Finn Valley Wind Action Group

C/O Charlene McClintock

Crossroads

Killygordon

Co. Donegal

F93 F5A2

23/05/2024

Ref: SU05E.319466

Development Description

Substitute Consent application for 25 no. deviations from the permitted Meenbog Windfarm development (granted under ABP PA05E.300460).

Please find attached a submission in respect of the above development on behalf of the Finn Valley Wind Action Group.

Dear Sir/Madam,

We would like to make a submission on the above application for Substitute Consent. Our community once again feels we must state our disbelief in the short comings and carelessness of this developer. It is now abundantly clear that this development should never have received planning permission in the first instance and any Substitute consent should not be granted.

We as a community, hired at our own cost, a number of experts to study the original application. Among those was Dr Padraig O Cathain on peat stability and Professor Paul Johston on Hydrology. Their reports on the original Meenbog Application highlighted the high risk of Peat Slides occurring on this site. The caution and concerns they raised appeared to have been ignored and instead the applicant's surveys, reports and findings were giving more weight and believed to be sound when in fact they were fatally flawed.

You can only imagine the shock and upset we as a community experienced in November 2020 when exactly what we warned off came to crushing reality, when approximately 86,240m3 of peat slid and entered the Shruhangrave Stream and onto the Mourne Beg River to do untold damage which we believe may never be quantified.

You are being asked to consider this substitute consent at the behest of Planree. However, it must be considered in light of Donegal County Council's (DCC) recent case where they took Planree to the High Court on unauthorised development continuing apace at the site, i.e., by way of twenty-five material deviations from the original grant of permission. The outcome of that case is vital in your considerations. In his judgement, Mr Justice Holland said:

*"I hold that the **unauthorised development** at issue in these proceedings consists, by reason of the Material Deviations, **of the entire Windfarm** and not, discretely considered, of each or all of the Material Deviations...On that basis I hold that I have jurisdiction, if I think it proper, to restrain Planree's further development of the Windfarm – at least pending regularisation of its present planning status."*

We are fearful that once again this developer will receive the benefit of the doubt when it comes to a decision on this application. This developer has proven time and time again to be untrustworthy and their findings and reports fall well below par for sound and proper development. Completion of the project is now a priority for the developer purely for commercial reasons and not for that of the local environment. Once again, we ask you to have regard for Mr Justice Holland who found that the unauthorised development at the site consists of the entire wind farm and not each of or all of 25 material deviations. He was particularly scathing of a written submission from Planree which he said was submitted *"only days before the trial"*. He described it as *"puzzling, unhelpful and entirely unrealistic"* the submission that contended that it was *'simply untrue'* that the peat slide was caused by its development works. He (Justice Holland) pointed out that

"Planree's own experts, Fehily Timoney and MKO, had long since made the contrary quite clear".

We put it to An Bord Pleanála that whilst the expert opinions of O'Cathain and Johnston were not properly assessed, underestimated, and set aside, that they now need to be re-evaluated and taken seriously and now is the time for redress.

The following is the findings and conclusion of the Inspector in the original Inspectors Report in the Granting of the Meenbog Wind Farm regarding the Dr O'Cathain and Professor Johnston reports.

"The concerns raised by the Dr. O Cathain in relation to the quality of the EIAR PSAR and Factor of Safety analysis, and Professor Johnston in relation to the EIAR hydrology and water quality assessments are also noted. However, I am satisfied that the site survey, data analysis and the overall results as presented in the EIAR, which have been carried out in accordance with the 2007 Scottish Executive Guidance and other relevant international guidance are robust. I am satisfied that the proposed peat and water quality mitigation measures are appropriate to the scale and upland location of the proposed development. With respect to other matters raised in relation to water quality in Lough Mourne, the borrow pits and the disposal of excavated tar from along the road network, it is noted that Lough Mourne drains S towards the site, adequate borrow pit details have been provided, and the tar will be disposed of at a licenced waste treatment facility. I am satisfied that the applicant carried out an extensive range of site suitability tests which were used to inform the location of the proposed turbines, met mast, borrow pits, substation and access tracks. I am satisfied that the results of the PSAR (including the Factor of Safety analysis) are robust and that the proposed works would not give rise to peat instability or slippage, subject to the stringent implementation of the EIAR mitigation measures, any recommended conditions, ongoing site inspections and monitoring for the lifespan of the windfarm project.

9.5.5 Conclusions

Having regard to all of the above, I am satisfied that the proposed development would not have a significant adverse effect on land, soils, geology or peat stability subject to the full implementation of the mitigation measures and any recommended conditions. The proposed development would not give rise to any significant adverse cumulative impacts in-combination with other windfarms, the grid connection route, or plans and projects in the wider area."

Five times repeated "*I am satisfied...*" whereas the scientific, unbiased, reports of Dr O'Cathain and Professor Johnston are summarily just "*noted*".

Thus, today We fervently hope that An Bord Pleanála will not summarily dismiss Justice Holland's opinions and decision. It is also disheartening to find that discovery around the DCC case in the High Court found that the November 2020 slide was preceded by two other slides in June 2020. Moreover, the parties agreed that Planree's works caused, or at least contributed to the occurrence of, the November 2020 slide. So, who else was on the mountain in June 2020 that interfered with nature and caused the two other slides that no one outside of the developer appeared to be aware of? A rhetorical question; NOBOBY else was on the mountain bar innumerable contractors for Planree. It is apparent they were complicit in three bog slides.

Thus, we ask that this development should not be giving the opportunity to carry out any further works until all investigations carried out by all parties involved in the multi-agency peat slide investigations are complete and it is known exactly the extent of the damage and just exactly what will be required to best restore all damage caused and that these restorations all are carried out to a successful conclusion.

