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Our Ref: P1453-1-0010

MKO Ireland
Planning & Environmental Consultants
Tuam Road,
Galway.
H91 VW84.

Attn: Ms Meabhann Crowe

Dear Meabhann,

Re: Hydrological & Hydrogeological Responses to An Bord Pleanála Further Information Request, and Statutory and Third-Party Submissions, in respect of the proposed Lyrenacarriga Wind Farm, Co. Cork/Co. Waterford (ABP Ref: 309121-21)

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO) to respond to a further information request from An Bord Pleanála (ABP) along with hydrological and hydrogeological matters raised in third-party submissions in relation to the proposed Lyrenacarriga Wind Farm, Co. Cork and Co. Waterford.

Firstly, this letter report provides responses to Item C and Item D listed under the heading "Biodiversity" in the ABP further information request letter which was issued on 8th April 2022 (Refer to Section 2 below). The other items from the ABP letter are dealt with by others.

Responses are then provided to hydrological and hydrogeological matters raised by prescribed bodies and third parties. Our response letter follows the following format:

- Cork and Waterford Local Authorities (Section 3 below)
- Statutory Bodies/ Prescribed Bodies (Section 4 below)
- Third-Party Submissions (Section 5 below)
- Submission Summary (Section 6 below)

Direct responses are provided to the Local Authority and Prescribed Body submissions. Responses to non-statutory submissions are grouped responses on repeated matters raised.

1 STATEMENT OF EXPERIENCE – WIND FARM DRAINAGE

Hydro-Environmental Services (HES) has extensive wind farm drainage and hydrogeological experience relevant to this project. Wind farm environmental impact assessment in respect of geology, hydrology and hydrogeology has and is a core business area for HES presently and also over the past 15 years. Wind farm drainage design/management requires experience both as a civil/drainage engineer, a hydrologist, and a hydrogeological specialist. HES have these combined experiences and expertise. HES has worked on over 100 wind farm projects in Ireland and Northern Ireland. Many of these required assessments of existing drainage features and streams and water quality data. HES work at all stages of wind farm developments including feasibility stage, layout design & drainage design/planning stage, and also at construction management stage.

HES's experience also covers the key area of water quality and drainage controls and mitigation during the construction phase of wind farm developments. HES work at EIAR/planning stage to assist with the development of the optimal site layout which involves the development of hydrological constraints maps and interaction with geotechnical and ecological specialists and with site designers, HES also provides a follow-on consultancy service

(if planning is granted and the development proceeds to construction) of detailed drainage design and construction management for drainage during wind farm development/construction stage. This practical on-site experience is invaluable as it has led to the development of improved preliminary and detailed drainage layouts and also many improvements/optimisations to standard peatland drainage mitigation measures.

HES specialises in wetland and peatland eco-hydrology. We also complete flood risk assessments for all types of developments across the country.

All these experiences are particularly relevant to this project, and they have been applied through the project development phase, the constraints mapping phase, and EIAR preparation work, including the cumulative impact assessment.

This response submission has been prepared by David Broderick and Michael Gill. David and Michael prepared the Land Soil and Geology and Water Chapters of the submitted EIAR, and their qualifications and experience are already presented in the EIAR.

2 RESPONSE TO ABP ITEM C AND ITEM D UNDER THE HEADING "BIODIVERSITY"

2.1 "BIODIVERSITY" ITEM C

Item C is written as follows:

> *"Further detail is required in respect of the design detail of the settlement pond structures".*

2.2 "BIODIVERSITY" ITEM C RESPONSE

The design of temporary settlement ponds is a relatively simple process and is a well-established science, being based on Stoke's Law. The design process is outlined in "Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006)".

The proposed structural design detail of the settlement ponds is shown in Drawing no. P1453-0-0121-A1-D501-00A which is attached as Appendix 4-6 of the EIAR. (Also note that the drainage drawings form part of the submitted Planning Drawings for the proposed Development).

As shown in detail A1 and A2 of that drawing (P1453-0-0121-A1-D501-00A), temporary settlement ponds will be constructed from suitable excavated soil material and lined with 1000 gauge impermeable polythene. The settlement ponds will be a 2-stage, or a 3-stage, construction (i.e. there will be either 2 stages of settlement, or 3 stages, broken into bays within the settlement pond structure).

There are design specifications referenced in detail A1 and A2 (of drawing P1453-0-0121-A1-D501-00A), but the referenced design table was not included in the final drawing by error (see "Note Dimensions Vary Depending on Catchment Size – See Attached table" referenced below the Title for Type A – Typical Road Side Settlement Pond Detail). An updated version of this drawing is attached in **Appendix I**, and the design table is included on the updated drawing. For clarity, the design table is also presented in **Table A** below. Please note that **Table A** covers a series of catchment sizes and design scenarios that will typically be encountered at the site.

Table A: Proposed Settlement Pond Sizes based on various catchment sizes

Return Period	100-year	Catchment Size (m^2)		
		500	1,000	2,000
6hr retention for Coarse Silt		2.8 x 9 x 1	4 x 13 x 1	5.7 x 18 x 1
11hr retention for Medium Silt		3.2 x 10 x 1	4.5 x 14 x 1	6.4 x 20 x 1m
24hr retention for Medium Silt		3.5 x 11 x 1	5 x 16 x 1	7 x 22 x 1
Settlement Pond Size:		W[m] x L[m] x D[m]	W[m] x L[m] x D[m]	W[m] x L[m] x D[m]

The design process to size the settlement ponds is as follows:

- The proposed development footprint is divided up into drainage catchments (based on topography, outfall locations, and catchment size. Catchment sizes are divided so they are <2,000m^2 in area, but they can be much smaller depending on local topographical conditions));
- Stormwater runoff rates which are based on the 100-year return period rainfall event are calculated and these flows are used to design settlement pond sizes for each drainage catchment;
- Retention times are based on Stoke's Law (particle settling velocity);
- The settlement ponds for access roads and hardstand surfaces are designed for an 11hr retention time used to settle out medium silt (EPA, 2006)[1]; and,
- Borrow pit/ repository areas settlement ponds have been designed to allow a 24hr retention time as per EPA guidance (2006), which is the highest level of protection recommended by the EPA with regard to retention time.

With regards to settlement pond designs and water quality protection, we summarise our response as follows:

- Settlement pond details were provided in the submitted EIAR in Appendix 4-6 and also within the application drawing pack as noted above.
- The design of settlement ponds is a well-established science and is detailed in a guidance document published by the EPA (EPA, 2006).
- We have outlined the design process for each required settlement pond above.
- We have provided example calculations for various catchment sizes within the proposed Wind Farm, and also for various design scenarios. These example calculations can be applied across the site.
- We note that settlement ponds are not a stand-alone element of the water quality protection mitigation outlined in the EIAR.
- Water quality protection will occur as part of a treatment train of mitigation, including source controls, in-line controls, treatment controls (including settlement ponds), and outfall controls. This suite of water quality protection controls will be applied in series to ensure the protection of downstream watercourses.
- To illustrate this point we have included process flow diagrams showing each element of the proposed drainage systems. These process flow diagrams are attached in **Appendix II**.

We trust the above demonstrates the detailed consideration of drainage controls and water quality protection presented in the EIAR.

2.3 "BIODIVERSITY" ITEM D

Item D is written as follows:

> *"You are requested to respond to concerns expressed in respect of the geochemistry of the borrow pit near the entrance, especially in relation to pyrite and/or marcasite and risk of acid drainage".*

2.4 "BIODIVERSITY" ITEM D RESPONSE

In order to respond to this Item, we have completed a detailed review of available geological and geochemical information in respect of acid mine drainage and the referenced minerals. We respond as follows:

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

- There is no history of mining in the area, suggesting there is no significant mineral resource available in the local bedrock geology. The general absence of mineral localities in the area of the wind farm site confirms this (refer to **Figure A** below);
- The nearest historical mines of note are along the Copper Coast (Bunmahon (Tankardstown Mine), in east Waterford;
- Old Red Sandstone (ORS bedrock) in Ireland is of continental origin, not marine and pyrite/marcasite would be a relatively unusual mineral constituent in that context. Unless there is a hydrothermal intrusion, sedimentary rocks need original anaerobic/reducing conditions to generate the sulphides;
- At the old mine in Allihies there is significant copper and sulphide mineralization in the Old Red Sandstone (similar bedrock geology to the proposed development site) but the mineralization is in injected veins in fractures in the ORS, not internal to the ORS itself;
- Therefore, with an absence of similar injected veins, or volcanic rocks (as is the case at Bunmahon), it is highly unlikely that such conditions can ever occur at the site;
- Acid mine drainage is usually associated with deep mines where mineral ores are extracted, and is not typically associated with shallow quarries/borrow pits;
- There are the (worked out and overgrown) remains of some local commercial quarries/pits, but there is no evidence associated with these quarries/pits that acid mine drainage is/was an issue locally;
- pH levels recorded in the streams/drains draining the site are all >7.0 (i.e. there is no apparent acid mine drainage occurring at the site as drainage water has a neutral pH);
- The installation of existing forestry access tracks has created several cut and fill areas within the proposed wind farm site and there is no evidence of acid drainage from these exposures (trackside drainage water pH >7.0);
- Proposed borrow pits at the site are relatively shallow excavations and will not be too dissimilar to the existing cut areas;
- We have also consulted with quarry operators in the region that extract similar rock types (Old Red Sandstone), and they are not aware of this being a significant issue or concern; and,
- We have also consulted with the Geological Survey of Ireland, and academics in Trinity College and University College Cork, and none are aware of this issue in the ORS geology at the proposed Wind Farm site.

As a result of the above, we consider that this particular issue will not result in significant impacts on downstream water quality from the proposed development. The research and investigation we have carried out on the matter have indicated that AMD is not a documented risk in the area of the proposed development.

Issues raised in respect of the Glenaboy River are addressed in Section 4.2 below.

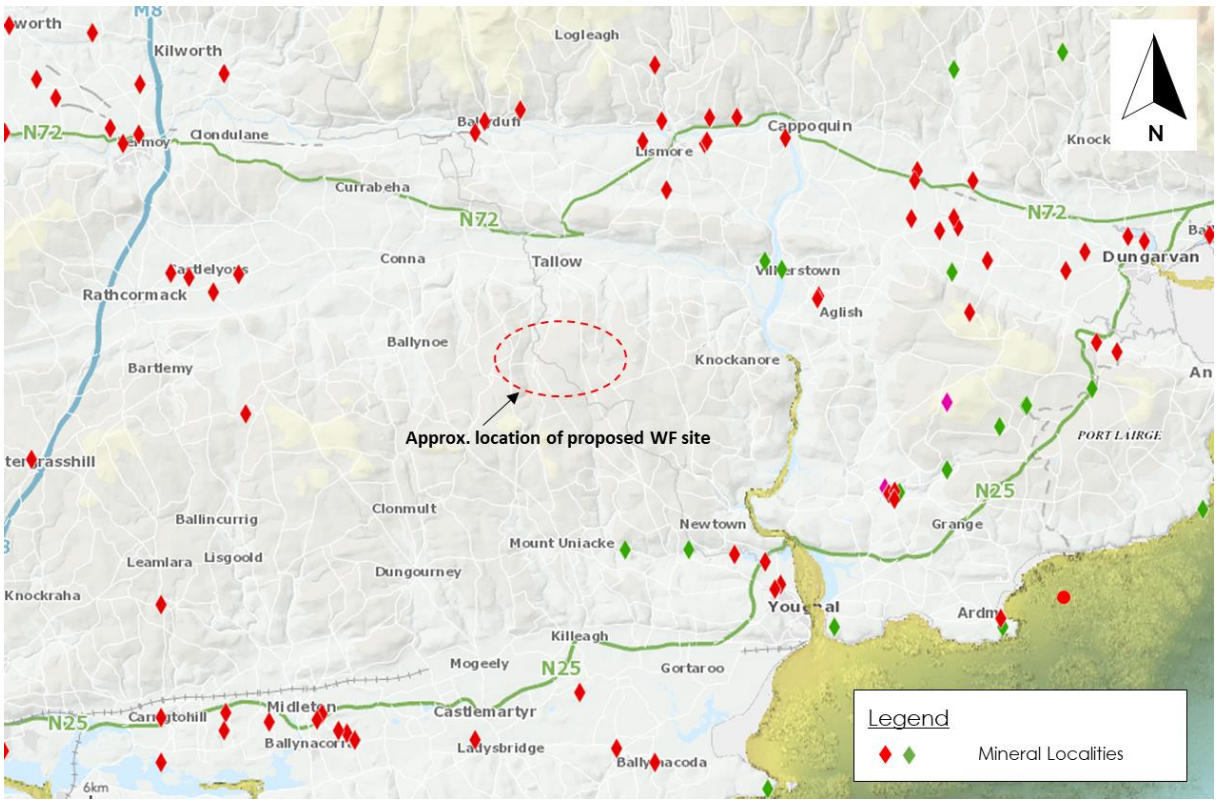


Figure A: GSI mapped Mineral Localities in the area of the proposed development site.
(note absence of mineral localities in the area of the proposed development)

3 LOCAL AUTHORITY SUBMISSIONS

3.1 CORK COUNTY COUNCIL

The following documents were reviewed with regard to the submission by Cork County Council:

- Planning Authority Report submission (Chief Executive's);
- Report of Area Engineer (Internal);
- Report of Heritage Officer (Internal); and,
- Report of Senior Executive Scientist (Internal).

3.1.1 Key Points Made with Regard Hydrology/Drainage/Water Quality by Cork Co. Co.

In relation to potential impacts on surface water, groundwater and the environment, the Planning Authority Report notes that:

> "*There is no objection to the grant of permission on environmental grounds*".

The Report of the Area Engineer states that:

> "*There are no objections to the proposals regarding site drainage and attenuation measures*".

Report of Senior Executive Scientist makes the following comments:

> "*There is a significant risk to surface water quality, primarily due to potential for run-off of sediment to surface water due to excavation, traffic movements, stream crossings, etc. There is also a risk to surface & groundwater due to leakage or loss of fuel or hydrocarbons from plant. This can be mitigated with good management, & provision of appropriate spill response equipment & procedures*".

> *"A 75m buffer from the main streams was applied during the constraints mapping and will be maintained during the construction phase. No development, other than identified stream crossings, will be carried out within this buffer. A buffer of this scale provides good protection to the watercourses on site & leaves a significant area for attenuation of any accidental discharges of silt laden water given the generally gently sloping nature of the site".*
>
> *"I have no objection to grant of permission on environmental grounds".*

The Senior Executive Scientist report recommends 9 no. Conditions with regard to water quality protection. All recommended conditions with regard to drainage mitigation/surface water quality protection are already proposed in the EIAR (Chapter 10) within Sections 10.5.2.1, 10.5.2.2 & 10.5.2.5.

