APPENDIX 6

HYDRO-ENVIRONMENTAL SERVICES RESPONSE

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Date: 7th November 2025
Our Ref: P1508-1-0001

MKO
Tuam Road,
Galway, Ireland,
H91 VW84

F.A.O. Mr Alan Clancy

Dear Mr Clancy,

Re: An Coimisiún Pleanála Further Information Request Response regarding Clonberne Wind Farm Co. Galway (ABP Ref: ABP-320089-24)

1 INTRODUCTION

Hydro-Environmental Services (HES) were requested by MKO to respond to a further information request from An Coimisiún Pleanála (ACP) regarding the proposed Clonberne Wind Farm, Co. Galway (ACP Planning ABP-320089-24).

The Proposed Project (Wind Farm site and Grid Connection) is described in full in Chapter 4 of the EIAR.

This RFI response letter relates only to the Wind Farm site element of the Proposed Project.

This letter provides a response to Items 3, 12, 14 and 15 as listed under the heading of 'Biodiversity'.

Item 3:

> *"Kilmurray turlough is identified as a "significant wetland site" in Chapter 7 (Ornithology) of the EIAR. An assessment of the likely effects on Kilmurray turlough in terms of hydrology/hydrogeology does not appear to have been included in Chapter 9 (Hydrology and Hydrogeology) of the EIAR. Please provide an assessment of the likely effects from the proposed development on Kilmurray turlough and potential indirect effects on the bird species that it support's".*

Item 12:

> *"It is noted that there are 2 no. watercourses (Levally Stream) crossings on the L-22321. Outline suitable mitigation measures to prevent sediment laden surface water run-off from entering the existing watercourses along this access route. Section drawings of the watercourses with the proposed mitigation detailed thereon to be submitted".*

Item 14:

> *"It is noted that it is proposed to upgrade a section of the internal access road between watercourse crossing no. C4 and C5. Given the location of this access road relative to the Levally Stream, you are requested to submit section drawings to illustrate the relationship between the upgraded access road and the existing watercourse and include the mitigation (silt fences etc.) as proposed to prevent direct surface water runoff. A section drawing should also be submitted of watercourse crossing no. C5".*

Item 15:

> *"Confirm whether it is necessary to backfill an existing drainage ditch to provide for the proposed spoil storage area. The proximity of the proposed spoil storage area to Levally Stream and the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)' is noted. Consideration to be given to additional mitigation measures to prevent silt laden surface water run-off from entering the nearby watercourses at this location. Section drawings showing the relationship between the spoil storage area and the nearby watercourse and drainage ditches to be submitted".*

2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist geological, 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.

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 has 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 geological conditions, 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, FRAs, 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 specialises in wetland and peatland eco-hydrology. We are very familiar with all type of peatland sites (i.e. blanket, fen, raised bogs, and other types of wetlands).

Relevant to the Clonberne Wind Farm project, HES has completed over 30 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water, and for private developments across the country in a wide variety of hydrogeological settings.

HES has also been involved in over 50 Uisce Éireann water supplies to date in Counties Tipperary, Wicklow Waterford, Kilkenny, Wexford, Cork, Limerick, and Carlow. HES have prepared hydrogeological audit reports for these sites, with follow-on works including water level monitoring, water quality monitoring, camera surveys, and borehole maintenance and remediation works. HES has also completed specification and tendering, and follow-on supervision and management of trial well and production well drilling works and pumping tests works.

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, competencies, and experience are already presented in the EIAR (refer to Section 9.1.2).

3 ITEM 3 RESPONSE

Kilmurray Turlough was discussed in the Hydrology/Hydrogeology Chapter (Chapter 9), but it was referred to as 'Gortagarraun Turlough'.

Kilmurray turlough (Gortagarraun Turlough) was one of the several groundwater monitoring locations used in the EIAR hydrogeological assessment for the determination of groundwater flow directions and groundwater contour mapping.

The following points were made on 'Kilmurray Turlough' in the EIAR:

Section 9.3.4.1 states:

> *"The third stream, Stream C emerges at the location of Gortagarraun Turlough, which is situated 1.5km to the northwest and upstream of the Wind Farm site. Stream C flows in a south-easterly direction prior to merging with the Levally Stream immediately downstream of the Stream A/Stream B confluence on the west of the Wind Farm site. The proposed borrow pit area, which is located on the west of the Wind Farm site, drains to Stream C via a field drain that starts close to the eastern boundary of the proposed borrow pit location. Gortagarraun Turlough is only typically present over the winter period when groundwater levels are highest".*

Section 9.3.9.3 states:

> *"The Levally Stream flows in a valley to the west of the Site which originates at Gortagarraun Turlough to the northwest of the Site".*

Albeit, not specifically stated in the EIAR, Kilmurray Turlough was scoped out for impact assessment, as the turlough is located up-gradient of the Wind Farm site with regard to surface water and groundwater flow direction.

Refer to Figure 9-3 (Site Drainage Map) and Figures 9-10 & 9-11 (Groundwater Contour Maps) of Chapter 9 '*Hydrology and Hydrogeology*' of the EIAR, which shows the upstream location of Kilmurray Turlough with respect the proposed Wind Farm site.

From a hydrological/ hydrogeological perspective there is no potential for the proposed Wind Farm to impact on Kilmurray Turlough.

The potential indirect effects on the bird species that it support is dealt with separately in the MKO Biodiversity response submission.

4 ITEM 12 RESPONSE

For the purpose of this response, the 2 no. existing watercourse crossings on the Levally Stream along local road L-22321, are referred to as Bridge 1 and Bridge 2. Bridge 1 is located furthest west on the L-22321, while Bridge 2 is closest to the Wind Farm infrastructure to the east.

Local road L-22321 will be used as an access road during the construction phase and the following proposed temporary drainage control measures will prevent any dirty runoff from the road surface entering the Levally Stream.

Refer to Drawings P1508-2-1125-A3-FI-101-00A and P1508-2-1125-A3-FI-102-00A, included within this appendixfor cross-sections and proposed temporary drainage control mitigation measures at Bridge 1 and Bridge 2 respectively.

Proposed drainage mitigation for Bridge 1 includes:

- Edge protection at the bridge location (extending 3m each side of the crossing) to prevent surface water runoff directly entering the Levally Stream;

- A drainage 'grip' across the road to the west that slopes down towards the bridge in order to divert runoff off the road and preventing it flowing towards the watercourse crossing;
- Placement of check dam/silt fencing arrangements in the roadside drain which runs along the southern side of the access road. This roadside drain discharges into the Levally Stream at the bridge crossing location; and,
- Daily road sweeping will be carried out along the L-22321 during the construction phase.

Proposed drainage mitigation for Bridge 2 includes:

- Edge protection at the bridge location (extending 3m each side of the crossing) to prevent surface water runoff directly entering the stream;
- A row of silt fencing on each bank of the watercourse upstream and downstream of the crossing; and,
- There is no roadside drainage at Bridge 2. Runoff is onto adjacent vegetated ground.

5 ITEM 14 RESPONSE

Cross-sections of the internal access road (proposed for upgrade) and the adjacent Levally Stream between watercourse crossing no. 'C4' and 'C5' are shown on Drawing P1508-2-1125-A3-FI-103-00A of this appendix, along with proposed temporary mitigation measures.

Cross-section XS8 is located at proposed watercourse crossing 'C5'.

6 ITEM 15 RESPONSE

Cross-sections of the proposed spoil storage area along with proposed drainage control mitigation measures are shown on Drawing P1508-2-1125-A3-FI-104-00A, enclosed within this appendix.

A 5m setback distance will be maintained between the proposed spoil storage area and the main field boundary drains located to the north, south and west of the proposed spoil storage area.

There is a vegetated shallow ditch that runs in a NW-SW direction through the western half of the proposed spoil repository area. The ditch is typically dry.

The dry ditch is not a main drain, as per those present along the field boundaries to the north, west and south of the proposed spoil repository area. The dry ditch feature acts as shallow herring bone type drainage feature, with a localised drainage effect to the field in which the spoil repository area is proposed. Once the area is backfilled, its purpose and function will be removed.

As shown on Drawing P1508-2-1125-A3-FI-104-00A, drainage mitigation at the proposed spoil storage area include:

- 50m watercourse buffer between the proposed spoil storage area and the Levally Stream;
- 5m setback distance between the storage area and the main drains to the north, south and west;
- Row of silt fencing located immediately downslope of the storage area and a second row of silt fencing upslope of the Levally Stream;
- Row of silt fencing between the storage area and the main drains to the north, south and west; and,
- Downslope collector drain capturing all runoff from the proposed storage area to a suitably sized settlement pond.

Please refer to Drawing P1508-0-0624-A1-D105-00C (submitted with the EIAR) which shows the drainage controls originally proposed at the spoil storage area.

The response provides additional mitigation measures to prevent silt laden surface water run-off from entering the nearby watercourses at the proposed spoil storage location.

7 RESPONSE SUMMARY

In summary, and in response to ACP's further information request:

- Kilmurray Turlough was assessed as part of the hydrogeological investigations but was scoped out for impact assessment due to lack of hydrological connectivity with Site;
- Cross-sections of 2 no. existing bridge crossing along the L-22321 showing temporary drainage control measures to prevent dirty runoff from the road surface entering the Levally Stream are provided;
- Cross-sections at proposed road upgrade locations along the Levally Stream showing temporary drainage control measures are provided; and,
- Cross-sections at proposed spoil storage area showing temporary drainage controls to prevent potential poor quality runoff entering adjacent drains and the Levally Stream are provided.

HES has responded to all matters raised in the ACP 3rd party submissions.

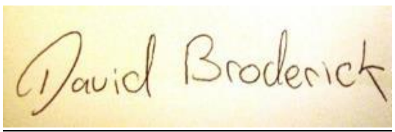
We respectfully submit to An Coimisiún Pleanála that this letter response reiterates the conclusions of the robust and comprehensive impact assessments presented in EIAR Chapter 8 (Land, Soils and Geology), EIAR Chapter 9 (Hydrology and Hydrogeology), the associated Flood Risk Assessment (Appendix 9-1), WFD Compliance Assessment Report (Appendix 9-3) and drainage design plan (Appendix 4-3).

The impact assessments presented in the EIAR are informed by a comprehensive site investigation dataset and rely upon the tried and tested, best practice mitigation measures which ensure the protection of the receiving environment. Similar mitigation measures have been successfully applied during the construction of countless wind farm developments across the country and were also presented in the EIARs for several recently permitted wind farm developments (i.e. Glenard WF, Co. Donegal).

8 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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Date: 6th November 2025
Our Ref: P1508-1-0001

MKO
Tuam Road,
Galway, Ireland,
H91 VW84

F.A.O. Mr Alan Clancy

Dear Mr Clancy,

Re: An Coimisiún Pleanála Third Party Submissions Response regarding Clonberne Wind Farm Co. Galway (ABP Ref: ABP-320089-24)

1 INTRODUCTION

Hydro-Environmental Services (HES) were requested by MKO to respond to third party submissions made to An Coimisiún Pleanála (ACP) regarding the proposed Clonberne Wind Farm, Co. Galway (ACP Planning ABP-320089-24).

The Proposed Project (Wind Farm site and Grid Connection) is described in full in Chapter 4 of this EIAR.

This response letter relates only to the Wind Farm site element of the Proposed Project. The Grid Connection submission response is dealt with in a separate response letter.

2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist geological, 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.

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 has 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 geological conditions, 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, FRAs, and also at construction management stage.

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Relevant to the Clonberne Wind Farm project, HES has completed over 30 Source Protection Assessments for the GSI/NFGWSs, and for Irish Water, and for private developments across the country in a wide variety of hydrogeological settings.

HES has also been involved in over 50 Uisce Éireann water supplies to date in Counties Tipperary, Wicklow Waterford, Kilkenny, Wexford, Cork, Limerick, and Carlow. HES have prepared hydrogeological audit reports for these sites, with follow-on works including water level monitoring, water quality monitoring, camera surveys, and borehole maintenance and remediation works. HES has also completed specification and tendering, and follow-on supervision and management of trial well and production well drilling works and pumping tests works.

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, competencies, and experience are already presented in the EIAR (refer to Section 9.1.2).

3 RESPONSE LAYOUT

Firstly, a direct response is provided for concerns raised in the following submissions:

- Dr Robert Meehan
- Hydro-G
- Dr Paul Johnston
- North-East Galway Environmental Protection CLG
- Inland Fisheries Ireland (IFI)

After those, a more general response is provided for recurring topics raised in the other submissions. The main recurring topics are as follows:

- Effects on local group scheme water supplies;
- Increased flood risk;
- Groundwater level effects;
- Surface water and groundwater quality effects;
- Potential effects on local private wells; and,
- Potential impacts on Lough Corrib SAC.

4 DR ROBERT MEEHAN SUBMISSION RESPONSE

The overall submission by Dr Meehan is founded on the assertion that no systematic field mapping of karst features was carried out as part of the EIAR. This is untrue as set out below.

The opening paragraphs of Dr Meehan's submission (submission pgs 1 & 2) states:

> "*The absence of data on karst features mapped systematically at field scale around the site locality*".
>
> "But *no karst mapping of sensitive karst features at field scale has taken place anywhere in or around the site area, or within or adjacent to the likely Zoc of the Gurteen/Cloonmore Group Water Scheme Spring Source*".

It needs to be clearly stated that **karst mapping at field scale was carried out as part of the EIAR** and that Dr Meehan's interpretation/understanding of the EIAR assessment is incomplete.

The statement by Dr Meehan is unfounded given that it is clearly stated several times in the EIAR that no additional karst features were identified during field surveys carried out at the Wind Farm site, other than those mapped by the Geological Survey of Ireland (GSI).

The walkover surveys and hydrological mapping did include karst mapping at a field scale as is clearly stated in Sections 8.3.4.1, 9.3.10 and 9.5.2.1 of the EIAR:

> *"No karst features were observed within the Proposed Project site during the walkover surveys".*

> *"Apart from the Gurteen/Cloonmore GWS karst spring, there are no other visible surface karst features within the Site".*

> *"There are no point sources of groundwater recharge within the Wind Farm site due to the thickness and coverage of peat and glacial tills".*

Therefore, its clearly stated on several occasions, other than the karst features identified by the GSI, no other features were identified within the Wind Farm site during the field mapping and walkover surveys.

HES are aware, as would any experienced hydrogeologist/geologist, that the GSI karst database is no way exhaustive and hence the importance of detailed field surveys as part of hydrogeological investigations.

Notably, the same opening paragraph in Dr Meehan's submission (pg. 2) ends on a somewhat contradictory tone by acknowledging the comprehensive assessment carried out in the EIAR with regard land, soils, geology and Water:

> "*Thus, a thorough characterisation and baseline monitoring exercise preceded the application for planning permission for the proposed Clonberne Wind Farm, as would be expected for any Environmental Assessment Report (EIAR)*".

And further down the submission on page 5 says:

> *"The EIAR report for the proposed wind farm site has completed a thorough, detailed study of general groundwater levels in the area of the wind farm site, both for summer and winter, as shown on Figures 9-10 and 9-11".*

The above statements are somewhat contradictory to Dr Meehan's earlier statement regarding of lack of karst feature surveys, because you cannot carry out *a "thorough characterisation and baseline monitoring exercise"* without doing detailed field surveys, including karst mapping.

On page 2 of the Dr Meehan submission, headed under "*The Importance of Karst*", Dr Meehan lists the type of karst features you would expect to find in a karst landscape (i.e. swallow holes, turloughs, enclosed depressions, dry valleys and limestone pavements are among those listed), with many having no relevance to the proposed Wind Farm site.