The applicant claims 90% of all works are carried out. Again, we find this claim incredulous particularly since the developer was ordered to cease all works on site associated with the wind farm (except those works to contain the peat slide). Before the bog slide occurred works where not that far advanced and it is now clear that all works on site did not cease as the Substation and Grid connection works continued. These works are part of the one overall project and should have ceased also. We are of the informed opinion that nowhere near 90% of works are complete. That serves as another example of the dishonesty and disregard shown towards the local community and authorities by this developer.

Were Mr Justice Holland to have the same jurisdiction as your Inspector, i.e. the recourse to actually inspect the site, we believe that he would find the 90% claim to be also *"entirely unrealistic"*. Planree freely admit to works carrying on apace even after the November 2020 bog slide. That is why they ended up in the High Court on the charge of Unauthorised Development. It is galling to think that they arrive at that 90% complete figure by the inclusion of works carried out after the bog slide and whilst a multi-agency investigation was ongoing. To that end we ask you to disregard the plea of we-are-nearly-finished and instead reflect once more on the illegality of the works completed and the massive environmental damage done. Perhaps, the easiest aspect to examine, on-site, is the substation and grid connection works referred to earlier. You will undoubtedly find DCC's many requests to cease works were not complied with. Major works continued after November 2020. The whole project was not treated as one – there certainly was 'project splitting' in respect of cessation works. And then you need only apply Mr Justice Holland's reasoning to back your REFUSAL of this substitute consent application:

"I hold that the unauthorised development at issue in these proceedings consists, by reason of the Material Deviations, of the entire Windfarm and not, discretely considered, of each or all of the Material Deviations."

Moreover, the High Court is the second court that has found Planree guilty of unauthorised development. In July 2022, at a sitting of the Letterkenny District Court the developers pleaded guilty to the pollution of the Shruhangarve and Mourne Beg stream and were handed down a fine of €1500. They undertook to carry out extensive remediation works under the watch of both Donegal County Council and the Environmental Protection Agency. Hence, it is decidedly unseemly that in advance of these remediation works being completed and, more importantly, a report being published on the bog burst event, that Planree should ask you to consider substitute consent on twenty-five material deviations from your (unfortunately) granted permission. We are strongly of the opinion that whilst one or two deviations from the permission granted could be deemed to be a simple oversight, five or six deviations would definitely raise an eyebrow. Scaling upwards, surely ten or twelve deviations should be deemed to be a shambolic implementation of the permission granted but to more than double that to twenty-five deviations, moreover, material deviations, shows utter contempt for the planning process.

Derrybrien Wind Farm

There are many similarities between Meenbog and Derrybrien wind farms. The Derrybrien wind farm was one of the largest in Europe when it was being built in 2003 and was quickly hit by controversy due to a large landslide at the site later the same year. Peat excavated to expose the rock to anchor the turbines was piled up, which initiated the landslides. The felling of conifer tress on the site was also a contributing factor.

The European Commission stated on 25th January 2018 that it was seeking to bring Ireland back before the Court of Justice of the European Union (CJEU) because it claimed it had not complied with a previous court judgement of July 3, 2008 (C-215/06, Commission v Ireland). In the statement the European Commission said no sufficient impact assessment has been carried out at Derrybrien and that it is required under EU rules. We contend that this developer has also failed to adequately assess the impacts in Meenbog. In February 2022 An Bord Pleanála refused Substitute Consent for Derrybrien and so it is to be decommissioned. With the fullest of due respect An Bord Pleanála set down an important precedent with that decision.

Having regard for your own precedent and the findings of Letterkenny Circuit Court and the High Court An Bord Pleanála is now legally obliged to refuse permission for SU05E.319466 with an attendant condition that all works should be decommissioned.

Please find below Dr O'Cathain and Professor Johnstons reports.

Thank you for your consideration.

Yours faithfully

Finn Valley Wind Action Group

Commentary on peat stability issues relating to the proposed Meenbog Wind Farm

DR PADRAIG Ó CATHÁIN

February 11, 2018

Overview

The proposed Meenbog Wind Farm contains 19 wind turbines in the townlands of Meenbog, Croaghonagh and Cashelnavean, Co. Donegal. The majority of the site consists of blanket peat, with large sections of this under commercial forestry. An environmental impact statement was carried out by McCarthy Keville O'Sullivan Ltd. (hereafter MKS) with specialist *Peat and Spoil Management Plan* and *Peat Stability Assessment Report* carried out by AGEC Ltd.

This report describes some methodological shortcomings of these reports. The main findings are the following.

1. The *Peat and Spoil Management Plan* acknowledges that improper storage of excavated peat is a substantial risk factor for slope failure during wind farm construction. This report describes some general best-practice guidelines for the storage of peat. However, **the plan omits any site-specific details of the three peat deposi- tion areas (referred to on maps as Borrow Pits).** There are no drawings of the borrow pits, or details of how much peat will be stored in each. The Stability report does not comment on potential soil failures at or near the Borrow Pits.

2. Borrow Pit 1 in particular, appears to be located in the vicinity of deep peat, and an identified area in which construction should be avoided. There does not appear to be any analysis in either report prepared by AGEC, or elsewhere in the EIS that excavation and refilling at this site will not lead to slope failure. In particular, the *Peat Stability Assessment* omits any reference to this structure, which seems a clear omission.

