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Review of the Flood Risk Assessment and Geotechnical Reports for the proposed development at Meadow Lane, Iffley, Oxfordshire.

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Executive Summary

In summary, the following key points have been identified for the Flood Risk Assessment (FRA) and Geotechnical and Geo-environmental Site Assessment for the proposed development at Meadow Lane, Iffley, Oxfordshire:

1. The FRA is dated December 2022 and the Geotechnical and Geo-environmental Site Assessment is dated August 2021.
2. The FRA is limited and lacking some basic information on flood risk at the site, such as the site topography, a proper description of the hydrology, evidence of historical flooding, predicted flood levels from the Environment Agency and a proper assessment of climate change.
3. The lack of any photographic evidence in the FRA suggests that the authors have not visited the site to make a full field-based assessment.
4. The FRA has used outdated methods from the 1970s for estimating greenfield surface runoff and design rainfalls.
5. The FRA has ignored information provided in the Geotechnical and Geo-environmental Site Assessment to give an incorrect assessment of the groundwater flood risk.
6. Field based infiltration tests and assessments of the seasonal maximum groundwater level are missing from the FRA.
7. The FRA does not provide an adequate Surface Water Management Plan, Foul Water Management Plan or robust SUDS design.
8. The FRA should be rejected by the local planning authority.
9. The Geotechnical and Geo-environmental Site Assessment is much more thorough and detailed than the FRA and raises concerns about the impact of groundwater on foundations, basements and tunnels for the new development.
10. The Geotechnical and Geo-environmental Site Assessment does not consider the issue of contamination and soil erosion during construction and gives an incorrect assessment of the potential impact on the nearby Iffley Meadows SSSI.

Background

Water Resource Associates LLP (WRA) was engaged by Friends of Iffley Village (FOIV) in January 2023 to undertake a review of the documents submitted as part of the Planning Application for a housing development at Meadow Lane, Iffley, Oxfordshire. This work follows an earlier study undertaken by WRA in May 2021, which considered the background environment, hydrology and risk of flooding for the same development site. This current report makes frequent reference to the information presented in the May 2021 report so they should be reviewed together.

This current report provides a review of only of the documents (and their appendices) submitted as part of the application which are relevant to flood risk. Documents submitted which cover other issues will be reviewed by other professionals.

Document Contents

The review considered six document files altogether. These were a Flood Risk Assessment and Drainage Strategy (provided in a single file) and a Geotechnical and Geo-environmental Site Assessment (provided as five files). The contents of each of these files are listed below:

Flood Risk Assessment and Drainage Strategy Meadow Lane, Iffley
The Hill Group, 9th Dec 2022, 56 pages total.
Document File Name:
22_03078_FUL_FLOOD_RISK_ASSESSMENT_AND_DRAINAGE_STRATEGY-2899002.pdf

Page 1 Title page
Page 2 Document control
Pages 3-4 Contents
Pages 5-23 Main text
Pages 24-25 Appendix A Greenfield Runoff rate calculations (MicroDrainage runoff rates report)
Page 26-27 Appendix B Proposed site layout (drawing)
Page 28-31 Appendix C Post-development runoff calculations (Tekla Tedds Design Rainfall report)
Page 32-33 Appendix D Surface Water Drainage plan (drawing)
Page 34-48 Appendix E Microdrainage Model results (MicroDrainage report)
Page 49-50 Appendix F Foul Water drainage plan (drawing)
Page 51-53 Appendix G Thames Water asset enquiry (letter to Mr James Marsh, dated Nov 2021)
Page 54-55 Appendix H Maintenance Schedule (table)
Page 56 Cover page

Land off Meadow Lane, Iffley Geotechnical and Geo-environmental Site Assessment
RSK Geosciences, August 2021, 152 pages total.
Document File Name: *22_03078_FUL-GEOTECHNICAL_AND_GEO-ENVIRONMENTAL_SITE_ASSESSMENT_-_PART_1-2899039.pdf*

Page 1 Title page
Page 2 Document Control
Pages 3-4 Contents
Pages 5-51 Main text
Pages 53-56 Figures
Pages 57-59 Appendix A Service constraints
Pages 60-62 Appendix B Summary of legislation and policy relating to land contamination
Pages 63- 152 Appendix C Environmental database report

Document File Name*: GEOTECHNICAL_AND_GEO-ENVIRONMENTAL_SITE_ASSESSMENT_-_PART_2-2899040.pdf*

Pages 1-9 Continued Appendix C from previous file, Environmental database report (maps).

Document File Name: *GEOTECHNICAL_AND_GEO-ENVIRONMENTAL_SITE_ASSESSMENT_-_PART_3-2899041.pdf*

Pages 1-20 Continued Appendix C from previous file, Environmental database report (maps).