Apart from the Gurteen/Cloonmore Group Water Scheme (GWS) spring source (as mapped by the GSI and visited by HES), none of the listed karst features in the submission were observed at the Wind Farm site during the walkover surveys and hydrological mapping (i.e. field-based karst mapping). The GSI also map a turlough (Gortagarraun/KIlmurray Turlough) and a swallow hole within 1.5km of the Wind Farm site.

As Dr Meehan's submission points out, enclosed depressions are typically the most common landform found in karst landscapes. Their presence is a strong visual indication of well-developed groundwater flow systems due to karst weathering in the underlying bedrock. Enclosed depressions are also generally easily observed during ground surveys while also being typically visible from aerial photography and identifiable during desktop studies.

No enclosed depressions were observed at the Wind Farm site from either historical /recent aerial photography or from historical OSI mapping. The absence of additional karst features was then confirmed by the follow up hydrological mapping and field surveys. (i.e. field-based karst mapping).

The submission on page 2 goes on to point out that "*The* [karst] *landscape is characterised largely underground drainage, with most flow occurring through the more permeable, solutionally enlarged, interconnected fissures/conduit zones, which may be several kilometers long*".

This is not the character of the Wind Farm site which has surface dominated drainage (i.e. high density of natural streams and manmade drainage) and shallow groundwater levels that exist close to ground level (refer to Section 9.3.9.3 of the EIAR for interpretation of site groundwater levels).

The submission then states that "*karst landscapes are usually very fertile and well drained*". This is the complete opposite to the landscape observed at the Wind Farm site where the GSI subsoils mapping (www.gsi.ie) shows large coverage of cutover raised peat (67%) which in turn is surrounded predominately limestone tills (30%) which show very poor natural drainage characteristics (i.e. low groundwater recharge rates).

The limestone tills are typically overlain by poorly drained peaty soils. There is also an extensive manmade drainage network across the entire Wind Farm site, including agricultural areas, due to the presence of poorly draining soils and subsoil (glacial tills).

Page 4 of the submission goes on to suggest that the hydrological/hydrogeological assessment carried out for EIAR relied on GSI mapping and GSI source protection reports.

> "*Thus, the existing information from the GSI database should not be used for site specific decisions, including the installation of the proposed windfarm development and its associated infrastructure. This is actually the reason why the studies completed for the Gurteen/Cloonmore Group Water Scheme and the Gallagh Group Water Scheme established potential Zones of Contribution only, rather than delineating Source Protection Zones following field scale karst feature mapping, as was completed for the nearby Gortgarrow Spring of the Dunmore/Glenamaddy Water Supply (Meehan, 2008).*
>
> "*But the "GSI Karst feature Map" shows only the currently mapped karst landforms in Ireland and is no way exhaustive*".

The limitation of the GSI preliminary ZoC mapping is clearly acknowledged in Section 9.3.8 of the EIAR:

> *"The Gallagh GWS and Gurteen/Cloonmore GWS SPAs, which overlap the Site, are delineated based on a conceptual understanding of groundwater flow and recharge patterns and therefore there is a larger element of unknown with regard the ZoC and SPA to these two sources. The SPAs are mapped as "Preliminary" according to the GSI online datasets".*

The above statements by Dr Meehan are not only contradictory to the opening paragraph of the submission where it states a "*thorough characterisation and baseline monitoring exercise"* was carried out but are also perplexing given the array of site investigations that were carried out at the Wind Farm site to overcome the limitations of the GSI preliminary Zone of Contribution (ZoC) mapping.

To overcome this limitation of the GSI mapping an array of site investigations were carried out at the Wind Farm site including bedrock boreholes (5 no.), trial pits (15 no.), peat depths (194 no.), long-term groundwater level monitoring (~1.5 years' worth of data), surface water flow measurements and water quality monitoring (surface water and groundwater). Many of the investigations were focused in the area where the GSI mapped Gurteen/Cloonmore Group Water Scheme ZoC overlaps with the Wind Farm site.

Dr Meehan submission refers to the source protection report for the nearby Dunmore-Glenamaddy Water Supply Scheme (i.e. Gortgarrow Spring). Dr Meehan himself being one of the authors of that report.

The reference is made (pg. 7) in a manner that suggest the investigations carried out to inform the Dunmore-Glenamaddy Public Water Supply Scheme (PWS) source protection area are somewhat benchmark, "*studies allowed robust determinations of exact groundwater flow directions, contributing areas to springs, and resultant assertions from same*".

Thus, below we provide a summary of the intrusive investigations and monitoring carried out for the Dunmore-Glenamaddy PWS and then make a comparison with the investigations carried out in the EIAR regarding refining the ZoC for assessing potential impacts on the Gurteen/Cloonmore GWS. The comparison is done on a study area basis (i.e. the density of site investigation data points is compared).

Dunmore-Glenamaddy PWS:

- **Study area**: 23.7km^2 (zone of contribution to spring);
- **Overburden investigations:** 16 no. auger holes & 6 no. geophysics locations (*22 no. investigation points*);
- **Bedrock drilling investigation holes**: 1 no. deep bedrock hole (*1 no. investigation points*);
- **Groundwater Level Monitoring Locations**: 1 no. deep bedrock hole and 1 no. spring (*2 no. investigation points); and,*
- **Dye Tracing:** 1 no. injection point and 5 no. sampling points (*6 no. investigation points*); and,
- **Surface Water Flow Monitoring:** None.

The investigations carried out for the Dunmore-Glenamaddy GWS amounted to 31 no. investigation points. These investigations were carried out over a study area of 23.7km^2, which is an investigation point density of 1.3 points per km^2.

Gurteen/Cloonmore GWS EIAR Investigation:

- **Study area**: 3.5km^2 (area of the Wind Farm site including area inside GSI mapped zone of contribution);
- **Overburden investigations:** 15 no. trial pits, 10 no. soil cores and 197 peat probes (*222 no. investigation points*);
- **Bedrock drilling investigation holes**: 5 no. deep bedrock hole (*5 no. investigation points*);
- **Groundwater Level Monitoring Locations**: 5 no. deep bedrock hole, 1 no. spring, 1 no. turlough and 3 no. third party wells (*10 no. investigation points);*
- **Dye Tracing:** none as no karst features are present for injection (i.e. swallow holes, dolines etc); and,
- **Surface Water Flow Monitoring:** 5 no. stream locations (*5 no. investigation points)*.

The investigations carried out for the Gurteen/Cloonmore GWS EIAR Investigation amount to 242 no. investigation points. If the peat probes and soil cores are excluded, it amounts to 35 no. investigation points.

These 35 no. investigations were carried out over a study area of 3.5km^2, which is an investigation density of ~10 points per km^2. This is significantly greater than the investigation density for the Dunmore-Glenamaddy Water Supply Scheme which amounts to 1.3 points per km^2.

The comparison of investigations <u>on a study area basis</u> clearly shows that the EIAR investigations/assessments carried out regarding the Gurteen/Cloonmore GWS are extensive and exceed the investigation density carried out for the Dunmore-Glenamaddy GWS.

Also, based on the surveys carried out for Dunmore-Glenamaddy Water Supply Scheme, Dr Meehan (on pg 5) gives recommendation on the time that should be dedicated to field mapping surveys:

> "*Field mapping if* (sic) *karst features has had reported terrain completion rates of 1km² per day where full field coverage is achieved (e.g. Meehan and Kelly 2011,) or 1.5 – 2km² per day where targeted mapped is completed (e.g. Meehan, 2008; Hickey, 2010)*

The number of days spent completing the EIAR investigations and surveys with regard the Gurteen/Cloonmore GWS amounted to 10 days as shown in Section 9.2.2 of the EIAR:

> *"Geological/hydrological/hydrogeological baseline monitoring and site investigations of the Site were undertaken by David Broderick of HES (refer to Section 9.1.2 above for qualifications and experience) on 5th March, 10th & 11th May, 21st & 22nd June, 10th August, 21st December 2021, on 19th January and 6th April 2022 and on 28th March 2023".*

Approximately 6 no. of the logged days was dedicated to drilling supervision/sampling/flow monitoring, with the other 4 spent of field mapping (i.e. drainage mapping, walkover surveys, geological mapping, peat probing and geomorphology (karst) mapping).

As stated above, the study area for the Gurteen/Cloonmore GWS EIAR Investigation is $3.5km^2$. Therefore, based on Dr Meehan's survey effort calculations, this area would have required 3.5 days to carryout full field coverage. The actual time spent carrying out field surveys for the Gurteen/Cloonmore GWS assessment/ Wind Farm EIAR exceeded Dr Meehan's recommendations.

Therefore, the closing statement of the submission (pg. 8) "*thus, an appropriate level of detail is not evident in the EIAR*" is therefore completely unfounded given the array of investigations carried out over a reasonably small study area. The statement is also contradictory to the earlier comment stating a "*thorough characterisation and baseline monitoring exercise*" was completed for the EIAR.

We demonstrate above that the investigations/assessments carried out regarding the Gurteen/Cloonmore GWS are on par if not exceed the levels of investigations carried out for the Dunmore-Glenamaddy Water Supply Scheme on a study area basis.

Finally, there are some misleading statements in the concluding paragraphs of Dr Meehan's submission that need to be clarified.

Page 8, third last paragraph states:

> *"The statement in Section 9.3.16 of the of the Environmental Impact Assessment Report that "there are no hydraulic pathways between the Site and PWS source springs along which impacts could occur or be transferred" is unverified therefore".*

This statement in the EIAR appears to relate to the Dunmore/Glenamaddy PWS source and not the Gurteen/Cloonmore GWS. The source protection area for Dunmore/Glenamaddy PWS was delineated by Dr Meehan himself on behalf of the GSI.

Based on the GSI source protection area mapping completed for the Dunmore/Glenamaddy PWS, the Wind Farm site is not located within the groundwater zone of contribution of the Dunmore/Glenamaddy PWS.

Hence, how could this determination be '*unverified*' if subsequent "*studies allowed robust determinations of exact groundwater flow directions, contributing areas to springs, and resultant assertions from same*" with regard the Dunmore/Glenamaddy PWS source protection area.

Also, please refer to Hydro-G submission response below (Section 5) which addresses the Dunmore/Glenamaddy PWS in more detail, with regard to lack of potential effects.

Page 8, second last paragraph of the Dr Meehan submission, which is also misleading, states:

> *"It appears that the EIAR considered Lough Corrib was 'safe' from the proposed wind farm development by nature of its geographical location only and the general thick depths of peat and till subsoil in the area of the proposed wind farm, and the proposed windfarms location on the relative periphery of the site".*

Nowhere in the EIAR was it determined that Lough Corrib was 'safe', the potential pre-mitigation effect on Lough Corrib SAC was assessed as "*Indirect, negative, moderate, short-term* (refer to section 9.5.2.0 of the EIAR).

Also, the above statement by Dr Meehan regarding Lough Corrib appears to be another misinterpretation of the EIAR assessment. The discussion in the EIAR around geographical location and thick depths of till subsoil is in relation to Levally Lough SAC assessment and not Lough Corrib SAC (Section 9.5.2.10 of the EIAR):

> *"Levally Lough SAC is located approximately 2km to the south of the Site and in the direction of groundwater flow (i.e. southerly/south-westerly) with regard the Site location. The Levally Stream flows between the Site and Levally Lough".*
>
> *"The groundwater level monitoring carried at the Site suggests that the Levally Stream is a local discharge zone for groundwater in the area of the Site. The fact that the Levally Stream separates the Site and Levally Lough, groundwater flows arising from the Site (especially shallow groundwater flows in the glacial deposits) are more likely to discharge into the Levally Stream rather than travel further south towards Levally Lough".*
>
> *"Also, due to the large coverage of peat, the presence of deep glacial till deposits, and poorly draining soils across the Site, the risk to groundwater quality in the deeper karst limestone is low. Considering these factors in addition to the proposed mitigation measures for groundwater protection, no effects on Levally Lough SAC are likely to occur".*

Key Summary Points in Response to Dr Meehan's submission:

- Dr Meehan's criticism of the EIAR assessment is largely focused on the apparent lack of field scale karst feature mapping and the apparent reliance on GSI desk study data;
- Field-based karst mapping was completed, as referred to several times in the EIAR and summarised above;
- We demonstrate that there was no reliance on GSI mapping/data and that the investigations concerning the Gurteen/Cloonmore GWS spring/Wind Farm EIAR were indeed thorough and detailed; and,
- The criticism by Dr Meehan is somewhat contradictory to other statements made in his submission which related to the robustness and detail of the EIAR carried out:

- *"Thus a thorough characterisation and baseline monitoring exercise preceded the application for planning permission for the proposed Clonberne Wind Farm, as would be expected for any Environmental Assessment Report (EIAR)";*
- *"The EIAR report for the proposed wind farm site has completed a thorough, detailed study of general groundwater levels in the area of the wind farm site, both for summer and winter".*

5 HYDRO-G'S SUBMISSION RESPONSE

Hydro-G's submission begins by explaining the large volumes of groundwater that can be transmitted in the underlying Regionally Important Karstified Aquifer (which is undeniable) and how these large volumes of groundwater will somehow be a hazard during the construction of the proposed Wind Farm development:

> "*Hydro-G holds videos of the hydrogeological magnificence portraying the magnitude of water that expels itself from these grounds when punctured by a drill hammer, as will be required for the foundations of any turbine mast".*

Firstly, there is no proposal to drill or excavate down into bedrock for the turbine foundation construction, which is as described in Section 9.5.2.1 of the EIAR:

> *"The following proposed construction design measures will ensure the bedrock aquifer below the Wind Farm is not disrupted during works:*
>
> - *The proposed construction method for turbine bases located inside the refined ZoC (i.e. T1, T2, T3, and T4) will either be a gravity foundation or pre-cast piling;*
> - *The gravity foundation option will seek a suitable founding in the glacial tills at a maximum depth of 3 - 3.5mblg and therefore excavations will only require the removal of overburden to the final base level which will be within the overburden layer and above the top of bedrock;*
> - *A considerable protective layer of overburden will be left in place above the bedrock;*
> - *Gravity foundation is the preferred option unless further site investigations deem it unsuitable. If a gravity foundation is not suitable at a depth of 3 - 3.5m or above, driven precast piling will be the approach;*
> - *Pre-cast piling will involve driving/hammering imported concrete piles down onto the top of bedrock below the glacial tills. The piles will not be drilled into the underlying bedrock aquifer nor will they grouted in place; and,*
> - *The gravity foundation or pre-cast piling approach will not require excavations or grouting down into the bedrock aquifer and therefore there will be no risk of intercepting potential underlying bedrock conduits/fractures that transmit groundwater to the spring.*

Also, as noted above 5 no. bedrock investigations holes were drilled at the Wind Farm site as part of the EIAR investigations and none expelled groundwater back up to the ground surface due to natural aquifer/fracture pressure.

The volumes of groundwater described by Hydro-G would indeed be problematic if tunnelling or deep bedrock quarrying were part of the Proposed Project, or if the volume of water was actually encountered on-site, but the fact is all turbine base excavations will be carried out above bedrock level as part of mitigation by design which is clearly described in the EIAR.

