APPEAL REF: APP/M3645/W/25/3372747

Land south of Barrow Green Road, Oxted.

Proof of Evidence

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1.0. Background

1.1 Hydro-GIS Ltd was engaged by Tandridge District Council ('TDC') in October 2025 to provide expert witness services on hydrology as part of the appeal against the decision of TDC to refuse planning permission for the Land South of Barrow Green Road, Oxted. This current document provides a proof of evidence from an independent perspective to TDC to assist with their refusal to grant planning permission.

2.0 Company Profile

2.1 Hydro-GIS Ltd is a specialist consultancy offering expert services in hydrology and Geographical Information Systems (GIS) which is specialist computer software used to store, manage, analyse, edit, output, and visualise geographical data.. The company was founded in 2004 and it has UK and international project experience ranging in size from flood catastrophe model development at a continental scale to site specific studies at the property level. Hydro-GIS Ltd has considerable experience in the UK undertaking numerous projects relating to hydrology and flood risk such as flood risk assessments for developers, hydrology reports for homeowners to assist with insurance or the sale of a property, and expert witness advice.

3.0. Qualifications and Experience

3.1 I am a consultant hydrologist with over 30 years' post graduate experience. I have a BSc in Environmental Science from Lancaster University and a PhD in Hydrological Modelling from Exeter University. I am is a Fellow of the Royal Geographical Society, a member of the British Hydrological Society and was awarded chartered water and environmental manager status in 2003. I have been Director of Hydro-GIS Ltd since 2004 undertaking a range of hydrological projects in the UK and overseas, most of which have been flood related including the application of hydrological modelling and GIS. I am also an Associate Professor at UCL contributing to the MSc in Geophysical Hazards since 2005.

3.2 The information provided in this proof is in accordance with the Royal Geographical Society Code of Conduct (https://www.rgs.org/about-us/governance/code-of-conduct). I confirm

that the opinions expressed are my true and professional opinions. I confirm that the evidence that I have prepared and provided is true to the best of my knowledge.

3.3 Hydro-GIS Ltd was engaged by the Oxted and Limpsfield Residents Group in March 2025 to undertake a flood risk survey of the development site and a review of the application documents. This included a visit by one Hydro-GIS Ltd staff member in April 2025. Following a meeting with TDC staff and the Surrey Wildlife Trust in August 2025 which discussed the need to assess seasonal impacts of the development on The Bogs, Hydro-GIS Ltd was then given the role of providing expert witness services to TDC in relation to the Planning Inquiry from October 2025. I also visited the site in October 2025.

4.0. Evidence Base

4.1 The hydrological studies at the application site undertaken by consultants on behalf of the applicant do not assess the impact of the proposed development on the hydrology of The Bogs. All of the work undertaken has been to satisfy the policy requirements relating to flood risk and surface water management. Although this submitted information has been approved by the Lead Local Flood Authority, it is purely for the management of flooding and drainage from extreme events and does not consider the impact of the development on the day to day hydrological process which is key to maintaining The Bogs habitat as an ancient wet woodland.

5.0. Site Description

5.1 The development site is an area of moderately sloping agricultural land on the western site of Oxted. The site borders an area of ancient wet woodland to the south known as The Bogs, and a small area of this wet woodland (not including the ancient woodland) extends into the site in the far south-west corner. The location of these areas is shown in the satellite image in Figure 1.

Figure 1. The location of the development site and The Bogs in Oxted, with contours at 4m intervals (Satellite Image Google Earth, 2025).

5.2 The topography of the area is steep to rolling as indicated in Figure 1 with the land falling from north-east to the south-west from 112m to 96m AOD. The land continues to slope towards the south-west in The Bogs to below 92m AOD. The area is underlain predominantly by permeable sandstone with areas of impermeable mudstone in the north, and superficial deposits of alluvium in the west.

5.3 The development site is in the catchment of the River Eden with the main channel flowing south through the centre of Oxted, some 1km to the east. An unnamed stream flows along the west of the site and continues into The Bogs (Figure 2). The Bogs also receive surface water runoff directly from the development site where springs emerge in the southern part and water flows to the south, a feature which is commonly observed (as shown in Figure 3). This water will find its way into the stream but during wet periods water will pond in depressions causing water-logging within the woodland (Figure 4). The Bogs may also receive groundwater from sub-surface flows emerging as springs further south into the wet woodland of the bogs.