3. Much of the site is forested. It is well known that commercial forestry degrades peat, reducing its strength and increasing the liklihood of a slope failure. This was iden- tified as one of the key causes of the Derrynbrien bog slide. Despite this, forestry is mentioned in four locations in the AGEC report, *each time in the same three sentence fragment*, which appears to have been cut and pasted repeatedly. **No attempt has been made to factor the presence of forestry into the stability analysis.**

4. Factor of Safety (FoS) is a technical formula for assessing soil stability, see below for a detailed discussion. There are substantial difficulties with applying FoS to peat soils – its use is mostly due to the lack of a viable alternative. Nevertheless, **AGECs analysis suffers from serious methodological flaws and limitations which**

invalidate their findings. In particular, some values necessary for the calculation of FoS were cherrypicked from the literature; and do not necessarily reflect on-site conditions in Meenbog.

5. The authors conflate qualitative and subjective measures of risk with judgment. This reduces the analysis to the factor of safety computation. Section 5 of the report of the Scottish executive describes an array of qualitative assessments which it recommends in addition to a factor of safety analysis, which is recommends be based on measurements of the peat present on the site (as opposed to values collected from the literature).

Statement of expertise

I hold BA, MLitt and PhD degrees in Mathematics from the National University of Ireland, Galway. My research is in the algebraic theory of the design of experiments, though I am acquainted with a broader area of modern mathematics. I have published eleven articles in peer reviewed international journals, and presented my research across Europe, America and Australia.

Given my background, in the past I have been asked to comment on Peat Stability reports prepared for a number of wind farm developments. I have read widely in this literature since 2010, and consider myself to be educated on the current state of the art. I note that peat stability report that I wrote was a key factor in An Bord Pleanála's decision to refuse planning permission for a proposed wind farm at Knockranny, Moycullen, Co. Galway. A report that I drafted was key to the oral hearing on the proposed wind farm in Straboy, Co Donegal which took place in October 2012. Again, in its decision, the listed grounds for refusal relate to peat stability and the potential of water pollution.

I am an internationally recognised expert in my area of mathematics. I am qualified, capable and experienced in the critical analysis of arguments and numerical data. While I do not hold any qualification in soil mechanics or civil engineering, I have ample experience with reading and commenting on technical reports, including soil stability analyses. In this report I comment on methodological issues with the soil stability report relating to the Meenbog Wind Farm. My main findings are summarised below.

Borrow Pits

The construction plan seems to require up to three Borrow Pits on the site, from which bedrock will be quarried, and into which excess peat excavated elsewhere will be stored. This construction process often results in very deep deposits of peat, and the peat is refilled to a meter or more higher than the original land. The *Peat and Spoil Management Plan* appears to be intended to discuss these deposition areas in detail, but does not do so. A number of general guidelines for the construction of borrow pits are outlined. Details specific to this site are referred to as being contained in Figures 7-9 of Section 4.2. As of the time of writing, there are no such figures in that section. **The applicants have failed to guarantee the safety of these aspects of the construction.**

Factor of Safety Analysis

Mathematical modelling is a sophisticated research area in modern mathematics, which typically involves extensive computer simulations with specially constructed algorithms. Without delving into the philosophy of modelling, it should be noted that a model is designed for a specific purpose, and its conclusions cannot be guaranteed to hold if it is applied in contexts for which it is not designed. Furthermore, developments in recent years mean that models over twenty years old are generally considered out of date. Factor of Safety is a widely used, and widely discredited, method of assessing peat stability.

1. FoS is a method developed for mineral soils in the 1930s. It has changed little from the days of slide rules, and sacrifices accuracy for ease of computation. In contrast to the detailed computer simulations standard in most other areas of engineering, FoS requires only a calculator and a primary-school-level grasp of arithmetic. **It is sixty years behind best practice in the field.**

2. FoS is intended for use with mineral soils. Mineral soils are essentially granular, while peat is fibrous. As a result peat responds radically differently to mineral soils with respect to disturbance, drying, vibration, and other factors associated with construction. These are all factors which are cannot be integrated into the model. As such, FoS is being used by AGEC in **a context for which it was not designed, invalidating their findings.**

3. The FoS is not regarded as a reliable indicator of peat stability. Among the leading authorities on soil and peat mechanics in the Irish context are Boylan et al. Their report, *Landslides in Ireland*, is a standard reference work. They state: *Peat has significant fabric and structural differences that make the direct application of traditional soil mechanics strength models doubtful.* As mentioned by the Scottish Executive, a key mechanism in peat failures is the attachment surface between the peat and the underlying bedrock. This report makes no attempt to invesitage this surface.

4. Several measurements are required to evaluate FoS, including peat depth, shear strength (i.e. resistance to shearing/cutting forces) and cohesion (resistance to break- ing up). These measurements refer to granular soils, and there is disagreement among experts on whether some of the measurements required for FoS can even be made for peat.

5. Shear strength is a particularly problematic measurement, which is crucially important as it is directly proportion to FoS. The measurement of this value is extremely problematic. The standard method of evaluating this value is the shear vane test, which was used by AGEC. One of the foremost authorities on the use of FoS with peat is Dr N. Boylan of UCD; he reports on several international studies which found that *the in situ vane test in peat is of little engineering use, and that it can, in fact, be directly misleading.* It would appear that his opinion is that ... *there are many uncertainties and difficulties about the use of standard laboratory and in situ shear strength test methods.*

6. We give a further quote from Boylan et al., which summarises their approach to FoS: *The huge areas of uncertainty that exist about peat strength and causal factors of failure mean that slope stability analyses in peat cannot be relied on, and should be*

used only as an indication of stability. Current practice is to use cautious infinite slope stability methods with low values of undrained shear strength and high factors of safety. The presence of any causal factors should also be identified in any stability assessment. (Page 103)

7. Perhaps the most relevant slope failure event in Ireland in recent years was the Derrybrien bog slide. This was investigated by internationally renowned experts, who concluded that the FoS calculations taken at that site were of little use in predicting t he landslide. The following is drawn from the Lindsay-Bragg report on that event: *the locations with high FoS values (i.e. stable) actually showed signs of instability while some locations with low FoS values showed no such signs, suggesting that the measurements gave only a crude picture of stability* (page 11). We conclude that FoS measurements alone are not sufficient to determine the suitability of a site for development.