Although they indicate some further clarifications are required, which are related to ecological issues (i.e. ex-situ species namely; otter and salmon, particular in the River Tourig) and not water quality or drainage issues, the Report of the Heritage Officer concludes that:

> *"The Heritage Unit of Cork County Council is not of the opinion that the proposed windfarm will have a significant negative effect on the ecology of the area".*

3.2 WATERFORD COUNTY COUNCIL

The following documents were reviewed with regard to the submission by Waterford County Council:

- Planning Authority Report submission (Chief Executive's);
- Heritage Officer (Internal);
- Conservation Officer (Internal);
- Environment Section (Internal); and,
- Water Services Section (Internal.

3.2.1 Key Points Made with Regard Hydrology/Drainage/Water Quality by Waterford Co. Co.

The Water Services (WS) Section makes the following comments:

> *"The most significant risk to water quality will be at deforestation (45.6 ha) and construction phase. WS note that the hydrology report states that many mitigation measures (silt traps, etc) will be put in place to mitigate risks".*
>
> *WS consider the Siltbuster technology referred to in the mitigation should be deployed if the surface water leaving the site does not comply with <25mg/l TSS and pH 6-9.*

Planning Authority Report submission (Chief Executive's) makes the following comments:

> *"There are 2 no. downstream public water supplies have also been considered. The comprehensive surface water mitigation proposed seeks to ensure no impact on these water sources and no impact on the downstream Blackwater SAC and pNHA".*
>
> *"WCCC consider the Siltbuster technology referred to in the mitigation should be deployed if the surface water leaving the site does not comply with <25mg/l TSS and pH 6-9".*

No issues or concerns were raised by the Heritage Officer, Conservation Officer or Environment Section in Waterford Co. Co.

3.2.2 Local Authority Submissions Summary

- In submissions made by Cork and Waterford Local Authorities to An Bord Pleanála, the proposed Lyrenacarriga WF wind farm was considered acceptable from a water quality/environmental perspective by both Planning Authorities;
- The submission by Cork Co. Co. (County in which Youghal water supply abstraction is located) states that *"There is no objection to the grant of permission on environmental grounds";*
- The submissions set out a recommended schedule of conditions. Those applicable to hydrology and water quality generally relate to pollution prevention measures, drainage management, and the submission of a drainage management plan; and,
- These issues have been addressed in the EIAR, and the suggested planning conditions (from the Local Authority Reports) are consistent with the mitigation already outlined in the EIAR for this proposed development.

4 STATUTORY/PRESCRIBED BODIES

4.1 IRISH WATER

Irish Water's (IW) submission was in relation to the Youghal Public Water Supply:

> *"Irish Water notes the proposed development is located upstream 0.65km of the nearby abstraction on the Glendine River for the Youghal Public Water Supply. As stated in the information submitted by the applicant this scheme is sensitive to changes in surface water turbidity and requires manual adjustment based on testing of raw water inflows".*
>
> *"While the risks to water quality in the Glendine River and catchment should be fully mitigated, such changes to landuse, soils and drainage patterns cannot fully eliminate the risk of impacts on the public water supply source. The onus on the applicant to ensure appropriate mitigations and measures are in place to protect water availability and quality throughout the life of the development, as well as the liability for additional efforts required to maintain normal supply or to recover from an incident preventing sufficient abstraction".*
>
> *It is critical that any and all surface/groundwater sources within proximity are protected from any possible pollution arising from the proposed development and it is an environmental objective of the Water Framework Directive to protect drinking water sources and ensure no additional treatment is required".*

4.1.1 HES Response

The wind farm design team were at all times aware that the Youghal Public Water Supply abstractions existed in the downstream watercourses, and as such, all proposed mitigation and drainage design proposals were designed toward providing a "best in class" drainage management proposal for the proposed development considering the significant catchment sensitivities, particularly the eastern cluster which is only 0.65km upstream of the Glendine River gravity offtake.

HES have good knowledge of the Youghal Public Water Supply. A site visit to the Glendine and Tourig abstractions along with the Boola Water Treatment Plant (elements of the Youghal Public Water Supply) was undertaken in January 2019 during the EIAR scoping and preparation in the company of Ken O'Keefe (engineer) from Cork County Council. HES has always been aware of this water supply and its sensitivities and its operating thresholds.

As described in Section 10.5.2.10 of the EIAR, early-stage design constraint mapping was a key avoidance mitigation measure. The proposed use of a 75m watercourse buffer is 50% wider than the standard 50m buffer that would normally be used in wind farm layout design. For a site where surface water rates are only moderate (compared to high rates in peatland sites),

the 75m buffer would be considered conservative. The 50m buffer has been effectively employed on numerous upland, steeper wind farm sites across the country and therefore the additional protection offered by the increased buffer at the Proposed Development is significant given its more undulating and gentle topography compared to an upland site.

Detailed drainage management design and pollution prevention measures proposed during the construction phase are presented in Sections 10.5.2 and 10.5.3 of the EIAR. These proposals are "best in class" and in line with current best practice approaches for surface water quality protection on wind farm and forestry sites.

In addition to the proposed robust drainage design proposal, a final line of defence can be provided by a water treatment train such as a "Siltbuster" if required. If the discharge water from construction areas fails to be of a high quality then a filtration treatment system (such as a 'Siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all surface discharge water collected in the dirty water drainage system.

Waterford County Council is in favour of the use of "Siltbuster" technology as stated in their submission.

IW's concern in relation to land use changes and alteration to drainage patterns is noted. However, due to the relatively small scale of the proposed development in comparison to the total catchment area upstream of the abstraction locations, the potential for effect is negligible as demonstrated below.

With regard to land use changes, the proposed permanent development footprint is approximately 23.3 ha, representing only <3% of the total development site area of 833 ha. Of the proposed wind farm footprint, approximately 6.4 ha are already in place in the form of existing forestry roads/farm tracks (~27.5% of the proposed development is already existing).

Also, the combined total surface water catchment area upstream of the Glendine River intake and Tourig River intake is almost 50km^2. Therefore, the proposed development footprint (23.3ha) only accounts for <0.5% of the catchment to the Youghal Public Water Supply. Therefore, the effects of land use change and the potential knock-on effect on existing drainage as a result of the proposed development is negligible even in the absence of mitigation.

The proposed development is located in a forested site where felling (in much larger proportions than those required for the wind farm) will be carried out anyway in the absence of the development.

There are two key elements of the proposed drainage design philosophy regarding mitigating hydrological/drainage effects within the proposed site and in downstream catchments:

- The first key element is to maintain the hydrology/drainage regime of the proposed wind farm site and to prevent changes in surface water flows downstream of the proposed development.
- The second key element is to utilize and integrate with the existing forestry infrastructure where possible, whether it be existing access roads or the existing forestry drainage network. Utilising the existing infrastructure means that there will be less of a requirement for new construction/excavations which have the potential to impact on downstream watercourses in terms of suspended solid input and runoff rates (unless managed appropriately).

The key objectives of the proposed drainage mitigation include:

- Surface water quality protection of downstream river water bodies;
- Prevention of increased downstream flood risk;
- Maintain the baseline hydrology/drainage regime;
- Comply with the WFD requirements; and,
- Protection of downstream receptors (designated sites/drinking water sources).

The drainage management proposals for this site are best in class, and were proposed and designed with the protection of downstream watercourses and water supply sources in mind.

For the above reasons, we consider that the minor landuse changes will not result in significant effects on the hydrological regime within the Glendine River and Tourig River catchments.

4.2 DEVELOPMENT APPLICATIONS UNIT - NPWS

Development Applications Unit (DAU)[2] submission was in relation to surface water quality effects on the downstream Blackwater River SAC:

> *"The following potential SAC conservation issues arise from the construction of the proposed wind farm:*
>
> *a) Siltation of the Glenaboy River due to uncontrolled runoff or landslides from the excavation of the wind farm infrastructure;*
> *b) Impacts on the Glenaboy River due to spills from construction machinery or from acid rock drainage from exposed pyritic or marcasitic rocks in the borrow pit.*
>
> *Although the frequency and location of the slope roadway settlement ponds are well-designed, the detailed design of the ponds themselves, and how they will be maintained is not stated in the NIS. In heavy rain events on unvegetated soils, the outflow from a settlement pond can often be breached by silt-laden water and this needs to be avoided where possible".*

4.2.1 HES Response

Proposed development within the Glenaboy River catchment is limited to 1 no. turbine and 1 no. borrow pit. The proposed turbine (T12) is set back more than 75m from the nearest watercourse while the borrow pit is ~300m from the nearest watercourse. Therefore, even in the absence of mitigation (i.e. uncontrolled runoff), the potential for significant effects on the Glenaboy River and downstream Blackwater River SAC is very unlikely.

Nevertheless, robust drainage control measures for access roads, turbine bases/hardstands and borrow pits are provided in Section 10.5.2.2 and Section 10.5.2.4 of the EIAR respectively.

Process flow diagrams detailing the range of drainage control measures at turbine bases/hardstands and borrow pits are attached as **Appendix II**. Any effects on the Glenaboy River will be imperceptible and brief in duration as assessed in Section 10.5.2.2 of the EIAR. No significant effects on the Blackwater River SAC downstream of the Glenaboy River will occur.

The Geotechnical Assessment carried out by Fehily Timoney and Company (included as Appendix 4-2 of the EIAR) concluded that there was no evidence of past failures, nor were there any signs of instability noted on the proposed development site. The geotechnical assessment was based on a walkover survey and several trial pits carried out in the area of T12 and the borrow pit (along with the rest of the proposed site). The site has also been used for

[2] *NPWS are part of the Heritage Division of the Department of Housing, Local Government & Heritage.*

forestry (including forestry road construction) for many years without any ground stability issues being reported.

The proposed design detail of the settlement ponds is shown in Drawing no. P1453-0-0121-A1-D501-00A (Appendix 4-6 of the EIAR). The design process with regard to settlement pond sizing is described in Section 2.2 above.

The settlement ponds have been designed to accommodate a 100-year return period rainfall fall event. Therefore, potential breaching of the settlement ponds would only occur during a more extreme weather event (>100-year return period) when flows in the receiving waters (i.e. Glenaboy River) would be at flood levels anyway, and thus turbidity levels would subsequently be naturally high. Runoff from the overall site would also be very high.

The monitoring and maintenance of the proposed drainage system are described in Section 10.5.2.2 of the EIAR:

> *An inspection and maintenance plan for the on-site construction drainage system will be prepared in advance of the commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.*
>
> *Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. Checks will be carried out on a daily basis.*
>
> *During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (as per the CEMP is included in Appendix 4-4 of this EIAR).*

For the reasons outlined above, we have demonstrated that even in the absence of mitigation (which will not be the case), no significant effects on the Blackwater River SAC downstream of the Glenaboy River will occur. Nevertheless, an array of mitigation measures are proposed to protect downstream designated sites.

The matter raised concerning acid mine drainage is addressed in Section 2.4 above.

4.3 INLAND FISHERIES IRELAND

In their submission, Inland Fisheries Ireland (IFI), reiterated (similar to their scoping submission) and emphasised the mitigation required to protect water quality and the downstream aquatic environment.

All of the matters raised are addressed through the comprehensive suite of mitigation outlined in the submitted EIAR.

4.4 AN TAISCE

An Taisce raised no water-related matters in their submission.

5 THIRD-PARTY SUBMISSIONS

5.1 INTRODUCTION

This section deals with third-party submissions. Due to the large number of third-party submissions, which generally have recurring themes, the responses outlined below are by matter of topic, except for our response to the submission by Eco-Hydrological Analysis Ltd where we have provided a direct response to a number of hydrological/hydrogeological matters raised.

The key hydrological matters raised by Eco-Hydrological Analysis Ltd are summarised at the end of their submission under the following headings/topics:

- Hydrological Conditions;
- Hydrogeological Conditions;
- Design;
- Buffer Zones; and,
- Elevated Risk.

A response is then provided to recurring matters that are raised in the other third-party submissions under the following topics.

- Private Well Supplies
- Youghal Public Water Supply
- Landfill Site "Super Dump" Unsuitability
- Substation/Battery Storage Area
- WFD Status Effects
- Flood Risk

5.2 ECO-HYDROLOGICAL ANALYSIS LTD

The key hydrological matters raised by Eco-Hydrological Analysis Ltd are re-written below and a response to each of the matters raised is then provided.

We state at the outset, that the issues raised by Eco-Hydrological Analysis Ltd are nit-picky and extreme worst-case scenarios, and we have addressed the key matters raised. The submitted commentary by Eco-Hydrological Analysis Ltd is at odds with the EIAR reviews and submissions made by Cork County Council, Waterford City & County Council, Irish Water, Inland Fisheries Ireland, and An Taisce.

"***Hydrological Conditions #1***: *The development lies in the catchment of two public drinking water supplies, both of which display high sensitivity to suspended sediment levels. The relationship between suspended sediment levels and hydrological conditions in both catchments has not been adequately demonstrated. (Data only for autumn/winter)".*

HES Response to Hydrological Conditions #1

- The proposed development is located within the catchments draining to the abstraction locations for one public water supply scheme, i.e. the Youghal PWS.
- No infrastructure associated with the proposed development occurs in the catchment to the Tallow Public Water Supply. This is clearly stated in the EIAR in Section 10.3.7.1.
- The EIAR addresses all potential significant effects that may arise from the proposed development.
- We have at all times during our EIAR assessment acknowledged the sensitivity of the receiving waters downstream of the proposed development.

- Our sampling was event-based (i.e. following rainfall), so we were specifically trying to understand the seasonal variation in flow and water quality (especially during higher flow events). To imply our approach is inadequate is wholly incorrect and disingenuous;
- It should be noted that in general surface water suspended solid levels are normally higher in Winter (high flow conditions) than during Summer (low flow conditions), therefore the collected autumn/winter data is worst-case.
- We also point out that site-specific sampling and monitoring were completed in January, February, June, September, October, and November (not only in autumn /winter as stated in the submission).
- Considering all of the above, the wind farm drainage design seeks to achieve a design threshold for Suspended Solids at the point of discharge, and this will meet required Surface Water quality and WFD requirements;
- For example, the drainage design will achieve <25mg/L in downstream receiving waters which is compliant with S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988, and the overall WFD requirements;
- Wind farm drainage design is based on 100-year return period rainfall depths, and includes an appropriate climate change factor, and also for variability in catchment sizes;
- Wind farm drainage design assumes high sensitivity of downstream receptors regardless of seasonal variations;
- Sufficient information on the local hydrological regime has been gathered to design a robust drainage system for the protection of the Youghal Public Water Supply;
- Both Local Authorities (Cork & Waterford) have assessed the information contained in the EIAR, and neither authority has expressed the concerns raised by Eco-Hydrological Analysis Ltd; and,
- Irish Water has not objected to the proposed development assuming the appropriate mitigation is employed, and that there is no significant alteration of the existing hydrological regime.

