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Michael Mahony
SASES

GWP Report No: 210602

Our ref: mm020621
Your ref:

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Dear Mr Mahony

Post-ISH16 Technical Submission on Flood Risk Matters in Friston Village due to Scottish Power Renewables proposed EA1N and EA2 Onshore Works

This letter constitutes a brief technical critique of the flood risk related matters discussed during the Issue Specific Hearings 16 (ISH16) held on Wednesday 26 May 2021, and the additional documentation submitted by Scottish Power Renewables (SPR) before the Hearing, on Infiltration Testing.

After formalities, the letter follows the agenda items and order determined by the Examining Authority during ISH16 on Flood Risk and Drainage.

Qualifications of Author

This letter has been prepared by Mr Clive Carpenter. Clive has a BSc (Hons) in Geology, an MSc in Hydrogeology and Groundwater Resources, is a Fellow of the Geological Society (FGS), Chartered Geologist (C.Geol), Chartered Member of the Chartered Institute of Water and Environmental Management (C.WEM, CIWEM) and Associate Member of The Academy of Experts (AMAE). Clive has more than 30 years of post-graduate experience in water resources management, water hazard mapping and risk reduction, flood risk assessment, climate change vulnerability assessment, and disaster risk reduction, both in the United Kingdom and overseas.

Instructions

SASES instructed Mr Carpenter in June 2019, to provide expert independent advice and review of the SPR environmental statement and related documentation, with respect to the flood risk impact on Friston Village, and to ascertain whether flood risk has been i) assessed in accordance with policy on site location; ii) adequately investigated; and iii) adequately mitigated.

Flood Risk and Drainage During Construction

The Applicants' position as stated previously is that the Construction Phase surface water management cannot be determined at this time due to a lack of detailed design of the proposed sub-stations and therefore a lack of detail on construction method statements.

We note Suffolk County Council (SCC) disagreed with this position, stated they expect to see a similar level of flood risk reduction and water management control as the Operational Phase of the project (1 in 100 Year Return Period), and highlighted that the construction period requires water management over much larger areas, in different locations and sub-catchments to the operational footprint of the site, and has to address issues of turbidity due to soil stripping that do not exist during the operational phase.

We GWP on behalf of SASES, in addition to agreeing with the SCC position, stated that the Applicant could readily evaluate the maximum disturbed area or even entire area within the Order Limits as assumed to

require surface water management, and demonstrate that a conceptual scheme (or schemes), phased where necessary, could drain surface water run-off to sufficient storm water storage structures in appropriate and necessary locations, size based upon the required LLFA design storm Return Period, and discharging at a rate consistent with reducing flood risk to Friston Village and achieving the necessary turbidity clarification.

The Applicant has made no attempt to date to demonstrate that such conceptual construction phase surface water management is possible on the site and as such has not confirmed whether construction phase surface water management sufficient to prevent an increase in flood risk to Friston Village is actually viable.

Instead, the Applicant referred to a lack of technical standards and procedures for construction phase drainage and stated the purpose of such drainage was to protect the construction site itself.

This self-evidently misses the primary concern of SASES' challenge on this issue, which is that the Applicant has not, and continues to not, consider the increased risk of flooding to Friston Village due to increased run-off rates, volumes and turbidity generated during the construction phase.

Operational Flood Risk and Drainage

a) Results and Implications of Infiltration Testing

Prior to ISH16, the Applicant submitted a document entitled 'Initial Infiltration Testing – Preliminary Results'.

The Applicant reported in ISH16 that they had used the minimum results of these tests to inform the outline design of, and the areas required for, the Infiltration Only and Hybrid surface water management scheme options. The Applicant concluded the options were both viable.

We note SCC however challenged the validity of the infiltration tests and stated they would not accept the results. Specifically, SCC referred to the CIRIA SUDS Manual (2015) and to the requirement for 3 repeat tests in each trial pit, quoting the Manual directly:

'It is important the test is carried out in accordance with the report [Bettess (1996) which is based on BRE (1991)] and that the test pit is filled three times. Repeating the test in this way can reduce the measured infiltration rate by at least half an order of magnitude each time the test is repeated, and is likely to reflect realistic event conditions … Stating that in failing to repeat the tests three times, the Applicant was using infiltration values potentially one or more orders of magnitude to high, which given the values selected by the Applicant, would move the infiltration rates from being acceptable to non-acceptable, and the required areas from being achievable to unachievable.

When questioned by the Examining Inspector as to why 3 tests were not completed in each trial pit, the Applicant responded that they had insufficient time to undertake the 3 tests and provide results to submit to ISH16.

