

Date: 27<sup>th</sup> October 2022  
Our Ref: P1320-2-0010

**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 Third-Party Submission in relation to the proposed Coole Wind Farm, Co. Westmeath (ABP Ref: 309770-21)**

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Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO) to respond to a further information request from An Bord Pleanála (ABP) with respect to geological, hydrological, and hydrogeological matters raised in relation to the proposed Coole Wind Farm SID application, Co. Westmeath.

**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 18 years. Wind farm drainage design/management requires experience both as a civil/drainage engineer, a hydrologist, and as 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 & preliminary 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 EIA/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 provide 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 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 EIA preparation work, including the cumulative impact assessment.

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

## **2 RESPONSE TO ABP ITEM 4 “SOILS AND GEOLOGY AND INTERACTIONS WITH PEAT HARVESTING”**

Further peat depth probing and investigations have been completed by MWP in the area of T12. As a result of those investigations, which are outlined in the report entitled “Response to RFI Item 4.1, Coole Wind Farm” (MWP, September 2022), the upper end of peat depths referenced in the EIAR should now be 8.7m. As such peat thicknesses from peat probing, window sampling, and drilling ranged from 0 to 8.7m.

### **2.1 “Soils & Geology interaction with Peat Harvesting” Item 4.2**

Item 4.2 is divided into 7 bullet points (for ease of reference we have numbered those as a) to g)). HES is responding below to items pertinent to the EIAR (Land, Soils & Geology and Water Chapters), namely items **(b)** and **(c)**. Item 4.2 is written as follows:

*“The comments of the Department of Housing, Local Government and Heritage on nature conservation raise a number of issues including the following which are considered of particular relevance to soil and geology and hydrology.*

- b) The potential for impacts on Gariskil Bog and Scragh Bog as a result of the effects of drainage works.*
- c) The need to identify the location of all mitigation measures involved in the construction phase drainage management.*

#### **2.1.1 HES Response to Item 4.2 (b)**

As outlined in Section 9.4.1.9 of the EIAR, the potential effects of the proposed development on the Gariskil Bog SAC and Scragh Bog SAC have been carefully considered.

These designated sites are >5km from the Coole Wind Farm, thus the proposed drainage measures incorporated into the Wind Farm design will not impact on them. However, the SAC's are located near the associated grid route.

As set out in Section 9.4.19 of the EIAR, and on Cross-Section X1 and Cross-Section X2 (refer to EIAR Appendix 9.4), Gariskil Bog SAC is situated ~60m from the Grid Connection Route along the L1826. The road (and Grid Connection Route) is ~ 2.5m lower than the raised bog that forms the SAC. The River Inny exists between the edge of the bog and the public road and acts as a hydraulic boundary to groundwater flow. A small stream (a tributary of the River Inny) exists, ~ 230m south of the bridge to the north of the SAC boundary. This stream is culverted under the L1826. The stream flows east, while drainage from the bog will flow west towards the River Inny.

In summary, the potential for hydrological impacts from the Grid Connection Route to Gariskil Bog SAC are limited by:

- The River Inny acting as a hydraulic boundary between the Gariskil Bog;
- The separation distance between the Grid Connection Route and the SAC;
- Local drainage patterns are towards the River Inny and away from the grid connection trench;
- The grid route ducting (and cable) will be installed in a shallow temporary trench;
- No groundwater dewatering will be required to install the grid connection trench;
- and,
- The base of the temporary trench is above the invert of the River Inny which is located between the SAC and the Grid Connection Route.

As set out in Section 9.4.1.9 of the EIAR, Scragh Bog SAC/pNHA is situated ~320m from the Grid Connection Route at its closest point. Land-use between the Grid Connection Route and the

Scragh bog is typically agricultural with some residential dwellings along the N4 road. There is a considerable amount of grass verge/shrubbery along the N4 roadside. Given the distance relative to the ~1.2m deep trench and the intervening land use, there is no direct or indirect hydrological pathway to the Scragh Bog SAC/pNHA, any excess surface water would infiltrate to ground within several metres of the road, based on permeability/groundwater recharge values mapped by the GSI.

In summary, the potential for hydrological impacts from the Grid Connection Route to Scragh Bog SAC/pNHA are limited by:

- The separation distance between the Grid Connection Route and the SAC;
- There are no direct/indirect hydrological pathways between the Grid Connection Route and Scragh Bog SAC/pNHA;
- The grid route ducting (and cable) will be installed in a shallow temporary trench;
- No groundwater dewatering will be required to install the grid connection trench; and,
- The shallow nature of the temporary trench along Grid Connection Route.