For the reasons outlined above, we have demonstrated that the original EIAR assessment is appropriate. We have completed sufficient seasonal monitoring to underpin our EIAR assessment, and the comments made by Eco Hydrological Ltd should be disregarded by the Board.

"***Hydrological Conditions #2***: *Generation and use of much of the hydrological data remains unclear, e.g. flow duration curves*".

HES Response to Hydrological Conditions #2

- Presentation of surface water flow measurements and flow duration curves (i.e. in Section 10.3.4 of the EIAR) is for baseline definition purposes only. This is a requirement of the EIAR guidelines. The EIAR guidelines require the definition of the baseline environment for the proposed site, and then to complete the environmental assessment with reference to the defined baseline. The duration curve data presented in the EIAR is taken directly from EPA sources;
- The source of the flow duration data is "Flow Duration Curves for Ungauged Catchments in Ireland" which is a dataset provided by the EPA. We reference these data sources in the EIAR ("*Environmental Protection Agency – "Hydro-tool" Map Viewer (www.epa.ie)*"; and,

- Both Local Authorities (Cork & Waterford) and Irish Water have assessed the information contained in the EIAR, and none of these statutory bodies has expressed the concerns raised by Eco-Hydrological Analysis Ltd.

For the reasons outlined above, we have demonstrated that the original EIAR assessment is correct and substantiated by EPA data sources and that the comments made by Eco Hydrological Ltd are minor, and should be viewed by the Board in that context.

"***Hydrological Conditions #3***: *Approximately 10% of the forest on the proposed development site will be cut. This will affect the hydrological regime on both the Eastern Site and Western Site, with changes around those areas where the hydrological properties of the ground surface have changed most proving greatest*".

HES response to Hydrological Conditions #3

- The felling percentage stated by Eco-Hydrological Analysis Ltd is incorrect;
- Proposed felling accounts for only 6.6% (45.6ha) of the existing forestry (~690ha);
- Felling is split between the two blocks of the proposed site. Eastern block and western block of wind farm amounts to 33 and 12.6ha of felling respectively;
- Felling is also split between three sub-catchments (the Glendine River, the Tourig River and the Glenaboy River) which further reduces the potential for downstream effects;
- Felling at the western block is sub-threshold with regard a felling licence (<25ha);
- Felling at the eastern block is slightly above the felling licence threshold level;
- Felling is largely linear in layout and is distributed throughout the site in a non-block/compartment fashion which also significantly reduces the potential for hydrological effects;
- The felling will be carried out over a period of months, not days/weeks which will also significantly reduce the potential for downstream surface water quality effects;
- The existing landuse at the proposed Wind Farm site is mainly forestry, and felling will occur whether the wind farm development is permitted or not;
- The proposed felling area accounts for <1% of the total catchment area to the Youghal Public Water Supply intake (Glendine and Tourig combined);
- Our assessment is based on the existing site context (forestry land use), and the scale and location of the proposed layout relative to each sub-catchment. In all catchments, the scale of proposed works relative to the overall catchment size is negligible; and,
- Impacts from forestry felling are assessed in the EIAR at Section 10.5.2.1, and conclude that with the implementation of standard forestry mitigation, along with a felling licence application and associated implementation of conditions of the felling licence, the impacts will be imperceptible.

For the reasons outlined above, we have demonstrated that the original EIAR assessment is correct and substantiated by quantification and that the comments made by Eco Hydrological Ltd are incorrect and minor, and therefore should be viewed by the Board in that context.

"Hydrological Conditions #4: *The loss of forestry and changing of ground surface conditions will increase peak runoff. The impact of this change on flow and water quality in receiving water bodies has not been specified, despite potentially affect both stream ecology and drinking water quality***".**

HES response to Hydrological Conditions #4

- The potential for increased site runoff due to wind farm hardstand emplacement was assessed in Section 10.5.3.1 of the EIAR;

- Even in the absence of drainage control measures (which will not be the case) the potential for increased site runoff is calculated to be very small (~4%);
- The proposed permanent development footprint is approximately 23.3 ha, representing only <3% of the total development site of 833 ha;
- Approximately 6.4 ha of hardstand (~27.5%) is already in place in the form of existing roads;
- Proposed felling accounts for <1% of the combined catchment to the Youghal Public Water Supply intake;
- The proposed development footprint accounts for <0.5% of the catchment to the Youghal Public Water Supply intake; and,
- The potential for significant hydrological effects on the downstream catchment simply does not exist even in the absence of mitigation measures.
- The purpose of the EIAR is to assess potential significant effects. The potential changes to hydrology have been assessed as insignificant, just based on land take areas alone. No further analysis or quantification is required.

For the reasons outlined above, we have demonstrated that the original EIAR assessment is correct based on the actual risks posed, and therefore the comments made by Eco Hydrological Ltd are minor, and should be viewed by the Board in that context.

Hydrogeological Condition #1: *The change has the potential to reduce recharge and diminish base flow in the headwaters of the streams draining the area. The loss of flow and associated change in water quality may impact aquatic ecology.*

HES response to Hydrogeological Conditions #1

- The above statement is completely unfounded from a hydrogeological point of view;
- All rainfall (potential recharge) intercepted by the development footprint is released back onto the site ground surface in a diffuse, regular manner and close to the point of capture. Captured rainwater/runoff will be allowed to dissipate and infiltrate/recharge into the ground naturally;
- There will be no direct discharge of development footprint runoff into local watercourses and therefore there will be no alternation of surface water/groundwater interactions/runoff or reduction in recharge potential;
- The area of the proposed development footprint is very small in the context of the wider landholding, therefore the ability to generate impact needs to be considered in terms of scale and context; and,
- Based on the GSI groundwater body description (see text below), groundwater baseflow (from the rock type underlying the site) is not significant in sustaining surface water flows during dry periods:

  > *"Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low" – (GSI, 2004)*[3].

- The purpose of the EIAR is to assess potential significant effects. The potential changes to recharge are assessed as insignificant (refer to Sections 10.3.2, 10.3.9 & 10.5.3.1). No further analysis or quantification is required.

[3] *Geological Survey of Ireland (2004) Glenville GWB: Summary of Initial Characterisation*

For the reasons outlined above, we have demonstrated that the comment/concerns raised by Eco Hydrological Ltd are already addressed in the submitted EIAR, and the potential for impact of the sort described is insignificant in the context of the overall landholding and underlying geology, and as such the issue raised should be viewed by the Board in that context.

"Hydrogeological Conditions #2: *Many of the comments made concerning how proposed development of the site will affect the groundwater are speculative, and not supported by site specific data-notably the absence of groundwater level data*".

HES response to Hydrogeological Conditions #2

- Due to the nature of wind farm developments, being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor investigated during impact assessments;
- The above point is not speculative, but is based on experience from over 100 constructed windfarms that HES has had involvement with across Ireland;
- Wind farms do not have the potential to alter the local hydrogeology regime in any significant manner;
- The assessed effects in the EIAR are not speculative, but weighted accordingly for a proposed development that is largely built at or close to ground level;
- The purpose of the EIAR is to assess potential significant effects;
- The primary risk to groundwater at the site would be from cementitious materials, hydrocarbon spillage and leakages. These are common potential impacts on all construction sites (such as road works and industrial sites);
- Turbine base depths are typically 3-4m below ground level and even in a shallow groundwater table scenario (which is not the case at the proposed site based on the trial pitting data[4]), the potential for the turbine structures to affect the groundwater flow regime would be negligible and limited to a very brief period (if any) over the construction phase when short term dewatering of excavations might be required;
- Also, the topographical and hydrogeological setting of the proposed borrow pit locations means no significant groundwater dewatering will be required as described below;
- The proposed borrows pits are relatively shallow excavations on the side of hills/elevated ground;
- The groundwater flow paths (i.e. the distance from the point of recharge to the point of discharge) in the underlying mapped sandstone/mudstone bedrock typically is short, localised, and will also be relatively shallow;
- Thereby, no regional groundwater flow regime, i.e. large volumes of groundwater flow, will be encountered at the proposed borrow pit excavations;
- Moreover, direct rainfall and surface water runoff will be the main inflows that will require pumping and water quality management; and,
- Any effects on groundwater levels/flow regimes will be brief, temporary, reversible and localised to excavation locations.

In summary, our assessment regarding the potential effects on the local groundwater regime is not speculative but based on relevant scientific data and also our experience as hydrogeologists working on numerous energy developments across the country and in hydrogeological conditions that are similar to those that exist at the proposed Lyrenacarriga WF site. As such, for the reasons outlined above, we have demonstrated that the original EIAR assessment (on groundwater regime and supplies and wells) is adequate and appropriate to the actual risks posed.

[4] *Groundwater was encountered in TP06, but this location is remote from any proposed wind farm infrastructure.*

Design #1: *Tracking the release of sediment to surface water has been proposed through a series of generic design of dams, culverts and settling ponds located around the site, and contained in drawings accompanying the planning application, but not the EIAR.*

Design #2: *The dimensions of these features does not appear to vary, despite their contrasting settings (catchment areas, topography), nor has this variation been specified in the application.*

Design #3: *The risk of the proposed sediment management measures becoming overwhelmed and failing to prevent significant sediment loss to water courses has not been presented in either EIAR or NIS documentation.*

HES response to Design #1 to Design #3

- Refer to the response to NPWS comments outlined in Section 2 above.
- Drainage drawings are site-specific and are referenced in the EIAR as Appendix 4-6.
- Settlement ponds will be sized based on design rainfall depths and surface area/catchments;
- Settlement pond size will be based on a 100-year return period event including climate change;
- Overwhelming of settlement ponds are possible during extreme events (>100-year return period), but downstream watercourses will already be in flood conditions and turbidity levels/sediment loads will be naturally elevated;
- In such extreme weather events (>100-year return periods), surface water runoff from all parts of the proposed development site will be high and most likely be elevated in turbidity (as will all of the catchment outside the development footprint); and,
- Regular monitoring and drainage inspections (as outlined in the EIAR) will ensure sediment trap/holding areas (i.e. check dams/settlement ponds etc) will be free of sediment build-up in advance of any forecasted extreme weather event.

The design of the settlement ponds was provided as part of the detailed drainage plans which accompanied the EIAR. The plans are site-specific and reflect the hydrological conditions at the proposed development site. As mentioned above, the settlement ponds are a part of a series of water quality protection mitigation measures proposed for the site. We trust our response above reflects these details and also demonstrates the detailed consideration of drainage controls and water quality protection presented in the EIAR.

"Buffer Zone #1: *Despite the application of the 75m buffer zone around water courses, many of the sediment management features are located within the buffer zones, in some cases less than 50m from a watercourse".*

"Buffer Zone #2: *Discharge from sediment traps in water course buffer zones are surrounded by silt fences. Again, the risk of silt fence failure has not been specified".*

HES Response to Buffer Zone #1 – Buffer Zone #2

- The purpose of *the* 75m buffer zone is to maintain setback distance for infrastructure such as turbines, borrow pits, the substation etc along with new access roads where possible;
- Water released within buffer zones will have already passed through checks dams, settlement ponds and buffered outfalls and therefore will be of good quality;

- Silt fences are only a minor component of the overall treatment train (check dams, settlement ponds, buffered outfalls, silt fences and vegetation filters) and the failure of a silt fence will not compromise the protection of downstream waters; and,
- Regular monitoring and drainage inspections (as outlined in the EIAR) will ensure the upkeep and efficiency of the proposed drainage control measures.
- This issue (encroaching into buffer zones) is raised on numerous occasions by third-party submissions on wind farm development. The purpose of buffer zones is misunderstood. Similar to any linear development (such as motorways or gas lines), there have to be stream and river crossings. In order to limit impacts, there has to be surface water management and controls close to streams and rivers.
- The identified buffer zones serve a number of purposes:
    - They are never intended to be a complete exclusion zone (as stated watercourse crossings are required).
    - They ensure all proposed significant infrastructure (turbine bases, substations, borrow pits etc) are located remote from sensitive watercourses.
    - They provide the separation from key infrastructure to ensure there is adequate space (between the infrastructure and the watercourses) to install appropriate drainage controls.
    - They identify clearly on the drainage drawings for the proposed development where sensitive watercourses are located.

The concerns raised by Eco Hydrological Ltd regarding buffer zones show a lack of understanding of the proposed drainage design for the WF development. Based on the reasons outlined above we consider that this issue has been appropriately explained and addressed.

"Elevated Risk #1: *The sediment management strategy relies on vegetation to trap sediment and prevent it reaching watercourses. In the absence of vegetation (in some cases yet to grow), there exists a heightened risk of sediment contamination".*

HES Response to Elevated Risk #1:

- Elevated Risk #1 statement is completely misinformed and shows a lack of understanding of the wind farm drainage proposal;
- Vegetation filters are not intended to be a single or primary treatment component for the treatment of works area runoff. They are not stand alone but are intended as part of a treatment train of water quality improvement/control systems (i.e., source controls→check dams→silt traps→settlement ponds→silt fences→vegetation filters) that will be applied in series to ensure the protection of downstream watercourses. Refer to the process flow diagrams in **Appendix II** attached for water treatment trains for all elements of the proposed development.
- Vegetation filters are essentially end-of-line polishing filters that are located at the end of the treatment train. Vegetation filters are ultimately a positive consequence of not discharging directly into watercourses which is one of the mitigation components of the drainage philosophy.
- This makes use of the natural vegetation of the site to provide a polishing filter for the wind farm drainage before reaching the downstream watercourses.

Elevated Risk #2: *Outflows from sediment traps onto formerly afforested areas have an elevated risk of contaminating water courses, even outside buffer zones, due to the presence of existing artificial drains linked to prior forestry, which act as preferential flow paths to receiving water courses".*

HES Response to Elevated Risk #2:

- Existing artificial forestry drains are widespread at the site whether the area is forested, afforested or deforested*;*
- The interaction with the existing forestry drainage is a key component of the drainage design and this interaction is described in Section 10.5.2.2 of the EIAR and presented again below for ease of reference;
- Existing artificial forestry drains are indeed the primary pathway/preferential flowpath to downstream waters and this has been accounted for in the drainage design; and,
- The main elements of interaction with existing drains will be as follows:
    - Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the proposed wind farm drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion;
    - Silt traps will be placed in the existing drains upstream of any streams where construction works/tree felling is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area;
    - Runoff from individual turbine hardstanding areas will be not discharged into the existing drain network but discharged locally at each turbine location through stilling ponds and buffered outfalls onto vegetated surfaces;
    - Buffered outfalls which will be numerous over the site will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site; and,
    - Drains running parallel to the existing roads requiring widening will be upgraded, and widening will be targeted to the opposite side of the road. Velocity reducing and silt control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, and silt fences will be used during the upgrade construction works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.

Again, the concerns raised by Eco Hydrological Ltd regarding vegetation filters and drainage outfalls show a lack of understanding of the proposed drainage design for the development. For the reasons outlined above, we consider that these issues raised have been appropriately explained and addressed.

