FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

Appendix 12.2

Surface Water Management Plan

FEHILY TIMONEY

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A SUSTAINABLE FUTURE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED SHANCLOON WIND FARM, CO. GALWAY

SURFACE WATER MANAGEMENT PLAN

Prepared for:

RWE Renewables Ireland Ltd.

RWE

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1. INTRODUCTION

This Surface Water Management Plan (SWMP) should be read in conjunction with the EIAR and relevant drainage design Planning Drawings Series 0100 and Series 500. The surface water drainage will be in accordance with The CIRIA SuDS Manual (c753) for sustainable drainage design.

1.1 Existing Environment

The waterbodies associated with the Proposed Development are presented in Table 1-1 to Table 1-3.

Table 1-1: WFD delineated waterbodies along the TDR and intersecting the Site

Proposed Development Element	Catchment	Sub-catchment	Sub-Basin
Site (including turbine array, 110kV on-site substation and loop-in)	Corrib catchment (Hydrometric Area 30)	Black[Shrule]_SC_010	BLACK (SHRULE)_010
Turbine Delivery Route	Corrib catchment (Hydrometric Area 30)	Clare[Galway]_SC_020	CLARE (GALWAY)_040 CLARE (GALWAY)_030
		Clare[Galway]_SC_030	CLARE (GALWAY)_040 NANNY (TUAM)_030 CLARE (GALWAY)_030
		Clare[Galway]_SC_040	CLARE (GALWAY)_060
		Clare[Galway]_SC_050	ABBERT_040 CLARE (GALWAY)_070
		Clare[Galway]_SC_070	CLARE (GALWAY)_100 CLARE (GALWAY)_090 CLARE (GALWAY)_080 CLARE (GALWAY)_070

Further details on the existing environment are included in Chapter 12 - Hydrology and Water Quality of the EIAR.

2. DRAINAGE OF PROPOSED WIND FARM

2.1 Drainage Design Principles

The wind farm infrastructure layout is considered the best possible design, in terms of minimising the impact to the hydrogeological environment through mitigation by avoidance and by design.

The proposed surface water drainage system utilises sustainable drainage devices and methods, incorporating the main components of Sustainable Drainage Systems (SuDS). A fundamental principle of the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing drains, is allowed to bypass the works areas without being contaminated by silt from the works. This will be achieved by intercepting the clean water and conveying it to the downstream side of the works areas either by piping it or diverting it by means of new drains.

The drainage system has been designed so that surface runoff remains in the same surface catchment area as under pre-construction conditions.

The proposed layout of the drainage system is provided in Planning Drawings Series 0100. The drainage strategy within internal areas of the Site will incorporate five main components of Sustainable Drainage Systems (SuDS):

- Interceptor Drains
- Cross Drains
- Diffuser in gravel and stones
- Swales
- Settlement Ponds

The layout will also incorporate river bridges and culverts.

Where required, on the upslope side of new sections of access track and hardstanding areas, overland flows will be intercepted in new drainage channels (interceptor drains). The flow will then be discharged diffusely over vegetated areas or diverted to a nearby drain/stream within the existing catchment. The roadside drains (swales) will therefore only carry the site access track runoff. This will ensure that there will be no mixing of ‘clean’ and ‘dirty’ water as shown on Image 2-1. Thus, erosion risks will be reduced and the quantity of water requiring treatment will be minimised.

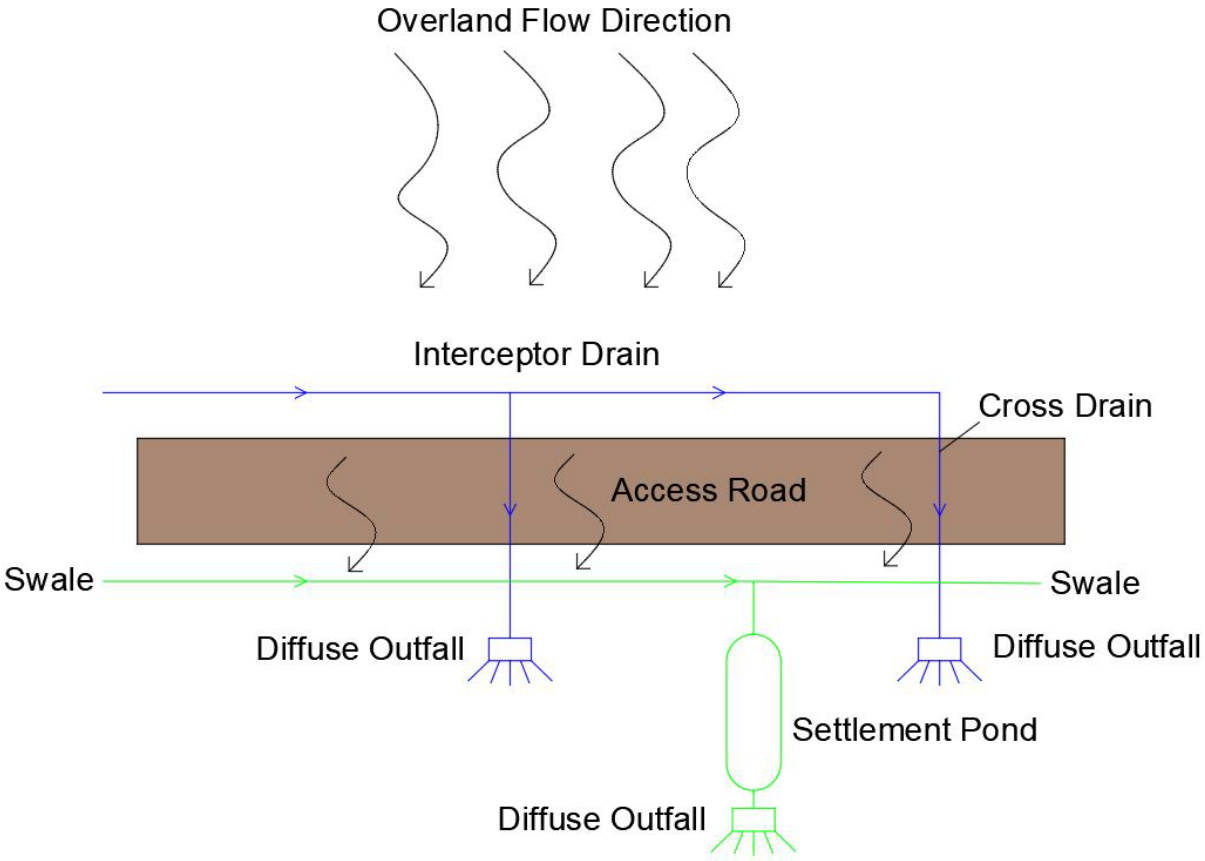

Image 2-1: Drainage Design Principles

The drainage system outlined below provides for a multi-stage treatment train of the discharges from the development, as recommended in the SUDS manual:

- grassed swales removing some of the sediment borne contaminants,
- settlement ponds providing retention and treatment of discharges,
- diffuse outflow from settlement ponds providing for further retention and settlement of suspended solids by reducing the velocities of flows and increasing the flow path of discharges,
- continuation of flows by natural flow paths over vegetated areas before entering the watercourse, providing further retention and treatment of discharges.

