Planning and Environmental Consultants

Appendix 4-4: Surface Water Management Plan

Proposed Slievegrine Renewable Energy Development, Co. Waterford

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Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

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1. INTRODUCTION

This Surface Water Management Plan (SWMP) is intended to compile the proposed surface water drainage control and treatment measures, set out in Chapter 4: *'Description of the Proposed Project'* and Chapter 9: *'Hydrology & Hydrogeology'* of the Environmental Impact Assessment Report (EIAR), and the proposed surface water monitoring programme, in a single document.

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

- Surface Water Drainage Design;
- Surface Water Drainage Management; and
- Surface Water Monitoring Programme.

As detailed in Section 1.1.2 in Chapter 1*: 'Introduction to the Proposed Project'* of the EIAR, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', the 'Site', 'Proposed Wind Farm', and 'Proposed Grid Connection'. A detailed description of the Proposed Project is provided in Chapter 4: *'Description of the Proposed Project'* of the EIAR.

1.1 Statement of Authority

This document was prepared by Michéal Cahill with support from Sophie O'Rourke and reviewed by Eoin McCarthy, all of MKO.

Michéal Cahill is an Environmental Scientist with MKO with over 2 years of experience in environmental consulting. Michéal holds a first-class honours degree in Environmental Science at University of Galway and was awarded the Professor Emer Colleran Medal for his academic achievements. Prior to taking up his position with MKO in June 2024, Michéal previously worked as an environmental sustainability intern with RPS Group. Michéal has previous experience in the preparation and review of Environmental Impact Assessment Reports for both offshore and onshore wind farm projects, as well as aiding in the research and design phase of a proposed pumped hydroelectric storage plant. Michéal's key strengths and areas of expertise are in environmental impact assessment, the preparation and writing of high-quality reports, proficiency in geographic information systems and ecology. As an environmental scientist within MKOs environmental renewables team, Michéal is involved in the preparation and revision of a variety of reports for a range of energy infrastructure projects.

Sophie O'Rourke is an Environmental Scientist with MKO. Sophie holds a BA in History and Political Science and a first class honours MSc in Environmental Science from the Trinity College Dublin. Sophie has excellent report writing and research skills. She is experienced in qualitative and quantitative data analysis. Sophie's key strengths and areas of expertise include environmental impact assessment, report writing and Geographical Information Systems. Within MKO, Sophie works as part of a large multi-disciplinary team to produce EIA Reports on the Environmental Renewables team. Sophie has been involved in a number of project since starting in MKO.

Eoin is a Project Director with McCarthy O'Sullivan Ltd. with over 15 years of environmental consultancy experience. Eoin holds B.Sc. (Hons) in Environmental Science from NUI, Galway. Eoin's

key strengths and areas of expertise are in project management, environmental impact assessment, wind energy site selection and feasibility assessment. Since joining MKO in 2011, Eoin has been involved as a Graduate, Assistant and Project Environmental Scientist on a significant range of energy infrastructure, tourism, waste permit, flood relief scheme and quarrying projects. He has overseen some of the largest SID wind energy in Ireland in that time. In his role as project manager, Eoin 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. Eoin is also involved in the development of project strategy for the projects that he manages. He has held the role of project manager on over 550MW worth of wind energy projects. Within MKO Eoin plays a large role in the management of and sharing of knowledge with junior members of staff and works as part of a large multi-disciplinary team to produce EIA Reports.

This document has also benefited from input by Henning Moe, Colin Fitzgerald, and Monika Kabza, all of MKO. Henning, Colin, and Monika are the authors and reviewers of Chapter 9: *'Hydrology and Hydrogeology'* of this EIAR Henning, Colin, and Monika also designed the proposed drainage plan for the Proposed Project that was submitted as part of the planning application.

Henning Moe is a trained hydrogeologist and registered professional geologist (P.Geo.). Firmly grounded in field-related aspects of geology and hydrogeology, Henning has more than 30 years of experience planning, implementing and managing a wide range of water resources projects involving groundwater exploration and management, environmental risk assessment and monitoring, and modelling. In Ireland, Henning has contributed to major water resources protection initiatives led by the Environmental Protection Agency (EPA) as part of Ireland's implementation of the Water Framework Directive (WFD). Henning has worked on a variety of environmental impact assessment reports for wind farms including a permitted 21-turbine wind farm development at Sheskin South, Co. Mayo, the permitted 22-turbine wind farm development at Glenora Forest in Co. Mayo.

Colin Fitzgerald is a Senior Environmental Geologist at MKO with over 12 years of experience in geological and environmental consulting. This experience can be categorised into the disciplines of contaminated land, hydrology, and mineral resources. Colin completed his undergraduate degree (B.Sc. Hons.) in geology from University College Cork and completed a P.G. (Dip.) in environmental engineering from Trinity College Dublin. He is also a Professional Geologist with the Institute of Geologists Ireland. Prior to his current position with MKO, Colin worked as a geologist in gold exploration, heavy minerals mining, and lead mining in Western Australia before joining AECOM in Dublin as an environmental geologist. Colin then joined CDM Smith as a senior geologist before MKO acquired CDM Smith Ireland in 2024. Colin has worked on small and large-scale projects on greenfield and brownfield development sites, providing project management, environmental assessment, and mitigation/remediation design. His key skills include data analysis, site investigation, risk assessment, report writing and communication. Colin has led and managed large project teams since the start of his career and aims to deliver the highest standard of work in a positive and effective project environment.