5.3 RESPONSES TO RECURRING MATTERS/TOPICS RAISED BY 3RD PARTIES

PRIVATE WELL SUPPLIES

As outlined in the EIAR due to the nature of wind farm developments, being near surface construction activities, impacts on groundwater are negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the site would be from cementitious materials, hydrocarbon spillage, and leakages. These are common potential impacts on all construction sites (such as road works and industrial sites). All potential contamination sources will be carefully managed at the site during the construction, operational, and decommissioning phases of the development, and mitigation measures are proposed below to deal with these potential minor impacts.

The potential risk to local wells was also assessed in the EIAR based on the characteristics of the underlying mapped bedrock (sandstone/mudstone) aquifer which is described in the GSI Glenville Groundwater Body Report (GSI, 2004)[5]. In Chapter 10, Section 10.3.8 of the EIAR the following is referenced from GSI Glenville Groundwater Body Report (GSI, 2004).

> *"The ORS rocks have no intergranular permeability. Groundwater flow occurs in faults and joints which vary in presence and frequency. Most groundwater flow probably occurs in an upper shallow weathered zone. Below this in the deeper zones water-bearing fractures and fissures are less frequent and less well connected. The water table is generally within 10 m of the surface. Groundwater in this GWB is generally unconfined. Local groundwater flow is towards the rivers and streams, and flow paths will not usually exceed a few hundred metres (200-300m) in length.*
>
> *Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater-surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low".*

Based on the hydrogeological conceptual model of the site, the potential impact on local wells was assessed in Chapter 10, Section 10.3.15 of the EIAR. The approach was described as follows:

> *"The private well assessment undertaken assumes the groundwater flow direction underlying the site mimics topography, whereby flow paths will be from topographic high points (i.e. top of a hill) to lower elevated discharge areas at local streams/rivers. This is consistent with the groundwater body conceptual model as reported by the GSI (2004).*
>
> *Using this conceptual model of groundwater flow, dwellings that are potentially located down-gradient of the footprint of the Proposed Development are identified and an impact assessment for these actual and potential well locations is undertaken if required.*
>
> *Based on the above approach no private dwelling houses were identified to be located down-gradient (i.e. downslope) of the proposed wind farm infrastructure (and, in particular, turbine and borrow pit locations where deeper excavations are required) and therefore there is no potential to impact on groundwater supplies. This assessment was focused on the turbine locations and borrow pits as this is where the deepest excavations will be required. All excavations required for roads, compounds, substation, met mast and cabling will be relatively shallow (~1.2m) and therefore have no potential to impact on groundwater supplies."*

The closest private dwellings (assumed private well location) downslope of the proposed infrastructure is at least 500m away. This is at least 1.5 times the expected groundwater flow path distance (*i.e.*, 200 - 300m) for this aquifer type. Therefore, the potential for the proposed development (even in the absence of the proposed pollution prevention mitigation measures) to impact on local groundwater wells/supplies near the site is extremely low as the pathways for potential contaminants does not exist.

Similarly, an excavation of 3 -4m in depth simply does not have the potential to alter the groundwater level in a well over 500m away.

The potential impact on local groundwater wells was thoroughly assessed in the EIAR. This assessment was based on the properties of the underlying bedrock aquifer and the location of the nearest wells.

[5] *Geological Survey of Ireland (2004) Glenville GWB: Summary of Initial Characterisation*

Therefore, to summarise:

- The site is underlain by an aquifer of relatively low productivity as stated by the GSI (sandstone/mudstone);
- Groundwater flowpaths are therefore typically short (~200 - 300m maximum);
- Consequently, the majority of groundwater flows within the site emerge as springs/baseline along streams/rivers and leave the site as surface water flows and not groundwater flows as stated by the GSI;
- Therefore, the potential to impact on local wells (whether they are downslope or not) is very low as groundwater flowpaths between the proposed development infrastructure and local wells typically do not exist due to the large setback distance (>500m);
- Nevertheless, mitigation is provided in the EIAR to deal with potential construction phase groundwater hazards such as oils and fuels; and,
- Therefore, based on our hydrogeological assessment of the site with regard to groundwater user risk and the proposed mitigation measures, we can say the potential to impact on local wells/water supply sources is negligible.

The purpose of the EIAR is to assess likely significant effects. We are satisfied, based on the prevailing hydrogeological conditions at the proposed development site, that the assessment presented in the EIAR that the potential to impact groundwater quality or quantity remote from the proposed development site is imperceptible, is a valid and appropriate assessment for the site.

YOUGHAL PUBLIC WATER SUPPLY

The potential impacts of the proposed development on the Youghal Public Water Supply were assessed in Section 10.5.2.10 of the EIAR. A response to the Irish Water submission on the matter of the Youghal Public Water Supply is also provided in Section 4.1.1. above. As outlined above (In Section 3 and Section 4.1) neither Irish Water nor the two Local Authorities are objecting to the proposed development, but they do emphasise the importance of mitigation in order to prevent impacts on the supply. We agree with this emphasis, and all mitigation as described in the EIAR will be implemented.

A third-party submission by Mr Thomas Morley also highlights the sensitivity of the Youghal Public Water Supply with regard to sediment. However, as previously mentioned, the wind farm design team was at all times aware that the Youghal Public Water Supply abstraction is a key downstream receptor. Please refer to Section 3.1 above which illustrates that Cork County Council (Operators of the Youghal Water Supply) have no objections on environmental grounds to the proposed development. In addition, to the proposed robust drainage design proposal, a final line of defence can be provided by a water treatment train such as a "Siltbuster" if required. Waterford County Council has suggested the use of "Siltbuster" technology as stated in their submission.

The submission by Paddy Massey, which included video footage of drainage at the proposed substation, argues that the proposed location of the substation is a wetland area and its construction at this location poses a risk to Youghal Public Water with regard to surface water quality effects. However, trial pits carried out at the substation location in May 2020 identified ground conditions similar to the rest of the proposed wind farm site (i.e. Devonian derived glacial till). Some surface water drainage was noted at ground level, but below ground level, no groundwater inflows were recorded as would most likely not be the case if it were a wetland setting. The proposed drainage design and setback distance (75m) from the Glendine headwater stream will ensure the protection of the Youghal drinking water abstraction and its associated drainage catchment. In simple terms, what Paddy Massey has highlighted is the exact type of scenario the proposed drainage design is intended to deal with. Therefore, this issue has been accounted for within the submitted application and EIAR.

LANDFILL SITE "SUPER DUMP" UNSUITABILITY

A number of the third-party submissions cite the decision not to proceed with the development of a municipal landfill "Super Dump" in the area of the proposed wind farm site (due to site unsuitability/water contamination risks) as a reason to also refuse the proposed wind farm development.

There is no comparison to be made between the risks posed by a municipal landfill and a proposed wind farm development.

Assessment and mitigation for receiving water protection for the proposed wind farm site are robustly dealt with in the EIAR.

SUBSTATION/BATTERY STORAGE AREA & ENVIRONMENTAL RISK

There is a potential for mechanical failures and fires in any given energy generation facility/industrial facility in the absence of regular maintenance and checks. However, mechanical/technical failure and fires at substations/battery storage areas are very rare.

The proposed wind farm development will be subject to routine/preventative maintenance throughout its operational life which will significantly reduce the risk of mechanical failure or fires from occurring (e.g. resulting in potential leakage of lubricating oil / hydraulic fluid or contaminated fire water).

There will also be an Operational Phase Emergency Response Plan (Section 6 of the Construction Environmental Management Plan) in place which can rapidly deal with any spillages/leaks/fires that might occur as a result of an unlikely mechanical failure. This will include the use of booms and spill kits that can contain and remove any spills that might occur.

The risk posed by the failure of a substations/battery storage area to surface water or groundwater quality is extremely low.

POTENTIAL EFFECTS ON WFD STATUS

A WFD assessment is included in **Appendix III** to determine if any specific components or activities associated with the proposed wind farm development will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status.

Strict mitigation measures (refer to Section **Error! Reference source not found.** and **Error! Reference source not found.** of the EIAR and also detailed in this submission) in relation to maintaining a high quality of surface water runoff from the development and groundwater protection will ensure that the proposed development will not impact upon any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

With regard to treatment standards, the drainage system has been designed to achieve compliance with surface water Environmental Quality Standards (EQS) in the downstream receiving waters. The details of the monitoring, to ensure this compliance, are included in Section 4 of the Construction and Environmental Management Plan (CEMP). The CEMP is included in Appendix 4-4 of the EIAR.

The application of the drainage management as outlined will ensure compliance with EU Surface Water Regulations and WFD requirements while also maintaining the baseline hydrology of the site.

As such, the proposed development is compliant with the requirements of the Water Framework Directive (2000/60/EC), as amended.

POTENTIAL EFFECTS ON FLOOD RISK

The proposed development site is in an elevated area, its flood risk is reduced by the prevailing ground slope, drainage density, and runoff rates. It is not intended to change these prevailing conditions, and the proposed wind farm development intends to mimic the prevailing hydrology as much as possible and provides attenuation and water treatment proposals where required.

It is a key mitigation of the proposed wind farm development to preserve and protect all existing watercourses by ensuring all surface water runoff is treated (water quality control) and attenuated (water quantity control) prior to diffuse discharge at pre-existing Greenfield rates. As such the mechanism by which downstream flooding is prevented and controlled is through avoidance by design.

It also should be noted that the Area Engineer from Cork Co. Co. has no concerns with regard to the proposed drainage:

> "*There are no objections to the proposals regarding site drainage and attenuation measures*".

We are confident that the proposed drainage design will remove any risk of increased downstream flooding as acknowledged by Cork Co. Co.

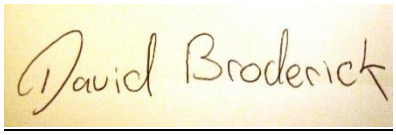
6 SUBMISSION SUMMARY

- A robust and detailed EIAR for the proposed wind farm development was submitted with the SID application. This included a detailed drainage plan.
- We have comprehensively responded to and addressed all matters raised by the Board, and by Statutory Bodies and third-party submissions.
- Both Local Authorities (Cork & Waterford) and Irish Water have assessed the water-related information contained in the submitted EIAR, and all of these statutory bodies recommend the implementation of the water-related mitigation outlined in the EIAR.
- As outlined, at all times during the preparation of the EIAR we were conscious of the requirements to protect water quality in the Glendine and Tourig catchments, both from a water supply and a WFD compliance perspective.
- There is significant water related mitigation outlined in the EIAR to ensure that water quality protection is upheld.
- All (water-related) mitigation as outlined in the EIAR will be implemented.
- We have comprehensively addressed the matters raised in the DAU submission relating to:
    - Settlement pond structure and design;
    - Potential for acid mine drainage; and,
    - Protection of hydrology and water quality in the Glenaboy River which drains to the Blackwater River SAC.
- We consider that the hydrological/hydrogeological matters presented in the Eco-Hydrological Analysis Ltd's submission has limited substance or scientific basis. We have thoroughly responded to and addressed any relevant matters raised; and,
- Other third-party concerns relating to surface water quality, drinking water quality, groundwater well sources, and flood risk are also addressed. All of these third-party concerns are assessed in the submitted EIAR, and appropriate mitigation measures will be applied where required.

7 CLOSURE

We trust the above response meets your requirements. Please contact the undersigned if you have any questions regarding the above.

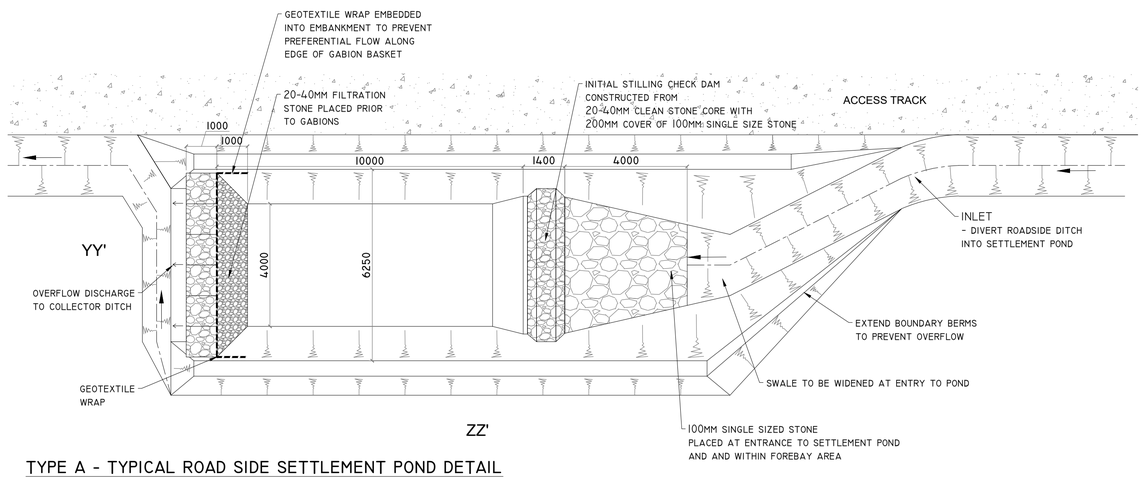
Yours sincerely,



David Broderick
Hydrogeologist
B.Sc., H. Dip Env Eng. MSc

APPENDIX I: UPDATED Drawing P1453-0-0121-A1-D501-00B

DETAIL A1



TYPE A - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL

SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)

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POND SIZE W [M] x L [M] x D [M]			CATCHMENT SIZE (M^2)		
RETURN PERIOD	*50 YRS*	STORM DURATION	500	1000	2000
6HR RETENTION FOR COARSE SILT		6 HRS	2.8 x 9 x 1 M	4 x 13 x 1 M	5.7 x 18 x 1 M
11HR RETENTION FOR MEDIUM SILT		12 HRS	3.2 x 10 x 1 M	4.5 x 14 x 1 M	6.4 x 20 x 1 M
24HR RETENTION FOR FINE SILT		24 HRS	3.5 x 11 x 1 M	5 x 16 x 1 M	7 x 22 x 1 M

