256398-06/11/2025-EIAR Appendix 4.7 Surface Water Management Plan

APPENDIX 4-7

SURFACE WATER MANAGEMENT PLAN

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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 SWMP has been divided into three sections, as listed below, and draws and expands on information already provided in Chapter 4 (Description of the Proposed Development) and Chapter 9 (Hydrology and Hydrogeology) of the EIAR and Section 3.2 of the CEMP (Appendix 4-3 of the EIAR).

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

As detailed in Section 1.1.1 in Chapter 1 (Introduction), for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Development', 'proposed turbines', the 'Site', the ' 2020 Application' and the 'Kealkill Wind Farm'. Please see Section 1.1.1 of this EIAR for further details. A detailed description of the Proposed Development is provided in Chapter 4 (Description of the Proposed Development) of this EIAR.

1.1 Statement of Authority

This section of the EIAR, has been prepared by Ellen Costello and Natasha Morley, and reviewed by Sean Creedon of MKO. Ellen holds a BSc (Hons) in Earth Science, and a MSc (Hons) in Climate Change: Integrated Environmental and Social Science Aspects where she focused her studies on renewable energy development in Europe and its implications on environment and society. Ellen's key strengths and expertise are Environmental Protection and Management, Environmental Impact Statements, Project Management, and GIS Mapping and Modelling. Since joining MKO, Ellen has been involved in a range of renewable energy infrastructure projects. In her role as a Project Manager, Ellen works with and co-ordinates large multidisciplinary teams including members from MKO's Environmental, Planning, Ecological and Ornithological departments as well as sub-contractors from various fields in the preparation and production of EIARs. Natasha is an Environmental Scientist with MKO and holds a PgDip. in Environmental Sustainability Implementation from UCD. Natasha's key strengths and areas of expertise are in project management, environmental impact assessment, GIS mapping and modelling, and environmental surveying. Since joining MKO, Natasha has experience in report writing including feasibility studies and EIA screening reports and EIAR chapters including Air Quality chapters for large-scale renewable energy developments. Sean is an Associate Director in the Environment Team at MKO. He oversees a team of highly skilled environmental professionals working on EIAR for large-and medium scale Renewable Energy infrastructure. Sean has directed and overseen multiple renewable energy projects across wind, solar, battery and hydrogen as well as a range of thermal and other energy related developments. He is a member of the MKO senior management team responsible for developing the business, mentoring team members, fostering a positive culture and promoting continuous employee professional development. Sean has over 23 years' experience in program and project development, holds an MSc from NUI Galway and a Diploma in Project Management from Institute of Project Management Ireland.

This document has also benefited from technical input by Michael Gill and David Broderick, both of Hydro-Environmental Services (HES). Michael and David are the authors of Chapter 9 (Hydrology and Hydrogeology)of this EIAR. Michael and David also designed the proposed drainage plan for the Proposed Development that was submitted as part of the planning application.

David Broderick (P. Geo., BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with over 19 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies David moved into the private sector. David has a strong background in groundwater resource assessment, karst hydrology and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed over 25 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water and for private developments across the country in a wide variety of hydrogeological settings. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Ardderroo Wind Farm, Knockalough Wind Farm, and Oweninny Wind Farm, and over 60 other wind farm related projects across the country. David worked on his first wind energy project in 2010, and he has continued to work on similar projects since then.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Civil/Environmental Engineer and Hydrogeologist with over 24 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. Michael has completed over 30 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water, and for private developments across the country in a wide variety of hydrogeological settings. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, karst hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Slievecallan Wind Farm, Seven Hills Wind Farm, Carrownagowan Wind Farm, and over 100 other wind farm related projects across the country. Michael worked on his first wind energy project in 2003, and he has continued to work on similar projects since then.

2. SURFACE WATER DRAINAGE DESIGN

The drainage design for the Proposed Development has been prepared by Hydro Environmental Services Ltd. (HES). The drainage design has been prepared based on experience of the project team of other wind farm sites, and the number of best practice guidance documents referred to in the Bibliography section of the EIAR.

The protection of the watercourses within and surrounding the Site of the Proposed Development, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the Site. 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, 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 around the existing natural drainage features have been used to inform the layout of the Proposed Development. A copy of the drainage design drawing which is included in Appendix 4-4 of this EIAR..

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

There are 2 no. existing stream crossings along existing roads that are proposed for upgrade. The upgrade works will be limited to extending the existing culvert.

There are also 5 no. existing watercourse crossings along forestry roads that will be used by the Proposed Development but will not require upgrading.

In addition to the natural watercourses, there are manmade agricultural, peat and forestry drains within the Site. However, these are not considered to be a significant constraint and can be rerouted around the Proposed Development infrastructure and/or integrated into the proposed drainage design.

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.

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

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Development are as follows:

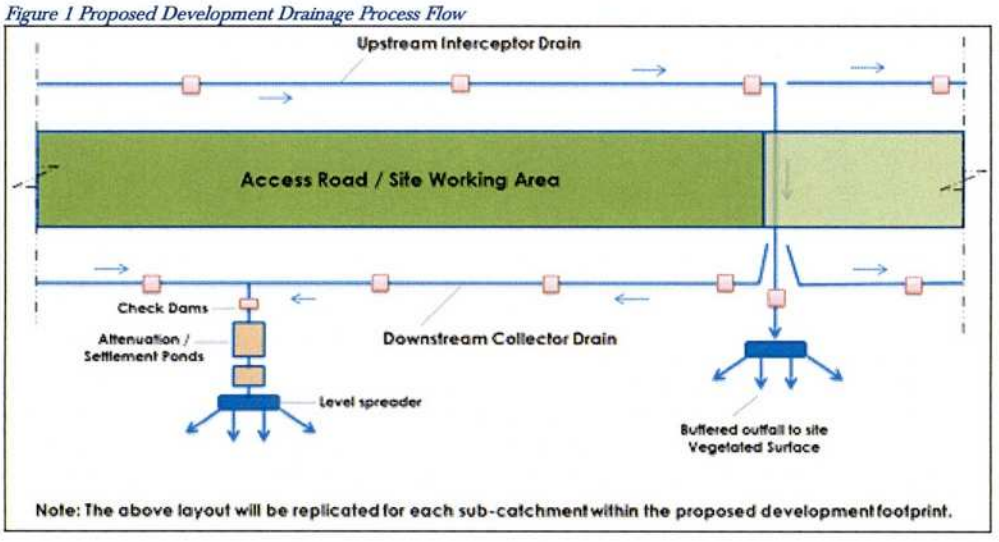
- Keep clean water clean by intercepting it where possible, upgradient of works areas, and divert it around the works areas for discharge as diffuse overland flow or for rewetting of land.
- Collect potentially silt-laden runoff from works areas via downgradient collector drains and manage via series of avoidance, source, in-line, treatment and outfall controls prior to controlled diffuse release as overland flow or for rewetting of land.
- No direct hydraulic connectivity from construction areas to watercourses or drains connecting to watercourses.
- Where possible, maintain 50-metre watercourse buffer zones for the wind turbines.
- No alteration of natural watercourses.
- Maintain the existing hydrology of the Site.
- Blocking of existing manmade drainage as appropriate.
- Daily inspection and recording of surface water management system by on-site clerk of works and immediate remedial measures to be carried out as required and works temporarily ceased if a retained stormwater/sediment load is identified to have the potential to migrate from the site.
- Use of silt buster if required.

Drainage water from any works areas 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 has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 1 below.

Figure 1 Proposed Development 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:

- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[1];
- European Commission (2017): Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report[2];
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements[3];
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;[4]
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;[5]
- Coillte (2009): Forest Operations & Water Protection Guidelines;[6]
- Forest Services (Draft 2018) Plan for Forests & Freshwater Pearl Mussel in Ireland;[7]
- Department of Agriculture, Food and the Marine (2018) Forests and Water, Johnstown Castle Estate, Co. Wexford[8]
- Department of Agriculture, Food and the Marine (2024), Forestry Standards Manual, Johnstown Castle Estate, Co. Wexford.[9]
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;[10]

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[1] *Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Dublin: EPA* https://www.epa.ie/publications/monitoring-assessment/assessment/strategic-environmental-assessment/guidelines-on-information-to-be-contained-in-environmental-impact-statements-eis.php

[2] *European Commission (2017) Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report. Luxembourg: Publications Office of the EU.* https://op.europa.eu/en/publication-detail/-/publication/2b399830-cb4b-11e7-a5d5-01aa75ed71a1

[3] *Institute of Geologists of Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements* https://igi.ie/assets/files/Codes%20and%20Guidelines/IGI%20Enviro%20Impact%202013.pdf

[4] *National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.* https://www.tii.ie/media/llvnszej/guidelines-on-procedures-for-assessment-and-treatment-of-geology-hydrology-and-hydrogeology-for-national-road-schemes.pdf

[5] *Forestry Commission (2004) Forests and Water Guidelines (4th edn). Edinburgh: Forestry Commission* https://cdn.forestresearch.gov.uk/2006/03/ukfs_water_fcgl007.pdf

[6] Coillte 2009: Forest Operations & Water Protection Guidelines

[7] *Forest Services (Draft 2018) Plan for Forests & Freshwater Pearl Mussel in Ireland* https://irishriverproject.com/wp-content/uploads/2022/01/forest-report.pdf

[8] *Department of Agriculture, Food and the Marine (2018) Forests and Water, Johnstown Castle Estate, Co. Wexford*

[9] *Department of Agriculture, Food and the Marine (2024), Forestry Standards Manual, Johnstown Castle Estate, Co. Wexford*

[10] *COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads* https://windenergyireland.com/images/files/cofordforestroadmanual.pdf

- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;[11]
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);[12]
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);[13]
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);[14]
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.[15]
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);[16]
- DOE/NIEA (2015): Wind Farms and Groundwater Impacts – A guide to EIA and Planning Considerations;[17]
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).[18]

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 4.7 of Chapter 4 (Description of the Proposed Development) 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 have therefore been 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 A.

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, upgrades of the existing road, and hard standing construction. Drains will be

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[11] *COFORD (2004): Forest Road Manual – Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;*[11] https://www.fisheriesireland.ie/media/guidelines-on-protection-of-fisheries-during-construction-works-in-and-adjacent-to-waters

[12] *PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);* https://www.approvedbusiness.co.uk/storage/brochures/49718-ppg-1-general-guide-to-the-prevention-of-pollution.pdf

[13] *PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);* https://www.gov.uk/government/publications/works-in-near-or-over-watercourses-ppg5-prevent-pollution#:~:text=Pollution%20Prevention%20Guidance%205%20(PPG5,streams%2C%20rivers%20and%20other%20watercourses.

[14] *CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006* https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C649&Category=

[15] *CIRIA 2006 Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006* https://www.ciria.org/CIRIA/CIRIA/Item_Detail.aspx?iProductCode=C532

[16] *Guidance for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018* https://www.gov.ie/en/department-of-housing-local-government-and-heritage/publications/guidelines-for-planning-authorities-and-an-bord-plean%c3%a1la-on-carrying-out-environmental-impact-assessment-august-2018/

[17] *DOE/NIEA (2015) Wind Farms and Groundwater Impacts – A guide to EIA and Planning Considerations;* https://niopa.qub.ac.uk/bitstream/NIOPA/7351/1/Wind%20farms%20and%20groundwater%20impacts.pdf

[18] *Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017* https://op.europa.eu/en/publication-detail/-/publication/2b399830-cb4b-11eZ-a5d5-01aa75ed71a1

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 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 could 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 may 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 would be maintained in localised areas along the roadway with culverts under the roadway, which would 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. Figure 2 below shows an illustrative drawing of an interceptor drain.

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.

2.5.2 Swales

Drainage swales 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 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. Figure 2 below, shows an illustrative example of a drainage swale.