Document File Name: *GEOTECHNICAL_AND_GEO-ENVIRONMENTAL_SITE_ASSESSMENT_-_PART_4-2899051.pdf*

Appendices, 108 pages total.
Pages 1-4 Continued Appendix C from previous file, Environmental database report (maps, photograph)
Pages 5-10 Appendix D Supporting desk study information (images of Borehole log report)
Pages 11-108 Appendix E Utility service plans (text, maps, images)

Document File Name: *GEOTECHNICAL_AND_GEO-ENVIRONMENTAL_SITE_ASSESSMENT_-_PART_5-2899062.pdf*

Appendices. 100 pages total.

Pages 1-43 Continued Appendix E from previous file, Utility service plans (text and images)
Pages 44-50 Appendix F Site reconnaissance photographs (photos)
Pages 51-54 Appendix G Technical background
Pages 55-63 Appendix H Exploratory hole records (log data)
Pages 64-75 Appendix I Laboratory certificates for soil analysis (text and tables)
Pages 76-81 Appendix J Laboratory certificates for geotechnical analysis (text and tables)
Pages 82-92 Appendix K Generic assessment criteria for human health (text and tables)
Pages 93-95 Appendix L Generic assessment criteria for phytotoxic effects (text and tables
Pages 96-97 Appendix M Generic assessment criteria for potable water supply pipes (text and tables
Pages 98-100 Appendix N GQRA data screening tables – soils (tables).

FRA Review

A Flood Risk Assessment (FRA) is a detailed report which is submitted as part of a Planning Application. This is required where development sites are shown to be within areas of medium to high risk of flooding, as shown on the Environment Agency's (EA) Flood Zone Maps or required for any areas in excess of 1 ha in area. For the Meadow Lane site, this is subject to both requirements. The aim of the FRA is to consider the flood risk to the development site from all sources and to ensure the flood risk to neighbouring properties is not increased by the development. The level of detail associated with an FRA should be proportional to the scale of the development, therefore a greater level of detail would be expected for a significant housing development, such as in the current study, as opposed to a proposed single dwelling development.

The 56-page report submitted by Ridge and Partners LLP would appear to be of considerable detail given its length. However, only 18 pages are actual written text within the FRA, the majority of the document is made up of the appendices including drawings, reports from other organisations, and printouts from modelling software. Within the 18 pages of report text, the actual relevant written information is limited, with figures, tables and lists making up much of the content. Given that the application is for a large development of 32 dwellings, the level of detail in the report is not commensurate with the scale of the development. In contrast, the WRA hydrology report for the site had 25 pages of written text and this was largely a desk-based study without the benefit of being able to access the site and take measurements.

Overall, the FRA is very brief for the size of the development, it is missing some basic information which is required as part of this type of assessment, other information which is presented is wrong and it has used outdated methods and data for the analysis. The key points where information is missing or incorrect are listed below:

1. The description of the site location is very short - no details are given on the current land use at the site nor any of the areas surrounding the site. There are no photos of the site

(which are normally included in an FRA) and this suggests the consultants working on the FRA have not even visited the site themselves.

2. The FRA is missing any detailed topographic information from the site. Normally an FRA would include a detailed topographic survey using DGPS and a description of the topography of the wider area showing the landscape setting of the study site. The only ground levels given are four corner levels in Table 2 of the FRA, showing a range of 63.58m AOD to 55.61m AOD. There is no indication to the source of this data. For the WRA report, we generated a 1m DTM for the study area, showing the ground levels ranging between 64.45m AOD and 55.05m AOD.

3. The FRA includes a description of the geology, with the text copied directly from the British Geological Survey (BGS) website. However, information is only given on the bedrock geology - maps and descriptions of any superficial deposits and the soil are missing. Note, the FRA classifies the bedrock for part of the site as the Temple Cowley Member, but the geology map in the WRA report classifies this as the Littlemore Member. The difference is due to the on-line BGS map viewer being updated in 2022 (both Members are given the same shading).

4. Brief details are given on the hydrogeology of the site but there have been no infiltration tests undertaken, or sinking of shallow boreholes to identify the depth to groundwater and a likely seasonal high level for the water table. Such information is an essential requirement for groundwater flood risk and surface water management. Groundwater levels will influence the building foundations and, together with infiltration rates, will help identify if any infiltration based measures for the site surface runoff are possible.