We GWP on behalf of SASES, in addition to agreeing with the SCC position stated above, made the following challenges to the inadequacy of the testing and use of their data:

i) 4 out of 10 tests (40%) did not achieve sufficient infiltration to enable an infiltration rate to be calculated as per the SUDS Manual and BRE (1996) formulae;
ii) The Applicant chose to ignore these tests, describing them as invalid. This is not a correct use of the observed lack of infiltration – these tests actually demonstrate that ground conditions at these locations were so impermeable as to prevent infiltration disposal as being an option;
iii) Lack of infiltration was observed at both the northern and southern infiltration basin locations;
iv) Contrary to SUDS Manual guidance the testing was not undertaken within the footprint of the proposed basin areas but at the periphery;
v) The Applicant failed to provide geological details of the trial pits – inconsistent with SUDS Manual requirements;
vi) The Applicant has made no attempt to identify the depth to the groundwater table beneath the proposed infiltration basin areas – despite this being a critical parameter to determine infiltration basin performance, and being a stated requirement in the SUDS Manual.

We conclude that these tests at best demonstrate that not only highly variable ground conditions exist on the site, including extremely low permeability strata incapable of supporting infiltration, but that the lateral extent of this low permeability remains unknown, as does the depth to groundwater, and therefore the viability of using ground infiltration remains entirely unproven.

Moreover, the Applicant has chosen to ignore the 'unfavourable' readings, and use higher values to explore outline design.

The Applicant responded that the failed tests were due to the collapse of the pits and that the only viable repeat test provided a higher infiltration rate than the first test.

We GWP would highlight here that 2 of the 3 trial pits that collapsed actually gave acceptable infiltration rates, hence pit collapse cannot be used as a reason for discounting the tests per se, and indeed the Applicant's report states 'heavier, impermeable soils would not collapse …'. The Applicant's response above is therefore factually incorrect and technically wrong.

The Applicant has used the lowest calculated values (57mm/hr and 63 mm/hr) and reduced the Factor of Safety used in their calculations from 10 to 5, based upon their perceived reduced uncertainty around infiltration values.

We note SCC challenged the reduction in the Factor of Safety (FoS), and referred to the SUDS Manual in which the consequence of damage occurring due to under design merits an FoS of 10. SCC stated they would only accept an FoS of 10.

We GWP, on behalf of SASES, in addition to agreeing with the SCC position stated above, made the following points:

i) The infiltration tests, including the low permeability observations of negligible infiltration not used by the Applicant, demonstrate that infiltration varies on the site by at LEAST one order of magnitude and therefore an FoS of 10 remains valid to reflect this variability;
ii) The basins are above ground on their western and southern sides, and could, by the Applicants own calculations, retain volumes of water up to and beyond the Reservoir Act (ie > 25,000 m^3) behind landscaped bunds, creating a risk so significant immediately uphill of a residential village as to justify an FoS of at least 10, given the consequences of infiltration non-performance, over-topping and bund failure.

The Applicant's response regarding the Factor of Safety was confused and self-contradictory, with Mr Davis stating the FoS related to the consequence of design failure whereas Mr Innes stated it related to the likelihood of failure (ie due to ground conditions).

GWP's response at the ISH16 was that the flood risk to Friston Village due to under-design of the structures was a function of likelihood and consequence, and that the unintended retention of up to 60,000m^3 of storm water within the retention basins due to over-estimating the infiltration rate, created a risk so significant should the structures over-top and the bunds collapse warranted at the very least an FoS of 10, if not relocation of the proposed site altogether.

b) Indicative Design

The Applicant stated that using their selected infiltration values there are practical solutions available to address surface water management, but they would not be drawn on the final form, location, area of the SUDS basins as there were too many other variables to consider at this time.

In response the Inspector asked whether the ability to drain the proposed site had been considered during site selection?

The Applicant stated they had considered drainage during the site selection process, but they were constrained by the limitations of the area made available to them and other landscaping and biodiversity requirements.

SASES (both Richard Turney and GWP) challenged this point stating surface water flood risk and management had not been included in the site selection process, and the Applicants' statement that they had done so was wrong and misleading and reflected instead a consideration of river (fluvial) flood risk only and not surface water run-off (pluvial) flood risk or groundwater flood risk. Indeed, if pluvial flood risk had been considered, this location would have been highlighted as being problematic.

GWP further stated the importance of infiltration to reducing Total Flows to pre-development levels to avoid increases in flood risk, and that all indicative designs discussed by the Applicant commenced with the ignoring of the unfavourable minimum infiltration responses observed during the recent trial pit tests.

The Applicant then stated there was no evidence base for flood risk in Friston, based upon a numerical model. SCC challenged this statement saying Friston village was regularly flooded. GWP directed the Hearing to the substantive photographic evidence base provided by SCC of flooding in the village, as well as the lack of data available to calibrate the model effectively and the well-publicised comments of the residents that the model was under predicting the modelled flood event.

c) Outline Operational Drainage Management Plan submitted at D8

i) Infiltration/Hybrid Storage Volumes

The Applicant verbally provided new revised volumes and areas in ISH16 based upon their selected infiltration rates from the infiltration testing, advising both options were viable – this was not the case for the D8 submission, which concluded infiltration was not viable.

The Applicant stated the volumes were smaller than in their D8 submission and that they would provide further details as part of their D11 submission.

SCC raised concerns that all of the Applicants' surface water management scheme designs in D8 were caveated as subject to the availability of space required for other land priorities eg landscaping and biodiversity. SCC also raised concerns about the water depths in the basins stating these exceeded their SUDS requirements.