5.4 The development site is characterised by arable land with a bridleway running across the site from north-west to south-east. An area of the far south-west of the development site was observed to be saturated during the visit in April 2025, with water flowing towards The Bogs as presented in Figure 3.

5.5 The stream channel and network of water-logged depressions within The Bogs generate the specific ecology associated with the wet woodland. The stream channel is not always flowing and has become dry during the summer or prolonged dry periods (Figure 5). Initial hydrological modelling by Hydro-GIS Ltd using cell-based analysis in GIS to generate flow pathways based on the topography, identified the flow of water from the central part of

the site to the south towards The Bogs (Figure 6), as had been observed from visiting the site.

Figure 2. The un-named stream flowing through The Bogs (April 2025, Hydro-GIS Ltd)

Figure 3. Surface runoff as sheet flow from springs in the southern part of the development site flows into The Bogs (April 2025, Hydro-GIS Ltd)

Figure 4. General water-logging and ponding in The Bogs (February 2007, Oxted and Limpsfield Residents Group)

Figure 5. The un-named stream in The Bogs during dry conditions (October 2025, Hydro-GIS Ltd)

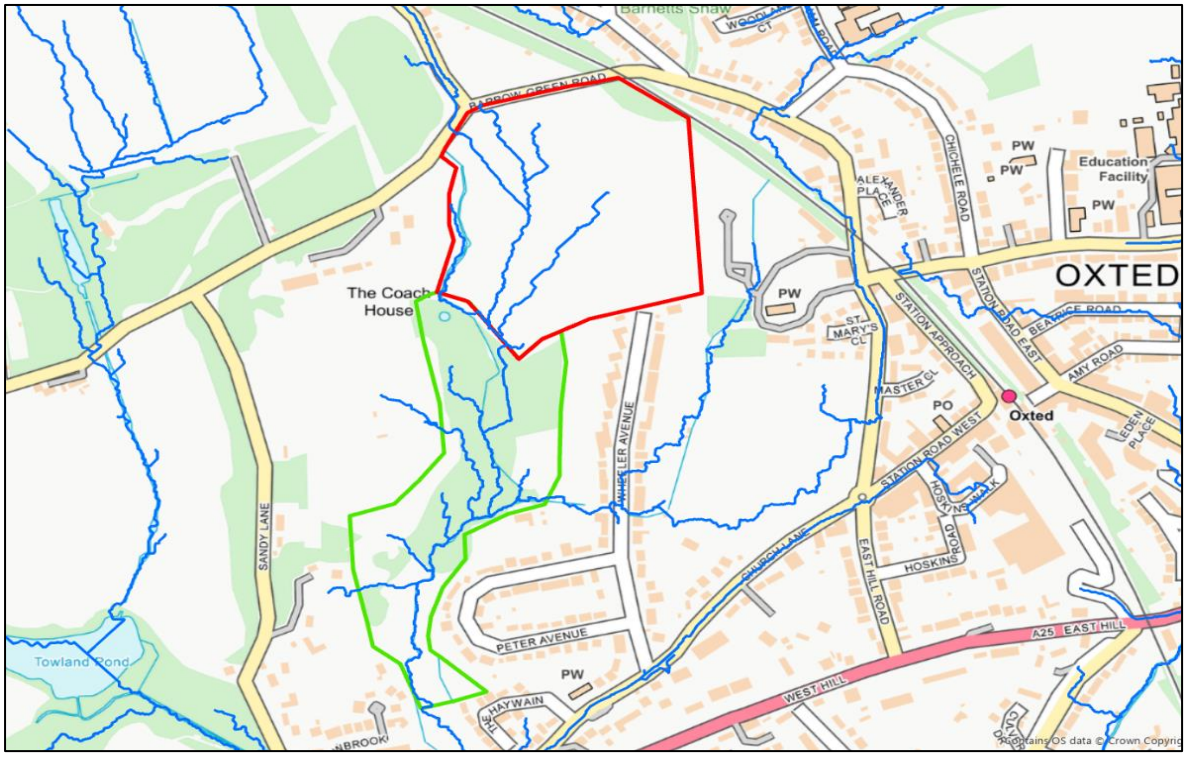

Figure 6. Flow pathways based on topography shown in blue for the area around the development site and The Bogs.