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.

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 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. Check dams may also be installed in some of the existing artificial drainage channels on the Site, downstream of where drainage swales connect in.

The proposed check dams will be made up of straw bales 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. Figure 2 below, shows illustrative examples of check dams.

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 insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

2.5.4 Level Spreader

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to 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 the proposed level spreader is shown in Figure 2 below.

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 by the ECoW. 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 proposed piped slope drain is shown in Figure 2 below.

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 (Settlement Ponds)

Stilling ponds will be used to attenuate runoff from works areas of the Site during the construction phase and will remain in place to handle runoff from roads and hardstanding areas of the Site 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 at each required location as two separate ponds in sequence, a primary pond and a secondary pond. 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 primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary 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. Figure 2, below, shows an illustrative example of a stilling pond system.

Water will flow by gravity through the stilling pond system. 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. 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.

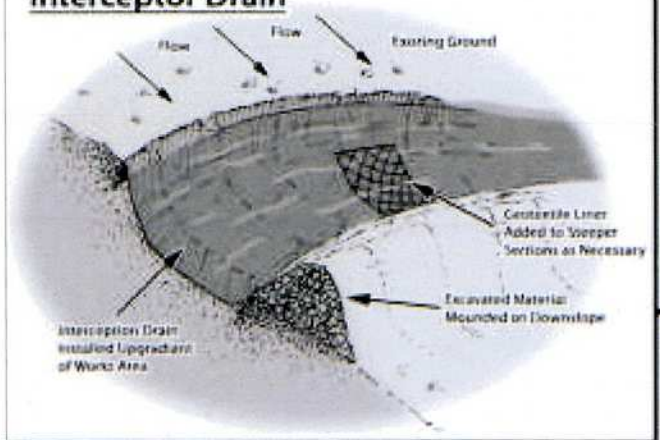
The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area. All material excavated during pond construction will be used locally for landscaping and berm construction around these ponds.

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.

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.

Drainage Design Measures

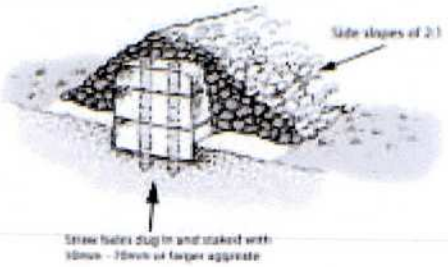
Interceptor Drain



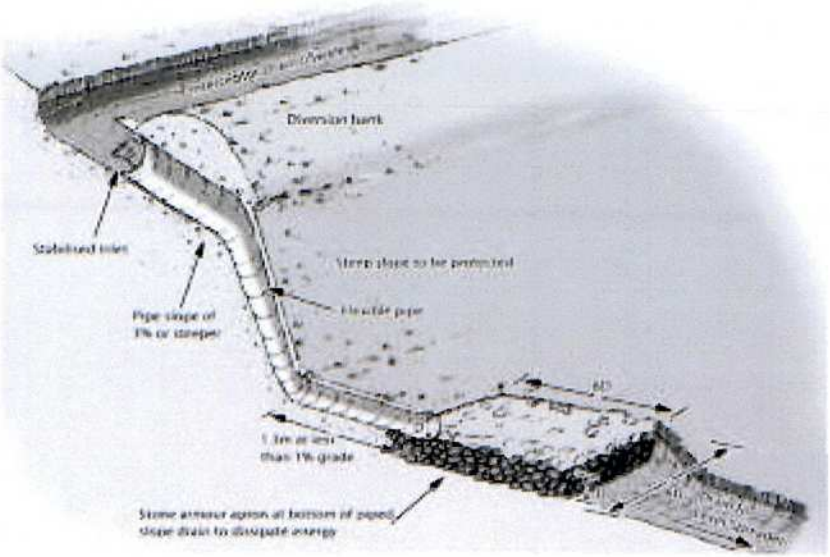
Check Dam (Stone Dam in Drain)

Check Dam

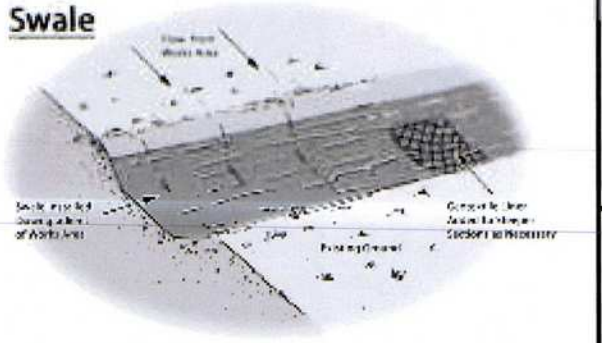
(Straw Bale & Stone Dam - Cross Section)