Page 2, paragraph 2 of the Hydro-G submission states:

> *"There is a hydrogeological phenomenon in this landscape in which there can be unmapped extents of sand and gavel subsoils bounding the peatlands and those gravels enable vast quantities of groundwater to be expelled from the ground if*

that ground is broken by construction activities. The site investigation in the EIAR for Clonberne is not sufficient to enable a conclusion regarding the landscape in which road building and excavation for trenches for connection cables are proposed. And herein lies the risk posed to Lough Corrib and many public and Group Water Scheme water supplies; vast volumes of groundwater are close to the surface and there are many Groundwater Source Protection Zone Reports, by many authors, for water supplies in this area that show how strings of gravels or small strips of extreme groundwater vulnerability can create an environment of too much water to manage".

Firstly, the relevant source protection reports for water supplies in the area of the proposed Wind Farm development include the Gurteen/Cloonmore Group Water scheme (GWS), Gallagh GWS and Dunmore/Glenamaddy Public Water Supply (PWS). None of these source protection reports document the phenomenon of saturated sand and gravels expelling large volumes of groundwater when excavated.

At the Wind Farm site, limestone tills are the dominant subsoil type mapped by the GSI outside of the peat bog areas except for a pocket of GRAVELS mapped in the central area of the site (refer to Figure 8-1 of the EIAR). This area of mapped GRAVELS, which has several visual exposures due to previous excavations carried out by the landowner, was found to comprise poorly sorted SILT/CLAY dominated subsoils with cobbles/bounders (i.e. glacial tills) when mapped during the EIAR surveys. It is also worth noting that this area of mapped 'GRAVELS' is largely avoided by the Proposed Project infrastructure as shown on Figure 8-1.

As stated in the Land, Soils and Geology Chapter of the EIAR (Chapter 8), 5 no. boreholes and 15 no. trial pits were carried out and albeit there was some variability (as would be expected with glacial tills), the subsoil were SILT or CLAY dominant. Where SAND or GRAVEL layers were encountered during trial pitting no significant groundwater inflows were recorded/reported. Also, during the borehole drilling no groundwater was expelled from the overburden deposits.

It also worth noting that the lands that abound the bogs are crossed by a large network of land drains that extend to a depth of between 1 - 2m below ground level. These land drains are essentially linear trenches, several kilometres of them! Similar type of trenching will be required for the Wind Farm cabling. There is no evidence from these drains (effectively linear trenches), based on the observed low flows or bank exposures, that they intercept outwash gravel deposits.

The Wind Farm site has also several kilometres of public roads, private road and bog roads. The northern section of the Wind Farm site has almost 1.5km of public roads inside the EIAR site boundary and these roads pass within 200 – 300m of proposed turbine locations T1 – T4. The point being made here is that significant development has already taken place on this site without the resulting catastrophic events portrayed by Hydro-G.

Therefore, the scenario portrayed by Hydro-G is unfounded for the Site. Furthermore, the description of 43,000 m^3/day of milk arriving at your front is intentionally dramatic and unscientific.

Page 5 of Hydro-G submission claims the Water Chapter of the EIAR "*makes so many statements that are misleading for the Board*" or has "*erroneous information*". We strongly rebut each one of statements made by Hydro-G as follows:

(i) *"That it is defensible to propose large scale excavations of peats and piling machinery work bases over a large extent of the Gurteen/Cloonmore GWS's GSI mapped zone of contribution (ZoC. This is factually incorrect";*

(ii) *"That there is an up-gradient and down-gradient turbine landscape relative to the Gurteen/Cloonmore GWS's spring discharge. This is factually incorrect. The Board is*

referred to the work of Dr. Robbie Meehan for the NFGWS and GSI relating to the Gurteen/Cloonmore GWS";

(iii) *"That the ZoC for the Gurteen Cloonmore GWS can be revised by the agent of a developer. This is factually incorrect. The Board is referred to the GSI to seek opinion on this." and,*

(iv) *"That the construction proposed for the lands mapped by the GSI for the NFGWS as the Zone of Contribution for the Gurteen/Cloonmore GWS could not impact on the Dunmore/Glenamaddy PWS when the ZoCs are mapped as overlapping. This is factually incorrect".*

In responding to **submission point (i)** above we refer to the scoping response from the GSI with regard the Proposed Project. The GSI are authors of the Gurteen/Cloonmore GWS source protection report.

The GSI scoping response is summarised in Table 9-1 of Chapter 9 of the EIAR and is provided below for ease of reference:

> *"Key to groundwater protection in general, and protection of specific drinking water supplies, is preventing ingress of runoff to the aquifer. Design of wind farm drainage will need to be cognisant of the group water scheme and the interactions between surface water and groundwater as well as run-off".*
>
> *"Appropriate design should be undertaken by qualified and competent persons to include mitigation measures as necessary, such as SUDs or other drainage mitigation measures".*
>
> *"Also, any excavation/cuttings required should ensure that groundwater flow within the zones of contribution to the groundwater abstraction points is not disrupted, resulting in diminished yields. Note that there could be other groundwater abstractions in the locality for which Geological Survey Ireland has not undertaken studies, and a robust assessment should be undertaken by qualified and competent persons".*
>
> *"Given the nearby drinking water sources (Group Water Scheme and numerous boreholes and domestic wells), the effects of any potential contamination dewatering as a result of the wind farm development would need to be assessed".*

Therefore, nowhere in the GSI scoping response does it state that the Proposed Project is indefensible or unacceptable. What is provided by the GSI are clear and rational recommendations on the matter of groundwater protection during the potential construction phase of the Wind Farm.

Similarly, the scoping response from Uisce Éireann, who own and operate the nearby Dunmore/Glenamaddy PWS, provide a similar rational and informative response:

> *"Where the development proposal has the potential to impact an Uisce Éireann Drinking Water Source(s), the applicant shall provide details of measures to be taken to ensure that there will be no negative impact to Uisce Éireann's Drinking Water Source(s) during the construction and operational phases of the development. Hydrological / hydrogeological pathways between the applicant's site and receiving waters should be identified as part of the report".*

Also, as shown on Table 9-1 of the EIAR, all the recommendations given by the GSI and Uisce Éireann were considered during the design phase and impact assessment of the Proposed Project and are addressed in the EIAR.

Submission point (ii) above is in relation to the Gurteen/Cloonmore GWS source protection mapping which was completed by Dr. Robbert Meehan on behalf of the GSI.

The GSI source protection mapping for the Gurteen/Cloonmore GWS shows a larger number of turbines inside the groundwater zone of contribution (ZoC) compared to the refined ZoC determined by the Wind Farm EIAR investigations. This is described in Section 9.3.15.1 of the EIAR.

> *"Given the measured southerly groundwater flow direction and the location of the spring with regard the Wind Farm infrastructure, all proposed Wind Farm infrastructure located to the north of the spring is potentially up-gradient of the spring and within the ZoC.*
>
> *To the south of the spring groundwater flow/gradient is measured to be in a southerly direction (away from spring). Therefore, the areas to the south and southeast of the spring cannot contribute groundwater flow to the source and are therefore outside the spring ZoC. Therefore, all proposed Wind Farm infrastructure located to the south of the spring cannot be inside the ZoC.*
>
> *Using the groundwater level and contour mapping a refined version of the ZoC was delineated in the area of the proposed Wind Farm site as* shown in Figure 9-13 *below* [Chapter 9 of the EIAR]. *The ZoC was only refined for the area inside the Site as there is not sufficient data to refine the ZoC in the wider area.*
>
> *The refined (worst-case scenario as explained below) ZoC mapping shows that 4 no. proposed turbine locations are potentially (as a worst-case scenario) located within the refined ZoC. Turbines potentially located inside the refined ZoC include T1, T2, T3 & T4.*
>
> *The preliminary GSI SPA show proposed turbine location T5, T6 and T11 inside the SPA/ZoC which is not the case based on the groundwater level monitoring. It's also worth noting that all the peat repositories and the southern temporary construction compound are now located outside the refined ZoC".*

Hydro-G appears to hold the opinion that the turbines to the south of the spring (i.e. T5, T6 and T11) are within the ZoC to the spring as shown on the GSI mapping (i.e. Hydro believes that turbines T5, T6 and T11 are also up-gradient of the spring and not down-gradient).

As was previously cautioned in the Dr. Robbert Meehan submission response (Section 4 of this response letter), the Gurteen/Cloonmore GWS mapping is largely a desk study exercise. As acknowledged by Dr. Robbert Meehan himself, no field mapping, site investigations or groundwater level monitoring was completed:

> "*Thus, the existing information from the GSI database should not be used for site specific decisions, including the installation of the proposed windfarm development and its associated infrastructure. This is actually the reason why the studies completed for the Gurteen/Cloonmore Group Water Scheme and the Gallagh Group Water Scheme established potential Zones of Contribution only, rather than delineating Source Protection Zones following field scale karst feature mapping, as was completed for the nearby Gortgarrow Spring of the Dunmore/Glenamaddy Water Supply (Meehan, 2008).*
>
> *"As such, the maps cannot be claim to be definitely accurate across the whole area covered and should not be used as the sole basis for site specific decisions, which will usually require the collection of additional site-specific data".*

The refined ZoC provided in the EIAR is based on almost 1.5 years' worth of groundwater level data from 10 no. monitoring locations within a ~2km radial distance of spring source. This data allowed accurate mapping of groundwater flow directions and gradients in the area of the Wind Farm site and the GWS spring.

The groundwater level monitoring data is presented in Section 9.3.9.3 of Chapter 9 of the EIAR and an interpretation of groundwater levels and flows is presented in the form of detailed groundwater level contour mapping shown on Figure 9-10 and Figure 9-11 of the EIAR.

As Dr Meehan stated in his own submission (Section 4 above) "*a thorough, detailed study of general groundwater levels in the area of the wind farm site, both for summer and winter*" was completed.

Therefore, Hydro-G appears to be making the argument that ZoC mapping from a largely desktop assessment by the GSI should take precedence over a more detailed hydrogeological investigation (spanning almost 3 years!) when making decisions on site specific planning matters for the Proposed Project.

There is no logic to Hydro-G's reasoning here and clearly at odds to what Dr. Robbert Meehan regarding the intended use of the Gurteen/Cloonmore GWS source protection mapping (i.e. *As such, the maps cannot claim to be definitely accurate and will usually require the collection of additional site-specific data").*

Submission Point (iii) above challenges the credibility of the developer's consultants (HES) refining the GSI ZoC as done in the EIAR.

To be very clear, the ZoC is a hydrogeological phenomenon, a physical state of the groundwater flow regime. It's akin to describing surface water flow directions, drainage patterns or catchments. It is factually the baseline environment. It is not a legal or planning designated area. ZoC mapping is also highly data dependant and the more data that is available, the more reliable the mapping will be.

The disclaimer is very clear in the GSI Gurteen/Cloonmore GWS source protection report that the mapped source protection areas are only indicative and recommend further site-specific investigations:

> *"As such, the maps cannot be claim to be definitely accurate across the whole area covered and should not be used as the sole basis for site specific decisions, which will usually require the collection of additional site-specific data".*

The refined ZoC presented in the EIAR, which is produced from the collection of additional site-specific data, is used to inform the impact assessment for the proposed Wind Farm. There is nothing "*factually incorrect*" about this and is in fact the recommended practice according to the GSI.

Lastly, **submission point (iv)** Hydro-G is claiming that because the ZoC for Gurteen/Cloonmore GWS and the Dunmore/Glenamaddy PWS are overlapping, there is a potential that the lands proposed for the Wind Farm development are also in the groundwater catchment to the Dunmore/Glenamaddy PWS.

Yes, it is clear from the GSI mapping that both ZoC's overlap (refer to Figure 9-7 of the EIAR), buts what's fundamental here is that the Wind Farm site is NOT located in the area where the two ZoCs overlap.

The proposed Wind Farm site is not located inside the Dunmore/Glenamaddy PWS ZoC which according to one of its authors, Dr Robert Meehan has "*robust determinations of exact groundwater flow directions, contributing areas to springs, and resultant assertions from same*".

Assuming the Dunmore/Glenamaddy PWS ZoC is accurate (as we are advised is the case), the hydrogeological scenario claimed by Hydro-G is hydraulically impossible.

In addition, the groundwater level monitoring completed at the Wind Farm site is also completely at odds with Hydro-G claim as it shows the measured groundwater flow direction is south-westerly towards the Gurteen/Cloonmore spring and away from the location of the Dunmore/Glenamaddy PWS source springs (to the northeast of the Wind Farm site).

Section 9.3.16 of the EIAR provides several robust scientific reasons why no effects on Dunmore/Glenamaddy PWS are likely:

- *The proposed Wind Farm site is not located inside the GSI mapped Dunmore/Glenamaddy PWS SPA;*
- *The nearest proposed turbine location (i.e. T2) is >2km from the PWS. The recorded geology on the north of the Wind Farm site shows between 6m to 14.6m of overburden over bedrock;*
- *Available groundwater level data for Dunmore/Glenamaddy PWS spring*[1] *shows the lowest water level (73.4m OD at Gortgarrow spring) is higher than the groundwater levels recorded at the Wind Farm site, therefore there is no potential for groundwater flow towards the PWS from the Wind Farm site;*
- *Surface water drainage in the area of Dunmore/Glenamaddy PWS is to the southeast, in an area that is upstream of the proposed Wind Farm site;*
- *The tracer lines within the SPA to the Dunmore/Glenamaddy PWS all suggest north-westerly flow directions which are remote and upgradient of the Wind Farm site;*
- *The measured groundwater flow direction at the Wind Farm site is south-westerly and away from the location of the Dunmore/Glenamaddy PWS source springs (to the northeast of the Site);*
- *Any drawdown associated with the operation of the Dunmore/Glenamaddy PWS will be localised to each source location and will not extend over the >2km separation distance between the source locations and the proposed Wind Farm infrastructure. In any event, those Wind Farm elements will not cause a drawdown or interruption to groundwater flow due to their shallow extent; and,*
- *Therefore, there are no hydraulic pathways between the Site and PWS source springs along which impacts could occur or be transferred.*

Finally, page 10 and 11 of the Hydro-G submission offers several reasons why the proposed Wind Farm development should be refused permission:

1. *"Owing to the large expanse of super saturated peatlands surrounding and on the site of the proposed Clonberne Wind Farm and the risks presented that have not been correctly concluded in the EIAR presented to the Board".*
2. *Owing to the proximity to the Gortgarrow Spring source of the Dunmore/Glenamaddy PWS and the risks presented that the limited site investigations for the EIA preclude the level of detail required for EIA in this hydrogeological setting;*
3. *Owing to the that the Groundwater Body underlying the construction site proposed is mapped to supply the Mid-Galway PWS source and this source has not been considered in any way by the EIA agents. The proposed development is within the GSI reported groundwater flowpath length for this groundwater body. The mid-Galway PWS source sits between the proposed development and Lough Corrib SAC and SPA;*
4. *Owing to the fact that it is scientifically unjustified to propose excavation of peat and bedrock piling in the mapped Zone of Contribution of the Gurteen/Cloonmore GWS; and,*
5. *Owing to the fact that it is scientifically unjustified to create a borrow pit on the lands mapped as the Zone of Contribution to the Gallagh GWS.*

Point 1 Response:
Firstly, peat is either saturated (i.e. in its intact natural state) or has been drained to some extent by land drainage, peat cutting etc. The term "*super saturated*" does not exist in science and

[1] *Geological Survey of Ireland (2008) Dunmore/Glenamaddy Water Supply Scheme – Gortgarrow Spring – Groundwater Source Protection Zones.*

is essentially hyperbole by Hydro-G. The fact is that all proposed Wind Farm infrastructure is located in cutaway/cutover and drained peat bog.