Mathematics of FoS

To discuss Factor of Safety in detail, we need to review the mathematical formulae in- volved. This section may be omitted by those who do not require an understanding of the mathematics required. The main findings are outlined in the following section.

Peat slope failure in Ireland [1] is a primary reference for the use of the Factor of Safety method on peat soils. It is a fairly detailed analysis of a number of bog failures in Ireland. Towards the end of the paper a pair of equations are given. We reproduce these here.

Parameter	Explanation	Comment
s_u	Shear strength of peat	Difficult to evaluate. Problematic.
γ	Bulk unit weight	Assumed equal to γ_w
β	Slope	Directly measured
z	Depth to failure plane	Assumed to be total depth of peat
c^r	Apparent drained cohesion of peat	Difficult to evaluate. Problematic.
γ_w	Bulk unit weight of water	Approx $10kN/m^3$
z_w	Height of water table from failure surface	
ψ^r	Effective friction angle of peat	

The formula for undrained peat is

$$FoS = \frac{s_u}{\gamma z \, \mathrm{Cos}(\beta)\mathrm{Sin}(\beta)} \tag{1}$$

The formula for drained peat is

$$FoS = \frac{c^r}{\gamma z \, \mathrm{Cos}(\beta)\mathrm{Sin}(\beta)} + \frac{(\gamma - \gamma_w \frac{z_w}{z})\tan(\psi^r)}{\gamma \tan(\beta)} \tag{2}$$

FoS is a measure of the likelihood of a bog failure in a given location. In the mathemat- ical model, values below 1 indicate instability and inevitable slope failure. Values above 1 indicate stability. Since there are uncertainties involved in estimating the parameters fed into the model, Boylan et al. recommend a minimal value of at least 1.4 for most purposes (though this is not without caveats).

AGEC and the use of FoS at Meenbog

We have already seen that there are very substantial difficulties with the use of FoS for modelling soil stability in peat. In this section we comment on the specific implementation as attempted by AGEC at Meenbog.

1. AGEC repeatedly report on average measurements for the site; they report that 80% of their depth measurements recorded depths of less than 2.5m peat, and that the average slope on the site is 3 . Measurements taken at peat depths of 0.2 meters might push down the averages reported, but do not reduce the probability of a peat failure. Likewise, AGECs choice of variables for cohesion and Friction Angle are based on averages appearing in the literature. **An analysis of average scenarios is inappropriate, since slope failures occur in worst case scenarios.**

2. A number of shear strength measurements were made (see above for details of the difficulties associated with these measurements). They then chose an average measurement for use in all of FoS calculations, based on a search of the literature. Shear strength is directly proportional to FoS: it is entirely possible to carry out all calcula- tions first and then choose a value for the shear strength which produces FoS values above whatever threshold is desired.

3. The value for cohesion used by AGEC is **not based on any measurement carried out at the site**. The provide 19 values quoted in the literature, and then choose something close to the average, but **still higher than the results of 9 published studies.** The value for friction angle chosen is lower than thirteen of the values found in the literature. Ths cherrypicking of such values has a huge effect on the outcome of the FoS analysis.

4. We note that by taking a different choice of constant for cohesion and friction angle, we could easily obtain values below 1 for the drained measurements at numerous locations. **Such numerical games say nothing about soil stability.**

In summary, FoS analysis is of questionable value in the analysis of peat stability. Notwithstanding questions over the soundness of FoS, the analysis carried out by AGEC is flawed by their arbitrary choices of constants and failure to detail exactly how they conducted their drained analysis. Without this data, they have done no more than choose convenient numbers for stability at each site.

In conclusion, we find the FoS analysis of this site to be based on limited data relating to the site. Slightly different input data could be used to achieve quite different results. As noted in the report following the Derrybrien bog failure, FoS is not a reliable indicator of peat stability. This analysis is unsupported by any other numerical or scientific modelling. As such AGEC has failed to demonstrate that construction will not pose an unreasonable risk of soil failure and ensuing pollution to the surrounding area.

Risk Assessments

It would appear that AGEC have attempted to create an in-house risk assessment for peat stability. This considers a number of visual features (such as 'evidence of surface water flow' and 'vegetation'). Such features are given *Probability* and *Impact* scores, and the

total risk is taken to be the product of these numbers. It would appear that the final value for a site is the maximum of the risk values at a site. FoS values above 1.3 are all given a value of 1, without distinction between marginal stability and areas lacking peat entirely. Values of 9 or below are considered suitable for construction. Conveniently, no turbine's value exceeded 9.

There is no rationale given for the inclusion or otherwise of factors, and this test is not independent of the Factor of Safety Analysis. **Notably, forestry is not mentioned as a risk factor.** Given the importance of forestry at Derrybrien, and its relevance to the current site, its omission is inexcusable. Forestry is known both to directly weaken peat, while also leading to drying and cracking of the surface; leading to an increase in the likelihood of peat failure.

Furthermore, in the risk assessment, each factor is analysed seperately, and it would appear that no effort is made to consider interactions between risk factors. Some sites may have a combination of risk factors indicative of higher risk of slope failure, but taking only the maximum risk factor means that there is now way to assess risks arising from combinations of factors.

Conclusion

I have examined the peat stability analysis of AGEC and found it to be flawed. The most serious of my concerns are outlined below.