Interceptor Drains

Interceptor drains will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. These drainage ditches will be installed on the upgradient boundary of the areas affected by the site infrastructure earthworks operations and installed ahead of the main earthworks construction operations commencing.

They will generally follow the natural topography of the ground. The interceptor drains will intercept any surface runoff and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. Collected runoff will be transferred through the construction areas via cross drains.

It will then be directed to areas where it can be redistributed over the ground. The overland flow will then discharge diffusely on the downslope side over vegetated areas within the site boundary.

Cross Drains

Cross drains will be implemented prior to the initiation of primary earthworks activities to mitigate the impact of accumulated water on exposed soils resulting from earthworks commencement. These drainage channels will be positioned at the elevated boundaries of regions influenced by the earthworks operations associated with site infrastructure, and they will be installed in advance of the primary earthworks construction activities.

These channels will typically conform to the natural topographical contours. The cross drains will intercept surface runoff and direct it towards pre-existing low points in the terrain, enabling the unadulterated flow of uncontaminated water through the project area without mingling with construction-related drainage.

The cross drains should be installed in such a way that the invert levels are slightly lower than the corresponding levels on the inlet and outlet sides, to allow a natural bed to form. Cross drains should not be installed with a "hanging" outlet (i.e. significantly higher than the corresponding ground level), as this will cause erosion of the ground through the forced action of the water flows, and would not provide a suitable path for small mammals to use in periods of drier conditions.

30 No Cross Drains are proposed in within the Proposed Development, as listed in Table 2-1 and shown on the 100 Series Panning Drawings.

Table 2-1: Cross Drains Location - ITM Coordinates - Planning Drawing 100 Series

	Cross Drains Location	
Cross Drain ID	X ITM	Y ITM
Cross Drain Interceptor 01	531503.5987	754416.3813
Cross Drain Interceptor 02	531467.3431	754408.4195
Cross Drain Interceptor 03	531546.6933	754348.7552
Cross Drain Interceptor 04	531685.3968	754234.056
Cross Drain Interceptor 05	531918.0498	754029.9348
Cross Drain Interceptor 06	532024.5610	754008.1928
Cross Drain Interceptor 07	531975.3519	753966.779
Cross Drain Interceptor 08	532134.9244	753814.4038
Cross Drain Interceptor 09	532211.0046	753637.3651
Cross Drain Interceptor 10	532405.3355	753652.9041
Cross Drain Interceptor 11	532462.6027	753641.1184
Cross Drain Interceptor 12	532561.9534	753612.7839

	Cross Drains Location	
Cross Drain ID	**X ITM**	**Y ITM**
Cross Drain Interceptor 13	532873.2406	753846.5087
Cross Drain Interceptor 14	533023.4607	754132.1273
Cross Drain Interceptor 15	533047.9168	754230.8014
Cross Drain Interceptor 16	533294.2620	754411.1790
Cross Drain Interceptor 17	533412.2294	754553.1716
Cross Drain Interceptor 18	533406.7098	754561.402
Cross Drain Interceptor 19	533478.7845	755168.4979
Cross Drain Interceptor 20	533467.1486	755176.3896
Cross Drain Interceptor 21	533445.2882	755352.5262
Cross Drain Interceptor 22	533440.1355	755395.9661
Cross Drain Interceptor 23	533551.3474	755081.5069
Cross Drain Interceptor 24	533936.5011	754832.3163
Cross Drain Interceptor 25	533996.6022	754844.2986
Cross Drain Interceptor 26	534009.027	754872.2186
Cross Drain Interceptor 27	534034.4121	754872.5287
Cross Drain Interceptor 28	534810.4542	755049.8919
Cross Drain Interceptor 29	535166.1592	755053.2549
Cross Drain Interceptor 30	535653.1440	755651.9605

Diffuser in Gravel and Stones

A gravel and stone-lined diffuser, also known as a gravel or stone-lined diffuser, is a hydraulic structure commonly utilized in interceptor drains. Its primary purpose is to effectively manage water flow and prevent erosion in areas with loose or erodible soils, such as gravel beds or riverbanks.

The structure consists of a layer of gravel of minimum 40mm Diameter or stones that disperses the flowing water's energy, safeguarding the surrounding environment from erosion impacts (see planning drawing P20-306-0501-0008). By distributing water across a larger area, slowing down its velocity, and facilitating water infiltration, the diffuser ensures energy dissipation and sediment trapping. This eco-friendly solution supports ecological coexistence and sustainable water management practices. Regular maintenance is essential to sustain its effectiveness in controlling water flow and preventing soil erosion.

Swales

The surface water drainage is designed to capture surface water run-off from the roads and other hardstanding areas in swales and discharge into settlement ponds specifically constructed for managing surface water runoff generated from the proposed wind farm infrastructure and earthworks. After passing through the settlement pond, surface run-off will be permitted to spread across the adjacent lands.

This treated water will ultimately percolate to groundwater or travel over ground and be assimilated into the existing drainage network. There will be no direct discharges from the proposed wind farm to any existing natural watercourse.

The internal access tracks will be constructed using unbound aggregate materials such that they will permit some degree of infiltration and reduce the volume of runoff generated.

Swales along access tracks will be installed in parallel with the main construction phase. Swales will provide additional storage of storm water where located along gradient. Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity and provide settlement opportunity. Check dams will be constructed from course gravel/ crushed rock.

The swales will be 0.3 m in depth with a bottom width of 0.5 m and side slopes of 1 in 3. A grassed swale is shown on Image 2-2.

The swales will be constructed in accordance with CIRIA C698 Site Handbook for the Construction of SUDS.

Image 2-2: Grassed swale along access track

Check Dams

At slopes greater than 2%, check dams will be required in the swales and interceptor drains to slow down the velocities of flows and prevent erosion occurring, as shown in Image 2-3. These check dams will be in coarse gravel of minimum size 40 mm and will be laid at a spacing of between 10 and 30 m dependent on the slope.

All check dams, etc will be checked at least once weekly via a walkover survey during the full period of construction. All excess silts will be removed and placed in embankments. Where check dams have become fully blocked with silt, they will be replaced and the removed material treated as construction waste.