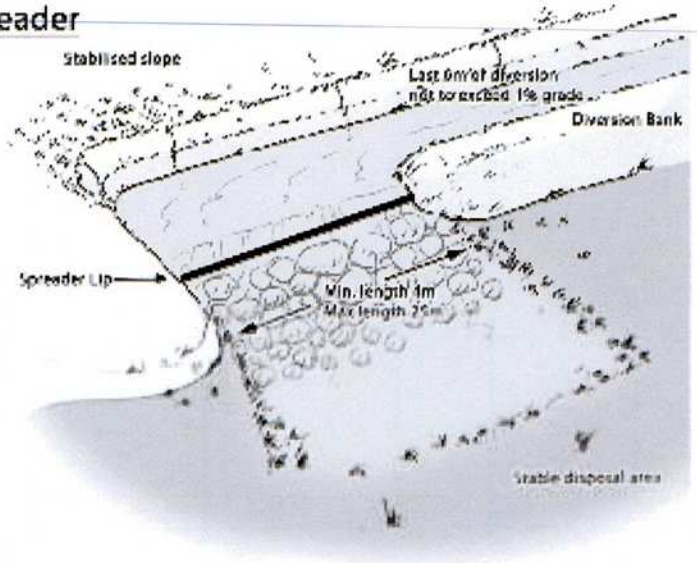
Slope Pipe Drain



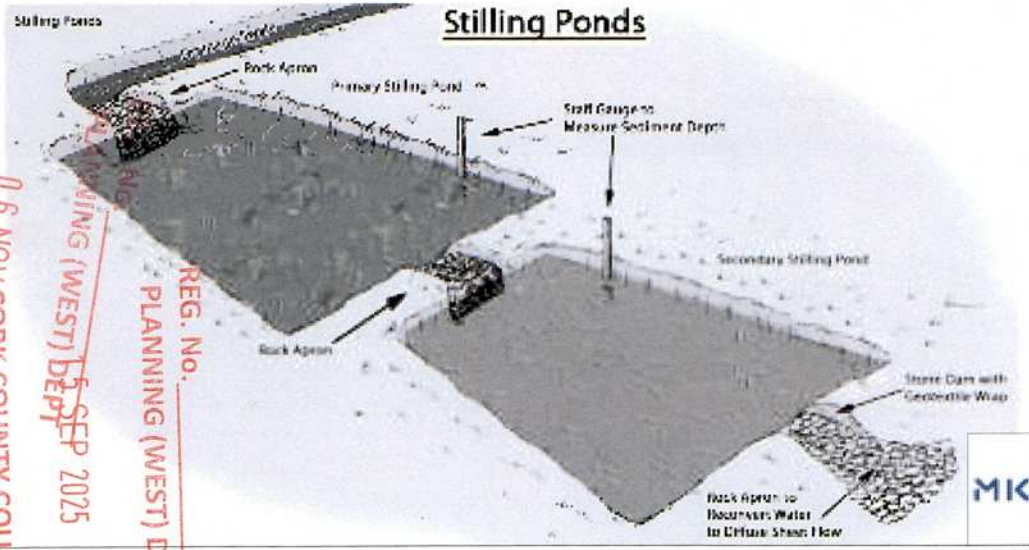
Swale



Level Spreader



Stilling Ponds



MAP TITLE: **Drainage Design Illustrations**		MAP NO.: **Figure 2**	SCALE: **NTS**
PROJECT TITLE: **Curraglass Wind Farm, Co. Cork**			DATE: **07.08.2025**
DRAWING BY: **CF**	CHECKED BY: **EC**		ISSUE NO.: **240614 - 2025.08.12- F**

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2.5.8 Siltbuster

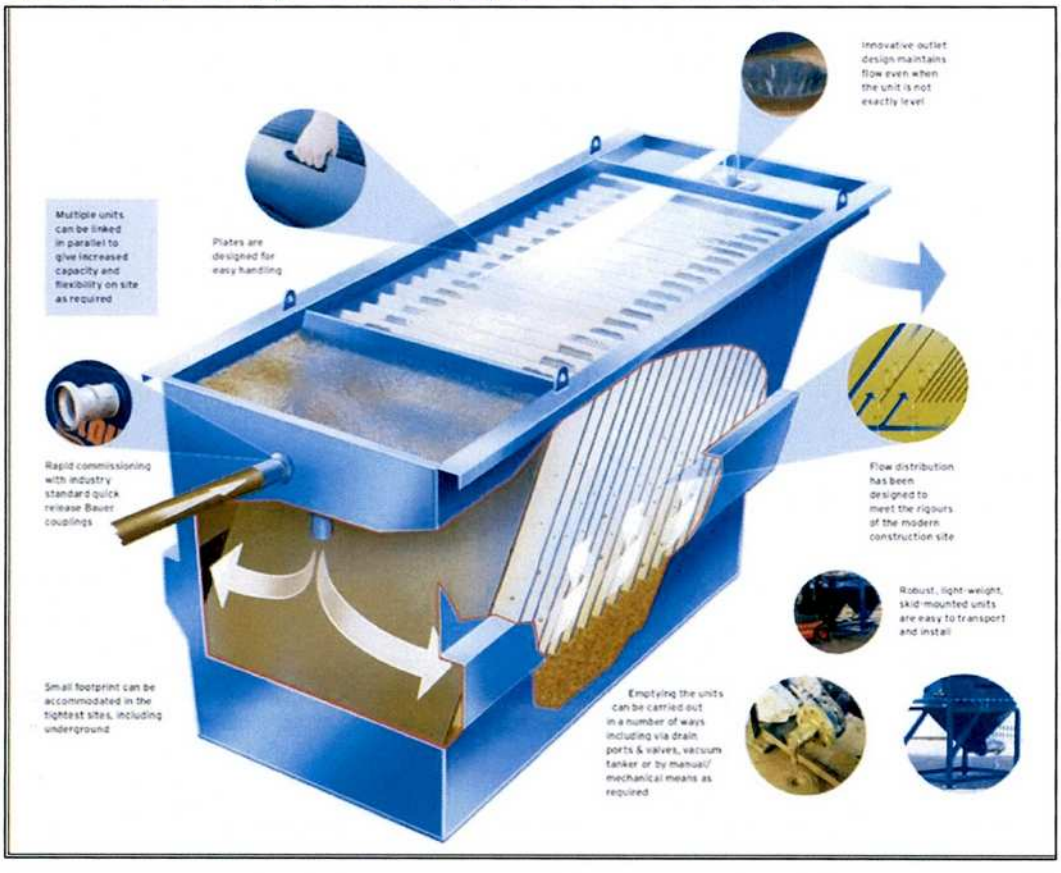
A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas, if deemed necessary by the Project Hydrologist and/or ECoW, prior to its discharge to stilling ponds or swales.

