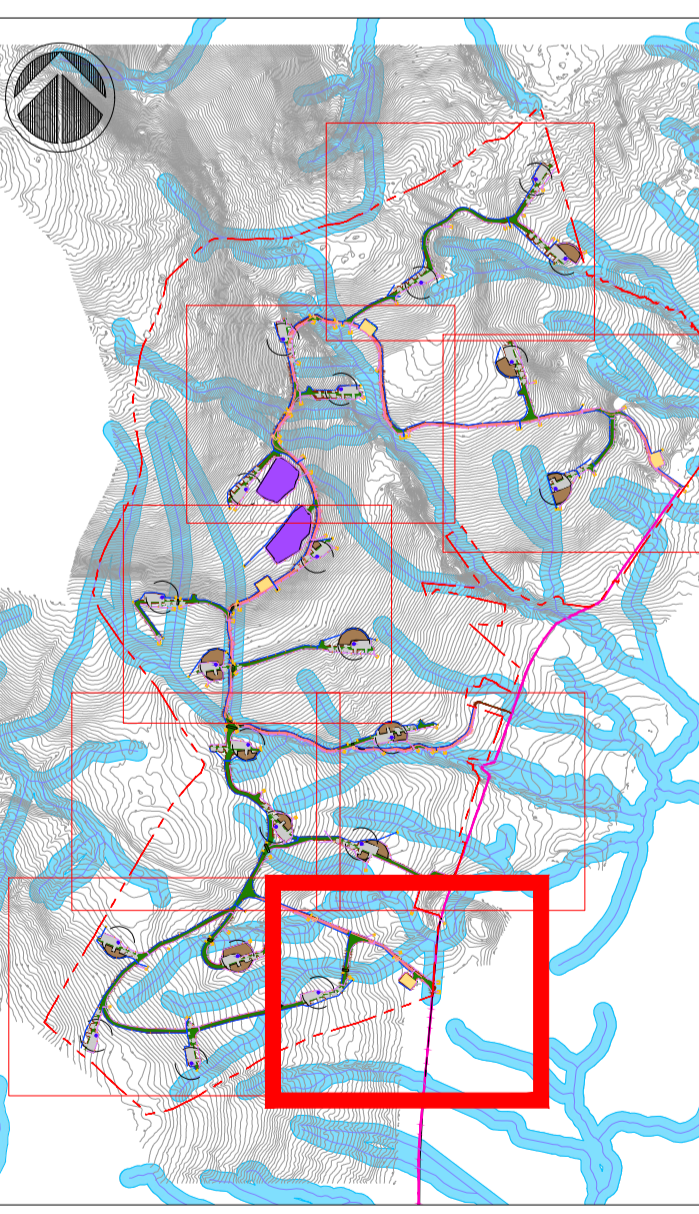




- LEGEND :**
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 - HARDSTAND
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 - STILLING POND - DIRTY WATER
 - UPSLOPE INTERCEPTOR DRAIN - CULVERT
 - DOWNSLOPE INTERCEPTOR DRAIN - CULVERT
 - + CHECK DAMS
 - ~ SILT FENCES
 - ~ DOUBLE SILT FENCES
 - DIRECTION OF FLOW
 - ▲ LS LEVEL SPREADER

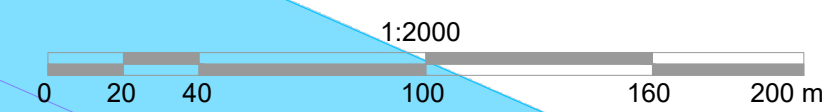
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MANAGEMENT TYPE	DESCRIPTION OF SUDS DRAINAGE CONTROL METHODS
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OUTFALL CONTROLS:	1) LEVEL SPREADERS 2) BUFFERED OUTFALLS 3) VEGETATION FILTERS 4) SILT DEWATERING BAGS 5) FLOW LIMITERS AND WEIRS

Drawing Title: **PROPOSED DRAINAGE LAYOUT SHEET 8 OF 8**
 Project Title: **SHESKIN SOUTH WIND FARM, Co. MAYO**
 Drawn By: **RP** Checked By: **HM**
 Project No: **260761** Drawing No: **FIG-8**
 Scale: **1:2000** Date: **-**





APPENDIX B

SCHEDULING OF WORKS OPERATING RECORD (SOWOR)

Work Item No.	Description	Estimated Duration of Works	Risk Schedule 1: very high risk Schedule 2: high risk Schedule 3: intermediate risk	Pre-commencement Triggers all four triggers should be met				Works Abandonment Triggers If <u>any</u> four triggers are met			
				Trigger 1 Drainage treatment infrastructure installed prior to works commencing. All in good working order	Trigger 2 River/ watercourse turbidity	Trigger 3 Daily Visual Inspection procedure in place by ECoW	Trigger 4 Weather forecast: (a) during planned works period (b) observed on site	Trigger 1 Damage to silt fence/other drainage measure or drainage point close to capacity	Trigger 2 River/ Watercourse turbidity	Trigger 3 Deterioration of SW quality as reported by ECoW	Trigger 4: Weather forecast (a) during the planned works period and (b) observed on site
1	Enabling works including felling, site compound establishment welfare facilities, site office and fencing	2 months	Schedule 2	Drainage measures to be installed as per EIAR & drainage management plan	Turbidity at baseline levels	Procedure for inspection must be in place with ECoW reporting satisfactory SW quality before works commence	Schedule 2 rainfall figures (see below) utilising reliable forecasting source	Works cease and emergency response procedure activated including the use and installation of additional pumping equipment, sedimats, siltbags and silt fencing	Turbidity 20% above baseline conditions or >15ntu – subject to baseline data analysis	Works cease and investigation conducted.	Schedule 2 rainfall figures (see below)
2	Preliminary enabling works and peat excavation operations	6 months	Schedule 1	Drainage measures to be installed as per EIAR & drainage management plan	Turbidity at baseline levels	Procedure for inspection must be in place with ECoW reporting satisfactory SW quality before works commence	Schedule 1 rainfall figures (see below) utilising reliable forecasting source	Works cease and emergency response procedure activated including the use and installation of additional	Turbidity 20% above baseline conditions or >15ntu – subject to baseline data analysis	Works cease and investigation conducted.	Schedule 1 rainfall figures (see below)