5.6 An evaluation of wet woodland, including identifying the characteristics of this habitat, how it is formed and how it should be managed is covered in a document by English Nature and the Countryside Council for Wales: *Eco-hydrological guidelines for wet woodland - Phase 1*. Information on the importance of groundwater and surface monitoring for wetland sites and how this should be undertaken is presented in a document by the Environment Agency: *A Guide to Monitoring Water Levels and Flows at Wetland Sites*. Both of these have been included in the list of core documents and provide information on how the potential impacts of the proposed development on The Bogs should be assessed.

6.0. Potential Hydrological Impact on The Bogs

6.1 As the development site is upstream of The Bogs and water from the site flows into The Bogs, the impact of the development on the hydrology and ecology of this sensitive part of the landscape would need to be considered as part of the application. In this context the hydrology refers to the full annual hydrological regime in relation to the water cycle and it is not just restricted to what can happen during extreme flood events.

6.2 As a starting point for the assessment of any impact, an adequate representation of the baseline (i.e. pre-development) conditions is required. This would not necessarily need to be a detailed monitoring programme measuring flows in different parts of The Bogs but it could look at the rainfall and weather conditions over the course of the year, observing when water is present in The Bogs and to what extent, identifying how this is related to other

hydrological observations on the site such as the flow in the stream on the western boundary and groundwater levels in the southern part of the site, and overall building up a conceptual hydrological model of The Bogs.

6.3 Once the adequate baseline conditions have been established an exercise could then be undertaken using the design of the site layout and surface water drainage to identify what the difference would be in terms of the flow of water into The Bogs and the impact this would have. This may be informed by hydrological modelling although the type of models used would need to consider wider ranging factors than just the impact of flood flows such as the annual water balance and the groundwater flows.

7.0. Flood Risk Assessment and Drainage Strategy

7.1 The consultants working on behalf of the applicant have undertaken a flood risk assessment and drainage strategy (FRA) for the proposed development, dated November 2024, which has been supplemented with a technical note (Technical Note 1) dated July 2024 and a further technical note (Technical Note 2) dated October 2025. The FRA was undertaken in order to meet the requirements of the Environment Agency (EA) and Lead Local Flood Authority (LLFA) in relation to flood risk and surface water management. This was to ensure the risk of flooding to the proposed development from rivers and surface water was low and that the flood risk to neighbouring properties was not increased by including a SuDS design to manage the additional surface runoff from the impermeable areas of the new development.

7.2 The work only considered the impact of the proposed development on the hydrology of the site in relation to flood risk, through the application of hydrological and hydrodynamic modelling to assess the flow in the stream over a range of flood magnitudes for the existing and developed site scenarios. The description of the site hydrology in the FRA made no mention of The Bogs as an area bordering the site nor did it describe any of the characteristics. The only aspects of relevance were that the hydrology described mapped watercourses flowing along the western and eastern boundaries of the site and that they met 175m to the south of the site. In addition a brief assessment of the hydrogeology (i.e. the status of water in the soil and bedrock below the ground surface) the FRA identified the area where springs emerge in the southern part of the site and that the groundwater flow direction is most likely in a north-west to south-east direction. The FRA mentioned that ground water monitoring wells were installed in the permanently wet area and recorded water levels at or near the surface, but no proper monitoring of groundwater levels in boreholes was undertaken over a period of time and no records of the depth and geology were presented from these wells. The only information on the underlying geology was from four trial pits excavated to a depth of 2m, shown in Appendix D (Trial Hole Logs) of the FRA. If boreholes have also been sunk at the site for monitoring groundwater then similar logs should appear for the boreholes. These would be expected to be deeper than the trial pits which have been excavated by a digger. Commonly boreholes sunk using a drilling rig extend 10m below the surface and often over 30m for exploration purposes (as indicated on the British Geological Survey Geoindex website (https://www.bgs.ac.uk/map-viewers/geoindex-onshore/).

7.3 The FRA has not included any sampling and analysis of water to give an indication of the baseline water quality, either from the stream, the groundwater or surface water in The Bogs. Not only is the ecosystem of The Bogs dependent on the quantity of water but the quality of the water should also be established. An assessment of the potential sources of pollution from the developed site has been included in the discussion of the SuDS measures at the site but as with the quantity of water, no attempt has been made to consider the impact on The Bogs on the changes in the quality of water discharged from the development site. The impact of pollution on the wet woodland environment is highlighted in the English Nature / Countryside Council For Wales guidelines document in Figures 22 and 23 (Pages 139-140).