5. The section on hydrology simply states the site is 200m from the River Thames and identifies a drainage ditch along the western boundary. There is no information about the nature of the Thames catchment, basic hydrological parameters such as rainfall, evapotranspiration and runoff. There is no description about the drainage ditch such as its size, source, flow, water levels and how these vary over the seasons and no description about the nature of the development site, how the soil and vegetation absorb rainfall and whether the soils are seasonally saturated and give rise to surface runoff.

6. The assessment of flood risk only considers the information provided in the Environment Agency (EA) Flood Zone Maps, Surface Water Flood Maps and Reservoir Flooding Maps found on the government website. For an FRA, a standard requirement is to request detailed flood risk information from the EA which includes maps and incidents of historical flooding, predicted flood levels from detailed modelling, the results of climate change scenarios and the assessment of the flood hazard for people. This information was provided in the WRA report and it is essential to define the finished floor levels of any proposed dwelling to ensure this is a minimum of 0.3m above the design flood level.

7. There is no detailed assessment of the potential flow pathways around the site as an alternative to the EA Surface Water Flood Risk Maps. Using the 1m DTM and cell based modelling using the ArcGIS software, WRA produced maps showing two potential flow pathways from south-east to north-west passing through the centre and northern edge of the development site, indicating a higher risk of surface water flooding than is shown by the EA maps. (The historical flooding of Meadow Lane would support this).

8. There is no information on historical flooding at or near the site. This is a key part of any FRA and demonstrating an understanding of historical flooding, knowing where it has occurred and how it was caused would give the general public more confidence in the ability of the consultant to manage flood risk at the site and provide a suitable design for the development site drainage.

9. The FRA includes a mention of groundwater flooding but has not included any maps, such as the risk of groundwater emergence and predicted depth to groundwater (as were included in the WRA report). The assessment of the groundwater flood risk is wrong - simply assuming low risk because the permeable strata is classified as an unproductive aquifer is incorrect. The boundary between the permeable and impermeable strata across Oxford and the surrounding area has caused many problems for building construction. A much more detailed assessment should be undertaken, including monitoring of groundwater levels on site and making use of the predicted ground water levels across the Oxford area. This is one of the few locations in the UK where such modelling has been undertaken.

10. Without the additional information from the EA on predicted river levels, or surface water flow pathways based on topography or on-site groundwater levels, the consultants assessment of the overall risk of flooding is not valid.

11. An assessment of the risk of flooding from existing water infrastructure failure at the site from watermains and sewers is not included in the FRA.

12. An assessment of the flood hazard ratings and safe emergency access to and from the site is not included in the FRA.

13. A proper assessment of the impact of climate change to flood risk using the latest climate change allowances from the EA is missing. This should identify the time period over which the allowances should apply, and what level to apply, based on the nature of the development.

14. The figures showing the proposed development are of poor quality and the lack of any shading makes it difficult to differentiate between buildings, roads and other paved areas

and areas left as greenfield. The figures also lack any topographic information. Despite this, the 100-year flood extent is shown on the figures to extend right up to some building outlines. The 100-year plus climate change has a higher magnitude flood (by up to 0.6m according to the EA) and would therefore flood these properties. The FRA needs to include a proper assessment of the flood risk, including climate change scenarios.

15. The proposed drainage strategy is a major concern as the estimates of greenfield flow and rainfall are based on data and methods from the 1970s, namely the Flood Studies Report (FSR – NERC, 1975) as stated on page 9. This was replaced in 1999 by the Flood Estimation Handbook (FEH – Institute of Hydrology 1999) which has been the standard suite of software for flood estimation in the UK for the past 2 decades and has undergone numerous updates, the latest in 2022. Anyone with a knowledge and understanding of flood hydrology would use the FEH methods. The use of the FSR based methods is simply not acceptable - it is outdated, it uses basic methods and data from the 1970s (such as paper maps and look-up tables) and estimates made using its methods have been shown to be highly inaccurate. Since it was published in 1975, there have been massive advances in the mathematical and statistical approaches, computer modelling, the use of GIS and some 50 years more data which already shows the effects of climate change.

16. The estimates of surface runoff from the development site use the Wallingford Procedure, which was published not long after the FSR (Kellagher, 1981) and also used rainfall and some other methods directly from the FSR. This method is also outdated and has been replaced by the FEH software which can provide flow estimates for urbanised scenarios.

17. The whole section on drainage design needs to be revised using the current FEH software to give the rainfall and greenfield flow estimates. Oxford City Council state in their SUDS D & E Guide (2018): “FEH methods are now preferred for estimating greenfield runoff rates”. The FRA then needs to clearly state the 100-year greenfield flow, the 100-year developed site flow (including an allowance for climate change) and the volume of attenuation (temporary storage) required so that the flow from the developed site would not exceed that expected from the greenfield site.