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 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 3 Siltbuster (Source: https://www.siltbuster.co.uk/sb_prod/siltbuster-fb50-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 3 meters in width by 4.5 meters (see Plate 1 and Plate 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 1 Silt bag under inspection

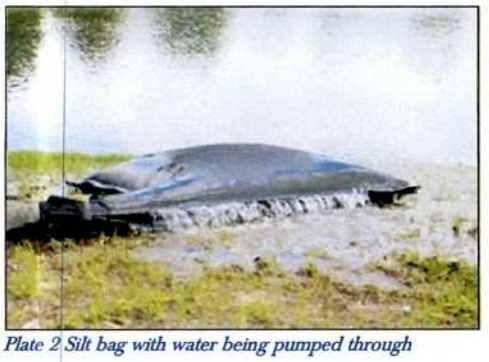


Plate 2 Silt bag with water being pumped through

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 3 below.

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

2.5.11 Culverts

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

Some culverts may be installed 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 does not occur above or below the culvert and water can continue to flow as necessary.

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

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 stream or 100m buffer zone of a lake, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Development. Double silt fences will be placed downstream of works inside the 50m buffer zone such as along the access roads. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the drainage design drawings included in Appendix 9-1 and Appendix 4-4 to the EIAR.

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 Construction Industry Research and Information Association (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.

Silt 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 4.

Plate 4: Typical Silt Fence Details

2.5.13 Hydrocarbon Interceptors

A hydrocarbon (or petrol) 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 compound).

2.5.14 Forestry Felling Drainage

As part of the Proposed Development, tree felling will be required within and around Proposed Development footprint to allow for the construction of the turbine bases, upgrade and construction of access roads, underground cabling, and the other ancillary infrastructure.

During tree felling there is a potential to generate silts and sediments in surface water runoff due to tracking of machinery and disturbance of the ground surface etc, however mitigation is provided in Section 9.4.2.1 of Chapter 9 (Hydrology and Hydrogeology) with regard surface water quality protection for this activity which is summarised below. Also, prior to the commencement of tree felling for subsequent road construction the following mitigation measures are proposed:

All felling operations will conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and DAFM guidance documents, including the specific guidelines listed below, to ensure that felling, planting and other forestry operations result in minimal potential negative effects to the receiving environment.

- Environmental Requirements for Afforestation (Forest Service, 2016a)
- Land Types for Afforestation (Forest Service, 2016b)
- Forest Protection Guidelines (Forest Service, 2002)
- Forest Operations and Water Protection Guidelines (Coillte, 2013)
- Forestry and Water Quality Guidelines (Forest Service, 2000b)
- Forestry and the Landscape Guidelines (Forest Service, 2000c)
- Forestry and Archaeology Guidelines (Forest Service, 2000d)
- Forest Biodiversity Guidelines (Forest Service, 2000e)
- Forests and Water, Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 (DAFM, 2018)
- Coillte Planting Guideline SOP
- A Guide to Forest Tree Species Selection and Silviculture in Ireland (Horgan et al., 2003)
- Management Guidelines for Ireland's Native Woodlands. Jointly published by the National Parks & Wildlife Service (Cross and Collins, 2017)
- Native Woodland Scheme Framework (Forest Service, 2018)
- Code of Best Forest Practice (Forest Service, 2000)

Mitigation by Design:

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods (from the guidance listed above) which are set out as follows:

- 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;
- Trees will be cut manually inside the 50m buffer and using machinery to extract whole trees only;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed felling area towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;
- 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 will be carefully disposed of in the peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion or where felling inside the 50 metre buffer is required, it will be necessary to install double or triple silt fencing;
- Double silt fencing will also be put down slope of felling areas which are located inside the 50 metre buffer zone;
- All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;

- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used 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. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall;
- Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- No crossing of streams by machinery will be permitted and only travel perpendicular to and away from stream will be allowed;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required;
- A permit to refuel system will be adopted at the Site; and,
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Silt Traps:

Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time, and allow settling of silt in a controlled manner.

Drain Inspection and Maintenance:

The following items shall be carried out during pre-felling inspections and after:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines;
- Inspection of all areas reported as having unusual ground conditions;
- Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches shall be identified. Ideally the pre-felling inspection shall be carried out during rainfall;
- Following tree felling all main drains shall be inspected to ensure that they are functioning;
- Extraction tracks near drains need to be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground;
- Culverts on drains exiting the Site will be unblocked; and,
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

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CORK COUNTY COUNCIL
NORTON HOUSE, SKIBBEREEN, Co. CORK

Surface Water Quality Monitoring:

Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling will be conducted within 4 weeks of the felling activity, preferably in medium to high water flow conditions. The 'during' sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown). The felling surface water monitoring data will also be compared with the EIAR baseline water quality sampling data.

Criteria for the selection of water sampling points include the following:

- Avoid man-made ditches and drains, or watercourses that do not have year round flows, i.e. avoid ephemeral ditches, drains or watercourses;
- Select sampling points upstream and downstream of the forestry activities;
- It is advantageous if the upstream location is outside/above the forest in order to evaluate the impact of land-uses other than forestry;
- Where possible, downstream locations will be selected: one immediately below the forestry activity, the second at exit from the forest, and the third some distance from the second (this allows demonstration of no impact through dilution effect or contamination by other land-uses where impact increases at third downstream location relative to second downstream location); and,
- The above sampling strategy will be undertaken for all on-site sub-catchments streams where tree felling is proposed.

Also, daily surface water monitoring forms will be utilised at every works site near watercourses. These will be taken daily and kept on site for record and inspection.

2.5.15 Cable Trench Drainage

Cable trenches are 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, would be used for landscaping and reinstatements of other areas elsewhere on site or disposed off-site at an appropriate licensed soil recovery facility.

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.

2.5.16 Transverse Drains (Grips)

On sections of access road, transverse drains ('grips') are constructed within the surface layer to divert runoff into swales or roadside drains. These drains can run perpendicularly from edge to edge of the road and are most commonly used on steeper gradients to prevent surface water from flowing down the centreline, thereby reducing the risk of erosion and protecting the road structure.