Monika Kabza is a Chartered Hydrogeologist (PGeo, EurGeol) with over 16 years of professional experience in groundwater resource assessment, environmental consultancy, and infrastructural development projects across Ireland. She holds an MSc (Hons) in Groundwater Engineering from the AGH University of Science and Technology in Krakow, Poland, and is a professional member of the Institute of Geologists of Ireland and the International Association of Hydrogeologists (Irish Group).

Monika has held key technical and leadership roles with organisations including the Geological Survey Ireland (GSI), Arup, Ryan Hanley, and Tobin Consulting Engineers. Her work spans complex site investigations, hydrogeological conceptual model development, groundwater monitoring network design, EIA/EIAR contributions, and stakeholder engagement. She has supported major national projects for clients such as Irish Water, the GSI, Dublin Airport Authority, the National Federation of Group Water Schemes, and Transport Infrastructure Ireland.

2. SURFACE WATER DRAINAGE DESIGN

The drainage design for the Proposed Project has been prepared by MKO. The drainage design has been prepared based on experience of the project team on other similar projects and the best practice guidance documents referred to in the References section of the EIAR.

The protection of the watercourses within and surrounding the Site, and downstream catchments that they feed is important to establish the most appropriate drainage proposals for the Proposed Project. The drainage design for the Proposed Project has been planned with the intention of having no significant negative impact on the water quality of the Site and its associated rivers, and consequently no impact on downstream catchments and ecological ecosystems. The assessment of potential impacts on hydrology and hydrogeology due to the construction, operation and decommissioning of the Proposed Project is included in Chapter 9: *'Hydrology and Hydrogeology'*.

No routes of any natural drainage features will be altered as part of the Proposed Project. Turbine locations and associated new roadways were designed to avoid natural watercourses with existing roads to be used wherever possible. There will be no direct discharges to any natural watercourses or land drains, 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 and drains. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Project.

2.1 Existing Drainage Features

The Proposed Project will require the crossing of 6 no. EPA mapped watercourses.

There will be no direct discharges to natural watercourses or drains. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from watercourses. These locations are provided in Appendix 4-2 of the EIAR and will be subject to approval by the project hydrologist in conjunction with the ECoW prior to the commencement of any construction or felling operations Buffer zones around the existing natural drainage features have informed the layout of the Proposed Project 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 post treatment, 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 Project 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.
- 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 Environmental 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.

Drainage water from any works areas of the Site 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 of the proposed Site drainage management is presented in Figure 2-1 below.

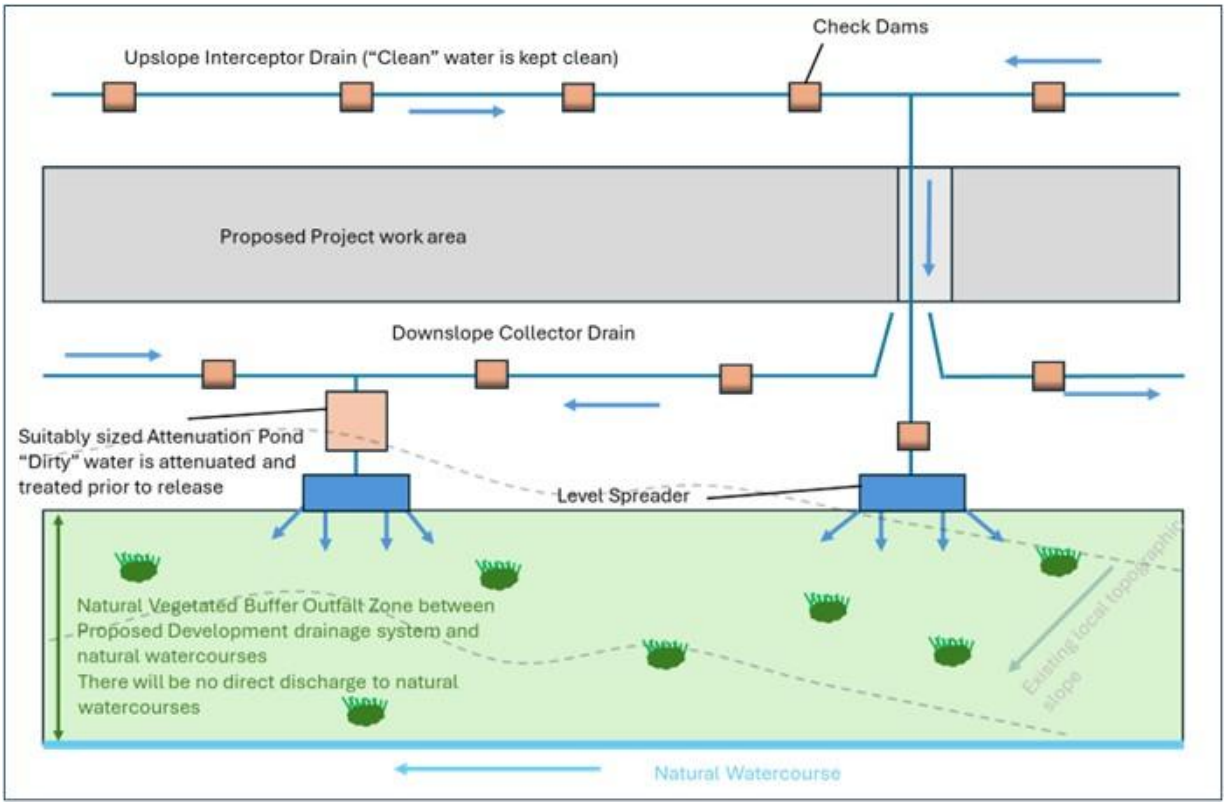


Figure 2-1 Proposed Project Drainage Process Flow

2.3 Drainage Design

A drainage design for the Proposed Project, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-2 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2011): Forests and Water UK Forestry Standard Guidelines, Fifth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte Forest (2013): Operations and Water Protection Guidelines;
- Standards for Felling & Reforestation (2019): Department of Agriculture Food and the Marine;
- Forest Service of the Department of Agriculture, Food & the Marine (2008): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Scottish Natural Heritage, 2019 Good Practice During Wind Farm Construction
- UK Guidance Note 2020 GPP1 - General Guide to Prevention of Pollution (UK Guidance Note);
- UK Guidance Note 2018 GPP5 – Works or Maintenance in or Near Watercourses
- Construction Industry Research and Information Association (CIRIA) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- Construction Industry Research and Information Association (CIRIA) 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