								pumping equipment, sedimats, siltbags and silt fencing			
3	Roads Excavation Excavate new road alignment, upgrade/widen existing carriageway	3-4 months	Schedule 1	Drainage measures to be installed as per EIAR & drainage management plan	Turbidity at baseline levels	Procedure for inspection must be in place with ECoW reporting satisfactory SW quality before works commence	Schedule 1 rainfall figures (see below) utilising reliable forecasting source	Works cease and emergency response procedure activated including the use and installation of additional pumping equipment, sedimats, siltbags and silt fencing	Turbidity 20% above baseline conditions or >15ntu – subject to baseline data analysis	Works cease and investigation conducted.	Schedule 1 rainfall figures (see below)
4	Culvert Upgrade or replacement works	4 months	Schedule 1	Drainage measures to be installed as per EIAR & drainage management plan	Turbidity at baseline levels	Procedure for inspection must be in place with ECoW reporting satisfactory SW quality before works commence	Schedule 1 rainfall figures (see below) utilising reliable forecasting source	Works cease and emergency response procedure activated including the use and installation of additional pumping equipment, sedimats, siltbags and silt fencing	Turbidity 20% above baseline conditions or >15ntu – subject to baseline data analysis	Works cease and investigation conducted.	Schedule 1 rainfall figures (see below)
5	Carriage way resurfacing	1 month	Schedule 3	Activity not dependent on drainage treatment infrastructure	Activity not anticipated to effect turbidity	Activity not dependent on visual inspection of SW quality	Activity not weather dependent	Activity not dependent on drainage treatment infrastructure	Activity not anticipated to effect turbidity	Activity not dependent on visual inspection of SW quality	Activity not weather dependent


11	Commissioning and snagging	2 months	Schedule 3	Activity not dependent on drainage treatment infrastructure	Activity not anticipated to effect turbidity	Activity not dependent on visual inspection of SW quality	Activity not weather dependent	Activity not dependent on drainage treatment infrastructure	Activity not anticipated to effect turbidity	Activity not dependent on visual inspection of SW quality	Activity not weather dependent
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Schedule 1 – Very high-risk activities		>10 mm/hr (i.e. high intensity local rainfall events)
Schedule 1 – Very high-risk activities		>25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
		>half monthly average rainfall in any 7 days.
		No overland flow or pathway for water movement
		Conditions on the ground match the forecast
Schedule 2 – High risk activities		>10 mm/hr (i.e. high intensity local rainfall events)
Schedule 2 – High risk activities		>25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
		>half monthly average rainfall in any 7 days.
		Conditions on the ground match the forecast
		Conditions on the ground match the forecast
Schedule 3 – Intermediate risk		>10 mm/hr (i.e. high intensity local rainfall events)
Schedule 3 – Intermediate risk		>25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
		>half monthly average rainfall in any 7 days.
		Conditions on the ground match the forecast
		Conditions on the ground match the forecast



APPENDIX C

DAILY VISUAL CHECK SHEET TEMPLATE

	<h1>Daily Visual Inspections</h1>	Project	201119 – Sheskin South	Draft Date	12/01/2023
		Client		Version	1
		File Name	201119 – Daily Visual Inspection – 2023.01.12 – V1		


Date:	
Weather:	
Rainfall previous 24hr (mm):	
Completed by:	

Surface Water Sampling Locations			
SW Ref	Visual Inspection Result	Action Required	Photographs
SW1			
SW2			
SW3			
SW4			
SW5			
SW6			
SW7			
SW8			
SW9			
SW10			

Visual Inspection Locations			
VC Ref	Visual Inspection Result	Action Required	Photographs
VI1			
VI2			
VI3			
VI4			
VI5			
VI6			
VI7			
VI8			
VI9			
VI10			

Visual Inspection Results:

1. Water clear – no issues.
2. Water turbid with a peaty tinge.
3. Water silty as a result of works NOT associated with the Croagh Wind Farm.
4. Water silty as a result of works associated with the Croagh Wind Farm works. ACTION REQUIRED.

	<h1>Daily Visual Inspections</h1>	Project	190114 – Glenard WF	Draft Date	12/01/2022
		Client	Coillte	Version	1
		File Name	190114 – Daily Visual Inspection – 2022.01.12 – V1		

Action Items / Notes / Comments:

Visual Inspection Results:

1. Water clear – no issues.
2. Water turbid with a peaty tinge.
3. Water silty as a result of works NOT associated with the Croagh Wind Farm.
4. Water silty as a result of works associated with the Croagh Wind Farm works. **ACTION REQUIRED.**