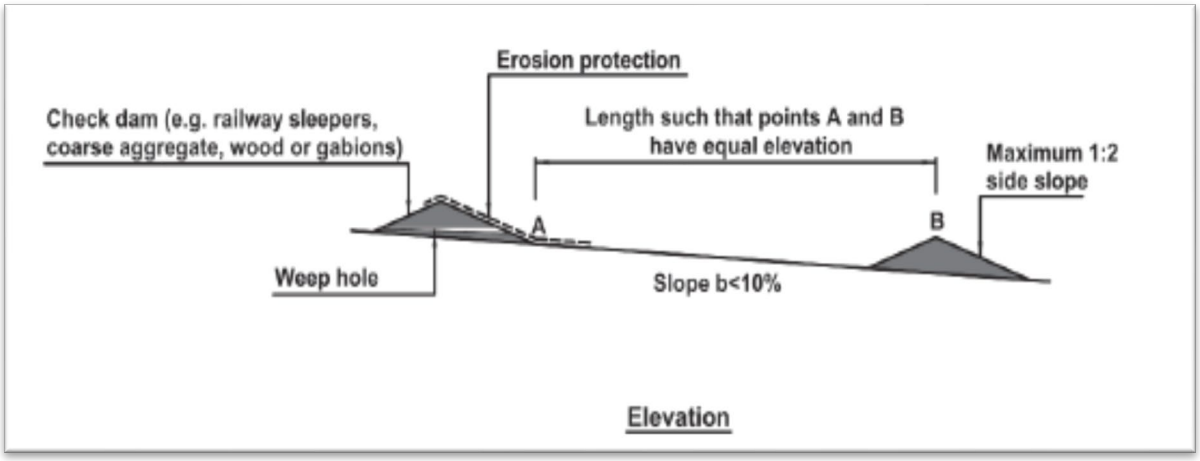

Image 2-3: Check Dam Detail

Temporary Settlement Ponds during Construction Phase

Temporary settlement ponds will be put in place as construction progresses across the Site (see P20-306-0501-0006 for Typical Details). Settlement ponds will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Temporary settlement will be provided to manage sediment runoff during the construction phase of a project. They are intended to be used temporarily, only for the duration of construction activities. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds.

The locations of temporary settlement ponds will be adjacent to earthworks. In the event of contaminated runoff being contained in a settlement pond, the incident will be reported in accordance with the CEMP (refer to Volume III of the EIAR), samples taken of the contaminated liquid for classification, as required, and the liquid pumped out of the pond using a suitable vacuum truck and disposed of at a licensed waste facility off-site.

The contractor, during the construction phase, will be responsible to provide the temporary settlement ponds, including the design, maintenance and operation. After the completion of the construction phase the contractor will be responsible for the decommission and the reinstatement of these settlement ponds.

Temporary Settlement Ponds for Compound Areas

Temporary settlement ponds will be put in place downstream of the location of the temporary site construction compounds to ensure water retention and settling of the particles (see P20-306-0501-0006 for Typical Details). To improve the water quality control the flow from the Compound areas will be treated with Full Retention Petrol Interceptor before reaching the Settlement ponds.

The settlement ponds will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds.

The locations of temporary settlement ponds (as shown in Table 2-2) will be adjacent to earthworks, as close as possible to the source of sediment while maintaining a minimum 10m buffer distance from existing watercourses. The settlement pond will also provide containment capacity in the event of a spill or leak within the drained area and the outflow can be closed off by a penstock device or similar to contain any potential pollutants within the settlement ponds. In the event of contaminated runoff being contained in a settlement pond, the incident will be reported in accordance with the CEMP (refer to Volume III of the EIAR), samples taken of the contaminated liquid for classification, as required, and the liquid pumped out of the pond using a suitable vacuum truck and disposed of at a licensed waste facility off-site.

Permanent Settlement Ponds during Operational Phase

45 no. permanent settlement ponds will be put in place across the Site (refer to 100 Series Planning Drawings for layout and P20-306-0501-0006 for typical Details). Settlement ponds will have a diffuse stone filled outflow which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Drainage stone will be placed at the inlet to the ponds to filter the flows before they enter the ponds.

After passing through the settlement ponds, the concentration of suspended solids in the surface water run-off due to the excavations will be reduced.

The following shall apply to construction of settlement ponds at the Site:

- Pond depths generally to be excavated to less than 1.5m;
- Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and
- Material excavated from the settlement pond should be compacted around the edge of the pond.

The settlement pond design is based on primary settling out of suspended solids from aqueous suspension. The calculation and sizing of the settling ponds will be in accordance with Stoke's Law. The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield run-off rates.

Settlement ponds will be installed concurrently with the formation of the road and will be fenced off for safety. Machine access will be required at settlement ponds to remove accumulated sediment.

Further sediment pond control measures include:

- Settlement pond maintenance and/or cleaning will not take place during periods of extended heavy rain, this will be carried out under low or zero flow conditions so as not to contaminate the clean effluent from the pond. The water level would first be lowered to a minimum level by pumping through a settlement tank without disturbing the settled sediment. Then excavator can remove sediment;
- Settlement ponds will be monitored closely over the construction timeframe to ensure that they are operating effectively.

In the event of an emergency, the settlement ponds will provide a temporary holding area for any accidental spills on site as it will be possible to block off the outflow from these ponds for a limited period. Erosion control and retention facilities, including settlement ponds will be regularly maintained during the construction phase.

The drainage system will remain operational and will be utilised for the decommissioning phase to treat any surface water from exposed areas as a result of decommissioning at the site. During the decommissioning of the turbine base, hardstanding areas and access tracks shall remain in place and be covered with local soil/topsoil to minimise disturbance to soils.

Swale draining to settlement pond is shown on Image 2-4.

The proposed schedule of settlement ponds is provided in Table 2-3.

Image 2-4: Swale draining to Settlement Pond

Table 2-2: Permanent Settlement Ponds

Pond ID	ITM Easting (X)	ITM Northing (Y)
SP01	531363.5501	754503.0154
SP02	531460.6113	754327.8787
SP03	531655.5394	754128.1322
SP04	531540.3116	753786.3519
SP05	531543.4141	753613.3655
SP06	531901.7588	754050.7833
SP07	532032.4163	753968.5963
SP08	532160.5582	754061.6375
SP09	532137.0738	753819.2488
SP10	532136.6676	753809.8356
SP11	532207.0239	753657.8349
SP12	532244.0451	753623.2047
SP13	532087.1206	753542.0723
SP14	532054.4391	753507.9570
SP15	532304.0609	753638.8254
SP16	533078.6453	754279.4069
SP17	533101.0150	754338.9805
SP18	533255.6049	754404.5520
SP19	533313.5005	754452.3948
SP20	533550.1431	754788.6833
SP21	533520.7081	754836.0209
SP22	533514.4141	754989.2841
SP23	533478.5507	755177.8650
SP24	533406.0939	755427.7490
SP25	533340.9357	755622.7891
SP26	533101.5701	755861.4735
SP27	533868.1482	754990.0121
SP28	533880.4469	754945.3136
SP29	533927.7620	754829.7075
SP30	533997.9809	754838.8632
SP31	534035.1569	754866.6444
SP32	534215.0362	754542.5698
SP33	534378.7470	754583.1237

Pond ID	ITM Easting (X)	ITM Northing (Y)
SP34	534442.3027	755073.3515
SP35	534685.8807	755095.4267
SP36	534751.7288	754971.8857
SP37	534898.4198	755024.0584
SP38	534950.5401	755019.9868
SP39	535438.7035	755393.5514
SP40	535591.4583	755295.8392
SP41	535469.9725	755403.9433
SP42	535666.0511	755601.2658
LSP01	532992.7413	754091.2594
LSP02	535375.9472	755257.7745
LSP03	535411.2216	755315.1326

3. WATERCOURSE CROSSINGS

3.1 River Crossings - Wind Farm Site

Drain and watercourse crossings will be constructed in accordance with National Roads Authority guidance 'Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes' and Inland Fisheries guidance 'Guidelines on protection of Fisheries During Construction Works in and Adjacent to Waters' (2016).