2.4 Drainage System

The early establishment of the drainage system 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, and the development of the Site will be phased accordingly.

The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other drainage features as each development phase progresses. They 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 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 and hard standing construction. Drains will be excavated, and settlement ponds constructed to eliminate any suspended solids within surface water running off the Site.

2.5 Surface Water Drainage Measures

2.5.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the Site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope 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, turbines 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 as 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.

The velocity of flow in the interceptor will be controlled by check dams (discussed further 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 (discussed 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 Project 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.

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 stone or straw bales where applicable (i.e. in cases where stone cannot be used). 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. Straw bales shall only be used where stone check dams cannot be utilised and shall require sign-off by the Project Hydrologist in conjunction with the Project Ecologist. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator.

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

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

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to 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 Spreaders

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 (discussed 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.

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 Project. on completion of the works, the pipes and rock aprons will be removed and all channels backfilled with the material that was originally excavated from them.

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

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 Proposed Project 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 2-2 shows an illustrative example of a stilling pond system.

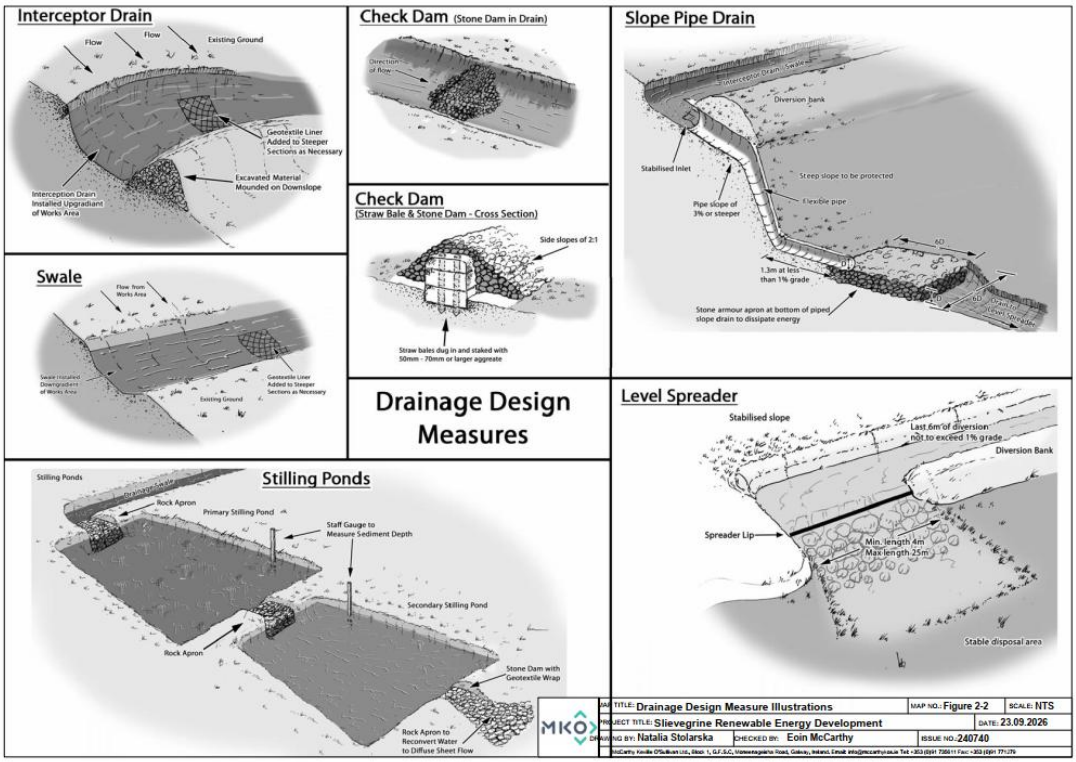
Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. The stilling ponds will be dimensioned so that the length to width ratio 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.

Figure 2-2 Drainage Design Measures



2.5.8 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, 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 silt into the stream.

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

Plate 2-1 Silt Bag with water being pumped through

Plate 2-2 Silt Bag under inspection

2.5.9 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.

2.5.10 Culverts

All new the new proposed culverts and proposed culvert upgrades at forestry drain crossings, the culverts will be suitably sized (approx. 900mm) for the expected peak flows in the relevant drain.

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

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water 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.

2.5.11 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, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the Proposed Project. 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 4-2.

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.

2.5.12 Oil Interceptor

An oil interceptor is a trap used to filter out oil and other 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 compounds) or where it is proposed to park vehicles during the construction and operational phases of the Proposed Project (i.e., construction compounds and substation compounds).

2.5.13 Tree Felling Drainage

Tree felling will be required within and around Proposed Project footprint to allow for the construction of the proposed turbines, access roads, underground cabling, and the other ancillary infrastructure. The felling will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing. A Harvest Management Plan is included as Appendix 4-5.