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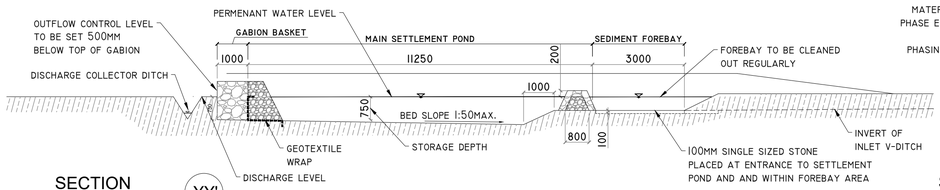
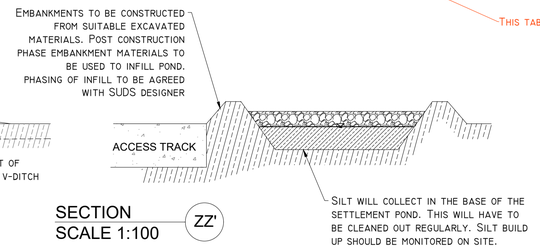
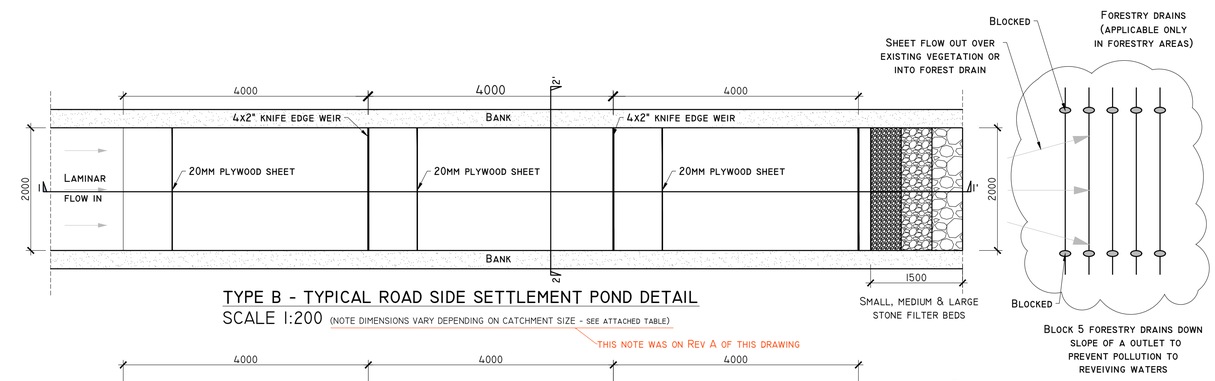


SECTION YY'
SCALE 1:100



SECTION ZZ'
SCALE 1:100



TYPE B - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL

SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)

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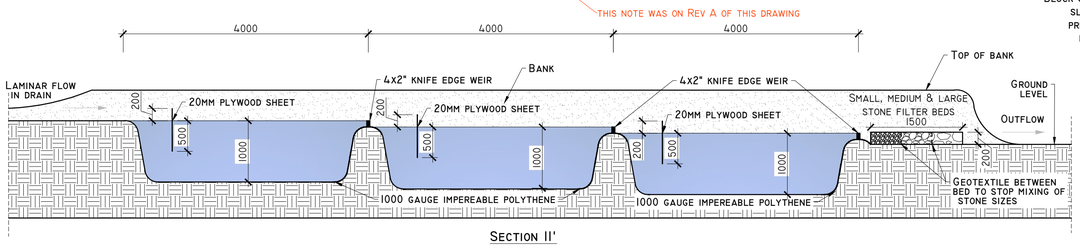

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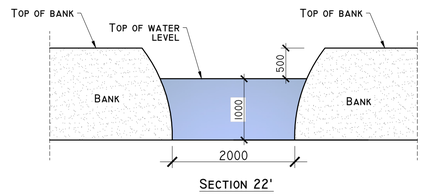

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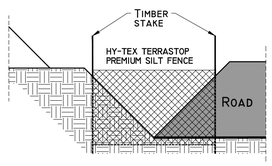

DETAIL A2

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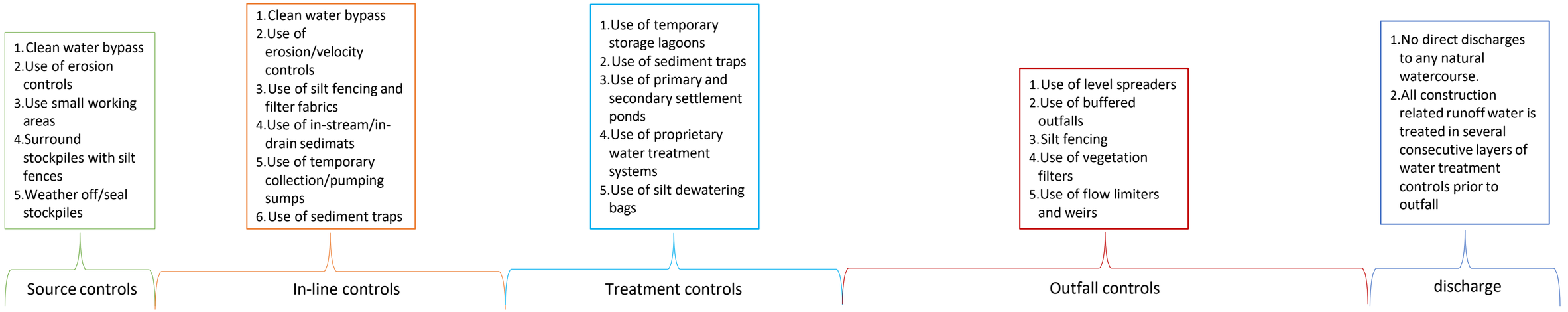
Title:
DRAINAGE DETAILS 1

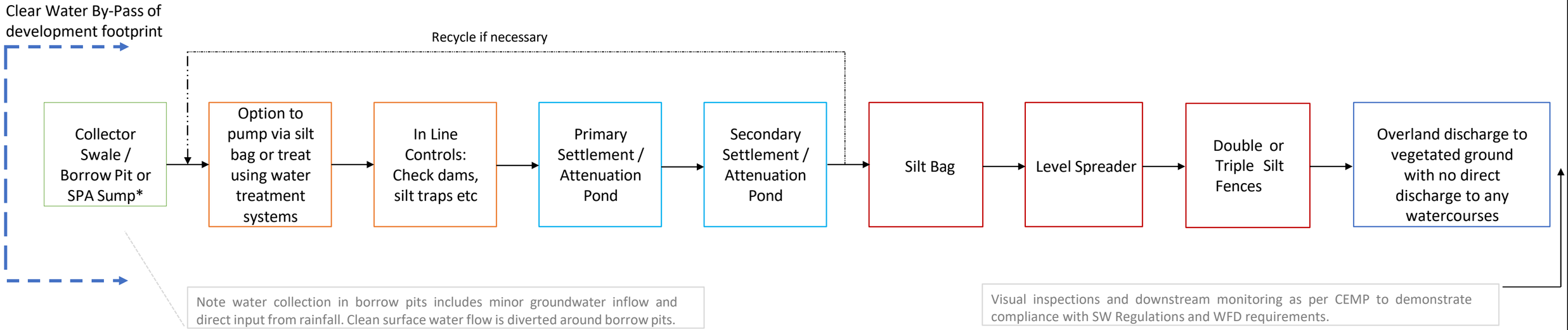
Figure No: D501

Drawing No: P1453-0-0922-A1-D501-00B	
Sheet Size: A1	Project No.: P1453-0
Scale: as shown (A1)	Drawn By: MG/GD
Date: 07/09/2022	Checked By: M.G.

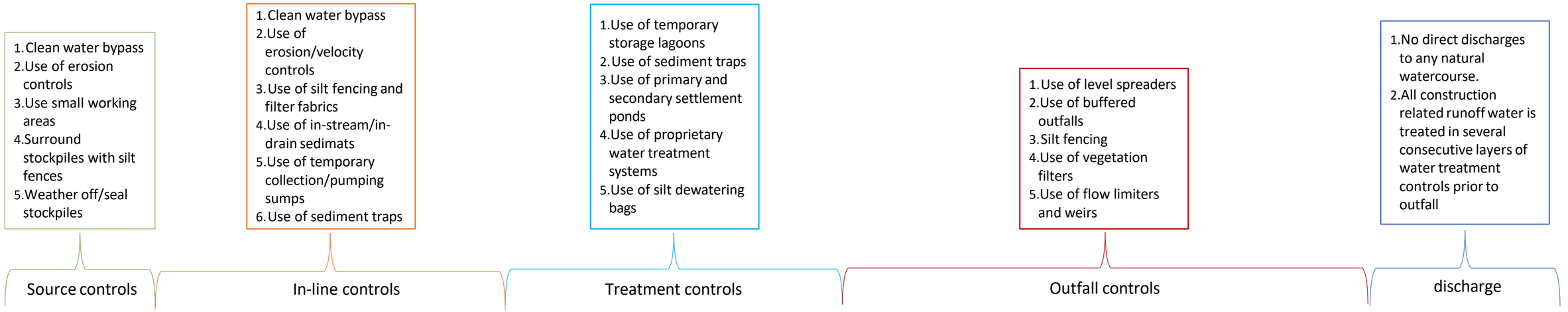
APPENDIX II: Drainage Process Flow Diagrams

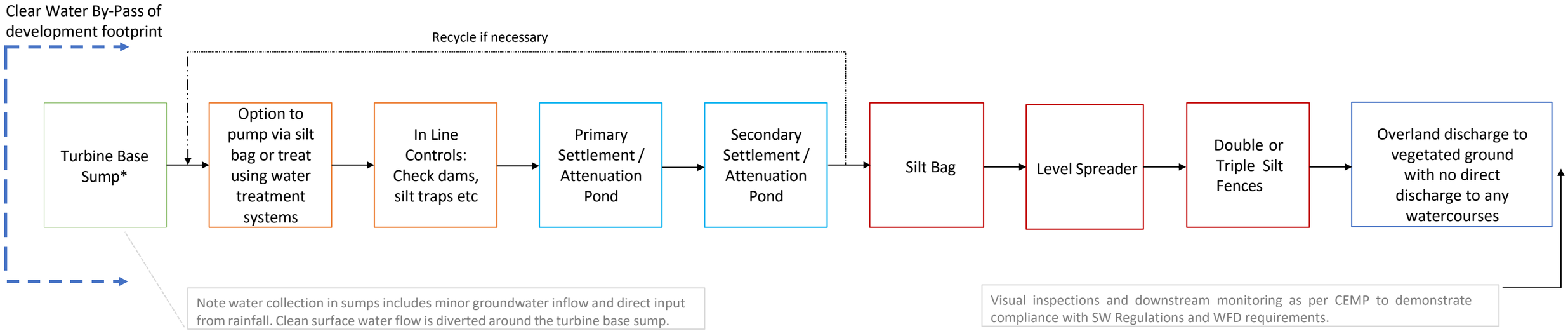
Water Management at Proposed Borrow Pits/Spoil Storage Areas



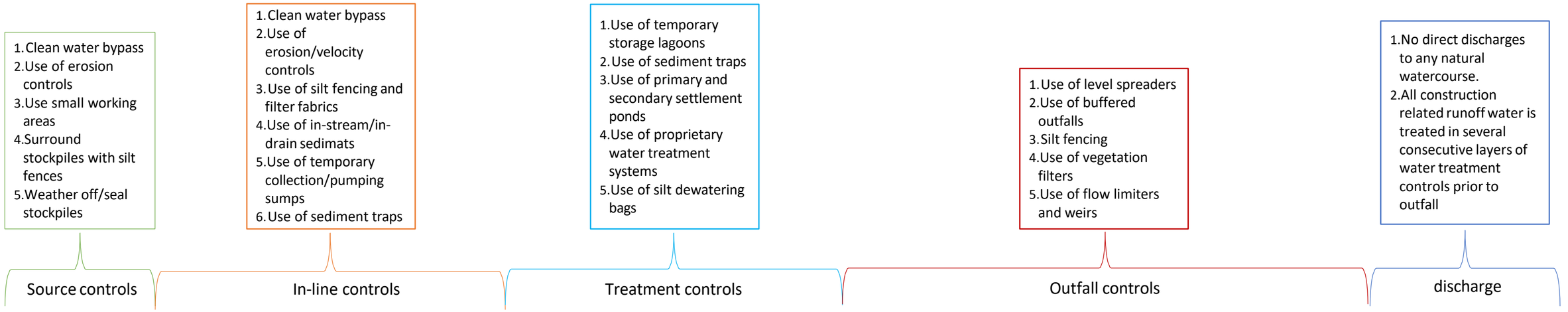


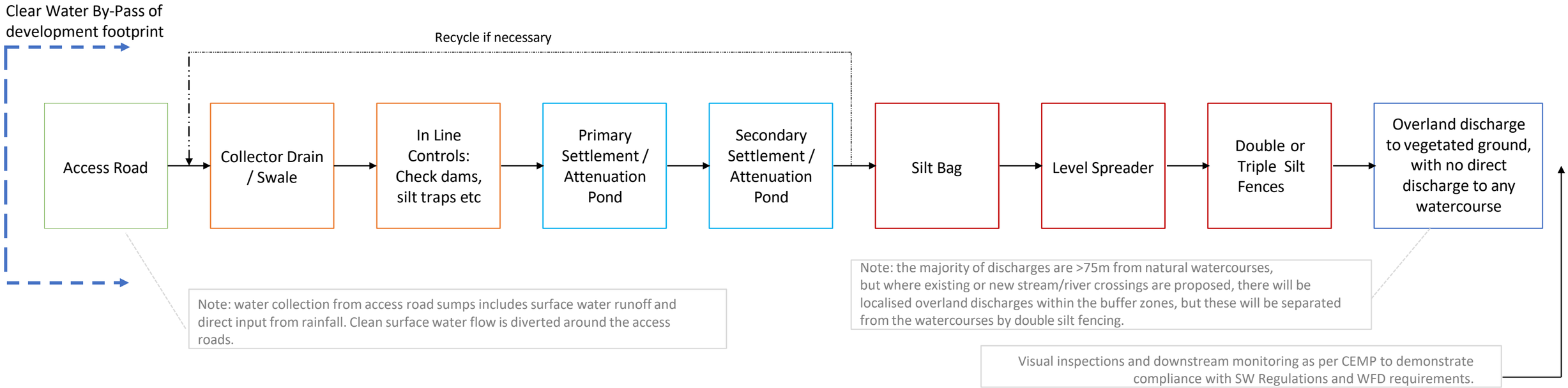
Water Management at Proposed Hardstand/Turbine Bases





Water Management at Proposed Access Roads





APPENDIX III: WFD Compliance Report

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WATER FRAMEWORK DIRECTIVE ASSESSMENT
PROPOSED LYRENACARRIGA WIND FARM, CO. WATERFORD & CORK

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**WATER FRAMEWORK DIRECTIVE ASSESSMENT PROPOSED LYRENACARRIGA WIND FARM, CO. WATERFORD & CORK**
Issue Date:	**08th September 2022**
Project Number:	**P1453-1**
Project Reporting History:	**P1453-1**
current revision no:	**FINAL_REV D1**
Author:	**MICHAEL GILL DAVID BRODERICK CONOR MCGETTIGAN**
Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO, to complete a Water Framework Directive (WFD) Compliance Assessment for a planning application for the proposed Lyrenacarriga wind farm and grid connection development. The proposed wind farm site is located approximately 5km southeast of Tallow, Co. Waterford and approximately 9km northwest of Youghal, Co. Cork. The proposed development comprises a total of 17 no. turbines (11 no. turbines located in Co. Waterford and 6 no. turbines located in Co. Cork), a grid connection and all associated development works. The Proposed Development Site is divided into an eastern cluster with 10 no. turbines and a western cluster with 7 no. turbines.