The proposed mitigation measures to eliminate any potential impacts on these SAC's are given in Section 9.4.1.9, and are summarised briefly as follows:

- Drainage control measures will be put in place during the excavation and construction of the grid route;
- Sediment control measures used during the construction such as silt bags, the covering of exposed soils and the avoidance of works during heavy rainfall;
- Mitigation measures related to spills/chemical releases, *i.e* petroleum products will be put in place during the construction;
- No groundwater dewatering is required during grid route construction;
- All trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed; and,
- No deep foundations are proposed near the SAC's or along the grid route in general.

Section 9.4.1.9 of the EIAR concludes, and we, HES, continue to assert, that with the implementation of the mitigation measures (as outlined in the EIAR and as summarised above), no significant hydrological or hydrogeological impacts on designated sites are anticipated from the proposed development.

In addition to the above, and in response to paragraph 1.3.5 of the Departments (DAU) submission, the type of drainage impact encountered by Regan et al (2019)<sup>1</sup> at Clara Bog SAC cannot occur at Gariskil Bog SAC nor at Scragh Bog SAC/pNHA, as in this instance the proposed grid connection trench will be 1.2m deep, it will be a transient and temporary excavation, and it will not intercept or drain the local groundwater system.

#### **2.1.2 HES Response to Item 4.2 (c)**

The locations of proposed mitigation measures to be implemented within the Coole Wind Farm site during the construction phase including check dams, attenuation ponds, settlement ponds, silt fences, and collector and interceptor drains are shown in Drawings D101 to D107 (EIAR Appendix 4.9).

The implementation of these mitigation measures is listed in detail in Section 9.4.1.1 of the EIAR. The concluding paragraph of Section 9.4.1.1 states:

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<sup>1</sup> Regan, S., Flynn, R., Gill, L., Naughton, O., & Johnston, P. (2019). *Impacts of groundwater drainage on peatland subsidence and its ecological implications on an Atlantic raised bog*. *Water Resources Research*.

*"The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be - Negative, indirect, imperceptible, temporary, low probability impact on the water environment within the Wind Farm Site, along the Grid Connection Route and near other ancillary works (River Inny, Glone River, River Deel, Monkstown stream, Lough Derravaragh).*

*For the reasons outlined above, no significant effects on the surface water quality are anticipated."*

Mitigation measures proposed along the grid route are also described in the EIAR (Section 9.4.1), and include the temporary use of appropriate interceptor drainage, which will be continuously implemented along the grid route during construction, as the route progresses. The mitigation measures implemented will be specific to the ground conditions/slope and related to the antecedent weather (i.e during periods of low/no rainfall, management of surface water will not be required). The EIAR includes the following requirements:

- The majority of the Grid Connection Route is >50m from any nearby watercourse, apart from a section of the N4 alongside Lough Owel and at bridges along the Grid Connection Route. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils
- A constraint/buffer zone will be maintained for all crossing locations where possible, whereby all watercourses will be fenced off.
- Source controls such as silt bags, silt fences, filter fabrics and interceptor drains will be installed where required.
- No batching of wet-cement products will occur along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site (along grid route) will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be banded.
- Mitigation measures relating to the use of biodegradable drilling fluids such as Clear Bore are included in Section 9.4.1.10 if directional drilling is deemed necessary.
- The hydrological regime locally will not be affected by the proposed works and so the regime of the SACs, SPAs, NHA and pNHAs will not be affected.
- No groundwater dewatering is proposed during grid route construction. Any rainwater removal will be temporary and at a very shallow depth above the groundwater table.
- All building and trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed.
- No deep foundations are required or are proposed. As such there will be no interruption or blocking of shallow or deep groundwater pathways below the site (grid route).

The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. These mitigation measures are included in the submitted CEMP, and during the construction phase works will be supervised and overseen by an ECoW. The residual effect is considered to be - Negative, indirect, imperceptible, temporary, low probability impact on the water environment within the Wind Farm Site, along the Grid Connection Route.

**2.2 “Soils & Geology interaction with Peat Harvesting” Item 4.4**

Item 4.4 is written as follows:

*“It is considered that more detailed information should be provided relating to water quality monitoring proposals specified in Section 9.4.1.1 of the EIAR. In particular, a suite of parameters to be monitored and the limits to be met should be specified.”*

**2.2.1 HES Response to Item 4.4**

The paragraphs relating to water quality monitoring in Section 9.4.1.1 of the EIAR states:

*“During the construction phase, field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly, and event based).”*

To supplement this, the following suite of parameters will be monitored:

Parameter	EQS	Event	Methodology
Visual Inspection	No abnormal change	Daily	Field Inspection and photographic record.
pH	4.5<pH>9.0	Weekly	Field Measurement (Handheld probe)
Dissolved Oxygen	No abnormal change	Weekly	Field Measurement (Handheld probe)
Conductivity	No abnormal change	Weekly	Field Measurement (Handheld probe)
Temperature	No abnormal change	Weekly	Field Measurement (Handheld probe)
Ammonia	High Status ≤0.04mg/L Good Status ≤0.065mg/L	Monthly	Accredited Laboratory Analysis
Nitrate	-	Monthly	Accredited Laboratory Analysis
BOD	High Status ≤1.3 mg/L Good Status ≤1.5 mg/L	Monthly	Accredited Laboratory Analysis
Total Petroleum Hydrocarbons	Below Detection Limit	Monthly/ Following potential hydrocarbon spill	Accredited Laboratory Analysis
Orthophosphate	High Status ≤0.025 Good Status ≤0.035		
Alkalinity	No abnormal change	Monthly/ potential leaching	Following cement

The inspections, monitoring, and sampling will be undertaken at the locations WF\_SW1 – WF\_SW5 show in Figure 9-9 of the EIAR. These sampling points are located along both the Glore River and River Inny.

**2.3 “Soils & Geology interaction with Peat Harvesting” Item 4.5**

Item 4.5 is written as follows:

*“You are requested to clarify the layout and management arrangements for the operational drainage structure.”*

**2.3.1 HES Response to Item 4.5**

The drainage system as outlined in drawings D101-D107 (Refer to Appendix 4-9 and 9-3 of the EIAR) will be utilised and maintained during the operational phase of the proposed Wind Farm. The maintenance and management of the drainage system will be included within the overall maintenance regime of the Wind Farm.

Coole Wind Farm Ltd will have the responsibility for maintaining the drainage system at the operational wind farm. The maintenance of the wind farm will incorporate the activities associated with keeping the drainage system operating effectively.

The drainage maintenance regime will include:

- The inspection and maintenance of swales and settlement ponds;
- Inspecting cross-drains for any blockages, and removal of any blockages identified;
- Inspecting and maintaining outfalls to existing field drains;
- Inspecting the existing roadside drains for any obstructions, and removal of any obstructions identified;
- Inspecting the progress of the re-establishment of vegetation and where required testing the water quality at the outfalls periodically; and,
- Inspection and regular cleaning of drainage channels and settlement ponds. Drainage inspections and maintenance will be in completed accordance with CIRIA C697 SuDS and Maintenance Manual.

Note, weekly inspections will be required during the construction period. Monthly inspections will be completed for one year following construction, and then on a quarterly basis thereafter during the operational lifetime of the Wind Farm.

## **2.4 Soils & Geology interaction with Peat Harvesting” Item 4.6**

Item 4.6 is written as follows:

*“It is noted that the heading of Section 8.5.1.2 of the EIAR includes reference to the alteration of peat/soil geochemistry. Please clarify how this topic is assessed under that heading or if it is addressed elsewhere in the submitted documentation”*

### **2.4.1 HES Response to Item 4.6**

The alteration of peat/soil geochemistry is included under Section 8.5.1.2 as “Contamination of soil by leakages and spillages and alteration of Peat/Soil Geochemistry”.

It is understood that this may have been misinterpreted as being separate items and should be renamed “Contamination of soil by leakages and spillages and **resulting** alteration of Peat/Soil Geochemistry”.

This section considers the possibility of hydrocarbon spills from the use of on-site fuel/oil and the potential impact on the Peat/Soil geochemistry as a receptor. A potential fuel/oil spill could alter the peat/soil geochemistry by lowering or raising the pH (depending on the specific type of hydrocarbon), by potentially reducing dissolved oxygen via the creation of an oil film and in a more general sense from introducing a range of hydrocarbon molecules which would not otherwise be present.

With the implementation of the mitigation measures outlined in the EIAR (Section 8.5.1.2), the assessed impact of this potential source is “*Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock*”.

## **3 RESPONSE TO 3<sup>RD</sup> PARTY SUBMISSIONS**

### **3.1 DAU Submission Point 2.3**

T1, T3 and T4 are close to the River Gore and Inny and associated features including Lough Bane pNHA. The Department is concerned about the potential impacts from the siting of a turbine with regard to the drainage impacts on this pNHA.

#### **3.1.1 HES Response to DAU Submission Point 2.3**

Potential impacts on Lough Bane pNHA have been assessed within Section 9.4.1.9 of the EIAR. Lough Bane pNHA is upgradient of the wind farm site therefore it is hydraulically disconnected from the Wind Farm site in terms of surface water. There is also a high bank and a number of deep drains separating the Wind Farm Site from the pNHA and the groundwater gradient at the Wind Farm Site is not in the direction of Lough Bane.

Please note Lough Bane was specifically targeted for investigation and monitoring during the EIAR process. Piezometers were installed to the south and southeast of the Lough, and seasonal monitoring was undertaken (refer to Sections 9.3.7.1 and 9.4.1.9). Hydrochemical monitoring was also completed in Lough Bane.