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. Also, prior to the commencement of tree felling for subsequent road construction the following key temporary drainage measures will be installed:

- All existing dry forestry drains that intercept the proposed works area will be temporarily blocked down-gradient of the works using forestry check dams/silt traps;

- Clean water diversion drains will be installed upgradient of the works areas;
- Check dams/silt fence arrangements (silt traps) will be placed in all existing forestry drains that have surface water flows and also along existing forestry roadside drains; and,
- A double silt fence perimeter will be placed down-slope of works areas that are located inside the watercourse 50m buffer zone.

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

- Attend the Site for the setup period when drainage protection works are being installed and be present onsite 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 3.4 (Monitoring and Recording) and Appendix 3 (Site Monitoring Form (Visual Inspections)) of the Forestry & Freshwater Pearl Mussel Requirements.
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
- Surface water samples shall be collected upstream and downstream of the keyhole felling 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.

To protect watercourses, the following measures will be adhered to during all keyhole/tree felling activities.

- All relevant measures, best practice methods and requirements set out in Chapter 9: *'Hydrology and Hydrogeology'* of the EIAR will be adhered to including Forestry & Water Quality Guidelines, Forest Harvesting & the Environment Guidelines and the Forest Protection Guidelines.
- The extent of all necessary tree felling will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected prior to any machinery being brought on Site to commence the felling operation. No tracking of vehicles through watercourses will

occur. Vehicles will only use existing road infrastructure and established watercourse crossings.

- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt traps will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed. No direct discharge of such drains to watercourses will occur from within felling areas.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- All silt traps will be sited outside of buffer zones and have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones.
- All new collector drains will taper out before entering the aquatic buffer zone to ensures the discharging water gently fans out over the buffer zone before entering the aquatic zone.
- Machine combinations, such as mechanical harvesters or chainsaw felling will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance.
- Mechanised operations will be suspended during and immediately after heavy rainfall.
- Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement.
- Brash which has not been pushed into the soil may be moved within the Site to facilitate the creation of mats in more demanding locations.
- Felling of trees will be pointed directionally away from watercourses.
- Felling will be planned to minimise the number of machine passes in any one area.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Check dams to be emplaced on the down gradient side of timber storage sites.
- 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 removing of natural debris deflectors will be avoided.

2.5.14 Cable Trench Drainage

Cable trenches are typically constructed in short, controlled 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 up-gradient side of the trench and is temporarily sealed/smoothed over, using the back of the excavator bucket. Should any rainfall cause runoff from the excavated material, the material is therefore collected and 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 Project, would be transported to one of the on-site designated spoil management areas or used for landscaping and reinstatement of other areas elsewhere on-site. Along sections of the Proposed Grid Connection underground cabling route that are further removed from the Proposed Wind Farm site it may be more practical to transport excess excavated material to a nearby licenced facility.

On steeper slopes, silt fences, as detailed in Section 2.5.11, 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. SURFACE WATER DRAINAGE MANAGEMENT

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

3.1 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, the establishment of new watercourse crossings, and upgrade of existing watercourse crossings within the Site, will have a minimal impact on watercourses.

3.2 Drainage Measure Implementation and Management

3.2.1 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 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, 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 stilling ponds prior to controlled diffuse release over vegetated surfaces. There will be no direct discharges to surface waters.

During the construction phase all runoff from works areas (i.e. dirty water) will be attenuated and treated to a high quality prior to being released.

A detailed drainage plan showing the layout of the proposed drainage design elements during construction and operation is shown in Appendix 4-2 of the EIAR.

3.2.1.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures detailed above, will be brought on-site in phases as they are required during the construction phase. The drainage measures detailed in Section 2.5 above will be installed prior to, or at the same time as the works they are intended to drain.

3.2.1.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the Proposed Project will also take account of weather forecasts, and predicted rainfall. Large excavations, large movements of overburden or large-scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

3.2.1.3 Reactive Site Drainage Management

The final drainage design prepared for the Proposed Project prior to commencement of construction will provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the Environmental Clerk of Works (ECoW) or supervising hydrologist on-site. The ECoW or supervising 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 in so far as is possible. 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, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground as a particular time.

In the event that works are giving rise to siltation of watercourses, the ECoW or supervising 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 such as those outlined above will be installed in advance of works recommencing.

3.2.2 Drainage Maintenance

An inspection and maintenance plan for the drainage system on-site will be prepared in advance of commencement of any works on the Proposed Project. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the ECoW or the Project Hydrologist. The drainage inspection and maintenance plan are included in the CEMP in Appendix 4-3 of this EIAR.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the Proposed Project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the Proposed Project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified by reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

Silt traps will be inspected weekly during the construction phase of the Proposed Project and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the Proposed Project. 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.

3.2.3 Construction Phase Drainage

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Project are detailed in Section 2.2 above with the proposed drainage infrastructure within the Proposed Project being detailed in Section 2.4 and 2.5 above. A preliminary drainage design for the Proposed Project, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in the drainage drawings included in Appendix 4-2 of the EIAR.

The Project Hydrologist will complete a detailed drainage design and maintenance plan before construction commences and will attend the Site to set out and assist with micro-siting of proposed drainage controls as outlined in Section 4.6 in Chapter 4: *'Description of the Proposed Project'* of the EIAR. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction.