Also, Hydro-G does not elaborate on the risks posed by peat, but it's assumed to be stability and workability, or water quality. All of which are dealt with in the EIAR.

However, In order to support the claim that "*risks presented that have not been correctly concluded in the EIAR to the Board"* there has been no reference made in the submission to the Geotechnical and Peat Stability Risk Assessment Report and Peat Management Plan (Gavin & Doherty Geosolution, 2024) submitted with the EIAR and planning application (Appendix 8-1 and Appendix 4-2 respectively of the EIAR).

The Peat Stability Risk Assessment (EIAR Appendix 8-1) undertaken showed that all Proposed Project infrastructure elements are located in areas of negligible to low risk. Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the Proposed Project to ensure peat failures do not occur on site.

A Peat Management Plan (EIAR Appendix 4-2) has been prepared for the Proposed Project which details management of peat and spoil during construction works and long-term storage thereafter. The majority of peat and spoil removed during the excavation works will be deposited in proposed on-site spoil and peat repositories which have determined to be suitable by the Geotechnical and Peat Stability Risk Assessment.

Point 2 Response:
The assessment of the potential effects on the Dunmore/Glenamaddy PWS in the EIAR is twofold as it is based on two separate hydrogeological investigations which give consistent findings regarding the location of the Wind Farm development in relation to the Dunmore/Glenamaddy source spring.

Firstly, the proposed Wind Farm site is not located inside the Dunmore/Glenamaddy PWS ZoC which according to one of its authors (Dr Robert Meehan) has "*robust determinations of exact groundwater flow directions, contributing areas to springs, and resultant assertions from same"*.

Secondly, Section 9.3.16 of the EIAR (listed again above) provides several robust reasons why no effects on Dunmore/Glenamaddy PWS are likely based on the investigations carried out for the wind farm EIAR. All of the reasons provided in the EIAR (as listed above) are based on scientific/site investigation data and not assumptions or skewed opinions.

Point 3 Response:
The proposed Wind Farm site is not located in the Mid-Galway PWS mapped ZoC. The ZoC was delineated by a detailed hydrogeological study, similar to the study carried out for the Dunmore/Glenamaddy PWS which included dye tracing and detailed surveys.

Secondly, the mapped boundary of Mid-Galway PWS ZoC is located 8km to the southeast of the Wind Farm site, which is a significant setback distance, even if they are some inaccuracies in the ZoC mapping. The Mid-Galway PWS spring source itself is located 12km from the proposed wind farm site. Based on this information it was considered reasonable to exclude (screen out) the Mid-Galway PWS for assessment in the EIAR.

The proposed Clonberne Wind Farm is located in the Clare-Corrib Groundwater Body as acknowledged in the EIAR. However, not all the Clare-Corrib Groundwater Body supplies groundwater to the Mid-Galway PWS which is a misleading statement in the Hydro-G submission.

Finally, the Clare-Corrib Groundwater Body (GWB) is very large, 1,338km^2 in area, extends into three counties (namely Galway, Roscommon and Mayo) and includes major towns such as Tuam, Claregalway and Ballyhaunis as well as the outskirts of Galway City. According to the

Mid-Galway PWS ZoC mapping, the groundwater contribution zone is 50km^2 and not the entire Clare-Corrib Groundwater Body.

Therefore, the fact that the proposed Wind Farm site is located in the same GWB (i.e. Clare-Corrib Groundwater Body) as the Mid-Galway PWS is irrelevant.

Point 4 Response:
Please refer back to our detailed response on page 10 relating to this topic (Hydro-G submission point (i)).

Nowhere in the GSI or Uisce Éireann submission does it state that the proposed Wind Farm is indefensible or unacceptable. This is Hydro-G's opinion. What is provided by the GSI in particular are clear and rational recommendations on the matter of source protection during the potential construction phase of the Wind Farm.

Point 5 Response:
Similar to the Gurteen/Cloonmore GWS ZoC mapping, the GSI mapping for the Gallagh GWS is a largely a desk study exercise with limited field surveys and no groundwater level monitoring.

Impacts on the Gallagh GWS were screened out in the EIAR based on site-specific hydrogeological data as summarised in Section 9.3.16 of the EIAR.

> *Gallagh GWS is screened out for further assessment for the following reasons:*
>
> - *The proposed Site (i.e. borrow pit location) is located inside the northeastern edge of the mapped SPA. Groundwater level monitoring carried out at the proposed borrow pit location indicates there is an easterly flow gradient towards the Levally Stream and away from the spring source location to the southwest;*
> - *These groundwater levels demonstrate that the proposed borrow pit is not located inside the SPA; and,*
> - *Therefore, there are no hydraulic pathways between the Site and source spring for effects to occur.*

The groundwater level monitoring carried out at the proposed borrow pit location was key in making this determination:

> *"The groundwater levels across the borrow pit location range between approximately 73 and 77m OD (over winter) with the gradient to the east in the direction of the Levally Stream. This is also consistent with the surface water catchment mapping and topography. The groundwater levels in the area of the borrow pit also suggest a relatively localised flow pattern with a steep gradient across the borrow pit footprint also being an indication of this localised flow pattern".*

Hydro-G submission response - key Summary Points:

- There is no evidence to support the dramatic claim that vast quantities of groundwater will be released by earthworks during the wind farm construction;
- The proposed turbine base design is to avoid bedrock drilling or excavation where there is a potential for large flows in the regionally important aquifer, as mapped below the Wind Farm site;
- We provide robust reasoning why using the refined ZoC is scientifically sounder than using the GSI's version which is largely a desk-based assessment, as acknowledged by the GSI themselves;
- The risks posed by the so called '*super saturated*' peat, as it's referred to in the submission, have not been substantiated nor have the findings of the Geotechnical and Peat Stability Assessment been challenged in the Hydro-G submission; and,
- Robust scientific reasoning has been provided in the EIAR to support the lack of potential effects on Dunmore/Glenamaddy PWS, Mid-Galway PWS and Galllagh GWS.

6 DR PAUL JOHNSTON SUBMISSION RESPONSE

A response is provided in this section to several points raised under the heading of 'Hydrology' in the Dr Paul Johnston submission.

The paragraph number of the submission report in which the point is raised is shown which is then followed by the response.

Submission Point 1 (Paragraph 1)

> *"The elongated liner wind farm site, comprising a proposed 11 turbines and ancillary works, is situated on a Regionally Important Aquifer (the Burren pure bedded limestone) which is a recognised karstfied geological formation. Groundwater flow rates of metres per hour have been recorded (Geological Survey of Ireland) which indicates the vulnerability of the aquifer to potential pollution".*

Point 1 Response:
Firstly, the GSI definition of groundwater vulnerability is as follows (https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/groundwater-vulnerability/Pages/default.aspx):

> *"The vulnerability category assigned to a site or an area is thus based on the relative ease with which infiltrating water and potential contaminants may reach groundwater in a vertical or sub-vertical direction. As all groundwater is hydrologically connected to the land surface, it is the effectiveness of this connection that determines the relative vulnerability to contamination. Groundwater that readily and quickly receives water (and contaminants) from the land surface is considered to be more vulnerable than groundwater that receives water (and contaminants) more slowly, and consequently in lower quantities. Also, the slower the movement and the longer the pathway, the greater is the potential for attenuation of many contaminants".*

As described above, the groundwater vulnerability rating is a function of the overburden depth and type/permeability, not the presence of underlying fracture/conduit network.

The GSI subsoil permeability mapping has "low permeability" subsoils mapped across 97% of the Wind Farm site, including the agricultural and forestry areas as well as the bogs.

Based on the depths and subsoil permeability, the vulnerability of the limestone aquifer underlying the Wind Farm site is classified as predominately "Low" by the GSI (www.gsi.ie) and this accounts for 67% of the site area. 30% is mapped ass "Moderate" while "High" to "Extreme" combined account for 3% of the site. All proposed infrastructure is located in areas rated as "Low" to "Moderate", with 10 no. of the 11 no. proposed turbines located in "Low" vulnerability areas.

The findings of the site investigations conducted at the Wind Farm site are relatively consistent with the GSI groundwater vulnerability rating.

Agreeably, the presence of fracture/conduit network would be a potential risk where excavations/dewatering within the bedrock are proposed, but as described above in Section 5 (Hydro-G response), there is no proposal to excavate or drill down into bedrock at the turbine location as precast piling in the overburden is proposed.

Submission Point 2 (Paragraph 2)

> *"The EIAR (Chapter 8) asserts that a variable cover of glacial till or a thin cover of marl under the widespread peat is enough to protect the aquifer. On the other hand, it is also recognised in the EIAR that there is vertical hydraulic continuity between the different layers and that the limestone bedrock is in fact, not confined".*

Point 2 Response:
Nowhere in the EIAR does is state that the glacial deposits or presence of marl are enough to protect the aquifer. This statement is factually incorrect and is a misinterpretation of the data. What the EIAR investigations do confirm is the dominant LOW groundwater vulnerability rating of the wind farm, as mapped by the GSI.

Also, the impact assessment carried out for the proposed Wind Farm does not rely solely on the presence of peat, marl or glacial tills for aquifer protection as there is an array of mitigation proposed for groundwater quality protection, including specific measures for protection of the Gurteen/Cloonmore spring source.

On the matter of hydraulic continuity, it is clearly stated in the EIAR that the groundwater outside of the bog areas is unconfined (i.e. the groundwater table sits unconfined within the glacial till deposits), but that there is strong evidence of confined conditions (based on recorded water levels) in the bog due to low permeability peat and shell marl. It is stated nowhere in the EIAR that the peat or shell marl is impermeable.

This is clearly described Section 9.3.9.3 of the EIAR:

> *"Groundwater level data for the boreholes located in grassland on the north of the Site (i.e. BH4 and BH5) shows groundwater level of between 1.4mbgl (73.151m OD) and 4.4mbgl (70.08m OD) at BH4, while at BH5 groundwater levels were between 0.01mbgl (70.53m OD) and 1.15mbgl (69.38m OD). Groundwater level data for the BH3, the most southerly borehole at the Site, show levels of between 1.6mbgl (72.9m OD) and 2.5mbgl (71.94m OD) over the monitoring period. The groundwater levels outside the bog areas are unconfined.*
>
> *"The monitoring also shows that the deeper groundwater level/pressure rises high enough to occur at an elevation within the upper peat layer. This means that the groundwater in the glacial tills below the bog is confined by the overlying low-permeability shell marl and peat deposits. Notably, there are no recorded artesian groundwater pressures above the level of the ground surface (i.e. there is no potential for groundwater to flow onto the bog surface)".*

Submission Point 3 (Paragraph 2)

> *"Moreover, the reported water quality sampling of the streams which cross and circumference the southern half of the site clearly indicate stream is fed by groundwater although with uncertainly as to the source".*

Point 3 Response:
Indeed, there is a high component of groundwater flow in the watercourses that flow through the Wind Farm site (as indicated by the hydrochemistry) as these streams drain both bog areas and the lands that adjoin the bog (i.e. grasslands and forestry). Within the Site, the streams are in hydraulic continuity with the glacial tills as stated above. More importantly, these streams also rise much further up the catchment and upstream of the Wind Farm site where the dominant subsoils are glacial tills and sometimes shallow bedrock. Nowhere in the EIAR does it state that the streams at the Wind Farm site are fed solely by rainwater. Again, this a is a misinterpretation of the data.

The point being made in Section 9.3.4.1 EIAR is that due to the presence of thick low permeability glacial tills and shell marl (in bog areas) underlying streams there is not likely to be any losing reaches of watercourses (i.e. 'losing streams' – point source of direct recharge) within the Wind Farm site. Nowhere does it state in the EIAR that the bed of the streams is not in hydraulic continuity with groundwater, however where marl is present above the mineral subsoils there is likely to be limited connectivity.

The absence of losing streams within the Wind Farm site was confirmed by the surface water flowing monitoring as described in Section 9.3.4.2 of the EIAR:

> *As discussed in Section 9.3.4, the main streams that flow through the Site do not have losing reaches within the Site as demonstrated by surface water flow monitoring. In addition, the sections of streams close to the bogs within the Site are also underlined by low permeability shell marl and deep glacial deposits which would prevent surface water losses to the underlying bedrock groundwater system.*

Submission Point 4 (Paragraph 2)

> *"Only 5 boreholes were drilled on the site (which anyway is inadequate to characterise the hydrogeology) but only two even penetrated the bedrock and then by less than 3m".*

Point 4 Response:
Firstly, all 5 no. boreholes were terminated at significant depths into bedrock and the comment by Dr Paul Johnston is a misinterpretation of the drilling logs provided in the EIAR. The logs are attached as Appendix 8-2 of the EIAR.

A summary of borehole total depth and depth to bedrock is as follows:

- BH1 – bedrock met at 13.2m ((total hole depth 24m)
- BH2 – bedrock met at 15.3m (total hole depth 24.5m)
- BH3 – bedrock met at 16.5m (total hole depth 25m)
- BH4 - bedrock met at 14.6m (total hole depth 15.7m)
- BH5 - bedrock met at 6m (total hole depth 11m)

The submission is critical of the number of boreholes drilled (5 no.) but does not offer any guidance on how many boreholes would be appropriate for this site. The purpose of the EIAR site investigation was characterise the geology and hydrogeology of the site and develop a robust hydrogeological conceptual model for which the Wind Farm development could be assessed and design of mitigation measure incorporated as required. This was achieved.

The GSI mapped geology in the area of the Wind Farm site is largely either limestone tills over limestone bedrock or peat and limestone tills over limestone bedrock. These were the general geological conditions encountered in all 5 no. boreholes with no notable significant variations.

Drilling of additional boreholes would not have likely have a different outcome with regard the hydrogeological conceptual model or to the proposed design mitigation measures.

What the submission fails to acknowledge is that in addition to the 5 no. boreholes, groundwater level monitoring was also carried out at 3 no. private wells/boreholes, the Gurteen/Cloonmore spring itself and at an off-site turlough located to the northwest at Gortagarraun/Kilmurray.

This is 10 no. groundwater level monitoring locations all within a 2km distal radius of the Gurteen/Cloonmore spring, which was the primary focus of the investigation. The groundwater level monitoring at these 10 no. locations was carried out for almost 1.5 years and shows consistent groundwater gradients and flow patterns (i.e. groundwater contours) over that period.

The submission also makes no acknowledgement of the 15 no. trial pits; 197 peat probe depths and 5 no. surface water flow monitoring locations carried out at the site which also informed the hydrogeological conceptual model and impact assessment.

Please also refer back to the response to the Dr Robert Meehan submission (Section 4 above) where we provide a summary of the investigations and monitoring that were carried out for the nearby Dunmore-Glenamaddy PWS ZoC and then make a comparison with the investigations carried out in the EIAR regarding the refining the ZoC for assessing potential impacts on the Gurteen/Cloonmore GWS.

The comparison of investigations on a study area basis clearly shows that the EIAR investigations/assessments carried out regarding the Gurteen/Cloonmore GWS are extensive and on par with the investigations carried out for the Dunmore-Glenamaddy GWS on a study area basis.

Submission Point 5 (Paragraph 2)

> *"While the overburden above the bedrock was underlain by variable thickness of glacial limestone tills, its constitution was highly variable with different proportions of silt, clay and gravel indicating equally variable permeability (which was not assessed)."*

Point 5 Response:
As stated above, The GSI subsoil permeability mapping has "low permeability" subsoils mapped across 97% of the Wind Farm site, including the agricultural and forestry areas as well as the bogs. The findings EIAR investigations and surveys are consistent with the GSI mapping.