There will be fifteen watercourse crossings within the Site: one single-span bridge (WC01) and fourteen culverts (CV01 to CV14). Reference numbers and locations of the crossings are included in Table 3-1.

All watercourse crossings will be designed to accommodate peak fluvial flood flows plus the mid-range future climate change scenario (1 in 100 year + climate change).

The bridge deck will be set above the 1% AEP flood height (100-year event plus climate change). The modelled peak 1% AEP + CC water level at the upstream face of the proposed bridge is 28.4m OD. Therefore, in compliance with the OPW Section 50 minimum freeboard requirements, the soffit level the bridge will be constructed to a minimum level of 28.7m OD. A cross section of a single-span bridge is included within the Planning Drawing P20-306-0300-0018.

Culverts will be made of precast units which will be sized specific to the hydraulic capacity required relative to the characteristics of the drain / watercourse to be crossed. A cross-section detail of a piped culvert is shown in planning drawing P20-306-0300-0026.

Further details on the watercourse crossing construction methodologies are provided in Chapter 2 of the EIAR.

With suitably sized piped culvert and a suitably-designed bridge, there will be no impact on flows within watercourses and the risk of flooding will not be increased as a result of the Proposed Development.

Table 3-1: Watercourse Crossings

Watercourse Crossing Ref	ITM Coordinates		Width at Base (m)	Width at top of bank (m)	Bank Height (m)	Depth of Water (m)	Type of Crossing
WC01	533089.53,	754307.53	8.83	17.28	3.84	0.74	18.5m slab length clear-span bridge on Togher River
CV01	532044.8643	753994.955	2.8	3.5	4.0	3.2	Upgrade of existing piped culvert on land drain used for turbary access
CV02	532051.1549	753526.061	0.9	1.0	0.2	0	piped culvert on land drain
CV03	533228.5454	754414.8103	1.42	2.8	1.8	0.62	Upgrade existing farm access piped culvert on land drain
CV04	533543.7619	754815.8888	0.8	4.1	1.5	0.44	piped culvert on land drain
CV05	533324.1022	755645.1961	0.46	1.4	1.33	0.52	piped culvert on land drain
CV06	533874.0242	754968.9821	1.14	3.64	1.53	0.48	Upgrade existing farm access piped culvert on land drain
CV07	534245.0059	754535.1195	0.54	2.87	0.8	0.35	piped culvert on land drain
CV08	534419.3487	755076.0733	0.78	3.5	1.82	0.38	piped culvert on land drain
CV09	534699.8902	755083.9407	0.51	0.51	0.1	0	piped culvert on land drain

Watercourse Crossing Ref	ITM Coordinates		Width at Base (m)	Width at top of bank (m)	Bank Height (m)	Depth of Water (m)	Type of Crossing
CV10	534787.3713	755074.1173	1.2	1.2 – 4.5	0.2	0	piped culvert on land drain
CV11	534764.4714	755050.5955	1.27	4.07	1.25	0.42	piped culvert – replace existing 600mm diameter culvert on land drain
CV12	534932.3086	755031.4635	0.6	4.17	1.2	0.34	piped culvert – upgrade of existing drain crossing on land drain
CV13	535338.3095	755225.2358	2.2	4.53	1.97	0.75	piped culvert on land drain
CV14	535417.3152	755371.7636	2.6	4.01	1.82	0.7	dual piped circular culverts on BLACK (SHRULE)_010 river

3.2 Temporary River Crossing - Turbine Delivery Route

There are accommodation works proposed at TDR node 16 which will require a drainage ditch to be temporarily culverted (see extract from Abnormal Indivisible Load Route Survey in Image 3-1 hereunder, the full report is available in Volume III of the EIAR). The temporary crossing will be sized to accommodate the 1 in 100-year flood flow. This will be carried out in dry conditions in accordance with IFI (2016) 'Guidelines on protection of fisheries during construction works in and adjacent to waters', as described in Chapter 2.