Proposed Mitigation Measures for watercourse crossings detailed in Section 9.4.3.3 of Chapter 9: *'Hydrology and Hydrogeology'* of the EIAR are as follows:

- All stream crossings will be bottomless-box culverts or clear-span crossings. Existing banks will remain undisturbed. Abutments will be constructed from precast units combined with in-situ foundations.
- All guidance / mitigation measures required by the OPW and/or the Inland Fisheries Ireland (IFI) is incorporated into the design of the proposed crossings;
- All drainage measures will be installed in advance of the works;
- Plant and equipment will not be permitted to track across the watercourse;
- Once the foundations have been completed at both sides of the watercourse, the pre-cast concrete box culvert will be installed using a crane and there will be no contact with the watercourse;
- Where a box culvert is installed in sections, the joint will be sealed to prevent granular material entering the watercourse;
- During near-stream construction works, double-row silt fences will be emplaced immediately downgradient of work areas for the duration of activity.
- In accordance with IFI (2016), any near-stream works will be undertaken from July to September inclusive, i.e., the relatively drier summer period. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses. Any deviation that may be temporarily necessary will be done in discussion with the IFI.
- All new stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

It should be noted that a network of drains already exists at the Proposed Project, and these will be integrated and enhanced as required and used within the Proposed Project drainage system. The integration of the existing drainage network and the Proposed Project network is relatively simple.

The 50m setback distance proposed from a majority of sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operated effectively. The proposed buffer zone will:

- Avoid direct physical damage to watercourses;
- Avoid excavations within close proximity to surface water courses;

- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase 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.

All of the Proposed Project works will be supervised by the ECoW supported by the Project Hydrologist.

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

The Appointed Contractor, with input from the Project Hydrologist, will complete a site drainage and maintenance plan before construction commences and will attend the Site to set out and assist with micro-siting of proposed drainage controls as outlined in Chapter 4*: 'Description of the Proposed Project'*, Section 4.6 of the EIAR. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction.

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 roles are outlined within Section 4.1 of the CEMP (Appendix 4-3 to Chapter 4 of the EIAR).

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

3.2.4 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 works.

In the operational phase of the Proposed Project, 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.

3.2.5 Decommissioning Phase Drainage

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 of the EIAR) and fully agreed with the local authority prior to any decommissioning works.

3.3 Activity Specific Drainage Control and Mitigation Measures

3.3.1 Refuelling, Fuel, Spills, Leaks and Hazardous Materials Storage

Wherever possible, vehicles will be refuelled off-site, particularly for regular road-going vehicles. On-site refuelling of machinery will be carried out at designated refuelling areas at various locations throughout the Site 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 in the construction compound 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.

The following mitigation measures are proposed to avoid release of hydrocarbons at the Site:

- The highest standards of site management will be maintained, with the utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the Site and surrounding environment during construction;
- An Emergency Response Plan for accidental spillages will be implemented as part of the CEMP. All construction staff will be familiar with the emergency procedures and the use of the relevant equipment;
- The ECoW will oversee the pollution prevention measures agreed for the Site to ensure that they are operating safely and effectively as well as having responsibility for the implementation of Emergency Procedures for spill control measures.
- Where possible, refuelling will occur at an off-site controlled fuelling station.
- On-site refuelling will be undertaken using an offsite fuel truck, with spill kits readily available for accidental leakages or spillages;
- Refuelling will be undertaken by designated, suitably trained personnel only;
- Refuelling of construction machinery will take place using drip trays at all times;
- All plant and machinery will be serviced before being mobilised to site and will be regularly inspected and maintained to minimise the risk of leaks and spillages;
- Maintenance of construction vehicles or plant will, where practicable, be undertaken off site;
- Spill response kits will be available at all active work areas, refuelling locations, concrete works and construction compounds, and personnel will be trained in their use;
- Fuels stored on-site will be minimised. Storage areas, where required, will be bunded appropriately for 110% of the fuel storage volume for the time period of construction and fitted with a storm drainage system and an appropriate oil interceptor;
- All waste tar material arising from the excavation of the 110kV underground cabling trench and resurfacing of roads will be removed off-site and taken to a licenced waste facility;
- An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (which is contained in Appendix 4-3).
- Hydrocarbon interceptors will be installed at the substations and construction compounds.

3.3.2 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching.

Before leaving the Site, washing of the delivery truck will be minimised and restricted to designated wash out areas. Wash out will be restricted to the concrete lorry's chute only. Concrete trucks will be washed out fully at the off-site batching plant, where facilities are already in place.

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or equivalent. This type of water treatment unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids will be removed off-site by an appropriately authorised waste collector for disposal at an authorised waste facility. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plates 3-1 and Plate 3-2 below.

Plate 3-1 Concrete washout area

Plate 3-2 Concrete Wash Out Area

The areas are covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents will be tankered off-site to an appropriately authorised facility as necessary. Any residual solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste, as noted above, by an appropriately authorised waste collector for disposal at an authorised waste facility.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete truck bodies will not be washed out on the Site but will be directed back to their batching plant for washout.
- Site roads will initially be constructed with a subgrade and compacted with the use of a roller to allow concrete delivery trucks access all areas where the concrete will be needed. The final wearing course for the Site roads will not be provided until all bases have been poured. No concrete will be transported around the Site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine foundations will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the Site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted at the Site.

3.3.2.1 Concrete Pouring

Due to the volume of concrete required for each turbine foundation, and the requirement for the concrete pours to be continuous, deliveries may be carried out outside normal working hours to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are normally completed in a single day per turbine. The main concrete pours for turbine foundations will be planned approximately one week in advance.

Specific procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These will include:

- Using weather forecasting to assist in planning large concrete pours and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses (including drains and ditches) while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available, and used, when necessary, for freshly placed concrete to avoid the surface washing away in heavy rain.
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or equivalent.