The presence of low permeability subsoils is also consistent the high stream density, man-made drainage density and coverage of poorly draining topsoil at the site. The presence of these drainage features implies there is a need to drain surface water, as it cannot recharge/percolate readily through the overburden deposits due to low permeability.

There might be localised variations in the glacial till composition (as would be expected in glacial deposits) but there is enough evidence to indicate the overall bulk permeability is low as mapped by the GSI.

Most importantly, there are no licensed discharges to groundwater at the Wind Farm (i.e. wastewater). Subsoil permeability is important when assessing the suitability of activities such as wastewater discharge from treatment systems, not wind farm developments.

The proposed Wind Farm does not rely on a specific subsoil permeability to achieve appropriate treatment/compliance. All surface runoff from the Wind Farm footprint will be rainfall generated and apart from some entrained sediments, will be clean water.

Spills or leaks of oils/fuels are a risk on all construction site and indeed farms (which they are several within the EIAR site boundary) but can easily be managed with standard control and management measures.

Submission Point 6 (Paragraph 3)

> *"Although the vulnerability of the aquifer as been mapped as Low to Moderate vulnerability, much of the low permeability peat at the surface has been cutaway leaving the permeability of the till cover uncertain".*

Point 6 Response:
Albeit peat depths are reduced in some areas due to cutting, underneath the peat there is still a very low permeability marl layer present and up to 15m of low permeability CLAY dominated glacial till deposited present below the peat.

The permeability of till deposits below the peat is indeed low, otherwise the bog would have not formed there in the first place. Raised bogs typically form on low permeability glacial deposits or lacustrine deposits. In addition, the year-round groundwater saturated state of the till deposits below the peat confirms this.

Submission Point 7 (Paragraph 3)

> *"While the overall water balance was presented in the EIAR, it was based on a desk study with no on-site evaluation. Hence the true impact of the of the proposed development on the underlying water resources has not been established. In, particular, the excavation for the wind farm turbines (at least 4m depth for gravity foundations and down to bedrock for piled foundations) almost certainly will increase the potential for greater recharge to groundwater and thus the overall risk of pollution".*

Point 7 Response:
The assessment of potential water balance effects on the spring source was not based solely on a desk study, but based on actual detailed site observations, hydrological mapping, intrusive site investigations, surface water flow monitoring and long-term groundwater level monitoring (~1.5 years' worth).

The lack of potential groundwater recharge at the wind farm is supported by the site investigations and hydrological monitoring as stated in Section 9.5.2.1 of the EIAR.

> *"The groundwater level monitoring data indicates that the majority of the recharge water in the glacial tills actually discharges to local streams that flow through the site. Therefore, only a very small portion of the recharge water in the glacial tills actually passes down to recharge the bedrock aquifer. Therefore, the total volume of recharge occurring within the Wind Farm site itself that contributes flow to the overall spring discharge is negligible. Therefore, the potential diffuse recharge pathways between the proposed construction works areas and the spring are extremely limited".*

> *"The volume of diffuse recharge occurring within the Wind farm Site itself that contributes flow to the overall spring discharge is negligible. This is again due to the peat coverage and significant depth of glacial tills at the Wind Farm site. The glacial till deposits do not directly supply groundwater to the spring (i.e. there are no groundwater flowpaths in the glacial till deposits that transmit flows directly to the spring)".*

To prevent groundwater quality impacts during the construction phase, including turbine foundation works, the following mitigation is proposed in Section 9.5.2.1 of the EIAR.

- *No storage of fuels, oils, cements, or chemicals will be permitted within the refined ZoC;*
- *Refuelling of mobile plant (i.e. diggers, dumpers etc) will only be permitted outside the refined ZoC;*
- *Refuelling of large immobile plant (i.e. cranes) will only be carried out with a double skinned fuel bowser that will be removed from ZoC immediately after use;*
- *Spill kit stations will be present at each turbine location (T1, T2, T3 and T4);*
- *There will be no long term storage of peat/spoil inside the ZoC;*
- *A geotextile liner will be placed below the founding layer (lean mix concrete) where concrete is to be poured. These both prevent vertical loss of wet concrete at turbine bases;*
- *Use of perimeter shuttering at turbine basis to prevent lateral loss of wet concrete;*
- *All cement washout lagoons will be located outside the ZoC;*

- *A protective layer of in-situ overburden (2 -3m) will remain above the top of bedrock where gravity foundation excavations are required for groundwater quality protection; and,*
- *There will be clear signage in place inside the refined ZoC to remind construction workers that the area is inside a drinking water protection area.*

It also needs to be pointed out that open excavations will only be temporarily present during the construction phase. Once the turbine foundations are in place, excavations will be backfilled with the original material, landscaped and ground levels restored, as close as possible to original ground levels.

Reinstated excavations at the site will not increase the potential for greater recharge to groundwater in the long term, nor will they increase the overall risk off pollution.

Submission Point 8 (Paragraph 4)

> *"Of equal concern is the excavation and removal of over 100,000 cublic metres of peat during the construction and its subsequent re-deposition. Runoff through and over this peat will certainly increase the Dissolved Organic Carbon (DOC) in the water. The runoff of such dissolved matter will not be prevented by the proposed drainage works (eg check dams and settlement ponds). Were it to percolate to groundwater, it is likely to reach the abstraction points (Group Water Scheme which intercept the site) with the risk of causing THM (trihalomethane) problems in the water treatment and supply".*

Firstly, the proposed peat and spoil storage areas are located outside the refined ZoC of the Gurteen/Cloonmore spring and therefore there cannot impact on the GWS. This was one of the key mitigation by design measures with regard the Gurteen/Cloonmore source.

Secondly, the proposed peat and spoil storage areas are located on existing cutaway bog areas and therefore the surface area of cutaway/exposed bog will not increase as a result of the long-term peat/spoil storage.

Also, mitigation is proposed in the EIAR (Section 9.5.2.3) to seal and vegetate the peat and spoil storage areas to ensure they are stabilised and protected from rainfall and erosion:

> *"Where applicable, the vegetative top-soil layer of the peat and spoil management areas will be rolled back to facilitate placement of excavated spoil, following which the vegetative-top soils layer will be reinstated. Where reinstatement is not possible, spoil and peat management areas will be sealed with a digger bucket and seeded as soon possible to reduce sediment entrainment in runoff"*
>
> *Peat/subsoil reinstatement areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil reinstatement areas will no longer be a potential source of silt laden runoff".*

Submission Point 9 (Paragraph 5)

> *"The evidence for the groundwater vulnerability is also demonstrated in the maps of the water table shown in the EIAR chapter 9. Albeit based on sparse data, the contours of the groundwater levels gleaned from a few boreholes show groundwater flowing on opposing directions (NE-SW) which suggests there may be a higher permeability conduit (?) controlling the flow, again emphasizing vulnerability".*

Point 9 Response:
As described above, the groundwater levels were measured from 5 no. boreholes, 3 no. private wells/boreholes, the Gurteen/Cloonmore spring itself and at an off-site turlough.

This is 10 no. groundwater level monitoring locations all within a 2km distal radius of the Gurteen/Cloonmore spring, which was the focus of the investigation.

Drilling of additional boreholes would not have likely have a different outcome with regard the mapped groundwater level contours as shown on Figure 9-10 and Figure 9-11 of the EIAR.

The opposing (NE-SW) groundwater flow direction was discussed in the Section 9.3.9.3 of the EIAR:

> *"The groundwater level contours show an overall southerly/south-westerly flow direction at the northern and central portions of the Wind Farm site. Groundwater flows appear to be towards the Levally Stream, which flows to the west and south of the Wind Farm site. The groundwater contours also appear to strongly mimic the local topographic of the northern portion of the Wind Farm site. This would be expected given the very low groundwater recharge characteristics of the Site which maintains a relatively high groundwater level (i.e. similar in a Locally Important or Poor bedrock aquifer setting).*
>
> *Groundwater levels at the far west of the Site (proposed borrow pit location) show an opposing groundwater flow pattern compared to the main Site, and this is easterly towards the Levally Stream.*
>
> *The opposing easterly/westerly groundwater flow patterns also suggest that the Levally Stream is a discharge zone for the underlying limestone aquifer in this area".*

The groundwater level gradient of the opposing NE-SW contours is towards the Levally Stream and hence its likely this surface water feature rather than a conduit controlling flow.

Nonetheless, there are no proposed direct surface water discharge to the Levally Stream (or tributaries) from within the wind farm site. All water will be treated to a high quality and slowed down prior to release. The treated water will be released in a diffuse and controlled manner through the use of level spreaders and vegetation filters and will not be directly discharged into any watercourse.

Drainage mitigation measures for surface water quality protection during the construction phase are summarised again below: (Please refer to Sections 9.5.2.2, 9.5.2.3 & 9.5.2.5 of the EIAR for the full description of these measures and how they will be applied).

- *The proposed mitigation measures which will include 50m buffer zones for avoidance of sensitive hydrological features (streams and rivers);*
- *Pre-construction drainage control measures;*
- *Robust drainage control measures (i.e. interceptor drains, swales, settlement ponds and treatment trains such as Siltbuster) will ensure that the quality of runoff from Proposed Project areas will be very high; and,*
- *Best practice measures with regard use of oils, fuels (Section 9.5.2.6) and cement based compounds (Section 9.5.2.8).*

Tried and tested, best-practice mitigation measures (as detailed in the EIAR and clarified further in this appeal response) for the protection of surface and groundwater water quality will be implemented during the construction phase of the proposed project to ensure that there is no deterioration in local or downstream water quality.

Submission Point 10 (Paragraph 6)

> *"Since much of the Zone of Contribution (ZOC) to one of neighbouring Group Water Schemes – the Gurteen-Cloonmore Spring – intersects the windfarm site, the vulnerability of the groundwater is fundamental to determining the impact of the proposed development. While the originally determined ZOC included 8 of the 11 turbine locations, even the revised ZOC determined in the EIAR included 6. On the basis of the evidence presented, there is little doubt that the proposed development poses a risk to the quality of this water supply but unfortunately, such impact has not been assessed adequately.*

Point 10 Response:
Firstly, Dr Johnston is incorrect with regard his statement relating to the number of turbines within the GSI mapped ZOC and the refined ZOC. The number of turbines within the GSI mapped ZOC and the refined ZOC is clearly stated in Section 9.3.15.1 of the EIAR and also shown on Figure 9-7 Figure 9-13 of the EIAR.

> *"The area of the Site inside the GSI mapped SPA includes 7 no. of the proposed 11 no. turbine locations. The proposed turbine locations mapped within the SPA include: T1, T2, T3, T4, T5, T6 & T11".*

> *"The refined (worst-case scenario as explained below) ZoC mapping shows that 4 no. proposed turbine locations are potentially (as a worst-case scenario) located within the refined SPA. Turbines potentially located inside the refined ZoC include T1, T2, T3 & T4".*

Secondly, the topic of groundwater vulnerability has been thoroughly assessed in the EIAR and is discussed above on several occasions in this submission response.

Also, specific mitigation measures for proposed works inside the refined ZoC are proposed in Section 9.5.2.1 of the EIAR to prevent both quantitative effects (groundwater level/flows) and qualitative effects on the Gurteen/Cloonmore Spring.

Dr Paul Johnston submission response - key Summary Points:

- The submission criticises the adequacy of the investigations carried out for the EIAR but provides no insight into what an adequate investigation would be for this Proposed Project;
- It is clearly demonstrated above (including in the Dr Meehan and Hydro-G submission) that the investigations concerning the Gurteen/Cloonmore GWS spring/Wind Farm EIAR were indeed thorough and adequate for the intended purpose;
- Points raised regarding groundwater vulnerability, subsoil permeability and groundwater protection are all addressed and it is shown how all these factors have all been thoroughly examined in the EIAR with regard potential effects of the proposed Wind Farm; and,
- There are several misinterpretations made in the submission that needed clarification (Points 2, 3, 4, 8 and 10) as these inaccurate statements are misleading in terms of understanding actual potential effects of the Proposed Project.

7 NORTH-EAST GALWAY ENVIRONMENTAL PROTECTION CLG

This part of the submission response addresses points raised under the headings of Flooding (Section 3.1), Hydrology (Section 3.3), Drainage (Section 3.4), Peat and Spoil Repository areas (Section 3.6), Impacts on Turloughs and Wetlands (Section 3.8), Lough Corrib SAC (Section 3.9) and Borrow Pit (Section 3.10). The section number relates to the heading number in the submission document.

The points raised in the submission are directly referenced in italics and then a response is provided underneath.

Flooding (Section 3.1)

Point 1

> *"Based on the OPW's National Indicative Fluvial Mapping, it is clear to see that a large portion of the existing site, on which the development is proposed, is identified as a flood plain. The floodplain is in very close proximity to several proposed 180m-high wind turbines, access roads, battery storage facility, 220kV substation, peat repositories and other related infrastructure. We have not found convincing proof that this vast industrial development will not pollute surface water or groundwater, proof that excludes the ineffective silt fencing that is often proposed as a mitigation among other often ineffective mitigations. It is our belief that this development will also lead to excessing flooding in the area".*

Point 2

> *"Much infrastructure, including numerous new river crossings and associated culverts are proposed in this area that is prone to flooding".*

Point 3

> *"Remember this is a very wet area of Ireland with above average levels of rainfall. Rainfall levels are increasing considerably each year".*

Point 4

> *"Unknown to both HES and MKO, this wind farm site is also hydrologically connected to a nearby turlough that had a recorded past flood event".*

Response (Points 1, 2, 3 & 4 collectively):

Point 1 of submission states that a '*large portion*' of the proposed Wind Farm site has mapped floodplains (flood zones) as sourced from the National Indicative Fluvial Mapping (NIFM). This is not an accurate observation as it can clearly be seen from the NIFM mapping (refer to Figure 9-6 of the EIAR) that the 100-year and 1000-year flood zones are generally localised to a tributary of the Levally Stream (Stream A) which flows through the lowest lying areas of the site. The area of the Wind Farm site mapped as fluvial flood zone by the NIFM is only ~10%.

The majority of the Wind Farm site, including all 11 no. turbines, battery storage facility, 220kV substation and peat/spoil repositories, are at an elevation above the 1000-year flood level (i.e. are in Flood Zone C) where there is a low risk of fluvial flooding.

As stated in Section 9.3.6 of the EIAR, a site-specific Flood Risk Assessment (Appendix 9-1 of the EIAR) was carried out at the early design stage of the project in order to ensure that as much of the proposed infrastructure as possible was placed outside of the NIFM mapped flood zones.

This was largely achieved with the exception of 1 no. existing watercourse crossing and 3 no. proposed crossings where very short sections (<100m) of associated access encroach the mapped flood zone at each location. These watercourse crossings are unavoidable. The area of the Proposed Project infrastructure inside a NIFM mapped flood zones is ~0.5ha which accounts for only 2% of the overall Proposed Project footprint.

Therefore, the next statement in the submission (Point 2 above) claiming that '*Much infrastructure*' is located inside mapped flood zones is clearly exaggerated.