7.4 Technical Note 1 was written in response to comments from the LLFA in order to meet approval for the SuDS design. The only drawing of the site layout included in the FRA (Appendix B) shows a sequence of detention ponds along the western margin of the site. The FRA states that the surface water runoff from the developed site is proposed to be discharged to existing surface water. Technical Note 1 included an updated layout drawing showing the SuDS of the site in more detail and the direction of flow. Ultimately the discharge of surface water will be from two pipes (point sources) from detention ponds in the south-west corner of the site to the existing ordinary watercourse that flows along the western boundary of the site. These will be discharge at a restricted rate, to meet the LLFA requirements. This would therefore be different from the existing situation where water from the site can reach The Bogs via the multiple and diffuse sources from spring emergences and overland flow shown in Figure 3 (page 4 of this proof). This change in the inflow to The Bogs both on the surface and below ground has not been identified in the FRA nor Technical Note 1 and therefore the potential impact on The Bogs has not been considered.

8.0 . Technical Note 2

8.1 Technical Note 2 (CD2.13) was submitted by the consultants in October 2025 after TDC had refused the planning application. This note acted directly in response to the reason given in the refusal in relation to hydrology and ecology: *"The applicant has not demonstrated that the proposed development, and in particular the outline drainage proposals, will not result in the loss or deterioration of an irreplaceable habitat both on-site and off-site, that is The Bogs ancient woodland, within and adjoining the site boundary."*

8.2 The note concentrated on four points where the consultants undertook further work to address the reason for refusal, which had been highlighted from the review of documents prepared by Hydro-GIS Ltd working on behalf of Oxted and Limpsfield Residents Group:

- Point 1 Suggested further flood model simulations at a range of return periods for the existing conditions and following development, and look at a typical annual water balance;
- Point 2 Suggested a programme of groundwater monitoring to understand the seasonal variation in the groundwater levels (at the site) and flows in The Bogs and surrounding area to give an idea of the baseline conditions;

- Point 3 With the proposed use of detention ponds part of the surface water would be held on site and lost through evaporation rather than reaching The Bogs, a water balance of the ponds was suggested;
- Point 4 Assuring that the volumes and quality of the water flowing from the development site to The Bogs are not altered under the proposed drainage strategy.

In response to these points the Technical Note included the following:

- Point 1: Further simulations of the flood modelling were undertaken to consider the effect of 1,2,5,10 and 30-year events in addition to the 100-year and 100-year +45% climate change events. However, no simulations or assessments were made to consider the typical annual water balance, hence the full extent of the impact of the developed site on the hydrology of The Bogs has not been assessed.
- Point 2: Technical Note 2 stated that groundwater monitoring wells were installed in parts of the site shown to be permanently wet. However, no information was presented on the exact location of these, or the geological logs and no proper programme of monitoring was reported on within the technical note. Technical Note 2 simply re-stated paragraph 2.9 from the earlier FRA and it assumed that single observations from the wells and trial pits showed there was a flow of groundwater from north-west to south-east. The conclusion was that based on this brief assessment, the role of surface water and groundwater in sustaining the environment of The Bogs had been considered. This is an inadequate assessment and it does not represent a programme of groundwater monitoring over a longer period encompassing the full range of seasonal conditions, nor does it attempt to relate the groundwater levels on the development site with the water level in The Bogs and the flow of water to The Bogs, or identify the full extent of the groundwater catchment.

8.3 It also does not attempt to consider the area which could contribute to the groundwater emerging at the spring, as shown in Figure 3 of this proof on the southern section of the site. The consultants have stated that the area around the location of the spring will not be built on, however the spring will be formed from the coalescence of groundwater over a wide area (the groundwater catchment), not just the immediate surrounds. The groundwater catchment is not the same as the surface water catchment as it is defined by the extent of the aquifer and the level of the groundwater across the aquifer. The consultants need to identify the flow directions of groundwater to the spring, the contributing groundwater catchment area and whether preventing infiltration from the developed area of the site, given in the FRA as 3.5ha, would have a detrimental impact on this spring and other groundwater flows to The Bogs. This will require a network of boreholes across the development site and extending into The Bogs, not just a few boreholes around the area of the spring.

8.4 Point 3: Technical Note 2 and further direct discussion with the consultants confirmed that the detention ponds would not provide any permanent storage of water and that the outlets would be at the base of the pond. However this information was not provided on any of the drainage strategy drawings in the FRA or Technical Note 2. Provision of these drawings is required to confirm this statement, the drawing from Technical Note 1 Appendix B shows this information and could be issued as a free standing drawing. If the ponds do not permanently retain any water then a water balance calculation for the ponds is not necessary.