3.3.3 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. It is not anticipated that vehicle or wheel washing facilities will be required as part of the construction phase of the Proposed Project as site roads will be formed before road-going

trucks begin to make regular or frequent deliveries to the Site (e.g. with steel or concrete). The Proposed Project roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

A road sweeper will be available if any section of the public roads requires cleaning due to construction traffic associated with the Proposed Project.

3.3.4 Spoil Management Strategy and Placement of Spoil

It is proposed to manage overburden generated through construction activities for the Proposed Project locally within the Site through the backfilling of the proposed borrow pit voids as well as landscaping within the Site. Linear berms will be placed along access roads where appropriate. It should be noted that there will be no stockpiling of excavated material within the stockpile exclusion area as depicted in Figure 3-1 below.

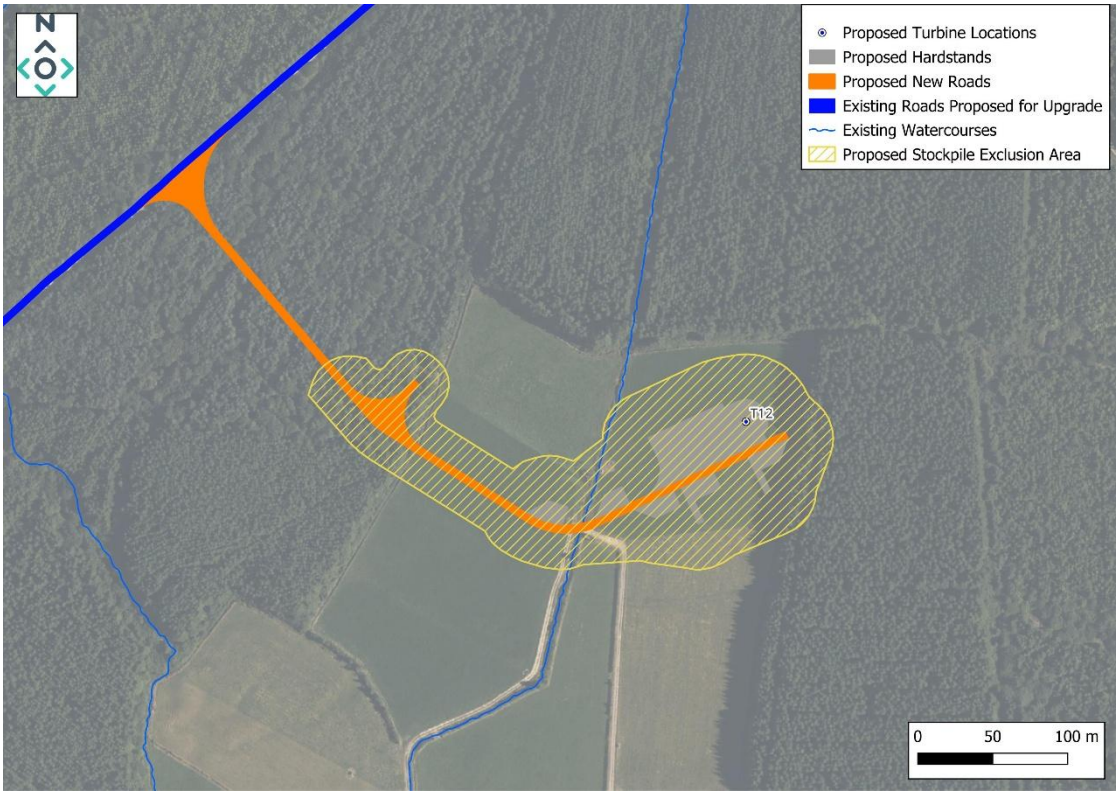


Figure 3-1: Stockpile Exclusion Area

The total estimated volume of spoil to be managed following excavations during the construction phase of the Proposed Project is approximately 425,882m3 (468,470m3 including a 10% contingency). Most material arising from the construction of the Proposed 110kV Underground Cabling Route will be temporarily stockpiled on Site and stored within the borrow pits within the Proposed Wind Farm site, with the rest to be used in landscaping around the Site. The total capacity of the Borrow Pit void is at a minimum 396,000m3. The remaining 72,470 m^3 of spoil, based on the contingency-inclusive estimate, will be accommodated through the proposed landscaping measures, including linear berms. Accordingly, sufficient capacity is available to manage the total volume of spoil arising from both the Proposed Wind Farm and the Proposed Grid Connection within the Site.

3.3.5 Borrow Pit Drainage

Pumping of water from excavations will be necessary, so localised and temporary groundwater lowering cannot be avoided if or where it is implemented. Quantities will be small given the generally low-

permeability characteristics of both the till and the bedrock groundwater flow system. Additionally, excavations will remain relatively shallow and most turbine bases and proposed borrow pits are located in elevated areas near hilltops. Pumping and water management is a matter of routine for contractors familiar with this type of development and activity. No direct discharges to steams will be permitted, and this will be enforced by the ECOW. All pumped water must be led and pass through a suitably sized settling basin prior to diffuse discharge to ground or a drain away from the excavation location.

The pumped water, which contains suspended solids, will be collected in sumps, pumped out, and led to associated settling basins or ponds which will be established in the first stage of construction. The purpose is to facilitate the settling out of fine sediments prior to subsequent discharge. The water will be pumped and discharged periodically, on as-needed basis. It is not a continuous process, and quantities pumped will vary from location to location, and seasons. Best practice methods will be applied to prevent accidental pollution of the water in open excavations, as described in Section 9.4.3.8 of Chapter 9: *'Hydrology & Hydrogeology'*. If or where required, additional specialist water treatment measures will be employed to ensure that no deterioration in downstream water quality occurs.