18. The FRA includes 14 pages of output from the MicroDrainage software, which is a drainage design software used by drainage engineers to assess the operation of a proposed drainage scheme. There should be a section of text included in the FRA to summarise this simulation and the results. The printed output confirms that the input rainfall has been taken from the FSR. These simulations should be re-run using the latest FEH rainfall.

19. The drainage scheme shows that the surface water will be attenuated in two underground storage areas using a cellular crate system. More details are required about this including dimensions, estimates of storage capacity and design drawings. However, it is not certain that these will be able to function as the groundwater level at these locations has not been

assessed. Also, such storage schemes are of no amenity or biodiversity value, they simply hide the excess water underground. Having a surface water feature in part of the site will provide the same amount of storage but will enhance biodiversity, provide amenity value and would make the residential area more desirable. Susdrain, the Construction Industry Research and Information Association website dedicated to sustainable drainage, (www.susdrain.org) states "*where ever possible runoff from developments should be managed on the surface. This enables their performance to be more easily inspected and managed with pollution incidents and potential flood risk being visible. Managing water on the surface can also greatly improve the quality of places by integrating water features into the development.*"

20. The only text in the FRA which covers the issue of contaminant transport from surface water form the developed site is a single sentence referring to a by-pass separator. The FRA does not give any attention to the different types and sources of contaminants. Given that vehicle access will be required, the impact of hydrocarbon from fuel leakage/spillage should be considered and appropriate measures such be included in detail in the design. Likewise the potential impact of and management of sediment in surface runoff into the drainage ditch and ultimately into the River Thames at the Iffley Meadows SSSI should be highlighted.

21. A single paragraph is given at the end of the FRA on the issue of foul water drainage. As the proposed site will include 32 additional dwellings, all requiring management of foul water, a proper Foul Water Management Plan is required. This should provide full details of the proposed foul water sewerage system and include permission from Thames Water that foul water discharge can be connected to their existing sewers and confirmation they will have the capacity for treatment at existing sewage treatment works. The Foul Water Management Plan should also address the issue of nutrient neutrality.

22. The FRA does not include a list of references, which is generally expected for this type of report, therefore checking the sources of the information presented is not possible.

Overall, the FRA is inadequate and should be rejected by the Local Planning Authority.

Geotechnical and Geo-environmental Site Assessment Review

The Geotechnical and Geo-environmental Site Assessment is a much more comprehensive document than the FRA and provides some of the additional details which the FRA should have referred to. It is well-written and provides details of the sources of information with an extended

list of references. This report generally covers all the potential environmental concerns relating to the development. For the current review we focussed on any aspect relating to the hydrology.

The report describes intrusive field investigations at the site with a total of eight trial pits dug across the site. Groundwater seepage was found in six of the eight pits, all of the pits which were excavated deep enough to encounter the permeable Beckley Sand Member. These pits were undertaken in June 2021 when groundwater levels would not be at their peak. The pits have since been filled-in, but groundwater monitoring using shallow boreholes should be undertaken throughout the winter and spring to find a seasonal maximum. The boreholes should also be used for infiltration tests, or new pits should be dug to enable this. Tests should be made when soils are likely to be most saturated in the winter/early spring.

The groundwater seepage was notable in some of the pits to the extent that three of the pits reported the walls collapsing and the report warned of rising groundwater affecting foundations basements and tunnels. This is in contrast to the FRA which assumed the risk of groundwater flooding to be low.

One aspect the Geotechnical and Geo-environmental Site Assessment fails to address is the potential impact during the construction phase. Excavation of the site would provide the potential for increased sediment erosion into the drainage ditch on the western boundary. This will drain into the River Thames downstream, where the Iffley Meadows SSSI is located on the west bank. The report identified the SSSI to be in close proximity to the site but considered potential risk to be very low. As there is a direct pathway for the drainage for the site to the SSSI, the risk is significantly greater. A proper assessment of the potential risk to the SSSI should be provided, including estimates of potential sediment erosion during the development phase and measures undertaken to prevent this erosion.

References

Institute of Hydrology (1999) *The Flood Estimation Handbook*, 5 Volumes. Wallingford, Oxfordshire.

Kellagher, R. (1981) *The Wallingford Procedure - for design and analysis of urban storm drainage.* HR Wallingford Ltd, Wallingford.

Natural Environment Research Council (1975) *The Flood Studies Report*, 5 Volumes. HMSO, Swindon.

McCloy Consulting and Robert Bray Associates (2018) *Oxford City Council SuDS D & E Guide.*

WRA LLP (2021). *Field at Meadow Lane/ Church Way, Iffley, Oxford: Hydrological Report*. June 2021.