The purpose of this WFD assessment is to determine if any specific components or activities associated with the proposed wind farm development will compromise WFD objectives or cause a deterioration in the status of any surface water or groundwater body and/or jeopardise the attainment of good surface water or groundwater status. This assessment will determine the water bodies with the potential to be impacted, describe the proposed mitigation measures and determine if the project is in compliance with the objectives of the WFD.

This WFD Assessment is intended to supplement the Hydrological and Hydrogeological Responses to a An Bord Pleanála Further Information Request in relation to the proposed Lyrenacarriga Wind Farm.

1.2 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types including wind farms.

This WFD assessment was prepared by David Broderick, Michael Gill and Conor McGettigan.

David Broderick (BSc, H. Dip Env Eng, MSc) is a hydrogeologist with over 13 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Derrykillew WF, Croagh WF, and Oweninny WF, and over 60 other wind farm related projects across the country.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Slievecallan WF, Cahermurphy (Phase I & II) WF, Carrownagowan WF, and Croagh WF and over 100 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is a junior Environmental Scientist, holding an M.Sc. in Applied Environmental Science (2020) from University College Dublin. Conor has also completed a B.Sc. in Geology (2016) from University College Dublin. In recent times Conor has assisted in the preparation of hydrological and hydrogeological impact assessments for a variety of wind farm developments.

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("**WFD**"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the WFD is not compromised.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include identifying river basin districts, water bodies, protected areas and any pressures or risks, monitoring and setting environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with the second cycle plan covering the period from 2018 to 2021.

The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed wind farm development, include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Our understanding of these objectives is that water bodies, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed.

We note that the River Basin Management Plan 2022-2027 is out for public consultation presently, and that closed in March.

2. WATERBODY IDENTIFICATION CLASSIFICATION

2.1 INTRODUCTION

This section identifies those surface water and groundwater bodies with potential to be affected by the proposed development and reviews any available WFD information.

2.2 SURFACE WATERBODY IDENTIFICATION

On a regional scale, the Proposed Development Site is located in the River Blackwater surface water catchment within Hydrometric Area 18 of the South-Western International River Basin District. The River Blackwater, which is a transitional waterbody at this location (i.e. estuarine), flows in a southerly direction approximately 5km to the east of the eastern cluster at its closest point.

On a more local scale, the northern section of the eastern cluster and the northern section of the western cluster (~20% of the overall wind farm site) are both located in the River Bride sub-catchment (Bride[Waterford]_SC_030). The River Bride flows in an easterly direction approximately 4km to the north of the western cluster and is a major tributary of the River Blackwater. In terms of the proposed wind farm infrastructures, 1 no. turbine (T12) and 1 no. borrow pit from the western cluster are located in the River Bride sub-catchment. This area of the western cluster drains to the River Bride via the Glenaboy River (Glenaboy_010) with all the aforementioned proposed infrastructure being located in the Glenaboy River sub-basin. Meanwhile, the northern section of the eastern cluster is drained by the Killbeg stream which forms part of the Bride[Waterford]_010 river waterbody. However, no proposed wind farm infrastructure associated with the eastern cluster are located in the Bride River sub-catchment.

The remainder of the western and eastern clusters are located in the Tourig River sub-catchment (Tourig_SC_010). In terms of the proposed wind farm infrastructures, 11 no. turbines, 1 no. proposed borrow pit, 1 no. 110kV substation and the eastern section of the overhead grid connection loop are located in the Glendine river sub-basin (Glendine_010). The Glendine River flows to the southeast before discharging into the Lackaroe (Glendine) Estuary, which in turn discharges into the Lower Blackwater Estuary. A small area in the east of the eastern cluster is mapped within the Harrowhill_010 river sub-basin. This river waterbody also drains to the southeast, towards the Lower Blackwater Estuary, however no proposed infrastructure is located in this river sub-basin. Further west, within the western cluster, a total of 5 no. turbines, 1 no. borrow pit, 1 no. temporary construction compound, the western section of the grid connection route ~~collector cable~~ (3.3km) and Turbine Delivery Route (TDR) works at Breeda Bridge are drained by the Tourig River (Tourig_010 SWB). Further downstream the proposed TDR works at Lombards Crossroads are located within the Tourig_020 river sub-basin. The Tourig River discharges into the Lower Blackwater Estuary to the northwest of Youghal, Co. Cork.

Error! Reference source not found. presents the catchment area of each river waterbody downstream of the Proposed Development Site. The Glenaboy_010 river waterbody in the vicinity of the site has the smallest catchment area of 8.70km^2. The catchment area of the river waterbodies increases progressively downstream as more streams and rivers confluence. Downstream of where the Glenaboy River discharges into the Bride River, the Bride(Blackwater)_070 river waterbody has a total upstream catchment area of 370.73km^2. Therefore, those river waterbodies which are located in close proximity to the Proposed Development Site with small catchment areas will be more susceptible to water quality impacts as a result of the Proposed Development in comparison to those located further downstream with large catchment areas.

Figure A below is a local hydrology map of the area.

Table A: Downstream Catchment Size for River Waterbodies

WFD River Sub-Basin	Total Catchment Area (km²)
Bride River sub-catchment (Bride_SC_030)	
Glenaboy_010	8.70
Glenaboy_020	18.16
Bride(Blackwater)_070	370.73
Bride[Waterford]_010	427.88
Tourig River sub-catchment (Tourig_SC_010)	
Harrowhill_010	24.51
Glendine(blackwater)_010	20.87
Tourig_010	17.21
Tourig_020	45.94

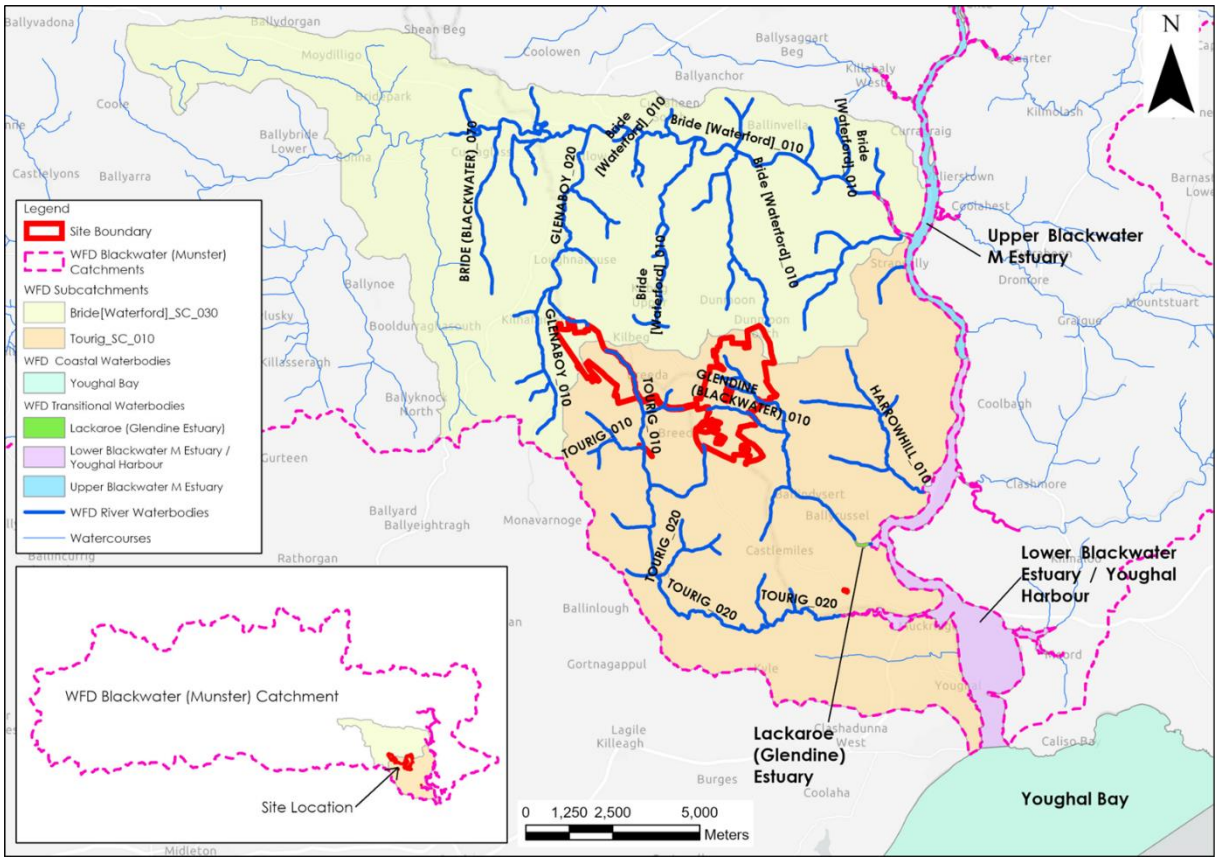

Figure A: Local Hydrology Map

2.3 SURFACE WATER BODY CLASSIFICATION

A summary of the WFD status and risk result for Surface Water Bodies (SWBs) downstream of the proposed development are shown in **Table B**. The overall status of SWBs is based on the ecological, chemical and quantitative status of each SWB.

Local Groundwater Body (GWB) and Surface water Body (SWB) status information is available from (www.catchments.ie).

As stated above the northern section of the Proposed Development Site is located in the River Bride sub-catchment. Within this sub-catchment the western cluster is drained by the Glenaboy_010 SWB which achieved 'Good Status' in both WFD cycles (2010-2015 and 2013-2018). Upstream of its confluence with the Bride River the Glenaboy_020 SWB achieved

'Moderate Status' in the latest WFD cycle. Further downstream the Bride River Bride(Blackwater)_070 and Bride[Waterford]_010 SWBs) achieved 'Good Status'. The Upper Blackwater Estuary achieved 'Moderate' status in both WFD cycles.

The SWBs downstream of the Proposed Development Site within the River Bride sub-catchment have been deemed to be 'not at risk' of failing to meet their WFD objectives with the exception of the Glenaboy_020 SWB is 'at risk'. Meanwhile the risk status of the Upper Blackwater Estuary is currently under review.

Meanwhile within the Tourig River sub-catchment all SWBs in the immediate vicinity of the Proposed Development Site (i.e. Harrowhill_010, Glendine(Blackwater)_010, Tourig_010 and Tourig_020 SWBs) achieved 'Good Status' in the latest WFD cycle (2013-2018). Furthermore, these surface waterbodies have been deemed to be 'not at risk' of failing to meet their WFD objectives and no significant pressures have been identified.

In terms of the transitional and coastal waterbodies downstream of the Proposed Development Site, the Lower Blackwater Estuary / Youghal Harbour transitional SWB and the Youghal Bay coastal SWB both achieved 'Moderate Status'. The Lackaroe (Glendine) Estuary remains unassigned with regards WFD status. In terms of risk status, the Lower Blackwater Estuary / Youghal Harbour transitional SWB and the Youghal Bay coastal SWB are both 'at risk'. The risk status of the Lackaroe (Glendine) Estuary remains under review.

The 3rd Cycle Draft Blackwater (Munster) Catchment Report states that for rivers within this catchment, the main significant issues are nutrient pollution, morphological issues, hydrological issues, organic pollution and sediment impacts. However, the draft report does not identify any significant pressures impacting on any of the river waterbodies downstream of the Proposed Development Site with the exception of the Glenaboy_020 SWB which is under pressure from urban runoff. With regards to the Lower Blackwater Estuary / Youghal Harbour Transitional SWB and the Youghal Bay coastal SWB, the draft report states that these SWBs are impacted by nutrient and organic pollution associated with agricultural activities. Meanwhile, the Lackaroe (Glendine) is listed as being under significant pressure from anthropogenic activities.

The SWB status for the 2013-2018 WFD cycle are shown on **Figure B.**

Table B: Summary WFD Information for Surface Water Bodies

SWB	Overall Status (2010-2015)	Risk Status (2010-2015)	Overall Status (2013-2018)	Risk Status (2013-2018)	Pressures
Bride River sub-catchment (Bride_SC_030)					
Glenaboy_010	Good	Not at risk	Good	Not at risk	-
Glenaboy_020	Good	At risk	Moderate	At risk	Urban Runoff
Bride(Blackwater)_070	Good	Not at risk	Good	Not at risk	-
Bride[Waterford]_010	Unassigned	Not at risk	Good	Not at risk	-
Upper Blackwater Estuary	Moderate	At risk	Moderate	Under Review	Agriculture
Tourig River sub-catchment (Tourig_SC_010)					
Harrowhill_010	Unassigned	Not at risk	Good	Not at risk	-
Glendine(Blackwater)_010	Good	Not at risk	Good	Not at risk	-
Lackaroe (Glendine) Estuary	Unassigned	Under review	Unassigned	Under review	Anthropogenic
Tourig_010	Good	Not at risk	Good	Not at risk	-
Tourig_020	Good	Not at risk	Good	Not at risk	-
Lower Blackwater Estuary / Youghal Harbour	Moderate	At risk	Moderate	At risk	Agriculture
Youghal Bay	Good	At risk	Moderate	At risk	Agriculture

2.4 GROUNDWATER BODY IDENTIFICATION

According to data from the GSI database and bedrock geology series (www.gsi.ie), the Proposed Development Site is underlain by a Locally Important Aquifer (Bedrock which is Moderately Productive only in Local Zones), which consists of Devonian Old Red Sandstones.

The Glenville GWB (IE_SW_020_0100) underlies the Proposed Development site (including the western and eastern clusters and the overhead grid connection loop).

2.5 GROUNDWATER BODY CLASSIFICATION

The Glenville GWB (IE_SW_020_0100) achieved 'Good Status' in both WFD cycles (2010-2015 and 2013-2018). This GWB is deemed to be 'at risk' of failing to meet its WFD objectives. The 3rd Cycle Draft Blackwater (Munster) Catchment Report states that chemical pollution associated with agricultural activities is impacting the Glenville GWB.

The GWB status for the 2013-2018 WFD cycle are shown on Figure B.