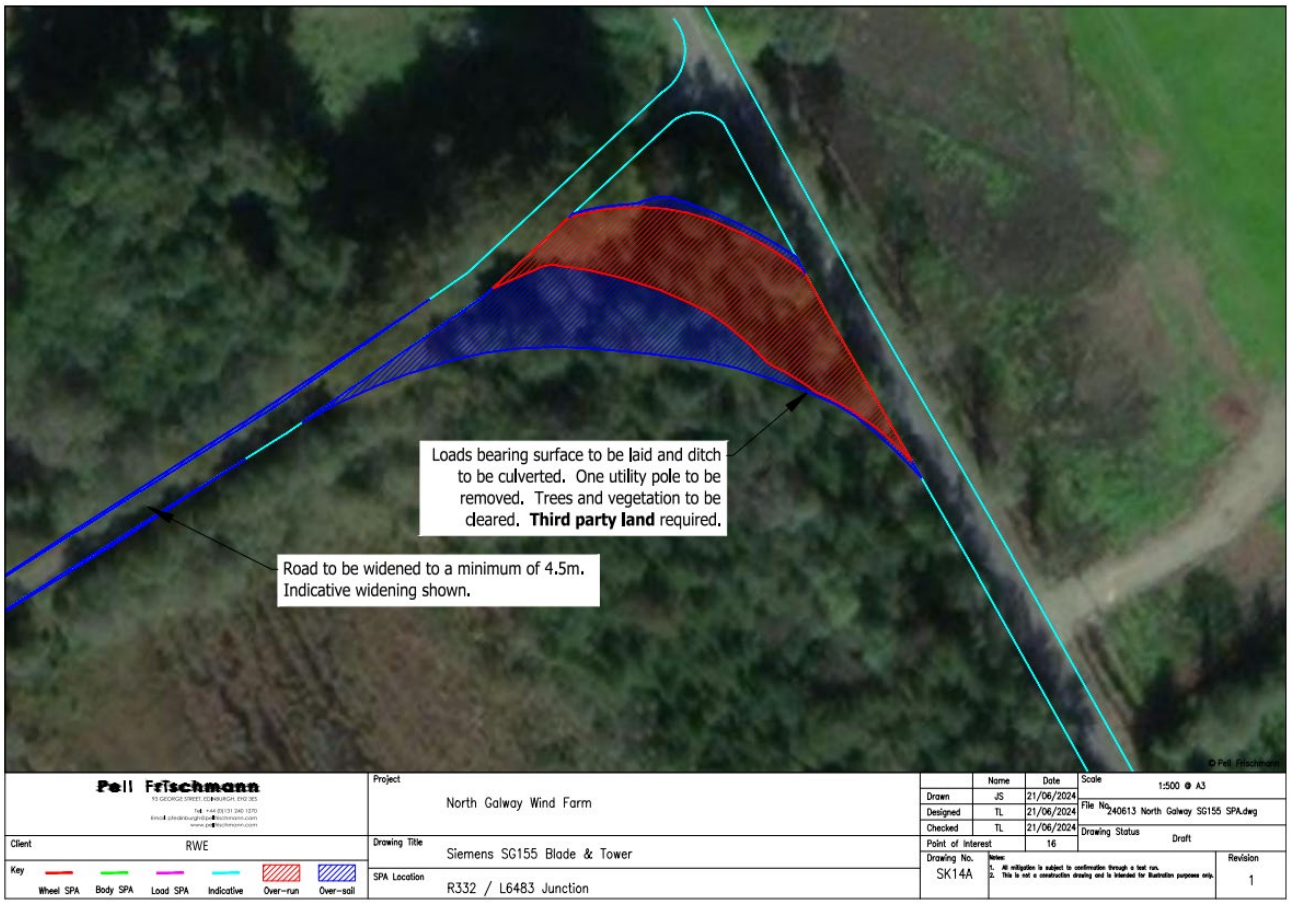

Image 3-1: Extract from Abnormal Indivisible Load Route Survey (Pell Frischmann, June 2024)

3.3 Overpumping and Fluming Construction Methodology

All in-stream works will be carried out under dry works conditions i.e. the works area will be isolated from the river/stream/drain flow by means of temporarily overpumping (in the case of drains and culverts) or fluming the flow (in the case of the new clear-span bridge).The construction of the piled / floated road along the periphery of Cloonbar Bog may be accommodated by either overpumping or fluming.

All works associated with overpumping and fluming will be supervised by the Ecological Clerk of Works.

Any watercourses requiring a dry works area will require a fish salvage exercise which must firstly be Authorised under Section 14 of the Fisheries (Consolidation) Act 1959. Fish salvage by electrofishing will not be carried out where water temperature exceeds 20ºC. Fish salvage operations can only be conducted by qualified ecologists under said licence. A detailed method statement will be required as part of the licence application. The work will have regard to the following general guidelines for electrical fishing include Beaumount et al., (2002) “Guidelines for Electric Fishing Best Practice” and Scottish Fisheries Coordination Centre (2007) “Electrofishing team leader training manual” and Central Fisheries Board (2008) Methods for the Water Framework Directive Electric Fishing in wadable reaches”.

The diversion of flow by overpumping / fluming will be into the same waterbody i.e. flows will not be diverted from one watercourse to another. The flume pipe and / or the pumps will be sized appropriate to watercourse flow and will have capacity to accommodate storm flows.

Fluming is the preferred option for fishery watercourses and must be such that fish passage is maintained. Where overpumping is proposed, measures (such as screening) will be taken to ensure that fish do not become entrained in the pump. Additionally, measures will be taken to reduce sedimentation caused by pumping e.g. creating of a gravel-lined sump. Direct dewatering into the watercourse will not be permitted as it will increase the risk of sedimentation. Instead dewatering will be via filter bag, sediment tank, filter mats or natural vegetation adjacent to the watercourse.

Discharging of construction water (trade effluent) directly to surface waters is a licenced activity. No extracted or pumped or treated construction water from the isolated construction area will be discharged directly to a drain or watercourse (This is in accordance with Local Government (Water Pollution) Act, 1977 as amended).

No in-stream works will be carried out in any WFD mapped watercourse or associated riparian area during the salmonid spawning season (which is October to May inclusive).

Overpumping

The over-pumping methodology will be in accordance with Inland Fishery Ireland (2016) 'Guidelines on Protection of Fisheries During Construction Works In and Adjacent to Waters'. This methodology requires the damming of the drain/watercourse upstream and downstream of the crossing location to create a dry works area. Water will then be diverted from where it has been impounded upstream and discharged downstream of the crossing area via pumps. The proposed construction technique is as follows:

- An over-pump inlet will be constructed inside a sump (vertical pipe with stone and cage surround that prevents aquatic fauna and riverbed material entering the pump) upstream of the works area. Pump size will be determined based on the flow rate of the river / drain. The water from the river will be over-pumped to downstream of the works area.
- To isolate the works area, sandbags (double bagged and tied) or as appropriate an aquadam will be placed within the drain / watercourse upstream and downstream of the proposed culvert location, starting with the barrier upstream. These works will be done under no flood conditions and when there is no precipitation forecast.
- The upstream and downstream barriers will remain in place for the duration of the works.
- The area of water between the barriers will be subjected to fish salvage under licence.
- The works area will be pumped dry using suitable sized pumps placed on the side of the banks. The outlet will be discharged downstream of the works and will be discharged through a filter bag of sediment tank. Sludge from the filter bag / sediment tank will be drained into a nearby skip for appropriate waste management.
- The pumps and generators will be kept back 10m from river/drain and will be silent running type to minimise noise generation. All pumps and generators shall be 110% bunded. Any external fuel lines shall also have drip trays placed underneath, with a capacity of 110%.
- Once the culverts has been constructed the works area will be rewetted by firstly slowly removing the downstream barrier to allow back watering of the works area, while upstream pumps and barrier remain in place (with pumps operating). Once backwatered, the upstream barrier will be slowly removed to allow partial downstream flow initially, pumps will remain on. The remainder of barrier will be removed and pumps turned off once flow is established through the culvert.

Fluming

In the flume pipe crossing technique, one or more temporary flume pipe sections are installed on the river bed along the corresponding length of the works, allowing the river water to flow through the pipe (and maintain river flow) whilst the construction works can be carried out such that there is full isolation from the river flow and habitats. The flume pipe will then be bedded and packed or surrounded with sandbags to create a seal or dam across the watercourse, to prevent scouring and to divert the water flow into the flume pipe.

The flume pipe will be sized appropriate to watercourse flow and will have capacity to accommodate uninterrupted flow of 1 in 100-year flood flows. These works shall not reduce the capacity or restrict the watercourse flow. The flume pipe will be sized in accordance with expected flows and through hydraulic analysis of the channel to ensure optimal performance without reducing the watercourse's capacity or flow. Standby pumps will be available to assist in partial bypass situations. This approach guarantees effective water management while maintaining construction accessibility and environmental integrity.

4. SURFACE WATER MANAGEMENT AND WATER QUALITY MONITORING

4.1 Daily Preparation During the Implementation of the Surface Water Management Plan

The Drainage Engineer appointed by the contractor shall conduct regular meetings with the Construction Management Team to discuss the phasing of construction and drainage as the work progresses. The focus of these meetings will be on establishing an operational drainage system in advance of the progression of the works.