1. Factor of Safety was developed in the 1930s for mineral soils. It is not an appropriate tool for use with peat soils. The lack of a widely accepted alternative method does not make this one more reliable. Slope failures at the Drrybrien site were not accurately predicted by Factor of Safety. No attempt has been made to employ any modern modelling or simulation techniques.

2. Furthermore, values were chosen for the variables in the formulae based on averages collected from the literature. Peat failures, by their very nature, occur at localised weak spots - as such an average case analysis is entirely inappropriate. Notwithstand- ing these failures, sufficient detail has not been included to understand the modelling procedure. AGEC appear to claim that in areas of borderline stability, draining the peat will **increase** the factor of safety, while in stable areas it will **decrease** the stability. For example on page 26 of the report, it is claimed that piling an additional meter of peat at the site of Turbine 6 will reduce stability, while doing the same thing at Turbine 7 will increase stability. This is paradoxical, and is not an intended function of the Factor of Safety formula. The contradiction has not been discussed at all in the report. It throws doubt on all of AGECs findings.

3. The soft risk assessment techniques used ignore key factors such as forestry. This alone invalidates this assessment. The site is forested. This is considered one of the key factors leading to the Derrybrien bog slide, and is an acknowledged risk factor. This was omitted entirely from the analysis.

4. The report has failed to distinguish between peat stability on the site at present with the stability of the site during construction and operation. This is contrary to the judgement on the Knockranny windfarm, in which An Bord Plean ála commented that *the Board did not think it was appropriate to address the geotechnical concerns by*

means of condition. We interpret this note as an indication that it is inappropriate to conclude that no peat slippage will occur during the construction or operation of the wind farm based on analyses of the site in its current state. The absence of cracking or other visible signs of stress **in undisturbed bog** cannot seriously be taken as an indication that major construction works will not trigger a peat slide, for example.Again, we outline our belief that the minimum required in a peat stability analysis for a project of this scale should involve excavation to the bedrock of sample sites, and extensive testing to determine the response of peat on site to
e.g. the loading associated with construction and the vibrations associated with the operation of the wind turbine. Given the lack of theoretical understanding of the mass movements of peat, we consider anything less to be in violation of An Bord Pleanála's recommendation.

5. We refer now to the Straboy judgement, denying planning permission for a wind farm near Glenties in Co. Donegal. Again, peat stability concerns were key in this decision. It was considered by An Bord that the applicant had failed to demonstrate that their proposed development would not impact on the watercourses surrounding the site. The applicants in this case have likewise failed to provide such a guarantee. The other main reason given for the Straboy judgement was the failure of the applicant to provide sufficient detail on their peat deposition area. AGEC also prepared a report on this (Appendix 4.2) which lists general principals for the construction of a peat storage area. For details specific to the site, the reader is referred to Figures 7, 8, 9 repeatedly. **No such figures are in the report available online, as such sufficient detail on the pet storage areas is not available.**

Should my expertise be required in relation to any aspect of the application, please do not hesitate to contact me at **p.ocathain@gmail.com**.
Yours Sincerely,

Padraig Ó Catháin

References

[1] N. Boylan, P. Jennings, and M. Long, *Peat slope failure in Ireland*, Quarterly Journal of Engineering Geology and Hydrogeology (2008), 41, pp.93–108.

[2] R.A. Lindsay, and O.M. Bragg, *Wind farms and blanket peat: a report on the Derrybrien bog slide, Second edition*, University of East London Press (2005).

[3] An Bord Pleanála, *Order on planning appeal PL07.239053, for the erection of 14 wind turbines and ancillary works in Knockranny and Arderroo, Moycullen, Co Galway*, (2012).

[4] R. Creighton, A. Doyle, E. Farrell, R. Fealy, K. Gavin, T. Henry, T. Johnston, M. Long, C. McKeon, X. Pellicer, and K. Verbruggen, *Landslides in Ireland*, Geological Survey of Ireland (2006).

[5] Scottish Executive, *Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments*.

Professor Paul Johnston's Report

PROPOSED MEENBOG WINDFARM DEVELOPMENT, CO. DONEGAL

OBSERVATIONS ON HYDROLOGY AND ENVIRONMENTAL ISSUES

PLANNING REFERENCE : 160502

INTRODUCTION

The proposal for the Meenbog windfarm, as a major piece of energy infrastructure on the east side of Barnesmore Gap (N15), would appear to be a reworked but reduced version of the proposal for the Carrickaduff windfarm development of 2015 which was then refused planning permission. The current proposal for 19 turbines (reduced from 49), however, have been slightly altered in position on the western facing slopes in the reduced area of the townlands of Meenbog and Croaghonagh in Donegal. A small fraction of the proposed main cable route along the main N15 road is in Cashelnavean but the area of the townlands to the southwest along the rest of the cable route, which seems to be included in the site, are said, nevertheless, not to be part of this planning application. If the intention is to eventually expand the development into the areas covered by the original Carrickaduff proposal, then the Environmental Impact assessment cannot be piecemeal or correspondingly incremental. The credibility of the current proposal as a stand- alone/isolated development is somewhat undermined by the occasional headings and use of the titles of the former development –eg, Carrickaduff Windfarm is the heading on two of the letters of landowner consent and the Natura Impact Statement (Document no. 160502 - NIS - 2017.11.29 – F) writes about the statement being for the 'Carrickaduff Wind Farm development' in its opening paragraph.

The proposed Meenbog windfarm development now covers an area of approximately 10 km^2 although the actual site development involving roads and turbine platforms is said to occupy only 2.9% of this area. Although this is almost certainly an underestimate (as the construction footprint is only part of the affected area of the site), it is the environmental consequences of that area and its engineering that is important. For example, it has long been established that a narrow road plus drainage in a bog can have far-reaching impacts on the integrity of the bog.