3. SURFACE WATER DRAINAGE MANAGEMENT

3.1 Introduction

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

3.2 Good Environmental Management During Construction

Timing of works can strongly influence the potential for damaging the freshwater environment. Operations 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 would 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 is being impacted. Given that this site has an established drainage network, 2 no. existing stream crossings along existing roads are proposed for upgrade and 5 no. existing watercourse crossings along forestry roads will be used by the Proposed Development but will not require upgrading. There will be minimal impacts on watercourses.

3.3 Drainage Measure Implementation and Management

3.3.1 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against impacts on surface water bodies. Two distinct methods will be employed to manage drainage water within the Proposed Development. The first method involves 'keeping clean water clean' by avoiding disturbance to existing drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, and nutrients, to route them towards new proposed silt traps and settlement ponds (or stilling ponds) prior to controlled diffuse release into the existing drainage network. There will be no direct discharges to the existing forestry drains.

During the construction phase, all runoff from works areas (i.e., dirty water) will be slowed down and treated to a high quality prior to being released. A schematic of the proposed site drainage management is shown as Figure 1 above. A detailed drainage plan showing the layout of the proposed drainage design elements is shown in Appendix 9-1 of the EIAR.

3.3.2 Pre-Construction Drainage

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 as the construction works develop across the Site, as works in all areas will not commence simultaneously.

Drainage and associated pollution control measures will be implemented onsite before the main construction works commence. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.

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. It is proposed that 2 no. upgraded drain crossings will be required to facilitate the Proposed Development infrastructure.

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 have to be blocked, the blocking will only take place after an alternative 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.

3.3.3 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 4.6 of Chapter 4 (Description of the Proposed Development) of this EIAR and shown in the drainage design drawings included with this planning application Appendix 9-1. The drainage system will be excavated and constructed in conjunction with the road, upgrade of existing roads, 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 Proposed Development. 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 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 the EIAR, there are additional site-based decisions and plans 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 4.1 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 mitigation and monitoring measures outlined in Section 7 and 8 of the CEMP, and to ensure protection of all watercourses.

3.3.3.1 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.

3.3.3.2 Pre-emptive Site Drainage Management

The works programme for the felling operations will also take account of weather forecasts and predicted rainfall in particular. Operations 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/weekly basis, as required, to allow site staff to direct proposed and planned construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Éireann 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 Éireann 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 Éireann provide a 24-hour telephone consultancy service. The forecaster will provide an interpretation of weather data and give the best available forecast for the area of interest.

Using the safe threshold rainfall values will allow planned works to be safely executed (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests any 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 shall 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.

3.3.3.3 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.

3.3.4 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 above and in Chapter 4 (Description of the Proposed Development), Section 4.7 and Section 4.8 of the EIAR.

The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.

The drainage system will not be altered upon decommissioning. Measures which will be implemented to ensure no impacts upon the drainage system during decommissioning will be outlined within the Decommissioning Plan (Appendix 4-6) and fully agreed with the local authority prior to any decommissioning works.

The operational phase drainage system will have been installed during the construction phase in conjunction with the upgrade of existing roads, the construction of new road and hardstanding construction work as described below:

- Interceptor drains will be installed up-gradient of all 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 into downstream field drains;
- Collectors drains will be used to gather runoff from access roads and turbine hardstanding areas of the Site, likely to have entrained suspended sediment, and channel it to new local settlement ponds for sediment settling;
- On sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/roadside drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of access road sections and at turbine locations, 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 existing drains;
- Settlement ponds will be designed in consideration of the greenfield runoff rate; and
- Finally, all surface water runoff from the development will have to pass through the settlement ponds at the existing forestry outfall locations.

In the operational phase of the Proposed Development, 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.

3.4 Activity Specific Drainage Control and Mitigation Measures

3.4.1 Keyhole Forestry Felling

Tree felling will be required within the Site to allow for the construction of the turbine bases, access road's underground cabling, and the other ancillary infrastructure including the relevant biodiversity enhancement areas. The commercial forestry felling activities required as part of the Proposed Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.

Mitigation measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses. These measures are derived from best practice guidance documents as outlined in Section 2.3 above.

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing. During tree felling there is a potential to generate silts and sediments in surface water runoff due to tracking of machinery and disturbance of the ground surface etc, however, mitigation is provided in Chapter 9 (Hydrology and Hydrogeology) with regard surface water quality protection for this activity which is summarised below.

Water protection measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses. These measures are derived from best practice guidance documents as outlined in Section 2.3 above. Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out above in Section 2.5.1.4.

Minimum buffer zones will be applied from all sensitive hydrological features, ensuring that adequate room is maintained for the proposed mitigation measures detailed above to be properly installed and operate effectively. Please see Table 3-1 below for the minimum buffer zone widths that will be applied on site.

Table 3-1 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

The buffer/setback zone will:

- Avoid physical damage (river/stream banks and river/stream beds) to watercourses and the associated release of sediment;

- Avoid peat/soil disturbance and compaction within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from works into watercourses; and,
- Avoid the entry of suspended sediment from the drainage system into watercourses, achieved in part by ending drain discharge outside the buffer zone and allowing percolation across the vegetation of the buffer zone.

3.4.1.1 Tree Felling Drainage Management

Before the commencement of any felling works, an 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 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 agreement of 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 7 (Monitoring) and Appendix D (Daily Monitoring Form) of the DRAFT Plan for Forests and & Freshwater Pearl Mussel in Ireland.
- 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 / riverbank, with no in-stream access permitted.
- The following minimum analytical suite shall be used: pH, EC, TSS, BOD, Total P, Ortho-P, Total N, 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.

3.4.2 Peat and Spoil Management Area Drainage and Management of Runoff

It is proposed to manage any excess overburden generated through construction activities within the Site, through deposition in the borrow pit, landscaping/enhancement proposals, and through the reuse of suitable materials as fill volume.