Particular regard will be taken of daily weather conditions and long-range forecasts. The Drainage Engineer will have the authority to suspend the works if weather conditions are deemed too extreme for the effective protection of receiving watercourses. Mitigation measures to protect receiving watercourses will be put in place as directed by the Drainage Engineer in response to extreme forecasts.

The surface water management system will be visually inspected on a daily basis during construction works by the SHEQ Officer (or equivalent appointed person) to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.

The Contractor will implement temporary control measures such as silt fences, silt bags, temporary settlement tanks, as required.

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

4.2 Personnel Qualifications and Key Contacts

All those carrying out work on site must have a Solas Safe Pass Card. All works must be supervised by a competent supervisor. Workers must be adequately trained in the tasks they are required to carry out. The key contact names and contact details shall be supplied to all personnel entering the site. All site staff shall be informed of the emergency procedures for the site.

4.3 Mitigation Measures for Pollution Control to Protect Water Quality

Additional infrastructure and measures used to protect water quality are described in the following sub-sections.

Silt Traps and Silt Fences

Silt traps will be provided in swales which will consist of geotextile staked across the swale at regular intervals. The geotextile will be weighed down on the upstream side with clean filter stone to provide further filtration and stability to the silt trap, as shown Image 4-1 and Image 4-2. Silt traps will be decommissioned after the end of the construction phase and will be replaced by check dams.

Silt fencing will be kept on site and erected as required during construction to provide further protection to prevent the ingress of silt into the existing land drains, streams and watercourses. Silt fences will be constructed using a permeable filter fabric (e.g. Hy Tex Terrastop Premium silt fence or similar) and not a mesh (see Planning Drawing P20-306-0501-0001). The base of the silt fence will be bedded at least 15-30 cm and posts set a maximum of 2 m intervals. Once installed the silt fence will be inspected daily during the proposed works, weekly on completion of the works for at least one month, but particularly after heavy rains and periodically thereafter. The silt fencing will be kept in place until the natural vegetation has been re-established.

Image 4-1: Silt trap across grassed swale

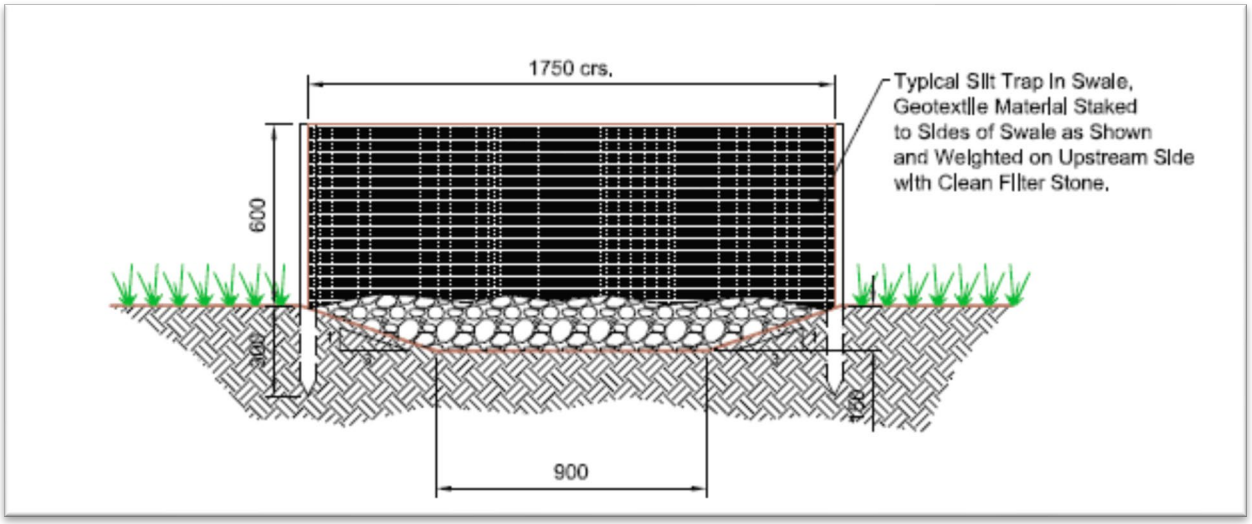

Image 4-2: Trap Details

Drainage of Temporary Site Compounds

Drains around the hard-standing areas of the site compounds will be in the form of shallow grassed swales to minimise the disturbance to sub-soils.

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity, and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50 m.

Any diesel or fuel oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity. Where there is more than one tank within the bund, the capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. Design and installation of fuel tanks will be in accordance with best practice guidelines BPGCS005 (Oil Storage Guidelines).

Portaloos and / or containerised toilets and welfare units with storage tanks will be used to provide toilet facilities for site personnel during construction. The sanitary waste will be removed from site by a licensed waste disposal contractor.

All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer's instructions and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase. Potable water will be brought onsite in bottles.

Temporary petrol and oil interceptors will be installed at the site compounds and at all locations dedicated for plant repairs/storage of fuel/temporary generator installation. Surface water run-off from the compound will be directed through a Class 1 Full Retention Oil Interceptor before discharge to the surface water drainage system for the site. This surface water drain flows to a settlement pond before final discharge over land. A trained and dedicated environmental and fuel spill emergency response team will be set up on site before commencement of construction on-site.

Drainage of Substation

The permitted on-site substation will be drained via an underground piped surface water drainage network. The network will also utilise linear drainage channels and filter drains. The settlement pond will remain in place following the construction period. At the upslope side of the sub-station overland flows will be intercepted in channels and discharged diffusely over vegetated areas.

In the operational stage, the substation drainage will consist of an underground surface water pipe system. This system will include a number of surface water manholes, rainwater pipes for the compound building roof, Class 1 Full Retention Oil Separator, an oil sensitive bund dewatering system, attenuation tank, ACO drains and filter drains. The system will discharge overland limited to the greenfield runoff. Attenuation for flows exceeding this rate will be provided within an underground tank.

In accordance with SuDs best practice, it is proposed to include rainwater harvesting tanks within the surface water system which will comprise of a filter, an underground tank and a pump. The system allows rainwater to run down the roof and into the guttering and downpipes in the normal way before passing through the filter, which removes any leaves and debris. Rainwater is then stored in the underground tank for reuse. Potable water will be brought onsite in bottles. There will also be no discharge of foul flows from welfare units within the substation, with water stored in tanks and removed from site by a contractor.

A foul system is proposed within the station to cater for the wastewater generated in the welfare facilities of the control building. The foul system will consist of an underground pipe network, foul manholes and an 10,000L full retention foul effluent storage tank. The tank will have an associated high-level alarm which will be connected to the control building.