We GWP, on behalf of SASES, raised the following points, which form part of the SASES D9 submission:

- The Applicants' calculations are based upon selected infiltration rates from tests already demonstrated to be unreliable and which selectively ignore the lowest observed infiltration rates in 40% of the trial pits;
- The Applicant has provided verbal calculations directly into ISH16 only, providing no opportunity for evaluation, familiarisation and checking – this is unreasonable;
- The Applicant always caveats the outline designs as subject to constraints and demands of land area for other site requirements;
- The Hybrid Option in D8 does not maximise infiltration, it actually allows all water above the lowest 0.5m depth of retained water to be sent to surface discharge, this is not consistent with the SCC SUDS hierarchy;
- No details of TOTAL flows discharged off-site are provided – there is a key requirement to not increase TOTAL flows leaving the site;
- The design volumes proposed at <2% larger than the calculated volumes required – this is unacceptably small, given the consequences of structure failure;
- The maximum volumes of water that could be retained by the structures if they do not work as intended exceeds the exemption of the Reservoir Act – demonstrating the risk these structure present to the village of Friston;
- None of the design work has considered the risk of shallow groundwater interfering with the infiltration performance; and
- There has been no assessment of increased groundwater flooding risk to Friston Village.

In summary we GWP conclude the viability of the infiltration and hybrid designs remains unproven due to the use of subjectively selected infiltration rates and no assessment of groundwater depth, the groundwater flood risk associated with the structures has not been assessed, and the proposed designs are too large a risk for this location, yet too small to adequately prevent flood risk from increasing.

ii) Discharge to Friston Watercourse

The Applicant provided no further details to its D8 submission of a buried outfall beneath the Friston Watercourse immediately north of Church Lane.

SCC stated it had concerns about the risk of damage due to traffic loading on the pipeline and outfall due to its shallow burial depth, and they advised they were awaiting advice from their Highways Team. But SCC stated its earlier concerns about blockage risk would be addressed if robust maintenance was undertaken under a legal binding maintenance agreement between the Applicant and the Environment Agency.

We GWP, on behalf of SASES reiterated our position submitted at D9, as follows:

- Blockage risk to a small diameter pipe outfall due to the heavy sediment loads already experienced in the receiving water course and the location of the outfall on the watercourse bed;
- Blockage risk within the discharge pipe due to the proposed presence of a wet woodland to be located within each stormwater basin – the basins should be devoid of substantive vegetation;
- Crushing risk due to inadequate cover depth beneath the road and upstream watercourse which is also the farm access road;
- Erosion and exposure risk due to the pipeline itself being located partially under the farm track, which is the Ordinary Watercourse.

We GWP, conclude the viability of the discharge to Friston Watercourse remains unproven, as resolving these risks is mutually exclusive – deepening the pipe burial to reduce crushing and erosion risks increases blockage risk from the receiving watercourse, and vice versa.

iii) Adoption and Maintenance

The Applicant confirmed they would maintain the systems during the operational phase.

SCC stated that they would require the authority to regulate these structures, given they are storm water flood risk management structures in a highly vulnerable environment and this would necessitate appropriate engineering design and maintenance, and could not be a vegetated environment.

East Suffolk Council (ESC) stated they wanted to regulate the design and maintenance, due to the integration of landscape and biodiversity needs.

We GWP, on behalf of SASES, in addition to agreeing with the SCC position above, reiterated our D9 submission position that not only have no details of maintenance been provided by the Applicant during the operational phase, nor the post-operational phase, but that the size and risk posed by the volumes of water that could be retained in these structures required an engineering design and maintenance regime, including inspections, of equivalent rigor to that required under the Reservoir Act, and that this was entirely inconsistent with the soft landscaping bunds and wet woodland ecosystem environment proposed for the surface water management scheme basins, which will result in infiltration clogging, outfall pipe blocking, water volume rise and eventual over-topping of the structures.

d) Relationship with the Outline Landscape and Ecological Management Strategy (OLEMS)

The Applicant confirmed the outline of the SUDS basins on the OLEMS drawings submitted immediately prior to ISH16 are smaller than those in their D9 submission.

SCC stated that they would not accept wet woodland inside the water storage structures nor on the bunds.

We GWP, on behalf of SASES, in addition to agreeing with the SCC position above, stated the use of soft or non-engineered landscape bunds was inappropriate and inconsistent with water retention structures of such size that if full of water would present a risk so substantial that ordinarily they would need to be regulated under the Reservoir Act. The risk of uncontrolled over-topping of such non-engineered bunds could result in catastrophic failure of the bunds and release of the entire water volume.

The Applicant's response was that the bunds would be designed with engineered overflow structures.

GWP stated this had not been mentioned in any information provided by the Applicant to date, and we do need see how this is consistent with the high value landscaping and biodiversity enhancement that the OLEMS is attempting to deliver.

Yours sincerely

Clive Carpenter

Partner and Head of Water Resources