As rock is removed from the borrow pit, it is proposed to backfill the borrow pit area with excavated peat and spoil generated from the cut exercise. The excavated rock from the borrow pit will be used in

the construction of the infrastructure elements (turbine foundations, hardstands, access roads, etc.) at the wind farm. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to construct cells within the borrow pit for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators

Prior to stripping of peaty topsoil, a cut-off drain will first be excavated upslope of the borrow pit, as shown on in Appendix 4-2, Peat and Spoil Management Plan, in order to intercept existing overland flows and divert them around the borrow pit prior to discharge via a buffer zone on the downslope side. The shallow peat overburden will then be stripped and temporarily stockpiled; vegetated-side upwards where possible, forming a berm around the borrow pit in order for it to be re-used in its reinstatement on completion. Any subsoil material overlying the rock will then be excavated and stockpiled separately from the peat. The stockpile will be sealed, and a perimeter drain installed to intercept any run-off so that it can be discharged through an appropriately designed silt trap.

To effectively manage potential effects from borrow pit activities, a series of open drains will be constructed within the area to isolate runoff containing increased concentrations of suspended solids. The drainage system, comprised of check dams, will attenuate the flow and provide additional storage capacity during exceptional rainfall events. This design will prevent contaminated runoff from mixing with clean catchment runoff.

Settlement ponds will be implemented as an additional mitigation measure. These ponds have been designed with a modular approach to accommodate varying runoff volumes. In the event that larger areas of runoff need to be treated at a single discharge point, the size of the settlement pond can be increased proportionately.

Post-construction, the borrow pit area will be permanently secured. A stock-proof fence will be erected around the borrow pit perimeters to prevent access. Appropriate health and safety signage will also be erected on the fencing and at locations around the fenced area.

Proposed surface water quality protection measures regarding the borrow pit are as follows:

- During the initial emplacement of peat and subsoil at the borrow pit, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the enclosure.
- The borrow pit is an enclosed area. Its drainage can be easily managed.
- Drainage from the borrow pit will be pumped to settlement ponds as required or will overflow through controlled overflow pipes.
- Discharge or pumping will be intermittent and will depend on preceding rainfall amounts.
- Once the borrow pit has been seeded and vegetation is established the risk to downstream surface water is significantly reduced.

Therefore, at each stage of the peat and spoil management development the above mitigation measures will be deployed to ensure protection of downstream water quality.

The repository area settlement ponds have been designed to allow a 24hr retention time as per EPA guidance (2006) which is highest level of protection recommended by the EPA with regard to retention time. The supporting design calculations for all settlement ponds are included on Drawing D501 included in Appendix 4-4.

3.4.3 Cable Trench Drainage

Cable trenches are 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, would be used for landscaping and reinstatements of other areas elsewhere on Site or stored in the dedicated borrow pit.

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.

3.4.4 Refuelling, Fuel and Hazardous Materials Storage

Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site in appropriately bunded containers. On-site refuelling of machinery will be carried out at dedicated refuelling locations. Heavy plant and machinery will be refuelled on-site by a fuel truck that will come to the Site as required on a scheduled and organised basis. Other refuelling will be carried out using mobile double skinned fuel bowser. The fuel bowser will be parked on a level area on-site when not in use. All refuelling will be carried out outside designated watercourse buffer zones. Only designated trained and competent operatives will be authorised to refuel plant on-site. Mobile measures such as drip trays and fuel absorbent mats will used during refuelling operations as required. All plant and machinery will be equipped with fuel absorbent material and pads to deal with any event of accidental spillage. throughout the Site.

Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays, spill kits and fuel absorbent mats will be available if necessary, during all refuelling operations. The following mitigation measures are proposed to avoid release of hydrocarbons at the Site:

- Road-going vehicles will be refuelled off site wherever possible;
- Fuels volumes stored on site should be minimised. Any fuel storage areas 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;
- Oils or fuels stored in turbines will be placed within an appropriately sized bunded unit to prevent leakage to groundwater or surface water;
- 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 6 of the CEMP). Spill kits will be available to deal with an accidental spillage in and outside the refuelling area.
- A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the construction phase.

3.4.5 Cement Based Products Control Measures

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills.

The following mitigation measures are proposed to avoid release of cement leachate from the Proposed Development:

- 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 the chute will be cleaned, 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. Chute cleaning water is to be isolated in temporary lined wash-out pits located near proposed site compound. These temporary lined wash-out pits will be removed from the Site at the end of the construction phase;
- Will use weather forecasting to plan dry days for pouring concrete; and,
- Will ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event

3.5 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 by the ECoW. 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 Proposed 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 watercourses 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 (as amended)
- 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. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010; and,
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

This water monitoring programme will be the subject of independent review by the Project 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.

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.

4.1.2 Construction Phase Monitoring

4.1.2.1 Daily Visual Inspections

Daily surface water monitoring forms (for visual inspections and field chemistry measurements) will also be utilised at every works site near any watercourse. These will be taken daily and kept on site for record and inspection, to allow for identification of 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 are shown in Figure 4 (VI1-VI8) will be confirmed 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 B. 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 by the ECoW. 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 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 by the Project Hydrologist/ ECoW of the drainage measures during construction phase;
- Quarterly site inspections by the Project Hydrologist/ ECoW 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 CEMP which will be maintained on-site during the construction phase.

4.1.2.2 Continuous Monitoring

During, the construction phase, continuous, in-situ, monitoring equipment will be installed where required at locations surrounding the 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 discussed in Section 4.1.2.1 above.

4.1.2.3 Laboratory Analysis

Baseline laboratory analysis at locations of a range of parameters with relevant regulatory limits and EQSs will be undertaken as per water monitoring programme for the overall wind farm development and each primary watercourse along the route. This will not be restricted to just these locations, seen below on Figure 4, around the immediate 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 Proposed 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.