Other relevant measures are:

- Interceptor drains will be established around the perimeter of borrow pits. These drains will divert any surface water away from the borrow pits and hence prevent water from ponding and lodging during construction (and also when reinstated).
- Settling basins have been designed at the lower side/outfall location of the borrow pits.

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 Project.

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 SOWOR is provided as Appendix A to this SWMP.

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. 477 of 2011: European Communities (Birds and Natural Habitats) Regulations 2011, 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. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended) 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;
    - Irelands WFD commitments are further aided by the River Basin Management Plan 2022-2027 and the Water Action Plan 2024[1]. In Ireland, the WFD requires the preparation of River Basin Management Plans (RBMPs), which set out the environmental objectives and programme of measures required to protect and restore water bodies during each six-year planning cycle.
    - The Water Action Plan 2024: Ireland's River Basin Management Plan 2022–2027 is Ireland's third RBMP and represents the State's current plan for implementing the objectives of the WFD. It identifies the principal pressures affecting Ireland's waters and establishes the actions and measures to be

[1] *Water Action Plan 2024, DHLGH (2024). Available at: https://assets.gov.ie/static/documents/water-action-plan-2024.pdf*

undertaken to protect water bodies, prevent deterioration and support the achievement of the environmental objectives established under the WFD.

- S.I. No. 51 of 2025: European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2025, resulting from EU Directive 2006/118/EC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 99 of 2023: European Union (Drinking Water) Regulations 2023, as amended by S.I. No. 673 of 2025: European Union (Drinking Water) (Amendment) Regulations 2025, which give effect to the requirements of Directive (EU) 2020/2184 on the quality of water intended for human consumption (recast).
- S.I. No. 355 of 2018: European Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2018.

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 Pre-Construction Baseline Monitoring

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

Analysis will be for a range of parameters with relevant regulatory limits along with Environmental Quality Standards (EQSs) and sampling will be undertaken at designated locations as outlined in Figure 4-1 below.

Baseline sampling will be completed on at least two occasions, and these should ideally 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.

A network of existing drains already exist, and these will be integrated and enhanced as required and used within the Proposed Project drainage system. These existing drains will continue to function as it is during the pre-construction phase.

However, prior to commencement of works in sub-catchments across the Site, drain inspections will be competed 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.

4.2 Construction Phase Monitoring

4.2.1 Daily Visual Inspections

An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works. Daily visual inspections of drains and outfalls will also be performed during the construction period to ensure suspended solids are not entering streams and rivers on site, to identify any obstructions to channels and to allow appropriate maintenance of the drainage regime. Should the suspended solids levels measured during construction be higher than the existing levels, the source will be identified, and additional mitigation measures implemented. Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse along the Proposed Grid Connection Site underground cable route and specifically following heavy rainfall events (i.e. weekly, monthly and event based).

Inspection sheets and photographic records will be kept on site. Inspection points will include the in-situ field monitoring point locations and the laboratory analysis sampling points. 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 Project Hydrologist who will monitor and advise on the records being received.

Daily Visual Inspection locations are shown in Figure 4-1 and 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 drainage infrastructure 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 and maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter will be noted and corrective action will be implemented. High risk locations such as settlement ponds will be inspected daily. Daily inspections checks will be completed on plant and equipment, and whether materials such as straw bales or oil absorbent materials need replacement;
- Event based inspections by the 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 during construction phase;
- Quarterly site inspections by the Project Hydrologist/ ECoW after construction for a period of one year following the construction phase; and,
- A written record will be maintained or available on-site within the CEMP which will be maintained on-site during the construction phase.

4.2.2 Continuous Turbidity Monitoring

Turbidity monitors or sondes can be installed where required at locations surrounding the Site. The sondes will provide continuous readings for turbidity levels in the watercourse. This equipment will be supplemented by daily visual monitoring at their locations as outlined in the sections below.

The proposed locations for continuous, in-situ monitoring will be confirmed by the Project Hydrologist prior to the commencement of the construction phase.

4.2.3 Monthly Laboratory Analysis

Baseline laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken as per water monitoring programme for the Proposed Project. This will not be restricted to

just these locations around the Site with further sampling points added as deemed necessary by the ECoW in consultation with the Project Hydrologist and Site Manager.

4.2.4 Field Monitoring

Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) will be taken at the surface water monitoring locations, as per water monitoring programme for the Proposed Project. These analyses will be carried out by either the ECoW or the Project Hydrologist. 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.

4.2.5 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 Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2018. The likely 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; and
- Dissolved Organic Carbon.

4.3 Construction Phase Drainage Inspections and Maintenance

The developer will appoint a Project Contractor who will be responsible for the construction of the Proposed Project in accordance with this SWMP which will be updated by the contractor as required during the construction phase of the Proposed Project. Drainage performance will form part of the civil works contract requirements. During the construction phase, the Project Contractor will be responsible for the effectiveness of drainage measures. This responsibility extends to drainage maintenance, to ensure that the installed drainage measures continue to perform as intended by the detailed drainage design. Silt fences, check dams, level spreaders and other drainage measures likely to form part of the detailed drainage design, require regular maintenance to ensure they continue to function effectively, and the Project Contractor is entirely responsible for this maintenance.