VISUAL IMPACT

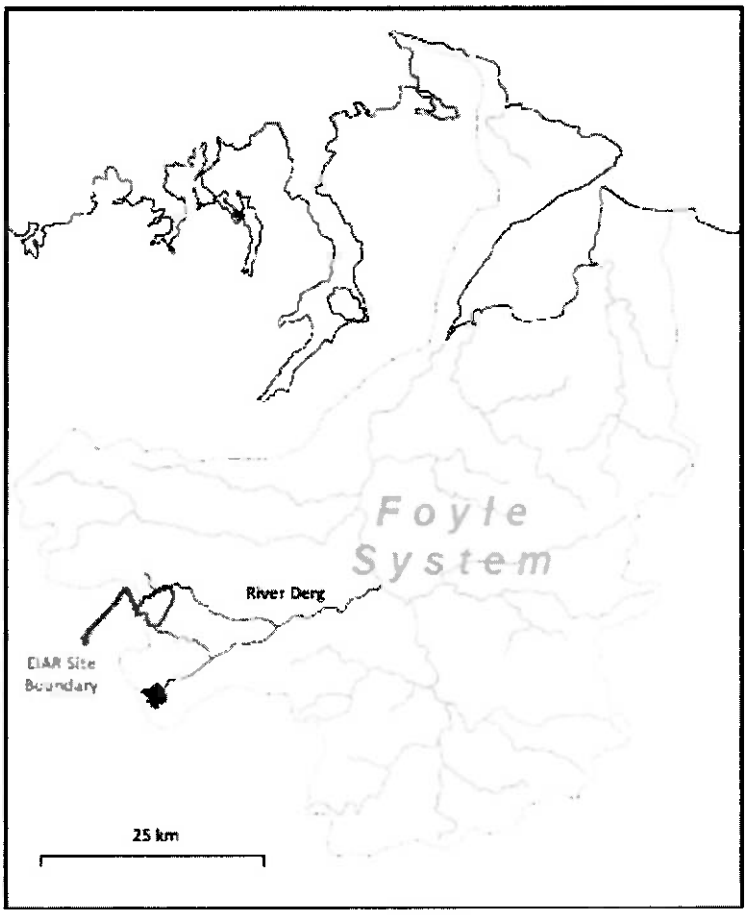
A principal concern of this proposal is the visual impact and the anomalous position of t windfarm in a landscape virtually surrounded and bordered by designated/protected areas such as SACs, NHAs and ASSIs (N.Ireland). The turbines are 156.5 m high on a slope having a relief of approximately 225m between N15 road level and the top of the ridge. In short, the turbines (as in the original proposal) are some 70% of the maximum relief in the landscape of the site. By any measure, these turbines will represent a significant visual intrusion, only mitigated slightly by the relatively small scale of the trees in the forestry which covers much of the site. The proposed turbines are significantly larger than most of those in the nearest windfarm development and in many cases, 50% taller. The included maps of visual impact in the EIA Report clearly demonstrate the wide impact of the scale of this windfarm development although the impact is often described as 'moderate' in the report, and not just along the N15.

The impact on a scenic landscape of 19 large turbines and the need to conserve such a landscape is the subject of the EU Landscape Directive. The flat valley of the Barnesmore Gap is a scenic landscape well-recognized in Donegal as well as nationally. That the area is worthy of conservation is demonstrated by the number of designated areas (under the Habitats Directive) on both sides of the border. As shown on an EIAR drawing (no. P1249-2-1217-A3-906-00A), the site borders the Barnesmore Bog NHA, the Cashelnavean Bog NHA, the Croaghonagh Bog SAC and pNHA as well as the River Foyle SAC & ASSI in Northern Ireland.

HYDROLOGICAL CONTEXT

The site sits almost entirely in hydrological catchments that are tributaries of the River Foyle. Only a small part of the site (and the cable route) close to the N15 road is in the Lowerymore River which drains southwest towards Donegal town. While the tributaries on the site have different names, they all connect across the border to the northward flowing River Foyle, discharging to the sea through Derry. While all the tributaries are a designated SAC/ASSI, this designation has been made by Northern Ireland agencies, so the legal designation stops at the border which is also the eastern border of the site. However, hydrologically, all these tributaries on the site feed directly into an SAC. Turbines T7 and T9 are on the banks of the Shruhangarve which actually forms the border with Northern Ireland adjacent to the site. Turbines T1, T2, T3 and T5 are all close to the un-named tributary flowing into Northern Ireland at the southeast corner of the site. The rest of the turbines are in the catchment of the Bunadaowen River which flows into the Mourne Beg and ultimately into the Foyle. While the forestry ultimately drains into these tributaries (and may be responsible for apparently slightly elevated nutrient levels

reported in the EIAR), the infrastructure for the windfarm will almost certainly exacerbate these effects. Notwithstanding an effective drainage system, the hydrological pathways will still lead to tributaries directly discharging into SACs/ASSIs.



The location of the site as depicted by the Fisheries Consultant in the EIAR.

HYDROGEOLOGICAL DATA :

The development of this windfarm is reported as requiring over 22 km of roads (albeit grafted onto an existing forestry track network), 19 turbine bases and 3 'borrow pits' to be used as repositories for excavated peat and soil material. The excavations required for this infrastructure will require over third of a million cubic metres of material (peat, soil and rock) to be removed and 'redeployed' either in the repositories or as part of 'landscaping'. As for the previous windfarm proposal, such a scale of material removal represents a significant potential impact on the environment and demands a good understanding of the existing geology and hydrology in which it is to take place. The improved field data on which the analysis in the EIAR is based consists of an extensive survey of peat depths using probes and gouge cores

with a single round of water quality and flow sampling at selected surface water points September 2017. Only four 'one-off' surface water flows were measured and no direct investigation of groundwater appears to have been undertaken, although excavation depths for the proposed borrow pits are as much as 12m below existing ground level.