Impact assessment with respect to T2 was also undertaken at Section 9.4.1.9 of the EIAR. This concluded:

*"The hydrological regime locally will not be affected by the proposed works and so the regime of the SACs, SPAs, NHA and pNHAs will not be affected as:*

- *No groundwater dewatering is proposed during construction. Any rainwater/surface water removal will be temporary and at a very shallow depth.*
- *All building and trenching works are proposed at or very near existing ground levels with minimal ground disturbance proposed.*
- *No deep foundations are required or are proposed. As such there will be no interruption or blocking of shallow or deep groundwater pathways below the site."*

Therefore there will be no hydrological or hydrogeological impacts on designated sites.

### **3.2 Other 3<sup>rd</sup> Party Submissions**

A total of 41 no. 3<sup>rd</sup> party submissions were received in relation to ABP Ref: 309770-21. Of these, 10 no. submissions contained comments relating to Soils & Geology or Hydrology/Hydrogeology.

The main hydrological/hydrogeological issues raised in those 10. no. submissions can be distilled down to the following themes:

- 1) Due to the emplacement of the turbine hardstands, a large volume of groundwater will be displaced, which will create a rise in the groundwater level, which will in turn flow to the River Gloré/Inny and could cause flooding.
- 2) All surface water from the site flows towards the Inny/Gloré River, which are headwaters of Lough Derravaragh. The proposed works will have a negative impact on water quality in these rivers, and thus the downstream lake.
- 3) The proposed development will have a negative effect on the hydrology/hydrogeology of Lough Bane, Gariskil Bog, Scragh Bog, and other designated sites.

#### **3.2.1 HES Response to 3<sup>rd</sup> Party theme 1) issue:**

- The installation of the turbine hardstands and its potential impacts on the water environment has been assessed in Section 9.4.1.1 (Construction) and 9.4.2.1 (Operation).
- The primary mechanisms for alteration of the water environment is considered to be excavation during the construction phase which has been carefully assessed in Section 9.4.1.1 and the emplacement of relatively impermeable concrete hardstands which has been carefully assessed within Section 9.4.2.1.
- The emplacement of the turbine hardstands will not displace a large volume of water, in the context of the overall bog basins. Any displacement of water caused by turbine installation will be a singular, localised occurrence, before the groundwater table recedes back to its static level, controlled by the surrounding drainage channels.
- The emplacement of a 600m<sup>3</sup> turbine hardstand will displace ~450 m<sup>3</sup> of water.

- Over a 523 hectare site, assuming each of the 15 no. turbines require the same approximate volume of concrete/lean mix, this will displace a volume of water leading to an average initial rise of 0.0012m, just over 1 millimetre.
- The groundwater will then recede back to its initial conditions with no further change in groundwater levels.
- For context, there is a ~ 20cm annual range in groundwater levels across the bogs.

On this basis, it is considered that implying the hardstands will displace a volume of water which could have any potential impacts on downstream hydrology/hydrogeology is shown to have a negligible impact on groundwater levels. This issue will not create or generate a potential significant impact.

### **3.2.2 HES Response to 3<sup>rd</sup> Party theme 2) issue:**

- The potential effects on downstream receptors such as the River Inny, River Glore and Lough Derravaragh has been assessed in detail in Sections 9.4.1.1 to 9.4.1.10 of the EIAR. Robust and effective mitigation measures have been included within the EIAR which will break the pathway between source and receptor. These mitigation measures are outlined briefly in Section **Error! Reference source not found.** above.
- Through the implementation of these mitigation measures, there will be no significant effects on surface water quality as a result of the proposed development, including the River Inny, River Glore, and Lough Derravaragh.

### **3.2.3 HES Response to 3<sup>rd</sup> Party theme 3):**

- Refer to Section **Error! Reference source not found.** above, i.e. response to Item 4.2 (b)

## **4 RESPONSE SUBMISSION SUMMARY:**

- A robust and detailed EIAR for the proposed wind farm development was submitted with the SID application.
- A detailed drainage plan outlining the location of drainage mitigation measures has been submitted (Appendix 4-9 and 9-3 of EIAR).
- We have comprehensively responded to and addressed all matters raised by the Board, and by Statutory and non-statutory submissions.
- 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 included in the CEMP and implemented on-site.
- We have comprehensively addressed the matters raised in the DAU submission relating to Lough Bane; and,
- The submitted EIAR concludes, and HES continue to assert, that through the implementation of the proposed groundwater and surface water protection related mitigation measures, this proposed development will not have significant impacts on the hydrology/hydrogeology of the Wind Farm Site, nor the Grid Connection Route, nor any downstream receptors such as the River Inny, River Glore and all nearby designated sites.

## 5 CLOSURE

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

Yours sincerely,



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Adam Keegan  
Hydrogeologist  
B.Sc., MSc.

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