Regular inspections of all existing and installed drainage measures should be undertaken by the Project Contractor, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water within the system. The contractor will devise a system of recording the findings of these inspections. 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. For this reason, the drainage measures installed on-site should be inspected at least weekly by the contractor and maintained as required during the construction phase of the Proposed Project to ensure good performance.

The ECoW will monitor the effectiveness of the on-site drainage during changing weather, ground or drainage conditions encountered on site, through their regular visual inspections of on-site watercourses and water monitoring programme. Where it appears that additional drainage measures will be required to ensure the drainage system remains effective, the ECoW will notify the contractor, the developer and project design team including the Project Hydrologist. The ECoW's role in this regard does not replace the need for the weekly (at least) inspections of the drainage system's measures by the Project Contractor.

4.3.1 Surface Water Monitoring Reporting

Visual inspection and 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 the Planning Authority in advance.

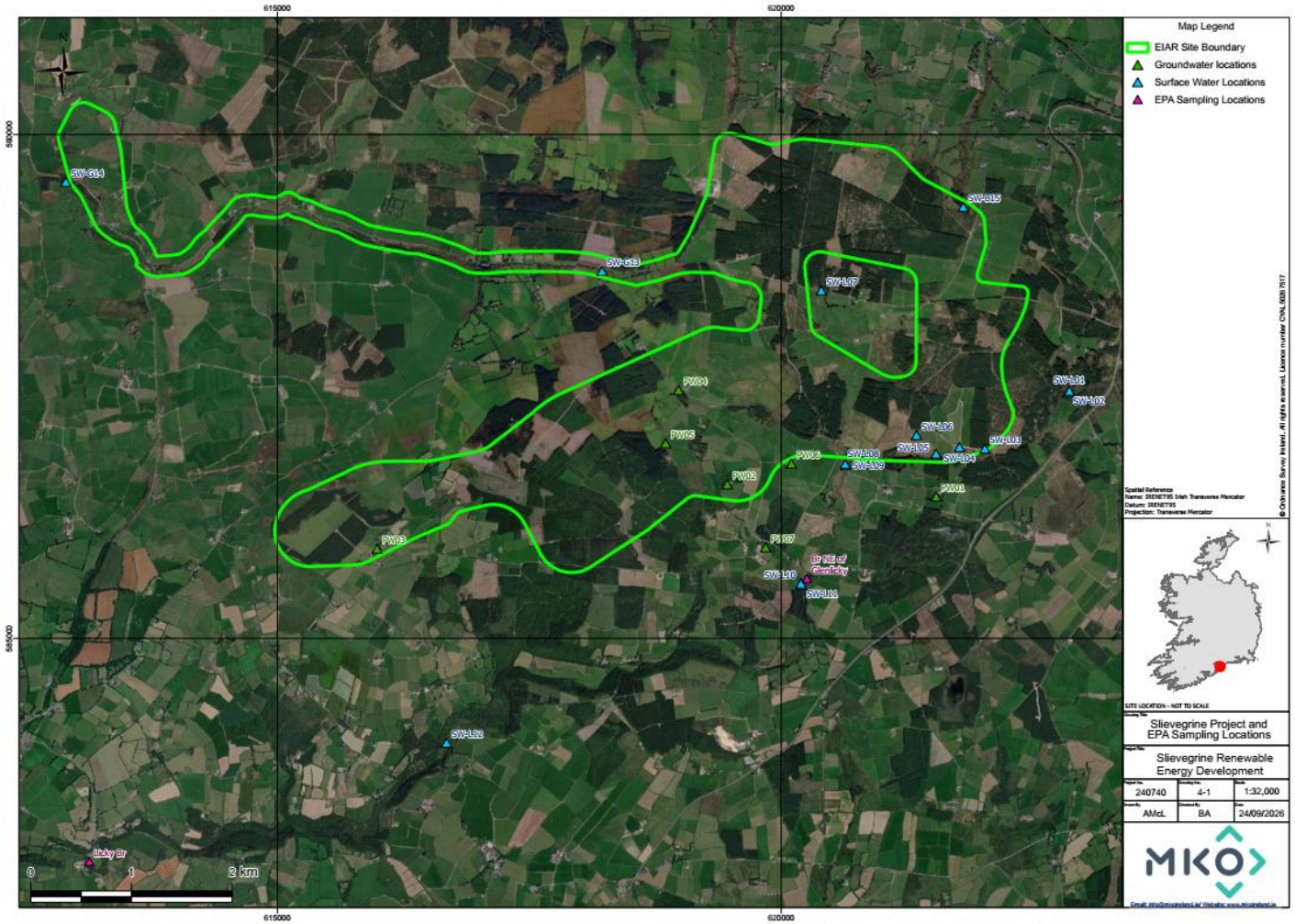
4.3.2 Post Construction Monitoring

4.3.2.1 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.

Surface water sampling and visual inspection locations are presented in Figure 4-1 below.

Figure 4-1 Surface Water Sampling and Visual Inspection Locations



5. COMPLIANCE AND REVIEW

5.1 Site Inspections and Auditing

Routine inspections of construction activities will be carried out on a daily and weekly basis by the ECoW and the Site Supervisor/Construction Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place. 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 Project.

References

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PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note) (2018);

Scottish Natural Heritage, 2010: Good Practice During Wind Farm Construction;

Wind Energy Development Guidelines for Planning Authorities, 2006 (the DoEHLG 2006 Guidelines) and the Draft Revised Wind Energy Development Guidelines (Draft DoHLGH 2019 Guidelines);

APPENDIX A

SCHEDULE OF WORKS OPERATING RECORD (SOWOR)

APPENDIX B

DAILY VISUAL CHECK SHEET TEMPLATE