A foul holding tank to be maintained and emptied bi-annually is the most preferable means of treating and disposing of foul waste from the site. The licensed contractor charged to empty and dispose of the waste will be the holder of a valid waste collection permit. It is not proposed to treat wastewater onsite.

Drainage of Cable Trenches

Cables running throughout the wind farm site will be installed in trenches adjacent to site access tracks. Cable trenches will be excavated using a mechanical excavator and the excavated materials placed in low mounds adjacent to the trenches for back filling, as shown in Image 4-3.

Cable trenches will be excavated during dry periods where possible, in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows.

Image 4-3: Backfill over Cable Trench

Procedure for Dewatering of Excavations

Standing water, which could arise in excavations, has the potential to contain an increased concentration of suspended solids as a result of the disturbance to soils. Water in the excavations will be pumped into the 'dirty water' drainage system which will be constructed at site clearance stage, in advance of any excavation works. Where dewatering is required in areas away from the Site drainage system, dewatering will be to adjacent lands contained within the Planning Boundary which are down topography of the works area and will be via filter bags (appropriate sized relative to pump rate) onto natural vegetation set back a minimum of 20 m from any drain or watercourse. There will be no direct discharge to the existing drainage or river network.

Drainage of Stockpiled Material and Embankments

During the construction period, the excavated material will be used to reinstate the turbine bases. All excavations shall be constructed and backfilled as quickly as possible. Excavation will stop during or immediately after heavy rainfall.

Excavation will precede the turbine base construction, cable trench and access track construction. Soil will be excavated and replaced with granular fill where required. Excavation will be carried out from access tracks where possible in order to reduce the compaction of topsoil. The silt fences will be inspected weekly and after rainfall events by Environmental Clerk of Works (ECOW).

During the construction period, spoil heaps from the excavations for the turbine bases will be stored and permanently kept during the Proposed Development. The following are the details of the permanent spoil heap drainage process:

- Collection: A system of pipes and catchment basins is installed on the spoil heap to collect and channel water to a central location.
- Pumping: Water is pumped from the catchment basins to a central location using pumps.
- Treatment and discharge: The water collected from the spoil heap may require settlement before being released back into the environment.
- Maintenance: The permanent spoil heap drainage system requires regular maintenance and inspection to ensure that it continues to function effectively and prevent any environmental harm.

Overall, permanent spoil heap drainage helps to maintain the stability of the spoil heap, prevent water-related environmental problems, and reduce the risk of accidents. It is a crucial aspect of responsible mining and environmental management.

Control of Concrete

On-site batching of concrete will not be permitted. Concrete will instead be transported to the Site by concrete truck. Quick setting concrete mixes will be used as feasible to reduce the risk of contaminated run-off to drains and watercourses. The use of ready-mixed concrete will eliminate any potential environmental risks of onsite batching.

Any plant operating within 50m of a drain or watercourse will require special consideration of the transport of concrete from the point of discharge from the mixer to final discharge into the delivery pipe (tremie). Care will be exercised when slewing concrete skips or mobile concrete pumps over or near surface waters.

Placing of concrete near watercourses will be carried out only under the supervision of the ECoW.

Concrete trucks will not be washed out on Site. Where chutes, hoppers/skips and equipment (e.g. vibrating wands) associated with concrete works need to be washed down this will be done into a sealed mortar bin / skip with the appropriate capacity, and which has been examined in advance for any defects. The location of wash down areas will be set back as far as practically possible from any drain or watercourse, and a minimum of 50 m.

Regular inspections of the wash down areas and associated mortar bins shall be carried out and adequate records kept. Concrete washing will be contained and managed. Waste concrete slurry, washings and supernatant will be allowed to settle/dry and will be taken to a licensed waste facility for disposal.

There will be no hosing of concrete, cement, grout or similar material spills into surface water drains. Concrete spills shall be contained immediately and runoff prevented from entering the watercourse.

Concrete waste and wash-down water will be contained and managed on site to prevent pollution of all surface watercourses.

General Pollution Control Measures

Refuelling of plant during construction will be carried out at the temporary compounds, which will be located a minimum of 50 m from any watercourse. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. In addition to the above, onsite re-fuelling of machinery will be carried out 50 m from watercourses using a mobile double skinned fuel bowser.

The fuel bowser, a custom-built refuelling trailer will be re-filled off site or at the designated refuelling area and will be towed to designated re-fuelling areas near to where machinery is located but at distances of greater than 50 m from watercourses.

Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

Any diesel, fuel or hydraulic oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.

Vehicles entering the site shall be in good working order, free from leakage of fuel or hydraulic fluid.

A wheel wash will be provided at the site entrance draining to a silt trap to avoid any silt laden run-off flowing on to the public road and entering roadside drains.

Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a licenced waste disposal contractor.

All personnel working on site will be trained in pollution incident control response. An emergency response procedure is contained within the main body of the CEMP which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.

A regular review of forecasts of heavy rainfall is required and a contingency plan will be prepared before and after such events.

In the event of a risk of pollution to a drain or watercourses due to an accidental spill, suitably sized pumps will be on hand to overpump the flow from upstream with the of isolating the flow away from the area of spill. Oil booms will be placed downstream of the spill as necessary.

Procedures for particular accidental spillages, from leaking or damaged fuel lines or a break-out of silt are outlined below.

Image 4-4: Typical Mobile Fuel Boswer

Accidental spillage from leaking or damaged fuel lines

Emergency spill kits with oil boom and absorbent materials will be kept on-site in the event of an accidental spill. Spill kits will be kept in construction compound, the vehicle transporting the fuel bowser and smaller spill control kits will be kept in all construction machinery. All construction personnel will be notified of where the spill kits are located as part of the site induction and will be trained on the site procedures for dealing with spills.

In the event of a leak or a spill in the field, the spill kits will be used to contain and absorb the pollutant and prevent any further potential contamination. The absorbed pollutants and contaminated materials will be placed into leak proof containers and transferred to a suitable waste container for hazardous materials in the construction compound. Where a leak has occurred from machinery, the equipment will not be permitted to be used further until the issue has been resolved.

The SHEQ Officer (or equivalent appointed person) will be notified of any spills on-site and will determine the requirement to notify the authorities.

Typically, the following procedures will be followed in the event of an incident:

- Works will stop immediately where safe to do so,
- The SHEQ Officer (or equivalent appointed person) will be contacted,
- The size of the incident will be assessed and determined if it can be controlled by site staff or if emergency services are required to attend,
- The appropriate enforcing authority will be contacted,
- The SHEQ Officer (or equivalent appointed person) will investigate after the incident,
- The findings will be sent to the appropriate authority; and
- An action plan will be prepared to set out any modifications to working practices required to prevent a recurrence.

Accidental break out of silt from settlement ponds

The settlement ponds will be equipped with a spillway to control overflow scenarios related to the not manageable storm events (more extreme than the design return period provided for the settlement ponds). To ensure to avoid potential erosion due to the overflow, scour protection (rip-rap or equivalent) will be provided along and the outfall location of the spillway.