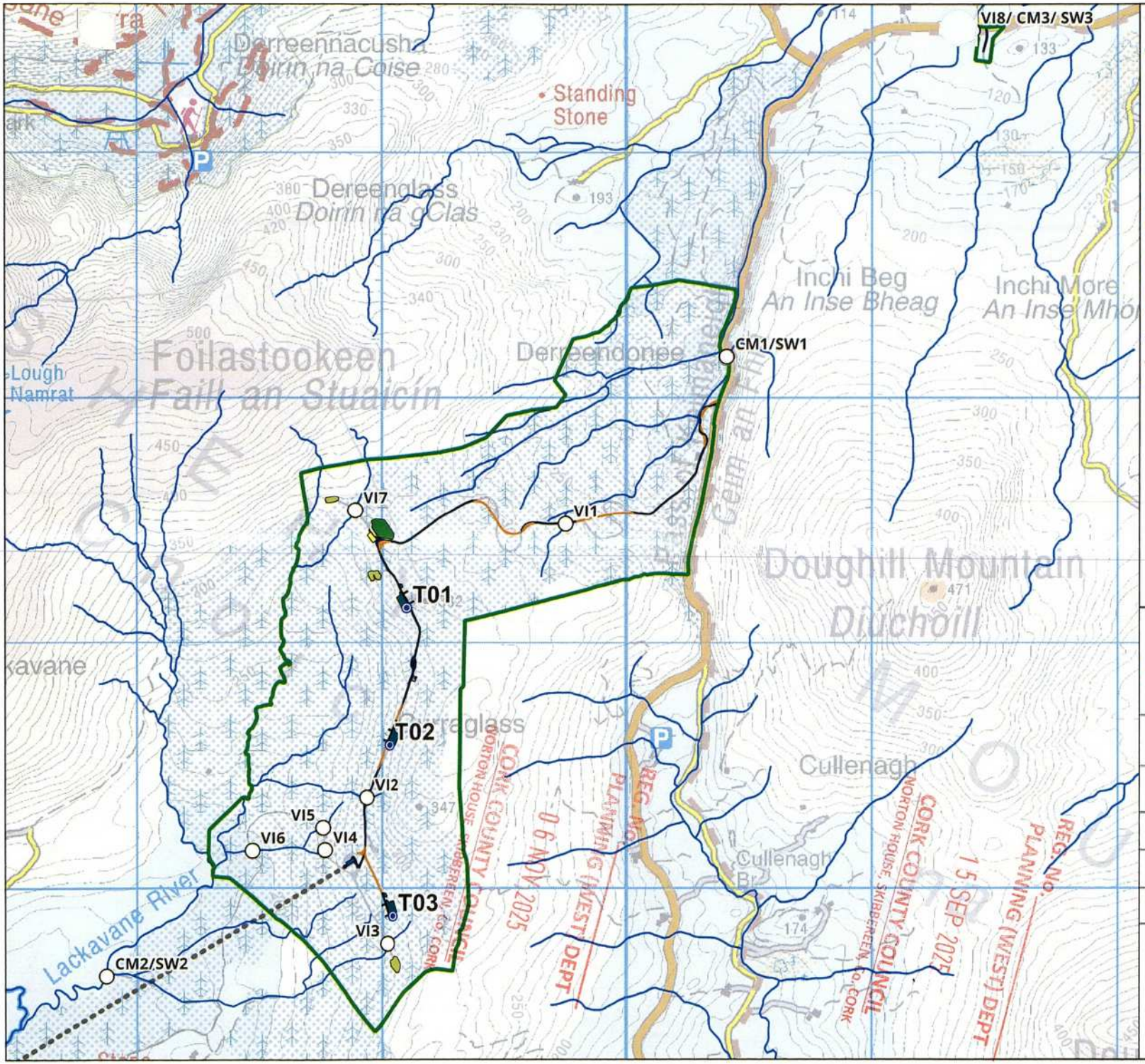
It will be the responsibility of the ECoW to present the ongoing results of water quality and weather monitoring at or in advance of regular site meetings.

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 Cork County Council in advance.

4.1.4 Post Construction Monitoring

4.1.4.1 Monthly Laboratory Analysis Sampling

Monthly 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.



Map Legend

- EIAR Site Boundary
- Proposed Turbines
- Proposed Hardstands
- Proposed Met Mast
- Proposed Met Mast Hardstand
- Proposed Borrow Pit
- Existing Roads to Upgrade
- Proposed New Roads
- Existing Infrastructure
- Temporary Construction Compound
- Proposed Peat & Spoil Management Areas
- Existing Onsite 38kV Substation
- Existing 38kV Underground Cabling
- Existing 38kV Overhead Line
- Watercourses
- SW = Monthly Laboratory Analysis Sampling Locations
  VI = Daily Visual Inspection Locations
  CM = Continuous Monitoring Locations

Drawing Title: Surface Water Sampling and Visual Inspection Locations

Project Title: Curraglass Wind Farm, Co. Cork

Drawn By	Checked By
EM	EC
Project No. 240614	Drawing No. Figure 4
Scale 1:15,000	Date 2025-09-03

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5. COMPLIANCE AND REVIEW

5.1 Site Inspections and Auditing

Field inspections and testing will only be carried out by an experienced ECoW 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 Proposed Development.

APPENDIX A

SCHEDULE 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 any 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

Schedule 1 – Very high-risk activities	>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.
	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)
	>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
Schedule 3 – Intermediate risk	>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.
	Conditions on the ground match the forecast

APPENDIX B

DAILY VISUAL CHECK SHEET TEMPLATE

	Daily Visual Inspections	Project	220245 - Lackareagh	Draft Date	21/05/2024
		Client	EDF Renewables Ireland Ltd.	Version	1
		File Name	220245 – Daily Visual Inspection – 2024.05.21		

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 Lackareagh Wind Farm.
4. Water silty as a result of works associated with the Lackareagh Wind Farm works. ACTION REQUIRED.

	Daily Visual Inspections				
		Project	220245 - Lackareagh	Draft Date	21/05/2024
		Client	EDF Renewables Ireland Ltd.	Version	1
		File Name	220245 – Daily Visual Inspection – 2024.005.21		

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 Lackareagh Wind Farm.
4. Water silty as a result of works associated with the Lackareagh Wind Farm works. ACTION REQUIRED.