Although the peat probing has established a range of depths of peat to be removed (ranged from 0 to 5.8m), the probing seems to have stopped at the encounter of mineral soil or bedrock. However, those thicknesses of mineral soil encountered indicate the amount to be removed is typically less than a metre. Although little seepage was observed in existing old borrow pits, no direct investigations of the bedrock was undertaken; thus the role of the bedrock subcrop is unknown and the presence of groundwater and its flow pathways under the blanket bog has not been established.

The EIAR reported an assessment of the hydrological regime and a water balance for the site. It is well known that this area of Donegal has a highly variable but relatively high rainfall so that the hydrological response of blanket peat catchments can be expected to be equally as variable. The source of the reported rainfall data ('Ballybofey at Lough Mourne') was difficult to verify but there is a Met Eireann station at Ardnawark at Barnesmore which is very close to the site and its 35 year record confirms the high annual rainfall of 1861mm. The maximum recorded daily rainfall was 87mm which is significant for drainage design. The nearest hourly gauge is at Finner near Donegal town (8years record) and with a lower annual rainfall of 1244mm. Nevertheless, the maximum hourly fall was 18mm. These figures confirm the importance of understanding the role of drainage on this site, especially with respect to the stability of the peat and the potential for pollution of streams (eg suspended sediment runoff). While the drainage system on site has been designed with an estimated 100 year/6 hourly rainfall, there is no substitute for measured data which apparently was available but not used. Moreover, without direct discharge data for the streams on site, any water balance cannot be validated and carries large uncertainty. Hence the stated negligible role of storm drainage from the development infrastructure remains largely unquantified.

As is widely recognized, defining a hydrological regime in an area, either surface or groundwater, is a process of characterizing a dynamic process and needs sampling in both time as well as spatially. Ideally, a year's worth of monitoring water levels and quality is required. However, a single round of water quality monitoring at a few selected surface water stations as reported in the EIAR is insufficient to establish a hydrological regime. In a high rainfall, rapid

runoff regime such as at Meenbog, a single round of sampling is highly unlikely to be representative – the low concentrations of water quality parameters, not surprisingly, do not reflect the reported biological 'at risk' status of the downstream rivers.

Apart from the improved peat probing, the EIA appears to rely largely on interpolated and estimated conditions based on published information. Real data is needed in order to have confidence in an analysis of the actual impact of the development, especially in a development of this magnitude. Ad hoc conditioning of planning approval is not a solution either.

GEOLOGY

Any analysis of impact has to understand the hydrological pathways involved at the site, as acknowledged in the EIS chapter on Water. The hydrology of blanket bogs is often difficult to evaluate, particularly in damaged areas such as under forestry – the role of tree roots, the associated drainage and tree interception has a significant impact on natural hydrological pathways for runoff and corresponding rates of runoff. At this site, concern is on the role of the mineral soil (grades of silt/clay ranging to gravelly clay) which is reported as occurring beneath the peat at some turbine sites (11 of 32 reported gouge cores), and probably across most of the area. The hydrological pathways at the base of the peat, above the mineral soil, and also at the mineral soil-bedrock weathered interface is unknown. At blanket bog sites elsewhere, the flow pathways at the base of the peat have been found to be very significant, depending on the source of the recharging water. The gneiss/schist bedrock at the site is assessed as being of low permeability. It is assumed in this EIS that some 80% of effective rainfall (ie rainfall less evapotranspiration) will drain as near-surface runoff. The other 20% is assumed to drain to 'groundwater'. This is probably not the case here, given the damaged nature of the blanket peat and the possible infiltration rates occurring following clear felling (adjacent to roads and at a radius of 70m around each pad) and the increase in flows at the base of the peat. A cause of peat slope failure on other windfarm sites has been related to the role of this 'drainage plane' at the base of the peat, particularly during construction when large areas of water entry at this level are exposed. Each turbine foundation represents a window cut through the peat/mineral soil/bedrock sequence exposing these layers to further water ingress, notwithstanding the landscaping and drainage measures planned. An analysis/assessment of the hydrological (and peat stability) conditions in *the as-built* situation is required if the EIAR is to have credibility.

GROUNDWATER

Although most of the site is situated on a 'Poor Aquifer', the groundwater bodies involved a reported as being in 'Good Status', it is acknowledged in the EIA that whatever state a water body has, its status should not be further impacted/affected by the proposed works. As mentioned, the baseline condition of the groundwater, its quality and flow, has not been evaluated and given the depths of excavation of the borrow pits and turbine foundations, groundwater cannot be assumed to be unaffected. As a consequence of this lack of knowledge, no estimate can be given of the likely impacts of any resulting discharges to the environment.

BORROW PITS

Three 'borrow pits' , as before, have been proposed as an ingenious solution to the combined problem of sourcing rock material for construction while also providing repositories for excavated peat and soil. The issue that arises, however, is one of methodology and any consequential environmental impact. In order to create these pits, excavations of up to 12 m depth in cells up to a cumulative 100m long are required. To create these cells in bedrock, significant excavation (peat, rock and mineral soil) have to be removed first – indeed, in total, as most of the excavated peat and soil (~350,000 cu.m.) across the whole development will be placed in the borrow pits, excavation of the borrow pits themselves has to coincide with the site development process. Moreover, at Borrow Pit 1 there is reported to be up to 4.7 m thickness of peat to be removed, over the bedrock. The logistics of temporarily removing this material, and completion of the excavation in bedrock at the same time as the removal of peat/soil from roads and turbine pads will demand considerable temporary storage. At the least, this needs an outline method statement and an assessment of environmental impact.