The drainage engineer shall be contacted if there is an accidental spillage or break out of silt on the Site.

4.4 Maintenance of Site Drainage Systems

The proposed drainage system has been designed in accordance with the current standards and guidelines to minimise the maintenance requirement for the proposed site, however excessive debris in the system could still result in loss of performance.

The drainage system for the development shall be maintained regularly to keep it operating effectively. The maintenance shall include the following:

- Inspection and maintenance of swales,
- Inspecting cross-drains for any blockages,
- Inspecting settlement ponds and outfalls,
- Inspecting the stream crossings and piped crossings for obstructions,
- Inspecting the progress of the re-establishment of vegetation,
- Implementing appropriate remedial measures as required after the above inspections.

Regular maintenance shall be provided to the site drainage system to ensure optimal operation to accommodate heavy rainfall events. All the drainage elements will be designed with a freeboard of 300 mm to provide additional hydraulic capacity to accommodate heavy rainfall event.

Biannual inspections will take place in spring and autumn where there is additional risk of blockage from debris associated with fallen leaves.

The proposed drainage system includes SuDS drainage ditches and settlement ponds. The key maintenance requirement for the ditches and associated headwalls and pipework will be the maintenance of vegetation and mowing of grass within and on the banks/verges and the removal of accumulated sediments and collection of litter and debris.

During the inspections the general operation, and structural condition of the headwalls and any erosion of banks or scour control features should be identified and rehabilitated as required.

Vegetation within and on the banks of the drainage ditches and settlement ponds should be trimmed twice a year, preferably in April and October to a height of 100 mm to establish a dense sward and provide long grass margins

All access tracks will be constructed from aggregate which will allow a portion of rainfall to infiltrate and, therefore, reduce surface water runoff. Adjacent swales will also intercept and retain surface water runoff allowing this to disperse naturally via infiltration and evapotranspiration. Where swales are installed on sloped ground, check dam structures will be used within the channels to provide attenuation, allowing a portion of the flows to disperse naturally.

Swales and drainage channels will discharge runoff from access roads and areas of hardstanding to settlement ponds. These will be suitably sized to accommodate flows from storm events up to and including the 1 in 100-year storm event.

Settlement ponds will not discharge directly to any drain or watercourse. Rather, flows from the ponds will be dispersed diffusely over land to allow natural overland flow and percolation within the catchment.

Watercourse crossings will be designed and suitably sized to accommodate peak, or storm discharge rates so as not to cause risk of impeding flows during extreme storm events and causing flooding upstream of the crossing. All drain and watercourse crossings will be designed in accordance with the requirements of Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010. The channel width will be maintained and the crossings will be designed so as not to cause an impediment to the passage of woody debris or sediment transport. Appropriate freeboard will be provided to OPW requirements.

The cable trenches will be excavated in dry weather where possible and infilled and revegetated if required to prevent soil erosion or generation of silt pollution of nearby surface water. There will, therefore, be no increase in the risk of flooding.

The surface water management system at the Site will ensure that there will be no increase in the risk of fluvial or surface water flooding downstream as a result of the windfarm development.

After the heavy rainfall and winds, it is necessary to assess the conditions of the site drainage system to evaluate that it is operating according to the design requirements. Maintenance is required to re-establish the regular status of the drainage system. If the event was too heavy and the drainage system is damaged, it is necessary to re-build the damaged drainage elements, according to the design requirements.

4.5 Water Quality Monitoring Plan

An Environmental / Ecological Clerk of Works (EnCoW / ECoW) will be appointed by the Developer with responsibility for monitoring at the Site during the construction phase of the Development. The Clerk of Works will have the authority to temporarily stop works to prevent negative effects on hydrology or to ensure corrective action is taken to mitigate adverse effects.

A Surface Water Quality Monitoring Programme will be established which will commence 12 months prior to construction in order to establish baseline physio-chemical conditions and hydromorphological conditions of the watercourses within the Site and will continue throughout construction and for three months post-commissioning phase of the Proposed Development.

Monthly water quality grab samples will be taken from the Black Shrule_10 at locations approximately 10 m downstream of the proposed watercourse crossings. Water quality sampling will be undertaken in accordance with *BS EN ISO 5667 - Water Quality Sampling*. The samples will be checked in situ for:

I. pH;
II. Temperature;
III. Turbidity;
IV. Conductivity; and
V. Dissolved Oxygen.

using a fully calibrated portable pH/temperature/conductivity meter (with pH resolution of 0.01 pH), turbidity probe and a flow impellor.

The samples will then be submitted to an appropriately certified laboratory (ILAB or similar) in accordance with the laboratory custody protocol for assessment of the following parameters:

i. Biological Oxygen Demand;
ii. Chemical Oxygen Demand;
iii. Total Hardness;
iv. Total Suspended Solids;
v. Total Dissolved Solids;
vi. Nitrate;
vii. Nitrite;
viii. Ammoniacal Nitrogen;
ix. Molybdate Reactive Phosphorus;
x. Total Coliforms; and
xi. Faecal Coliforms (E.coli).

A record of monthly meteorological conditions (as a minimum precipitation and temperature) will be maintained.

Biological water quality assessment using the EPA Q-value methodology will be carried out once prior to the commencement of construction and on a six month basis during the monitoring period.

The hydromorphological baseline at the proposed watercourse crossings within the Site will be established using the River Hydromorphology Assessment Technique (RHAT)[1]. Annual RHAT assessments will be carried out which will be compared against the baseline. The Design and Construction of the bridge crossing and culverts will minimise upstream afflux, avoid turbulence and minimise loss of the natural channel bed due to the culvert or structure in order to ensure that hydromorphology is not affected. The Design will ensure that the baseline river Hydromorphological Condition Score derived from the initial RHAT assessment is not altered such that it would impact the derived WFD hydromorphology classification.

The Contractor will ensure that the daily visual monitoring of the surface water network for visible signs of construction impact is carried out on a daily basis for example, riparian vegetation loss, evidence of oil/fuel slick, sediment plumes, fish kill.

During the construction and commissioning phase, water quality monitoring results will be recorded and compared against baseline data and where there is a deviation beyond the 95%ile, the Contractor will investigate and as necessary sample further upstream and determine if elevated concentrations are coming from the Site, in which case the Contractor will ensure that emergency control measures are put in place to return the levels to the baseline. Similarly, the Contractor will compare results of water quality monitoring with the 95%ile High Status Environmental Quality Standards arising from the European Union Environmental Objectives (Surface Waters) Regulations 2009 as amended. Any deviation beyond these standards will be investigated and the findings will be report to the Community Water Officer, West Region.

During the construction and commissioning phase, daily inspection of environmental protection measures e.g. silt traps, check dams, ponds and outfalls and drainage channels will be carried out and any improvement works carried out within a timely manner.

[1] https://www.riverhabitatsurvey.org/RHSfiles/RHSToolboxHelp/RiverHabitatSurveyToolbox.html?RHAT.html

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