8.5 Point 4: Technical Note 2 re-states that under the proposed development layout there will be no diminution in the supply of water to The Bogs based on the modelling of the flood events. However Technical Note 2 does not consider the impact of the development on flows to The Bogs under non-flood conditions nor does it consider the changes in how the water is now delivered to The Bogs in that all of the surface water draining from the developed part of the site is now discharged via the detention ponds into the stream feeding The Bogs, and there is no assessment of what may happen to the surface water flow to The Bogs as shown in Figure 3.

9.0. Missing Information

9.1 Overall the FRA and technical notes have not provided adequate additional information on the how the development site may impact on the hydrology of The Bogs. Information is needed on the baseline hydrology of The Bogs which could be identified using the following:

- Installing a network of boreholes with regular monitoring over a long period (e.g. every 1 – 2 weeks over a year) to get the full seasonal variation in water levels, the flow
- Directions of ground water flow and an idea of the extent of the groundwater catchment;
- Concurrent monitoring of flows and water levels in the watercourses draining to and within the Bogs. This does not have to involve detailed flow measurements it can just be a visual observation or a level from a stage board or consistent measuring location
- Concurrent assessment of occurrence of surface water runoff to the Bogs and the extent of surface water ponding within The Bogs through visual assessment with photos
- Comparison of monitoring with rainfall measurements e.g. EA gauge at Godstone S Wks
- Measuring the quality of the water in the stream, in groundwater and surface water within The Bogs to give some baseline values
- Developing a conceptual hydrological model of the Bogs and in particular showing the importance of the contribution of flow from the development site.

9.2 Then the impact of the development needs to be assessed in terms of the overall hydrology not just considering the effect of the proposed drainage scheme on flood events. This should consider the following:

- The impact of the flows from the developed area of the site which is being changed from diffuse sources to two point sources into The Bogs
- The reduction of infiltration to groundwater from the developed area of the site with all surface water now going through the drainage features
- The effect of the reduced infiltration on the groundwater emergence in the south of the site and the subsequent overland flow into The Bogs
- The impact on any changes in the quality of water discharged to The Bogs.

10. Conclusions

10.1 The development site is bordering a sensitive area of ancient wet woodland known as The Bogs. This area is downslope of the development site and it currently receives water from the stream flowing along the western boundary of the development site, surface runoff and potentially groundwater from the development site.

10.2 Any change to the land use of the development site is likely to have an impact on the flow of water into The Bogs and therefore affect the sensitive ecosystem which is characterised by the presence of water. It is essential therefore that the application includes an assessment of the impact of the development on the hydrology of The Bogs.

10.3 The work undertaken on behalf of the developer in the form of a flood risk assessment and drainage strategy plus follow up technical notes has only considered how the development may impact The Bogs during flood events rather than considering the impact on the overall hydrological regime. That is what is expected day to day under average conditions over the course of an annual cycle to identify the seasonal influences.

10.4 In order to assess the impact of the development baseline hydrological conditions in The Bogs should be identified through a seasonal programme of monitoring and the impact of the development should be identified through knowing where water is going to be redirected. This could be illustrated through developing a conceptual hydrological model of how The Bogs function. This seasonal programme of monitoring is required as in the UK groundwater levels and river flows demonstrate a seasonal variation. These are generally higher in winter due to higher precipitation and reduced evapotranspiration (evaporation and uptake by plants) then lower in summer with reduced precipitation but increased evapotranspiration. An indication of seasonal maximum and minimum levels would be required to properly identify the hydrological regime of The Bogs. The EA guidance document shows an example seasonal monitoring output on page 23.

10.5 The work which has currently been submitted by the developer does not provide this baseline information nor does it provide a proper assessment of the impact of the development on the hydrology of The Bogs.

References

British Geological Survey (2025) Geoindex website (https://www.bgs.ac.uk/map-viewers/geoindex-onshore/)

English Nature Countryside Council For Wales (2005) Eco-hydrological Guidelines for Wet Woodland Phase 1. English Nature, Northminster House, Peterborough PE1 1UA.

Environment Agency (2003) A Guide to Monitoring Water Levels and Flows at Wetland Sites. Environment Agency, Rio House, Almondsbury, Bristol BS32 4UD.