Table C: Summary WFD Information for Groundwater Bodies

GWB	Overall Status (2010-2015)	Risk Status (2010-2015)	Overall Status (2013-2018)	Risk Status (2013-2018)	Pressures
Glenville	Good	Under review	Good	At risk	Agriculture

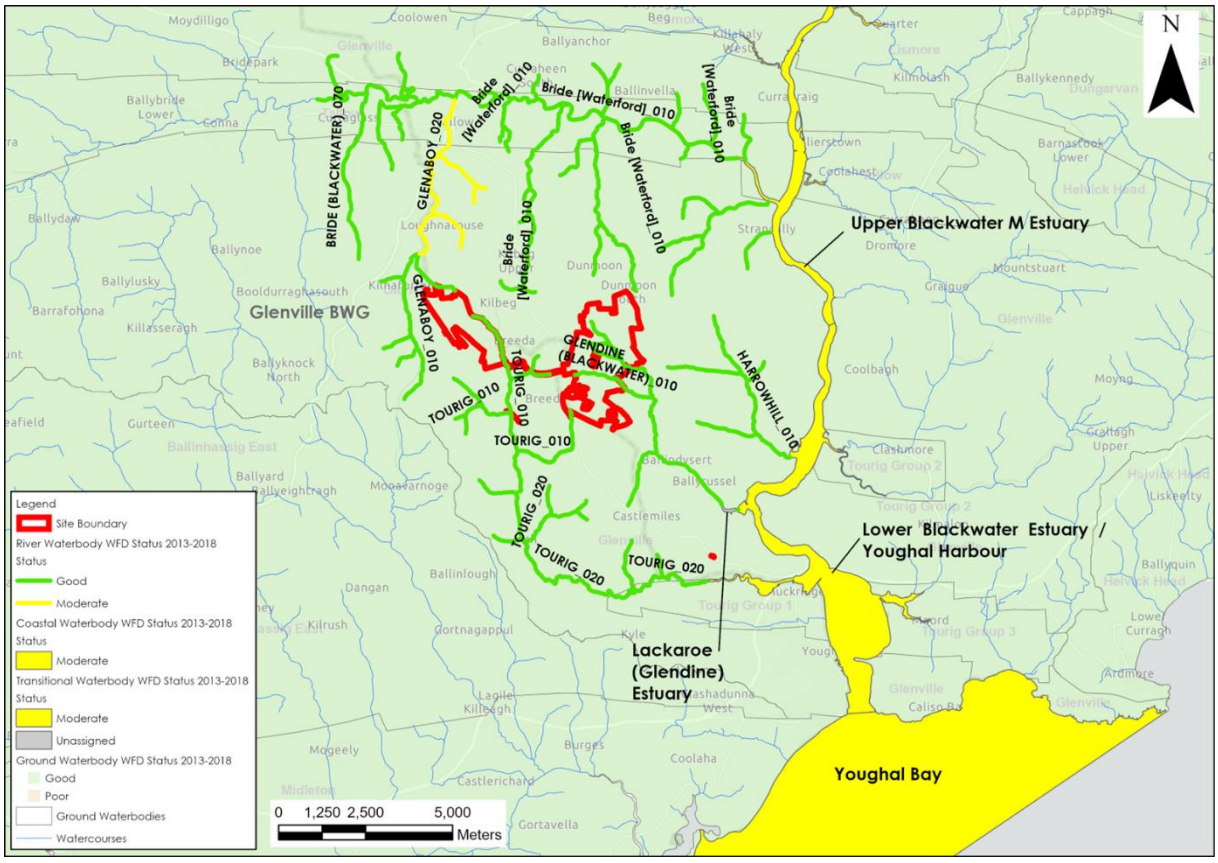

Figure B: WFD Groundwater and Surface Waterbody Status (2013-2018)

3. WFD SCREENING

As discussed in **Section 2**, there are a total of 8 no. river water bodies that are located in the vicinity or downstream of the Proposed Development Site. In addition, there are 3 no. transitional waterbodies and 1 no. coastal waterbodies located downstream. Furthermore, the Proposed Development Site is underlain by 1 no. groundwater body.

3.1 SURFACE WATER BODIES

As shown in **Figure A** above, there are 11 no. SWBs located in the vicinity or downstream of the Proposed Development Site.

With consideration for the construction, operational and decommissioning phases of the proposed development, it is considered that all sections of the Glenaboy (Glenaboy_010 and Glenaboy_020), Glendine (Glendine(Blackwater)_010) and Tourig Rivers (Tourig_010 and Tourig_020) in the vicinity and downstream of the site are carried through into the WFD Impact Assessment. These SWBs have been screened in due to their close proximity to the Proposed Development Site and the occurrence of proposed infrastructure within their respective catchments. These SWBs also have relatively small catchment areas, making them susceptible to potential water quality impacts associated with the Proposed Development. The Bride(Blackwater)_070 SWB has been screened in due to its location directly downstream of the Glenaboy River. However, the potential for water quality impacts on the Bride River in comparison to the Glenaboy are significantly reduced due to its large upstream catchment area. The Proposed Development works must not in any way result in a deterioration in the status of these SWBS and/or prevent them from meeting the biological and chemical characteristics for good status in the future.

Due to the lack of any proposed development works within the Bride[Waterford]_010 and the Harrowhill_010 river sub-basins, these SWBs have been screened out of further assessment. The proposed development has no potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

The Upper Blackwater Estuary, the Lackaroe (Glendine) Estuary and the Lower Blackwater Estuary / Youghal Harbour transitional SWBs and the Youghal Bay coastal SWB have been screened out due to their distant location from the Proposed Development Site, the large volumes of water within these SWBs and the saline nature of these waters. The proposed development has no potential to cause a deterioration in status of these SWBs and/or jeopardise the attainment of good surface water status in the future.

Please note that we recognise that the Lackaroe (Glendine) Estuary remains unassigned with regards to WFD status. However irrespective of the condition of this waterbody if it was categorised, the proposed development will not cause it to deteriorate and will not in any way prevent it meeting the biological and chemical characteristics for good status.

3.2 GROUNDWATER BODIES

With respect to groundwater bodies, the Glenville GWB has been screened in due to its location directly underlying the Proposed Development Site. The Proposed Development works must not in any way result in a deterioration in the status of this GWB and/or prevent it from meeting the biological and chemical characteristics for good status in the future.

3.3 WFD SCREENING SUMMARY

A summary of WFD Screening discussed above is shown in **Table D**.

Table D: Screening of WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name/ID	Inclusion in Assessment	Justification
Surface Water Body	River	Glenaboy_010	**Yes**	The northern section of the western cluster, including 1 no. turbine and 1 no. borrow pit, is mapped within the catchment area of the Glenaboys_010 SWB. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Glenaboy_020	**Yes**	The Glenaboy_020 SWB is located directly downstream of the Glenaboy_010 SWB and in close proximity to the Proposed Development Site (<1km). An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Bride(Blackwater)_070	**Yes**	The Bride(Blackwater)_070 SWB is located directly downstream of the Glenaboy River and in close proximity to the Proposed Development Site (<1km). An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Bride[Waterford]_010	No	The northern section of the eastern cluster is located within the catchment area to the Bride[Waterford]_010 SWB. However, no key development infrastructure is located within this area of the Proposed Development Site. Therefore, the Bride[Waterford]_010 SWB has been screened out as the Proposed Development has no potential to impact the status of this SWB.
	Transitional	Upper Blackwater Estuary	No	The Upper Blackwater Estuary has been screened out due to the saline nature of its waters and the large volumes of water within the estuary. The Proposed Development has no potential to impact the status of this SWB.
	River	Harrowhill_010	No	A small area in the east of the eastern cluster is mapped within the catchment area to the Harrowhill_010 SWB. However, no key development infrastructure is located within this area of the Proposed Development Site. Therefore, the Harrowhill_010 SWB has been screened out as the Proposed Development has no potential to impact the status of this SWB.
	River	Glendine(Blackwater)_010	**Yes**	Much of the eastern cluster, including 11 no. turbines, 1 no. borrow pit, 1 no. temporary construction compound, 110kV substation and the eastern section of the OHL grid connection loop, is mapped within the catchment area of the Glendine(Blackwater)_010 SWB. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	Transitional	Lackaroe (Glendine) Estuary	No	The Lackaroe (Glendine) Estuary SWB has been screened out due to the saline nature of its waters and the large volumes of water within the estuary. The Proposed Development has no potential to impact the status of this SWB.
	River	Tourig_010	**Yes**	Much of the western cluster, including 5 no. turbines, 1 no. borrow pit, 1 no. temporary construction compound, the western section of the grid connection loop and TDR

				works (Breeda Bridge), is mapped within the catchment area of the Tourig_010 SWB. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	River	Tourig_020	**Yes**	The Tourig_020 SWB is located directly downstream of the Tourig_010 SWB and in close proximity to the Proposed Development Site (<1km). In addition, TDR works are proposed within this river sub-basin at Lombards Crossroads. An assessment is required to consider the potential impacts of the Proposed Development on this SWB.
	Transitional	Lower Blackwater Estuary / Youghal Harbour	No	The Lower Blackwater Estuary / Youghal Harbour SWB has been screened out due to the saline nature of its waters and the large volumes of water within the estuary. The Proposed Development has no potential to impact the status of this SWB.
	Coastal	Youghal Bay	No	The Youghal Bay SWB has been screened out due to the saline nature of its waters and the large volumes of water within this coastal waterbody. The Proposed Development has no potential to impact the status of this SWB.
Groundwater Body	Groundwater	Glenville GWB	**Yes**	All of the 17 no. turbines, grid connection and associated infrastructure immediately overlie the Glenville GWB. An assessment is required to consider potential impacts of the proposed development on this GWB.

4. WFD COMPLIANCE ASSESSMENT

4.1 PROPOSALS

The proposed development includes 17 no. turbines, 2 no. borrow pits, 2 no. temporary construction compounds, a 110kV substation, 3.3km collector cable, overhead line grid connection, TDR works and all associated site development works including tree felling, drainage infrastructure and landscaping.

Due to the nature of wind farm developments (and associated grid connections and TDR works), being near surface construction activities, impacts on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risks to groundwater at the site will be from cementitious materials, hydrocarbon spillage and leakages, and potential piling works.

The primary risk to surface waters will be entrained suspended sediments (peat and soil particles) in site runoff during earthworks and tree felling along with cement-based compounds.

The proposed development includes works over and in close proximity to waterbodies. There are a number of potential adverse effects to both surface and groundwater.

The primary risks of degradation of surface water bodies include:
- Changes in surface runoff flow volumes and flow patterns;
- Entrainment of suspended solids in surface waters; and,
- Chemical pollution of surface waters by concrete, oil and or fuels.

The primary risks of degradation of groundwaters include:
- Chemical pollution of groundwaters by concrete, oils and fuels.

4.2 POTENTIAL EFFECTS

4.2.1 Construction Phase (Unmitigated)

4.2.1.1 Potential Surface Water Quality Effects from Works within the Wind Farm Site

Construction phase activities including tree felling, site levelling/construction and building turbine foundation excavation and the borrow pit will require earthworks resulting in removal of vegetation cover and excavation of soil and subsoils. A total of 45.6ha of forestry will be permanently felled with an additional 5.4ha of temporary felling.

The main risk will be from surface water runoff from bare soil, spoil storage areas and borrow pit drainage/dewatering during construction works.

Hydrocarbons and cement-based compounds will also be used during the construction phase. The release of effluent from the on-site wastewater treatment systems also has the potential to impact on surface water quality.

These activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks of downstream water bodies such as the Glenaboy, Glendine and Tourig Rivers.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the proposed development in the unmitigated scenario are outlined in **Table E**.

Table E: Surface Water Quality Impacts from works within WF Site during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Glenaboy_010	IE_SW_18G050200	Good	Moderate
Glenaboy_020	IE_SW_18G050600	Moderate	Moderate
Bride(Blackwater)_070	IE_SW_18B050820	Good	Good
Glendine(Blackwater)_010	IE_SW_18G070300	Good	Moderate
Tourig_010	IE_SW_18T030300	Good	Moderate
Tourig_020	IE_SW_18T030700	Good	Good

4.2.1.2 Potential Groundwater Quality/Quantity Effects

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a major pollution risk to groundwater. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Chemicals such as cement-based compounds also pose a threat to the groundwater environment. Runoff from concrete works can impact on groundwater quality. Furthermore, the release of effluent from the on-site wastewater treatment systems also has the potential to impact on groundwater quality. These sources of contamination have the potential to impact on groundwater quality in the underlying Glenville GWB groundwater body.

The dewatering of borrow pits and other deep excavations such as turbine bases have the potential to impact local groundwater levels. However, groundwater level impacts are not anticipated to be significant due to the local hydrogeological regime. No groundwater level impacts are predicted from the construction of the collector cabling trench, access roads, substation, compound or met mast due to the shallow nature of the excavation (i.e. 0 -~1.2m).

A summary of potential status change to GWBs arising from potential groundwater quality impacts during the construction phase of the proposed development in the unmitigated scenario are outlined in **Table F**.

Table F: Groundwater Quality Impacts during Construction Phase (Unmitigated)

GWB	WFD Code	Current Status	Assessed Potential Status Change
Glenville GWB	IE_SW_G_037	Good	Moderate

4.2.1.3 Potential Surface Water Quality Effects associated with Grid Connection

The two clusters of the Wind Farm Site will be connected via a c.3.3km underground collector cable connection which passes through the Tourig_010 and Glendine(Blackwater)_010 river

sub-basins. The grid connection will be made to the existing 110 kV Overhead Line which passes through the eastern cluster at the location of the proposed on-site substation.

Earthworks are required for the construction of the underground collector cable connection and these activities can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks of downstream water bodies such as the Glendine and Tourig Rivers.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the proposed development in the unmitigated scenario are outlined in **Table G**.

Table G: Surface Water Quality Impacts during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Glenaboy_010	IE_SW_18G050200	Good	Good
Glenaboy_020	IE_SW_18G050600	Moderate	Moderate
Bride(Blackwater)_070	IE_SW_18B050820	Good	Good
Glendine(Blackwater)_010	IE_SW_18G070300	Good	Moderate
Tourig_010	IE_SW_18T030300	Good	Moderate
Tourig_020	IE_SW_18T030700	Good	Good

4.2.1.4 Potential Surface Water Quality Effects associated with TDR works

Earthworks are required for the turbine delivery route (TDR) works. These include road widening, a new 300m stretch of access road on agricultural land and temporary levelling of the centre island of some roundabouts. Works are proposed at Breeda Bridge within the Toutig_010 river sub-basin and at Lombards Crossroads within the Tourig_020 river sub-basin.

These works can result in the release of suspended solids and pollutants in runoff water and could result in an increase in the suspended sediment load, resulting in increased turbidity, increased pH and contamination which in turn could affect the water quality and fish stocks of downstream water bodies such as the Tourig River.

A summary of potential status change to SWBs arising from surface water quality impacts from earthworks during the construction phase of the proposed development in the unmitigated scenario are outlined in **Table G**.