There are also measures outlined in the FRA (Section 4.3.11) to mitigate these very minor encroachments of the NIFM flood zones:

> *"The FRA shows that only short sections of proposed access road and watercourse crossing locations will potentially be affect by fluvial flooding.*
>
> *For these new crossing works a Section 50 consent will be sought under Section 50 of the Arterial Drainage Act, 1945 to install a new culvert/bridge with the hydraulic capacity to accommodate a 100-year flood flows while maintaining at least a 300mm freeboard above the flood level.*
>
> *The proposed access road surface level will be close or at the existing ground level to prevent obstruction of surface water flow paths. There will be negligible loss of floodplain storage".*

The statement around flooding also mentions the use silt fencing (Point 1 above) which is not used in any way to defend against flooding. Silt fencing is just one single element in an array of proposed surface water control measures for the protection of surface water quality from potential suspended sediments (see response in the Hydrology Section below which deals with drainage control).

Firstly, with regard Point 3, numerous wind farm developments have been successfully constructed in the west of Ireland at upland elevations much higher (and with higher rainfall depths) than the proposed Clonberne Wind Farm site.

Secondly, the NIFM flood zones have been modelled for 2 no. potential future climate change scenarios, with the Mid-Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively (refer to Section 4.3.9 of the FRA).

These worst-case modelled flood extents show similar flood zone extents along the Levally Stream tributaries to the Present Day Scenario as shown on Figure 9-6 of the EIAR.

Lastly, the 'unknown' turlough that Point 4 refers to is Gortagarraun/Kilmurray Turlough which is discussed in the FRA and Sections 9.3.4 and 9.3.6 of the EIAR:

> *"The third stream, Stream C emerges at the location of Gortagarraun Turlough, which is situated 1.5km to the northwest and upstream of the Wind Farm site. Stream C flows in a south-easterly direction prior to merging with the Levally Stream immediately downstream of the Stream A/Stream B confluence on the west of the Wind Farm site. Gortagarraun Turlough is only typically present over the winter period when groundwater levels are highest".*
>
> *"One of the closest mapped recurring flood events is at the location of Gortagarraun Turlough, 1.5km to the northwest of the Wind Farm site where "low lying land floods after heavy rain every year". The flooding is caused by rising groundwater levels over the winter period".*
>
> *"There are no mapped recurring fluvial flood events downstream of the Proposed Project along the Levally Stream or the tributary of the Sinking River within 10km of the Site".*

Gortagarraun/Kilmurray Turlough is located to the northwest of the proposed Wind Farm site which is also an up-gradient location with regard to surface water and groundwater flow.

Therefore, there is no groundwater or surface water drainage from the Wind Farm site to the turlough, hence the Proposed Wind Farm cannot affect flooding in Gortagarraun Turlough.

Hydrology (Section 3.3)

Point 1:

> *"Construction of the drainage will lead to overflow into the streams and danger to the many healthy salmon spawning beds and healthy white-clayed Crayfish, also downstream".*

Response (Point 1):

The mitigation measures detailed in Chapter 9 of the submitted EIAR are tried and tested, best-practice mitigation measures for the protection of the hydrological (surface water) and hydrogeological (groundwater) environment. These mitigation measures are used at construction sites across the country and have been used in the construction of the countless existing wind farm developments. Note that similar mitigation measures for the protection of the receiving water environment were proposed in the EIARs for the recently permitted Glenard Wind Farm (ABP Case No: 312659) and the permitted Seven Hills Wind Farm (ABP Case No. 313750).

In recent years many wind farms have been constructed using similar mitigation measures (as proposed for the Clonberne WF development) with respect to suspended solids, hydrocarbons, cement-based products, and wastewater during their construction and operational phases. These mitigation measures, the same of those detailed in the submitted EIAR for the Proposed Project, have proven to be successful in the protection of the hydrological and hydrogeological environment, and are summarised below:

- The key surface water control is that there will be no direct discharge of any wind farm runoff into any local watercourses or into the existing drainage network at the Proposed Wind Farm site;
- This will be achieved through avoidance (i.e. self-imposed buffer zones were used during the design of the Proposed Project to avoid sensitive hydrological features) and the proposed surface water drainage measures;
- Two distinct methods will be employed to manage drainage water within the Proposed Project:
    - Firstly, clean water will be kept clean by avoiding disturbance to existing drainage features, minimising any works in or around existing drainage features and by diverting clean water around the proposed works areas; and,
    - Secondly, all drainage waters from the proposed works areas that may carry silt or sediment, will be routed towards silt traps (for details on the Terra Stop Premium silt fences to be used please see https://ssienvironmental.ie/silt-fence-terra-stop-premium/) and settlement ponds prior to controlled diffuse release via buffered outfalls.
- The Proposed Project drainage system comprises of source controls (interceptor drains, small working areas etc.), in-line controls (such as check dams, sand bads, silt fences etc) and treatment systems (settlement ponds and sediment traps):
    - Each individual element of the water treatment train is not intended to be a standalone or a single treatment but rather forms part of a treatment train of water quality improvements/control systems;
    - The drainage measures will be installed prior to the onset of construction works;
    - Source controls are designed to reduce the volume of water requiring treatment and include the use of interceptor drains, small working areas, covering stockpiles and the cessation of works during periods of heavy rainfall;

  - Runoff from the works areas will be collected in collector drains and treated and attenuated via in-line controls and treatment systems such as check dams, silt traps, silt fences and settlement ponds;
  - All water will be treated to a high quality and slowed down prior to release; and,
  - The treated water will be released in a diffuse and controlled manner through the use of level spreaders and vegetation filters and will not be directly discharged into any watercourse.
- Furthermore, all works will be completed cognisant of weather forecasts and no works will be completed during or within 24 hours of heavy rainfall events. This will minimise the risk of the entrainment of suspended solids in runoff;
- Best-practice mitigation measures will also be employed in relation to the protection of surface water quality during felling works including the application of buffer zones, the use of brash mats, suitable machine combinations and the installation of silt traps in advance of all felling works;
- Additional mitigation measures will be implemented where works are proposed within the hydrological buffer zones including the use of double or triple silt fences and the completion of works during dry weather conditions;
- An inspection and maintenance plan for the onsite construction drainage system will be prepared in advance of construction activities and will include regular inspections of the drainage systems and the removal of any excess build-up of silt which may decrease the effectiveness of the drainage system;
- The proposed drainage system has also been designed to account for climate change effects on rainfall with the settlement ponds designed for the 1 in 10-year flows plus a 20% allowance; and,
- Preventative measures relating to fuels and concrete management are also proposed in Chapter 9 of the EIAR.

Prescribed mitigation measures with respect to suspended solids, hydrocarbons, cement-based products and wastewater are best in-class and will ensure that there is no potential for significant effects on the receiving water environment including protection of Crayfish.

Point 2:

> *"The following is extracted from Section 9.3.4.1: Aside from the main streams draining the Wind Farm site as described above, there is also a high density of man-made drains located within the cutover bog, grassland and forestry areas. We reference the figure below* [Figure 23 of submission], *we argue that those are not manmade drains, but are indeed, a result and indication of the amount of that flows from this wetland area".*

HES Response (Point 2):
Aside from the main streams, all other drainage features within the cutover bog, grassland and forestry areas are indeed artificial and manmade. The forestry drainage is systematic and typical of such plantations. The agricultural drains typically follow field boundaries and roadsides

The cutover bogs have systematic, parallel running drains on the high bog which drain into larger lower-level larger drains located along the cutaway bank face. These drains are manmade and were installed to facilitate peat cutting.

The statement in the submission claiming these features are not manmade is incorrect. Figure 23 of submission, which is an aerial photograph of an area of bog at turbine location T7, shows the high-level drains and the larger drains along the peat bank face draining towards local watercourses. The flow in the bog drain is mostly rainfall runoff.

Point 3:

> *"We challenge the statement made on the shell marl on the river beds where it would prevent any surface water leakage into the underlying aquifer. While shell marl can exhibit permeability, it is inaccurate to state categorically that shell marl on riverbed has low permeability and that it would prevent surface water leakage. Therefore, a wider and more thorough site-specific analysis is necessary to accurately assess the shell marl permeability in any given context. This has to be an important consideration when the aquifer in question is a regionally important aquifer".*

Response (Point 3):
The key point being made in Section 9.3.4.1 of the EIAR with regard marl was in relation to the potential for losing streams (i.e. point source of rapid groundwater recharge to the bedrock aquifer) at the Wind Farm site and not an assessment of marl permeability itself.

Typically, shell marl indeed has low permeability material (not impermeable) and would undoubtedly significantly reduce the loss of water from streams into the underlying subsoils/aquifer where the watercourse is underlined by such deposits of marl. It is not stated anywhere in the EIAR that marl creates an impermeable layer. It is fact though, that it is due to the low permeability nature of the shell marl that peat forms on top of this material in the first place, as it impedes vertical drainage into the underlying glacial tills.

It also needs to be noted that the shell marl below the bog is underlain by several metres of CLAY/SILT dominated glacial as demonstrated by the investigation drilling (refer to Table 8-5 of the EIAR for summary subsoil depths) which would also significantly reduce recharge into the underlying bedrock aquifer. The Proposed Project does not rely on the presence of marl for the protection of groundwater, but it does significantly reduce the overall groundwater vulnerability.

Lastly, the surface water flow measurements taken in the watercourses all showed increasing flow with downstream distance which would strongly suggest there are no losing reaches within the Wind Farm site (refer to Section 9.3.4 of the EIAR for details on the flow measurements).

There is a GSI mapped swallow hole present along the Levally Stream upstream of the Wind Farm site and the flow measurements were undertaken to rule out such karst features being present within the Wind Farm site, which was confirmed.

Point 4:

> *"In the Gurteen/Cloonmore GWS final report of 2015 the area around T7 and T6 is included in the ZOC of the GWS but in the HES report the ZOC contribution this (sic) has been revised. We do not believe this is accurate. From local knowledge and based on the experience of local people who are connected to the GWS, when the spring was dredged in the 1980's the source is much lower than described and we believe there is every chance these excluded turbine locations will have an impact on the aquifer of the GWS"*

Response (Point 4):
Firstly, the area of proposed turbine T7 is not located inside the GSI mapped ZoC for the Gurteen/Cloonmore source (refer to Figure 9-7 of the EIAR).

Secondly, it was the measured water level surface (groundwater pressure head) at the spring sump that was used to determine the groundwater level, not the existing ground level or the base of the spring sump.

The measured groundwater level at proposed turbine T7 (BH1) to the south is approximately 1.2m lower than the groundwater level at the spring, which shows a definite downward gradient flow to the south of the spring (both turbines T6 and T7 are located to the south of the spring). Refer to the groundwater level contour mapping on EIAR Figure 9-10 and Figure 9-11.

Also, topographically, both turbines T6 (66.3m OD) and T7 (66.5m OD) are also downslope of the spring where the local ground level is approximately 67m OD.

In addition, what also must be considered is the surface water drainage flow direction (i.e. Levally Stream and tributaries) in this area which is strongly to the south (i.e. away from the spring location) which is consistent with the groundwater level contours in this area (refer to Figure 9-10 and Figure 9-11 of the EIAR).

The discharge watercourse from the spring itself (Stream B) flows southerly and away from the spring location as shown on Figure 9-3 of the EIAR.

All the hydrological and hydrogeological data suggest groundwater flow is southerly to the south of the spring location.

Point 5:

> *"These statements made in Section* 9.3.9.2 [of the EIAR] *are very important to note: The bedrock at the borehole carried out in the bog areas (BH1, BH2 and BH3) was notably more weathered and karstified than the boreholes carried out in the grassland areas (i.e. BH4 and BH5). Large water strikes were also encountered in the bedrock below the bog, while in BH4 no groundwater strikes were recorded, and in BH5 water strikes were very minor as the bedrock was noted to be very competent.*
>
> *We are challenging the above statement also from section 9.3.9.2. The borehole logs do state that fractures were found at BH5 which is in the northern portion of the site and challenge the fact that there were no boreholes drilled anywhere in the in the northern portion at all as BH5 was the most northerly drilling location".*

Response (Point 5)
The point being made in Section 9.3.9.2 of the EIAR was that no well-developed karst system or conduit network was encountered on the north of the site (i.e. at BH4 & BH5). From the BH5 drilling log (Appendix 8-2 of the EIAR) it can be seen that there was only 1 no. water strike in bedrock and the groundwater inflow was logged as 'slow'. No water strikes were recorded in BH4.

BH4 and BH5 were drilled to assess the ground conditions in the area of proposed turbine locations T1 to T4. There are no proposed turbines on the far north of the Wind Farm site and hence no investigation drilling was carried out on that part of the site.

Point 6:

> *"Glacial till is a mixture of clay, silt sand, gravel and boulders. Till with a higher proportion of course material (sand and gravel) tend to be more permeable because the larger particles create more pore space for the water to move through. HES cannot claim that the glacial till can have low permeability characteristics. Glacial till can have various permeability characteristics. According to the U.S. Geological Survey, the permeability of glacial till can range from very low to moderate, depending on the specific composition and structure of the till deposit. Some till act as aquifers, allowing significant water movement, while others act as confining layers".*

HES Response (Point 6):
The GSI subsoil permeability mapping has "low permeability" subsoils mapped across 97% of the wind farm site, including the agricultural and forestry areas as well as the bogs. The subsoil permeability mapping was prepared by the GSI and not HES.

However, the observed ground condition, the site drainage regime and site investigations all support the presence of a glacial till with low bulk permeability characteristics.

The presence of low permeability subsoils is consistent with the high stream density, man-made drainage density and coverage of poorly draining topsoil at the site. The presence of these manmade implies there is a need to drain surface water (i.e. rainfall), as it cannot recharge/drain readily through the overburden deposits due to low permeability.

Also, the saturated state of the glacial tills all year round, even on the sloping higher ground on the north of the Wind Farm site (as shown by >1.5 years of monitoring data) strongly implies that the bulk permeability of the glacial tills is low. There might be localised variations in the glacial tills due to sand and gravel layers but overall, the bulk permeability is low as mapped by the GSI and supported by site data.

Point 7:

> *Please take this statement extracted from Section 9.3.9.3 into consideration:*
>
> *"Groundwater level monitoring shows that the glacial till deposits below the bog/peatland areas are saturated (i.e. contain groundwater) all year round which would be typical for a low-lying basin peat setting".*
>
> *This indicates that the glacial till portion also acts an aquifer, yet earlier they state that it has low permeability characteristics. How can this area get so saturated with water if all the water entering it is confined by the overlying low permeability shell marl and peat deposits. All this indicates that the construction phase of this project will have detrimental effects on the groundwater when it is stated that in all the boreholes sites the groundwater is not far from the surface".*

HES Response (Point 7):
The GSI do not classify glacial till deposits as aquifers. Only bedrock and large extents sand/gravel deposits are classified as aquifers. The GSI only map a bedrock aquifer at the Wind Farm site and correctly so. The bedrock aquifer below the proposed wind farm site is covered by several metres of low permeability glacial tills. The glacial tills below the bog are not an aquitard/impermeable, have some permeability and hence will contain some groundwater.

Raised bogs, such as the bogs at Clonberne, typically developed over shallow basins formed by glacial/lacustrine deposits during the last Ice Age. After the ice retreated, the landscape was littered with many depressions underlain by low permeability glacial till. These glacial basins therefore retained water, became saturated and which then resulted in the formation of peat and fen environments.

Therefore, the statement '*the construction phase of this project will have detrimental effects on the groundwater*' is ill-informed with regard the nature of the glacial till deposits.