The borrow pits are situated on elevated ground, being close to the headwaters of streams, two of which drain southwards to the Mourne Beg, a protected stream in Northern Ireland and one to the Glendergan, also a protected stream. While some are on slopes as steep as 6 degrees (Pit 2), the effect of the topography has been mitigated by creating level cells or, effectively, tanks in the bedrock. While this is a useful design solution, it appears to conceive of the 'tank in the bedrock' as the containment for the peat/soil and rock material to be deposited (notwithstanding the 4.7 m of peat at pi 1). The connection with groundwater in such circumstances becomes critical – if the rock tank is in low permeability bedrock, the high rainfall will rapidly infiltrate the material in the repository and ultimately cause overflow with consequential effects on any re-vegetation or landscape restoration, apart from impacts on drainage. On the other hand, if

the tank 'leaks', the impacts on groundwater occurring as baseflow in the stream headwaters may occur.

It is also reported in the EIAR that approximately 2000m^3 'of tar' from the works on the cable trench route will be placed in the borrow pits. As tar is a classified hazardous material, the potential for pollution is high and under the EU Groundwater Directive, such dumping is not permitted.

In short the environmental impact of these repositories has not been fully assessed and could be significant.

DRAINAGE

While the drainage from roads and pads is utilizing a well-developed design for windfarm development on the basis of keeping the hydrology as close to possible to the natural condition (while keeping storm drainage from hard surfaces separate), its application here raises a number of issues. In a hydrologically flashy environment, especially in high rainfall areas, as acknowledged in the EIAR, drainage should take account of flows from extreme events rather than relying on maximum monthly averages. The data for assessing an appropriate 'design storm', however, was not collected/evaluated so the impact of the increased runoff from sealed and semi-sealed surfaces carries considerable uncertainty. While a mapped Met Eireann 6 hour storm of return period 100 years was used to design the drainage system, its validity in such a variable rainfall area is in doubt. For example, taking a recorded maximum hourly rainfall of 18mm (at Finner, the nearest station with such data), a determination of the peak runoff in the vicinity of T2, (using a standard urban runoff calculation) indicated a significant value of 25 litres per second. Although the storm runoff is designed to be separated from the 'natural' catchment runoff, the discharge points for T2 are very close to/in the buffer zone for the tributaries of the Glendergan (a protected SAC across the adjacent border). Given the slope of this site and the density of infrastructure, the risk to surface water is high and suggests the overall unsuitability of this landscape for such development.

While the imposed buffer zone along stream courses is good practice, some of the drainage infrastructure appears to be right on or inside these boundaries (eg T2,7,8,9,10 and 18). Related to this issue are the likely pathways to be taken by the 'diffusing', draining discharges, particularly close to streams and where clear felling will have changed the infiltration

characteristics of the peat. The role of the roadways and improved forestry tracks in creating new drainage pathways also needs assessment particularly now, through comparison with windfarm developments that have been in place for some years. Recent cases have demonstrated the effect of windfarm roadways in causing excessive runoff, especially in high rainfall events.

An assessment of the likely discharge rates (and the ability of drainage to cope) as well as the relevant pathways needs to be undertaken for an environmental impact to be credible in the planning process. In short, it is not just the increased volumes of runoff that will occur from the change in landuse but the greatly increased *rates* of runoff that will impact on drainage pathways and on a sensitive landscape and they must be evaluated and validated. In such a high rainfall area and with this density of infrastructure, effective drainage will be difficult to achieve in a sustainable way.

PEAT STABILITY

This site is on a high rainfall, western facing slope of blanket peat. Slopes vary from near flat to as much as 15 degrees. While the average thickness of peat is about 1.7m, it is over 5m in places. This irregular rock surface with locally deep pockets, sometimes with a skin of mineral soil below the peat, is not unusual in the west of Ireland. As reported in the geotechnical report, this results in pockets of extremely liquid peat. Thus the in situ shear strength measurements of peat across such as site are of limited value, given the areal variability and the uncertainty attached to assessments of 'factors of safety', particularly when the most risk of failure attaches to the period of excavation when the peat profile is exposed. Moreover, the assumed extent of drainage (as mentioned in the carbon balance exercise) is very likely to be a gross underestimate. Although most of the peat cover is relatively thin, the steep slopes in some places give concern with respect to the stability of the excavations involved, especially given the high rainfall (averages 5mm per day!) and the nature of the construction involved.

CONCLUSION

The review of the hydrological and environmental data provided in the EIAR suggests that while the investigations made and the data collected are an improvement on the previous undertaking for the Carrickaduff proposal, there remain fundamental issues with this site as a suitable location for a wind farm, notwithstanding nearby permitted developments. In spite of

.e forestry, the visual impact of 19 very tall wind turbines on a landscape of great amenity value will be significant and a detriment to its value for tourists and for residents alike. Moreover, the potential for environmental impact is high notwithstanding inadequacies in data collection. The density of the infrastructure (albeit small in net constructed area), in a high rainfall area surrounded by, and adjacent to, several designated and protected habitat sites on both sides of an international border make this a particularly sensitive development. The evaluation of the hydrological and hydrogeological regime and the changes that would be expected from the development is inadequate for the risks involved.. Planning permission should not be granted in the face of such inadequacy, in view of the environmental sensitivity of the site.

Paul Johnston

15 February 2018