Table H: Surface Water Quality Impacts during Construction Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Glenaboy_010	IE_SW_18G050200	Good	Good
Glenaboy_020	IE_SW_18G050600	Moderate	Moderate
Bride(Blackwater)_070	IE_SW_18B050820	Good	Good
Glendine(Blackwater)_010	IE_SW_18G070300	Good	Good
Tourig_010	IE_SW_18T030300	Good	Moderate
Tourig_020	IE_SW_18T030700	Good	Moderate

4.2.2 Operational Phase (Unmitigated)

4.2.2.1 Increased Site Runoff and Hydromorphology Effects on River Water Bodies

Progressive replacement of the soil or vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. This could potentially increase runoff from the Proposed Development Site and increase flood risk downstream of the development.

As stated in the EIAR the emplacement of the proposed development infrastructure could result in an average total increase in surface water runoff of ~15,543m^3/month. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and causing hydromorphological effects.

However, this is a small increase in average runoff and results from a relatively small area of the overall Proposed Development site being developed. Specifically, the proposed permanent development footprint is approximately 23.3 ha, representing approximately 3% of the total development site of 733 ha. Of the proposed wind farm footprint, approximately 6.4 ha are already in place in the form of existing roads.

A summary of potential status change to SWBs arising from increased runoff during the operation stage of the proposed development in the unmitigated scenario are outlined in **Table I**.

Table I: Potential Impact on Surface Water Flows during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Glenaboy_010	IE_SW_18G050200	Good	Good
Glenaboy_020	IE_SW_18G050600	Moderate	Moderate
Bride(Blackwater)_070	IE_SW_18B050820	Good	Good
Glendine(Blackwater)_010	IE_SW_18G070300	Good	Good
Tourig_010	IE_SW_18T030300	Good	Good
Tourig_020	IE_SW_18T030700	Good	Good

4.2.2.2 Surface Water Quality Impacts from Operational Site Drainage

During the operational phase, the potential for silt-laden runoff is much reduced compared to the construction phase. In addition, all permanent drainage controls will be in place and the disturbance of ground and excavation works will be complete. Some minor maintenance works may be completed, such as maintenance of site entrances, internal roads and hardstand areas. These works would be of a very minor scale and would be very infrequent. Potential sources of sediment laden water would only arise from surface water runoff from small areas where new material is added during maintenance works.

A summary of potential status change to SWBs arising from surface water quality impacts during the operation stage of the proposed development in the unmitigated scenario are outlined in **Table J**.

Table J: Surface Water Quality Impacts during Operational Phase (Unmitigated)

SWB	WFD Code	Current Status	Assessed Potential Status Change
Glenaboy_010	IE_SW_18G050200	Good	Good
Glenaboy_020	IE_SW_18G050600	Moderate	Moderate
Bride(Blackwater)_070	IE_SW_18B050820	Good	Good
Glendine(Blackwater)_010	IE_SW_18G070300	Good	Good
Tourig_010	IE_SW_18T030300	Good	Good
Tourig_020	IE_SW_18T030700	Good	Good

4.3 MITIGATION MEASURES

In order to mitigate against the potential negative effects on surface and groundwater quality, quantity and flow patterns, mitigation measures will be implemented during the construction and operational phases of the proposed development. These are outlined below.

4.3.1 Construction Phase

4.3.1.1 Mitigation Measures to Protect Surface Water Quality during Felling Operations

All felling of coniferous plantations will be done in accordance with the current best practice methods.
These best practice methods/mitigation measures relating to clear felling of coniferous plantations are summarised in

Table K below. These include avoidance controls and mitigation by design which includes source controls, in-line controls, water treatment controls, and outfall controls.

In addition to these mitigation measures, drains in the vicinity and downstream of the proposed felling areas will be subject to frequent inspection both pre and post-felling. Additionally, surface water quality monitoring shall be completed before, during (if the operation is conducted over a protracted time period) and after felling operations and until the water quality has returned to pre-activity status if an impact has occurred. Daily surface water monitoring forms will also be utilised at every works location in close proximity to a watercourse.

Table K: Summary of Mitigation Measures Associated with Proposed Felling Operations

Management Type	Description of drainage control method	Applicable Works Area
Avoidance Controls:	• A self-imposed 75m buffer will be maintained for all streams with the exception of existing road crossings and proposed stream crossings; • Only 2.9ha of the total tree felling area of 45.6ha will be located within the 75m buffer zone; • The large separation distance between the proposed felling areas and sensitive aquatic zones means that potential poor quality runoff can be adequately managed and attenuated prior to reaching sensitive watercourses; • Works will be completed during periods of no or low rainfall	Felling areas where sediment is being generated.
Mitigation by Design	• Machine combinations will be chosen to minimise soil disturbance; • Crossing of streams will not be permitted; • Removing soil from roads during wet periods and dust suppression during dry periods; • Ditches draining from the proposed felling area towards existing watercourses will be blocked and temporary silt traps constructed i.e. no direct discharge to surface watercourses will occur. • Double silt traps will be installed where felling is inside the 75m aquatic buffer zone; • Discharge channels will taper out before entering 75m buffer zone allowing for further sediment filtration by ground vegetation; • All drains and sediment traps will be maintained during the felling works; • Brash mats will be used to support vehicles on soft ground; • Timber will be stacked in dry areas outside of the buffer zone with straw bales and check dams placed downstream of these storage areas; • Trees will be cut manually from along streams and using machinery to extract the tree; and, • Travel will only be permitted perpendicular to and away from a watercourse.	Felling areas where sediment is being generated.
	• Using small working areas; • Covering stockpiles; and, • Timber will be stacked in dry areas outside of the buffer zone with straw bales and check dams placed downstream of these storage areas.	Timber stockpile areas

4.3.1.2 Mitigation Measures to Protect Surface Water Quality during Earthworks

A suite of general SuDs drainage controls available for surface water management are summarised (along with their application) in

Table L below. These include avoidance controls, source controls, in-line controls, water treatment controls, and outfall controls.

Table L: Summary of Drainage Mitigation & their Application

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

Each element of the wind farm development (*i.e.,* access roads, turbines, borrow pit and peat repository) will have an array of drainage control measures to ensure protection of downstream watercourses. Each drainage control element is not stand alone but occurs as part of a treatment train of control systems (i.e., check dams, silt traps, settlement ponds etc).

4.3.1.3 Mitigation Measures to Water Quality during Excavation Dewatering

Management of groundwater seepages and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;

- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via volume and sediment attenuation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk of hydraulic loading or contamination will occur;
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken; and,
- A mobile 'Siltbuster' or similar equivalent specialist treatment system will be available on-site for emergencies in order to treat sediment polluted waters from settlement ponds or excavations should they occur. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction-sites. They will be used as a final line of defense if needed.

4.3.1.4 Mitigation Measures to Protect Against the Release of Hydrocarbons

Mitigation measures proposed to avoid the release of hydrocarbons at the wind farm site and along the grid connection route include:

- Minimal refuelling or maintenance of vehicles or plant will take place on-site. Off-site refuelling will occur where possible;
- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser;
- The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located.
- The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages.
- The fuel bowser will be parked on a level area in the construction compound when not in use and 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 be used during all refuelling operations;
- Onsite refuelling will be carried out by trained personnel only;
- Fuels stored on site will be minimized and will be appropriately bunded;
- Surface water runoff from temporary construction compounds will be collected and drained via silt traps and hydrocarbon interceptors prior to recharge to ground;
- A permit to fuel will be put in place;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages is included within the Construction and Environmental Management Plan;
- Spill kits will be available to deal with any accidental spillage in and outside the re-fuelling area.

4.3.1.5 Mitigation Measures to Prevent Groundwater and Surface Water Contamination from Wastewater Disposal

Mitigation measures proposed to avoid the release of wastewater at the Wind Farm site include:

- It is proposed to manage wastewater from the staff welfare facilities in the control buildings/substation by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site.

4.3.1.6 Mitigation Measures to Prevent the Release of Cement-Based Products

Best practice methods for cement-based compounds:

- No batching of wet-concrete products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of concrete contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined concrete washout ponds;
- Weather forecasting will be used to plan dry days for pouring concrete; and,
- The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

4.3.1.7 Mitigation Measures to Prevent Morphological Changes to Surface Water Crossing and Drainage Patterns

The proposed mitigation measures include:

- All proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed.
- No in-stream excavation works are proposed;
- Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road;
- All guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland[1] (IFI) is incorporated into the design of the proposed crossings;
- As a further precaution, near stream construction work, will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", i.e., May to September inclusive.
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase.
- All new river/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.

With respect to the collector cable watercourse crossings, 4 possible construction crossing methods are proposed that will avoid in-stream works and these are:

- Method 1 - Where no crossing culvert currently exists, the cable will pass over the watercourse on a new bottomless box culvert or pre-cast concrete slab in a standard trefoil arrangement;

[1] *Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*

- Method 2 - Where the required depth above the culvert to accommodate the standard trench is achieved in the road, the cabling will pass below the road surface; and,
- Method 3 - Where the required depth above the culvert to accommodate the standard trench cannot be achieved in the road, the cabling will pass over the culvert in a flatbed formation.
- Method 4 - In the event that none of the above methods are appropriate, directional drilling will be utilised. Mitigation Measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling include:

    - The area around the Clear Bore™ batching, pumping and recycling plants shall be bunded using terram and sandbags in order to contain any spillages;
    - One or more lines of silt fences shall be placed between the works area and adjacent rivers and streams on both banks;
    - Accidental spillage of fluids shall be cleaned up immediately and transported off site for disposal at a licensed facility; and,
    - Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

4.3.1.8 Mitigation Measures to Protect Groundwater Quality

The potential pollution of groundwater during the construction phase will be mitigated by the provision of appropriate controls and working methods. These include best practice methods for storage and handling of fuels and chemicals and wastewater outlined in Sections 4.3.1.4, 0 and 4.3.1.6 above.

4.3.1.9 Mitigation Measures to Protect Water Quality along the Turbine Delivery Route

Proposed Mitigation Measures:

- Silt traps will be temporarily placed in all drains intercepted by the works prior to works commencing;
- Silt fence perimeters will be placed downslope of the works before excavations begin;
- At the Breeda Bridge proposed access road temporary drains (interceptor and collector drains) and settlement ponds will be put in place to deal with surface water runoff.

4.3.2 Operational Phase

4.3.2.1 Increased Site Runoff and Hydromorphology Effects

The operational phase drainage system of the Proposed Development will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader;
- Swales/road-side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during

periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses; and,
- Settlement ponds have been designed in consideration of the greenfield runoff rate.

4.3.2.2 Mitigation Measures to Protect Surface Water Quality

The mitigation measures to protect against poor quality runoff during the operational phase of the proposed development are the same as those outlined in **Section 4.3.1.2** above.

Mitigation measures for oils and fuels during the operational phase of the proposed development are the same as those outlines in **Section 4.3.1.4** above.

4.3.2.3 Mitigation Measures to Protect Groundwater Quality

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.

4.3.1 Decommissioning Phase

The potential impacts associated with decommissioning of the proposed development will be similar to those associated with the construction phase but of a reduced magnitude, due to the reduced scale of the proposed decommissioning works in comparison to construction phase works.

During decommissioning, it will be possible to reverse or at least reduce some of the potential effects caused during construction, and to a lesser extent operation, by rehabilitating constructed areas such as turbine bases and hard standing areas. This will be done by covering with vegetation to encourage vegetation growth and reduce run-off and sedimentation.

The wind farm site roadways will be kept and maintained following decommissioning of the wind farm infrastructure, as these will be utilised by ongoing forestry works and by other participating landowners.

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

The turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported off-site along their original delivery route. The disassembly and removal of the turbines will not have an impact on the hydrological/hydrogeological environment at the wind farm site.

Other potential impacts such as possible soil contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site. Similar mitigation implemented during the construction phase will be utilised during the decommissioning phase to ensure no impacts on receiving waters.

Some of the potential impacts on water bodies will be avoided by leaving elements of the proposed development in place where appropriate. The substation will be retained by EirGrid as a permanent part of the national grid. The turbine bases will be rehabilitated by covering with local topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

With the implementation of the mitigation measures outlined above no significant effects on the hydrological and hydrogeological environment will occur during the decommissioning stage of the proposed development.

4.3.2 Potential Effects with the Implementation of Mitigation

In all instances, the mitigation measures described in **Section 4.3** are sufficient to meet the WFD Objectives. The assessment of WFD elements for the WFD waterbodies is summarised in **Table M** below.

Table M: Summary of WFD Status for Unmitigated and Mitigated Scenarios

SWB	WFD Code	Current Status	Assessed Potential Status Change - Unmitigated	Assessed Status with Mitigation Measures
Glenaboy_010	IE_SW_18G050200	Good	Moderate	Good
Glenaboy_020	IE_SW_18G050600	Moderate	Moderate	Moderate
Bride(Blackwater)_070	IE_SW_18B050820	Good	Good	Good
Glendine(Blackwater)_010	IE_SW_18G070300	Good	Moderate	Good
Tourig_010	IE_SW_18T030300	Good	Moderate	Good
Tourig_020	IE_SW_18T030700	Good	Good	Good
Glenville GWB	IE_SW_020_0100	Good	Moderate	Good

5. WFD ASSESSMENT CONCLUSION

WFD status for SWBs (Surface Water Bodies) and GWBs (Groundwater Bodies) hydraulically linked to the Proposed Development Site are defined in **Section 2** above.

The proposed development does not involve any abstraction of groundwater or alteration of drainage patterns. Therefore, the quantitative status (i.e., the available quantity (volume) of groundwater and surface water locally) to the receiving waters will remain unaltered during the construction and operational phase of the proposed development.

There is no direct discharge from the development site to downstream receiving waters. Mitigation for the protection of surface water during the construction, operation and decommissioning phases of the development will ensure the qualitative status of the receiving waters will not be altered by the proposed development.

There is also mitigation proposed to protect groundwater quality within the proposed development scheme during the construction, operational and decommissioning phases of the development. These mitigation measures will ensure the qualitative status of the underlying GWB will not be altered by the proposed development.

There will be no change in GWB or SWB status in the underlying GWB or downstream SWBs resulting from the proposed development. There will be no change in quantitative (volume) or qualitative (chemical) status, and the underlying GWB and downstream SWBs are protected from any potential deterioration.

In the event where the current status of the waterbody is Moderate (i.e. Glenaboy River) or unassigned (i.e. Lackaroe (Glendine) Estuary) the proposed development will not prevent them from achieving Good Status in the future.

As such, the Proposed Development:

- will not cause a deterioration in the status of all surface and groundwater bodies assessed;
- will not jeopardise the objectives to achieve 'Good' surface water/groundwater status;
- does not jeopardise the attainment of 'Good' surface water/groundwater chemical status;
- does not jeopardise the attainment of 'Good' surface water/groundwater quantity status;
- does not permanently exclude or compromise the achievement of the objectives of the WFD in other waterbodies within the same river basin district;
- is compliant with the requirements of the Water Framework Directive (2000/60/EC); and,
- is consistent with other Community Environmental Legislation including the EIA Directive (2014/52/EU), the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC).

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