Point 8:

> *"The groundwater level in the Gurteen/Cloonmore GWS spring sump ranged between 65.811m and 66.371m OD over the monitoring period. Given the groundwater flow direction in the area of the spring is from the northeast, the northern portion of the Site is potentially up-gradient of the spring, while all the Site area to the south of the spring is down-gradient of the spring".*
>
> *The GWS spring rises lower than this. Members of the CLG were present when the well was dredged in the 1980s. We have anecdotal evidence of this and our knowledge is key to understanding this site and its receiving environment.*

HES Response (Point 8):
A response on the matter of spring dredging is provided in Point 4 above.

Point 9:

> *"An extract from Section 9.3.10 states: A very localised area of 'Extreme' groundwater vulnerability is mapped to the south of proposed turbine T3 but there is no proposed development in this area. The investigation drilling indicates the 'Extreme' groundwater vulnerability mapping is not correct.*
>
> *We want to see the results of this investigation drill. The developer did not include this result in the EIAR".*

HES Response (Point 9):
Firstly, the subsoil type to the south of proposed turbine T3 where the groundwater vulnerability rating is 'Extreme' is mapped as 'Gravels' by the GSI and not 'Karstified bedrock outcrop or subcrop'. This is consistent with site investigations and walkover surveys conducted in this area.

BH4 is located ~200m to the northwest and upslope (higher) of this area mapped as 'Extreme' vulnerability. BH4 shows 14.6m of overburden in this area. The deposits encountered at BH4 comprised mainly of sandy, gravelly SILT (refer to Appendix 8-2 of the EIAR for logs).

In addition, exposures of poorly sorted glacial till (mixture of clay, cobbles and boulders) can be observed within the 'Extreme' groundwater vulnerability mapped area and reveal it is a ridge of glacial deposits/boulder clay that slope steadily to the south. This is consistent with the GSI subsoil mapping.

The low-lying ground to the south, at the base of the glacial deposits, which was found to be very wet and boggy and is drained by several land drains that pass through the forestry further to the south. The boggy, poorly draining ground at the base of the deposit would suggest that there is little if any recharge occurring in this area and is similar in character to the rest of the Wind Farm site.

<u>**Drainage (Section 3.4)**</u>

Point 1:

> *"We don't agree that the following drainage method proposed by the developer should be used on this site; 'The second method involves collecting any drainage waters from the works areas within the Site that might carry silt or sediment, and nutrients, to route them towards still ponds prior to controlled diffuse release over vegetated surfaces".*
>
> *"Look at one example of the sub-surface in the proximity to T3, T4 and very much in the centre of the site. That number of rocks just below the surface indicates to us that there is a greater recharge in the area of the than described in the hydrology report".*

HES Response (Point 1):

It is explained in Section 9.4.1 of the EIAR why the proposed drainage is suitable for the site:

> *"Due to the low groundwater vulnerability rating of the Site and the poor surface water and bedrock aquifer interaction, no special design requirements are needed to prevent the ingress of Wind Farm surface water drainage into the karst groundwater system where works inside the refined Gurteen/Cloonmore GWS ZoC are proposed (i.e. turbine locations T1, T2, T3 and T4).*

Please refer to the response in Point 9 above regarding the area of mapped 'Extreme' vulnerability to south of turbine T3.

Based on the extensive site investigations carried out at the Wind Farm site, no shallow bedrock was identified below the footprint of the proposed Wind Farm infrastructure or proposed wind farm drainage outfalls.

It's also worth noting that the water that will be released from the proposed drainage outfalls will largely be clean rainwater runoff. Any sediments will be removed by the settlement ponds prior to discharge. The water released from proposed wind farm drainage has no potential to pollute groundwater.

Point 2:

> *"Gravity foundations is the preferred option unless further site investigations deem it unsuitable. If a gravity foundation is not suitable at a depth of 3 – 3.5m or above, driven precast piling will be the approach"*
>
> *"The above extract from the application states the developer's rationale behind foundation choice. The approach is not conclusive enough because the integrity of an important GWS spring is at stake".*

HES Response (Point 2):
The rationale behind the proposed turbine base construction methodology is described in Section 9.5.2.1 of the EIAR:

> *"In order for potential contaminants (i.e. oils, fuels, cements, sediments etc) to reach the spring from the Wind Farm construction areas, a groundwater flowpath (pathway) must be present.*
>
> *The proposed turbine base construction design outlined above (which avoids bedrock excavations) removes the risk of intercepting/disrupting potential bedrock conduit/fractures that directly transmit groundwater to the spring. A protective layer of overburden will be left in place above the bedrock to prevent ingress of construction water down into the bedrock aquifer.*
>
> *Intercepting/unearthing a bedrock conduit/fracture during the construction works would potentially create a direct pathway between the construction work area (i.e. turbine base) and the spring. This risk can be entirely eliminated by the proposed construction methods outlined above".*

Point 3:

> *"Therefore, with both approaches there will be no potential whatsoever to disrupt underlying groundwater flowpaths (conduits/fractures) in the bedrock that feeds the GWS spring".*
>
> *We question this statement because of the following reasons:*
> - *There is no borehole or related borehole logs or ground investigations data near T1 or the northern part of the site;*
> - *At the borehole near T2, the limestone is only 6mbgl; and,*
> - *T3 is very much uphill of the GWS.*

HES Response (Point 3):
As stated above, BH4 and BH5 were drilled to assess the ground conditions in the area of proposed turbine locations T1 to T4 which are the furthest northerly turbines. There are no proposed turbines on the far north of the Wind Farm site and hence no investigation drilling was carried out on the part of the site.

With regard proposed turbine T2, either design approach (gravity or piled foundation) can be applied at this location where there is an overburden depth of 6m. Please note that the underlying bedrock at turbine T2 was largely competent with no evidence of karstification (i.e. conduits or large fracture water strikes).

Proposed turbine location T3 is indeed at a higher ground elevation than the GWS spring, but the ground in the area of T3 slopes steadily to the south towards the Levally Stream tributary (Stream A), whereas the GWS spring is located 750m to the southwest at an across-gradient position in terms of the groundwater level contours (refer to EIAR Figure 9-10 and Figure 9-11 for groundwater contours).

The groundwater level contours in that area also show that turbine T3 is not located directly up-gradient of the GWS spring from a groundwater level/gradient perspective, as the gradient is clearly to the south towards the Stream A based on the groundwater contours.

The measured groundwater flow patterns on the north of the Wind Farm site in the area of turbines T2, T3 and T4 as well as the rationale behind the refined ZoC is discussed in Section 9.3.15.1 of the EIAR:

> *"The groundwater level contours at the Wind Farm site suggests that shallow groundwater flow patterns are strongly influenced by local topography. This is not surprising given the very low recharge characterises (due to thick deposits of low permeability glacial sitting on competent limestone bedrock with low bulk permeability) which drives shallow, localised groundwater flow patterns towards the nearby streams that flow through the Site.*
>
> *The groundwater contours in the grasslands on the north of the Wind Farm site (particularly in the area of proposed turbine locations T2, T3 and T4) indicates groundwater flow closely mimics topography which is sloping steadily to the south towards Stream A.*
>
> *Even though the groundwater level monitoring suggests a localised groundwater flow regime at the Site (i.e. groundwater contours strongly mimic the local topography with groundwater discharge to local streams), in a worst-case scenario we are assuming that anywhere on the northern portion the Wind Farm site where the groundwater level is higher than the water level in spring (@BH4, BH5 and Farm Well) is potentially located within the ZoC to the spring (this only includes turbine locations T1, T2, T3 and T4).*
>
> *This worst-case approach is taken due to the karst nature of the underlying limestone bedrock and the potential for groundwater flowpaths in bedrock conduits that do not conform with the overall southerly groundwater flow direction/gradient in the area. For example, the potential link between the losing stream and spring does not conform with the mapped groundwater contours as it is more westerly. The groundwater flow in this possible link appears to preferentially follow a structural feature in the deeper bedrock such as a fracture/conduit".*

Point 4:

> *"The following statement from Section 9.5.2.1 states:*
>
> > *"The groundwater level monitoring data indicates that the majority of the recharged water in the glacial tills actually discharges to local streams that flow through the site. Therefore, only a very small portion of the recharge water in the glacial tills actually passess down to recharge the bedrock aquifer".*
> >
> > *"In the statement above, extracted from the application, the developer admits that some water will permeate into the bedrock aquifer. This statement contradicts the earlier statement made above, where the developer stated that no water will pass down into the bedrock aquifer".*

HES Response (Point 4):
This statement in the submission shows that the author fails to understand the hydrogeological assessment carried out in the EIAR. Nowhere in the EIAR does it state that there is no recharge to the bedrock aquifer within the Wind Farm site.

The hydraulic continuity between the glacial tills and the bedrock aquifer is well documented at an early stage in Chapter 9 of the EIAR (refer to Section 9.3.9.2):

> *"There is no recorded confining layer between the glacial till deposits and the underlying weathered bedrock/competent bedrock layers. As such it is our interpretation that the bedrock and glacial till deposits are connected, albeit that connection is limited by the low permeability characteristics recorded in the glacial till deposits".*

Point 5:

> *"Wind farms using pile-driven foundations can disrupt natural groundwater flow patterns. This can lead to changes in groundwater levels and potentially affect local water supplies. The physical insertion of piles into the ground can create pathways for water to flow in unexpected directions, which can disrupt local hydrology and impact vegetation and wildlife that depend on consistent groundwater levels".*

HES Response (Point 5):
As previously stated above and in the EIAR, the driven piles will only penetrate low permeability deposits such peat, marl clay and glacial tills and therefore the potential to affect groundwater flow patterns is extremely low.

The piles will not penetrate the underlying bedrock aquifer where groundwater flowpaths (i.e. fractures etc) potentially do exist. Potential groundwater effects associated with piled turbine foundations are assessed in Section 9.5.2.16 of the EIAR including mitigation for preventing the creation of potential preferential groundwater flowpaths at the works area.

Point 6:

> *"We take exception to this statement from Section 9.5.3.3.:*
>
> *"Turbines located inside the refined ZoC include T1, T2, T3 & T4. As stated above, the only proposed turbine T1 is located upslope of the spring. Anywhere to the south of the spring is not located inside the refined ZoC. This includes all the remaining Wind Farm site area (including borrow pit and peat/spoilstorage areas) as well as the Grid Connection (including substation)".*

HES Response (Point 6):
It is acknowledged in the EIAR (Section 9.3.15.1) that proposed turbine locations T1, T2, T3 & T4 are at locations where the groundwater level elevation is higher than the GWS spring and hence are included in the refined ZoC. The point being made is that topographically, turbine T1 is the only turbine that is directly upslope of the spring location. Hence, turbine T1 is the only turbine where there is a potential for groundwater flows in the glacial tills to reach spring under the flow of gravity in the mineral subsoil.

> *"The groundwater contours in the grasslands on the north of the Wind Farm site (particularly in the area of proposed turbine locations T2, T3 and T4) indicates groundwater flow closely mimics topography which is sloping steadily to the south towards Stream A".*
>
> *Furthermore, the likelihood of any significant diffuse recharge pathway between the more remote proposed turbine locations T2, T3 and T4 is even further diminished*

(hence we consider the refined ZoC conservative). Albeit the groundwater levels at these turbine locations are higher than the spring, the groundwater level contours strongly suggest that flows in the glacial tills is more southerly and not in the direction of the spring. The groundwater flow direction in the area of T2, T3 and T4 appear to strongly mimic topography which is sloping steadily to the south towards Stream A. Any potential spills or leaks that might occur in the area of T2, T3 and T4 will preferentially drain to Stream A".

Proposed turbine T1 location on the other hand is located more upslope of the spring location and the local topography here would potentially permit localised groundwater recharge to flow south-westerly towards the spring".

Nevertheless, in Section 9.5.2.1 of the EIAR the following mitigation is proposed at all construction works areas and all <u>4 no. turbines inside the refined ZoC</u> and not just T1:

- *No storage of fuels, oils, cements, or chemicals will be permitted within the refined ZoC;*
- *Refuelling of mobile plant (i.e. diggers, dumpers etc) will only be permitted outside the refined ZoC;*
- *Refuelling of large immobile plant (i.e. cranes) will only be carried out with a double skinned fuel bowser that will be removed from ZoC immediately after use;*
- *Spill kit stations will be present at each turbine location (T1, T2, T3 and T4);*
- *There will be no long term storage of peat/spoil inside the ZoC;*
- *A geotextile liner will be placed below the founding layer (lean mix concrete) where concrete is to be poured. These both prevent vertical loss of wet concrete at turbine bases;*
- *Use of perimeter shuttering at turbine basis to prevent lateral loss of wet concrete;*
- *All cement washout lagoons will be located outside the ZoC;*
- *A protective layer of in-situ overburden (2 -3m) will remain above the top of bedrock where gravity foundation excavations are required for groundwater quality protection; and,*
- *There will be clear signage in place inside the refined ZoC to remind construction workers that the area is inside a drinking water protection area.*

<u>**Spoil Repository Area (Section 3.6)**</u>

The submission states:

"Note the proximity of the spoil deposition area to the Levally Stream, also take note of the drain flowing through the spoil repository area".

"As seen from the other side, the unmentioned stream [referred to as drain in the above statement] *flowing through this proposed area is even more evident. This massive mistake must have been the result of yet another desk survey".*

"Backfilling a drain such as this in such a wet area is not in any way significant, although this drain is completely unmentioned in any report. Backfilling may be a mitigation in time but completely inadequate in such an area".

HES Response:

Firstly, the proposed spoil repository area is located outside the 50m watercourse buffer of the Levally Stream and mitigation is provides in Section 9.5.2.3 of the EIAR for protection of the Levally Stream:

"During the initial construction of repository/deposition areas, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from works areas.

Where applicable, the vegetative top-soil layer of the peat and spoil management areas will be rolled back to facilitate placement of excavated spoil, following which the vegetative-top soils layer will be reinstated. Where reinstatement is not possible, spoil and peat management areas will be sealed with a digger bucket and seeded as soon possible to reduce sediment entrainment in runoff.

Drainage from peat and spoil storage areas will ultimately be routed to an oversized swale and a number of stilling ponds pond with appropriate storage and settlement designed for a 1 in 10-year return period before being discharged to the on-site drains.

Peat/subsoil reinstatement areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil reinstatement areas will no longer be a potential source of silt laden runoff".

The feature being referred to in the submission is a vegetated, shallow ditch that runs in a NW-SW direction through the western half of the proposed spoil repository area. The ditch is typically dry as it only receives localised surface water runoff during wet periods. It is not a watercourse (i.e. stream).

The feature is also not a main drain as those present along the field boundaries to the north, west and south of the proposed spoil repository area. A 5m setback distance will be maintained from the main boundary drains (refer to the Clonberne Wind Farm further information request response to ACP for details on this).

The feature acts as shallow herring bone type drainage feature, with localised drainage effect to the field in which the spoil repository area is proposed. Once the area is backfilled, its purpose and function will be gone.

As acknowledged in the submission itself, '*Backfilling a drain such as this in such a wet area is not in any way significant'* as it only has a very localised drainage function.

Impacts on Turloughs and Wetlands (Section 3.8)

Section 3.8 of the submission deals with potential hydrological/hydrogeological effects on local turloughs and wetlands.

The following statements are made in the submission:

"Allowing large industrial windfarm developments in this region is contrary to Ireland's international obligations towards the protection of these rare and priority habitats which are of transboundary importance. We believe that the cumulative impacts of all proposed windfarm, and the developments as proposed have the potential to impact negatively on surface water and groundwater hydrology".

"The site has a hydrological connection to Levally Lough SAC. The site has a hydrological connection to Gortagarraun Turlough".

"Gortagarraun Turlough on the other hand which is even closer to the, 500m at it eastern (Sic) *side has been completely ignored by the NIS and hydrology report. This is another one of the many examples of lacunae prevalent across the EIAR".*

HES Response:
Firstly, Gortagarraun Turlough is discussed on several occasions in the Water Chapter of the EIAR (Chapter 9).

Section 9.3.4.1 states:

> *"The third stream, Stream C emerges at the location of Gortagarraun Turlough, which is situated 1.5km to the northwest and upstream of the Wind Farm site. Stream C flows in a south-easterly direction prior to merging with the Levally Stream immediately downstream of the Stream A/Stream B confluence on the west of the Wind Farm site. The proposed borrow pit area, which is located on the west of the Wind Farm site, drains to Stream C via a field drain that starts close to the eastern boundary of the proposed borrow pit location. Gortagarraun Turlough is only typically present over the winter period when groundwater levels are highest".*

Section 9.3.9.3 states:

> *"The Levally Stream flows in a valley to the west of the Site which originates at Gortagarraun Turlough to the northwest of the Site".*

Albeit, not stated in the EIAR, Gortagarraun Turlough was not scoped in for impact assessment, as the turlough is located up-gradient of the wind farm site with regard surface water and groundwater flow. Refer to Figure 9-3 (Site Drainage Map) and Figures 9-10 & 9-11 (Groundwater Contour Maps) for the location of Gortagarraun Turlough with respect the proposed Wind Farm site.

From a hydrological/ hydrogeological perspective there is potential for the proposed Wind Farm to impact on Gortagarraun Turlough.

With regard Levally Lough SAC, several robust hydrological/hydrogeology reasons are provided 9.5.2.10 of the EIAR why no significant effects will occur:

> *"Levally Lough SAC/pNHA (Site Code: 000295) is located ~2km southwest of the Site. There is no surface water connection between the Site and Levally Lough. However, given that the measured groundwater flow direction in the area of the Site is southerly/south-westerly, Levally Lough is potentially down-gradient of the Site with respect to groundwater flow".*
>
> *"The groundwater level monitoring carried at the Site suggests that the Levally Stream is a local discharge zone for groundwater in the area of the Site. The fact that the Levally Stream separates the Site and Levally Lough, groundwater flows arising from the Site (especially shallow groundwater flows in the glacial deposits) are more likely to discharge into the Levally Stream rather than travel further south towards Levally Lough".*
>
> *"Also, due to the large coverage of peat, the presence of deep glacial till deposits, and poorly draining soils across the Site, the risk to groundwater quality in the deeper karst limestone is low. Considering these factors in addition to the proposed mitigation measures for groundwater protection, no effects on Levally Lough SAC are likely to occur".*

Lough Corrib SAC (Section 3.9)
A comprehensive impact assessment was completed for the Lough Corrib in Section 9.5.2.10 of the EIAR. All other designated sites were screened out of the impact assessment due to the lack of hydrological and/or hydrogeological connectivity.

Drainage mitigation measures for surface water quality protection during the construction phase are summarised again below: (Please refer to Sections 9.5.2.2, 9.5.2.3 & 9.5.2.5 of the EIAR for the full description of these measures and how they will be applied)

- The proposed mitigation measures which will include 50m buffer zones for avoidance of sensitive hydrological features (streams and rivers);
- Pre-construction drainage control measures;
- Robust drainage control measures (i.e. interceptor drains, swales, settlement ponds and treatment trains such as Siltbuster) will ensure that the quality of runoff from Proposed Project areas will be very high; and,
- Best practice measures with regard use of oils, fuels (Section 9.5.2.6) and cement based compounds (Section 9.5.2.8).

Tried and tested, best-practice mitigation measures (as detailed in the EIAR and clarified further in this response) for the protection of surface and groundwater water quality will be implemented during the construction phase of the proposed project to ensure that there is no deterioration in local or downstream water quality at Lough Corrib SAC.

Borrow Pit (Section 3.10)
Section 3.10 of the submission discusses the borrow pit and raises concerns about impacts on local hydrogeology, the Gurteen/Cloonmore GWS spring and the Gallagh GWS spring, all of which have been assessed in the EIAR.

The proposed borrow pit was thoroughly assessed in the EIAR by means of existing borehole log data and groundwater level monitoring carried out as part of the EIAR. From a general groundwater level/hydrogeology perspective, effects were assessed in Section 9.3.9.2 & section 9.5.2.4 of the EIAR):

> *"The drilling logs show solid, competent, dry limestone down to a depth of approximately 25mbgl. Some isolated fractures with small to moderate groundwater inflows (0.025 – 1.5L/s) were recorded below 25mbgl. Overburden depths of between 2.5 and 5.6m were recorded in this area".*

(Please note that the proposed depth of the borrow pit is between 7 and 13m below ground level (mbgl) and not 25mbgl)

> *"The groundwater level monitoring carried out in the area of the borrow pit show steep groundwater gradients across the footprint of the borrow pit location, indicating competent low permeability bedrock with localised groundwater flow patterns. Groundwater flows in the bedrock of the borrow will be limited to localised flows in the upper weathered bedrock layers or localised weaknesses. No regional groundwater flows will be intercepted during the operation of the borrow pit. Any dewatering/pumping required at the borrow pit will likely be associated with rainfall input/surface water runoff rather than groundwater inflows".*

With regard the Gurteen/Cloonmore Spring, a very robust assessment regarding the lack of potential effects was demonstrated in Section 9.5.2.1:

> *"The proposed borrow pit location on the west of the Wind Farm site is neither located inside the GSI SPA/ZoC or the refined ZoC. The borrow pit location is 1.2km away from the spring source on the opposite side of the Levally Stream valley".*
>
> *"The proposed borrow pit location and the spring source is separated by the Levally Stream valley which appears to be a local groundwater discharge zone (i.e. there is no potential for groundwater flow from the proposed borrow pit towards the spring)".*
>
> *As a precautionary design measure, the extraction depth of the borrow pit will not go deeper than 67m OD which means the borrow pit floor will always be above*

> *the water level in the spring source sump (65.811m to 66.371m OD over the monitoring period)"*.

Finally, the groundwater level monitoring carried out at the proposed borrow pit was conclusively able to scope out any effects on the Gallagh GWS spring as described in Section 9.3.15.1 of the EIAR:

> *"The proposed borrow pit is located inside the northeastern edge of the mapped SPA for Gallagh GWS. However, groundwater level monitoring carried out at 2 no. boreholes (EH1 and EH3) located adjacent to the proposed borrow pit location indicates there is an easterly gradient towards the Levally Stream and away from the source location to the southwest. These groundwater levels demonstrate that the proposed borrow pit is not located inside the Gallagh GWS SPA"*.

8 INLAND FISHERIES IRELAND

IFI provide a general submission on the topic of surface water quality protection. The following key topics listed below, all of which are already addressed in the EIAR, are summarised from the IFI submission. The section of the EIAR that addresses each topic is also provided:

- Managing surface water drainage to prevent erosion and soil instability (refer to EIAR Sections 9.4.1, 9.5.2.3, 9.5.2.5 and Appendix 4-5 (drainage plan));
- Ensuring proper drainage and sediment control through settlement ponds and silt traps (Refer to EIAR Sections 9.4.1, 9.5.2.3 and Appendix 4-5 (drainage plan));
- Addressing waste disposal and runoff from stockpiled soils (refer to EIAR Sections 9.5.2.3 & 9.5.2.7);
- Containing pollutants like cement leachate and hydrocarbons. (refer to EIAR Sections 9.5.2.6 and 9.5.2.8);
- Avoiding sedimentary rocks like shale in road construction to prevent water pollution (refer to EIAR Section 9.5.3.2);
- Consulting IFI for watercourse crossings and minimizing their impact (refer to EIAR Section 9.5.2.9); and,
- Scheduling instream works for the period July 1–September 30) which is outside salmonid spawning seasons (refer to EIAR Section 9.5.2.9).

All of the IFI recommendations have been addressed in the EIAR and appropriate mitigation measures proposed where appropriate.

9 3RD PARTY SUBMISSIONS – GENERAL RESPONSES

This section presents our responses to recurring themes included in the various 3rd party submissions relating to the water, land, soils and geological environment.

The following recurring themes listed below were raised in the third-party submissions. Some of these themes/matters have previously been dealt with in the detailed responses provided in Section 3 to Section 8 above, as indicated below.

- Effects on local group scheme water supplies (refer to Section 3 - Section 7 above);
- Increased flood risk (refer to Section 7 above);
- Groundwater level effects;
- Surface water and groundwater quality affects;
- Potential effects on local private wells; and,
- Potential impacts on Lough Corrib SAC (refer to Section 7 above).

Groundwater Level Effects

Potential effects on groundwater level are assessed in Section 9.5.2.4 of the EIAR. The assessment is supported by extensive site investigations and follow-up groundwater level monitoring which is detailed in the EIAR and also summarised in the responses above within this document (Section 3 - Section 7).

The main works for potential groundwater levels effects include turbine base/foundation construction and working of the proposed on-site borrow pit.

The key points made in Section 9.5.2.4 with regard turbine base/foundation construction are:

> *"Turbine foundations will either be gravity base or piled. Due to the relatively shallow depth of the gravity foundations (3 – 3.5m deep) and the low permeability nature of the glacial till overburden, significant groundwater inflows into turbine excavations will not occur. In addition, any effects on groundwater levels will only be for a temporary basis during the foundation construction work. Groundwater level effects are unlikely to be significant beyond 10m from the turbine base excavation. Gravity foundations are proposed at all turbine locations unless further site investigation deem the option unsuitable".*
>
> *"Any potential piling at turbine locations T1, T2, T3 and T4 will be restricted to imported precast piles which will be driven down to the top of bedrock without the requirement for any pumping or dewatering".*
>
> *"Standard bored piling will be an option at all other turbine locations outside of the Gurteen/Cloonmore GWS refined ZoC, if gravity foundations are deemed unsuitable. Bored piling does not require active dewatering/pumping (albeit some displacement of groundwater is likely to occur during drilling and placement of grout) and therefore has no potential to significantly affect groundwater levels".*

The key points made in Section 9.5.2.4 with regard working the proposed borrow pit are:

> *"The proposed borrow pit is located on elevated ground (west side of Levally Stream valley) on the west of the Wind Farm site. The proposed depth of the borrow pit is between 7 and 13m below ground level (mbgl)".*
>
> *"The drilling logs for the existing boreholes located in the area of the proposed borrow pit show solid, competent, dry limestone down to a depth of approximately 25mbgl".*
>
> *"The groundwater level monitoring carried out in the area of the borrow pit show steep groundwater gradients across the footprint of the borrow pit location, indicating competent low permeability bedrock with localised groundwater flow patterns. Groundwater flows in the bedrock of the borrow will be limited to localised flows in the upper weathered bedrock layers or localised weaknesses. No regional groundwater flows will be intercepted during the operation of the borrow pit".*
>
> *"Any dewatering/pumping required at the borrow pit will likely be associated with rainfall input/surface water runoff rather than groundwater inflows".*

Surface Water and Groundwater Quality Effects

The mitigation measures prescribed in the EIAR for the protection of the hydrological/hydrogeological environment are proven, tried and tested, best in class mitigation measures which will ensure that the Proposed Project has no potential for significant effects on the receiving water environment. The Proposed Project drainage system will ensure that there is no discharge of untreated or unattenuated waters. The EIAR also prescribes best practice mitigation measures in relation to hydrocarbons, cement-based products and wastewater. With the implementation of the prescribed mitigation measures, there will be no potential for significant effects on the hydrological/hydrogeological environment.

Effects on Local Private Wells

Potential effects on local private wells are assessed in Section 9.5.2.4 of the EIAR.

For the reasons provided in Section 9.5.2.4 (repeated below for ease off reference), we are satisfied that the Proposed Project site will not impact in any significant way on any potential down-gradient private wells.

Also, similar to the assessment of groundwater level effects, the assessment on private wells is supported by extensive site investigations and follow-up groundwater level monitoring:

- *The large set back distances between turbine locations and downstream potential well locations (>0.85km);*
- *The proposed project will involve relatively shallow excavations (3 – 3.5mbgl), other than at borrow pit;*
- *The low permeability of the glacial deposits in which the turbine gravity base foundations will be constructed;*
- *The large depths of peat and glacial deposits that protect the underlying limestone bedrock aquifer (i.e. the majority of the Site has a low groundwater vulnerability rating);*
- *Localised groundwater flow patterns in the glacial deposits which is towards local streams that flow through the Site;*
- *The Levally Stream acting as a hydraulic boundary between the Site and the dwellings to the southwest and south;*
- *The absence of dwelling houses at down-gradient or up-gradient locations with regard the proposed borrow pit location;*
- *The competent nature of the bedrock in the area of the proposed borrow pit with only shallow localised groundwater flowpaths; and,*
- *The shallow excavation depths required for Grid Connection cable and End Masts.*

10 OVERALL SUBMISSION RESPONSE SUMMARY

In summary and in response to ACP's submission response request:

- A comprehensive site investigation dataset, comprising of trial pits, boreholes, long-term groundwater level monitoring, surface water flow monitoring and water sampling was accrued as part of the baseline characterisation of the Proposed Wind Farm site in the EIAR. This site-specific dataset informed the robust impact assessment which was presented in the EIAR;
- As acknowledged by Dr Robert Meehan a "*a thorough characterisation and baseline monitoring exercise preceded the application for planning permission for the proposed Clonberne Wind Farm, as would be expected for any Environmental Assessment Report (EIAR)";*
- We demonstrate that the investigations/assessments carried out regarding the Gurteen/Cloonmore GWS are on par if not exceed the levels of investigations carried out for other sources in the locality;
- We provide robust reasoning why using the Gurteen/Cloonmore GWS refined ZoC is scientifically sounder than using the GSI's version which is largely a desk-based assessment, as acknowledged by the GSI themselves;
- Robust scientific reasoning has been provided in the EIAR to support the lack of potential effects on Dunmore/Glenamaddy PWS, Mid-Galway PWS and Gallow GWS;
- Robust scientific reasoning has been also provided in the EIAR to support the lack of potential effects on Levally Lough SAC, Lough Corrib SAC, Gortagarraun Turlough and local wells;
- Any potential significant issues with regard flood risk were dealt with at the early design stage of the project in order to ensure that as much of the proposed infrastructure as possible was placed outside of mapped fluvial flood zones; and,

- With the implementation of the tried and tested, best practice mitigation measures there will be no potential for significant effects on surface or groundwater quality/quantity.

HES has responded to all matters raised in the ACP 3rd party submissions.

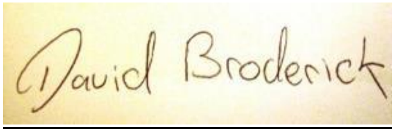
We respectfully submit to An Coimisiún Pleanála that this letter response reiterates the conclusions of the robust and comprehensive impact assessments presented in EIAR Chapter 8 (Land, Soils and Geology), EIAR Chapter 9 (Hydrology and Hydrogeology), the associated Flood Risk Assessment (Appendix 9-1), WFD Compliance Assessment Report (Appendix 9-3) and drainage design plan (Appendix 4-3).

The impact assessments presented in the EIAR are informed by a comprehensive site investigation dataset and rely upon the tried and tested, best practice mitigation measures which ensure the protection of the receiving environment. Similar mitigation measures have been successfully applied during the construction of countless wind farm developments across the country and were also presented in the EIARs for several recently permitted wind farm developments.

11 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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