



Land at Bird in Eye Farm, South of Bird in Eye Hill, Uckfield

Rebuttal Proof of Evidence

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BEng (Hons), MSc, C.WEM, MCIWEM, CEnv

PINS Ref: APP/C1435/W/22/3307820

LPA Ref: WD/2021/2198/MAO

On behalf of **Croudace Homes Ltd**

Project Ref: 48494/2002 | Rev: | Date: August 2023

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1 Introduction

1.1 Introduction

- 1.1.1 This rebuttal proof of evidence ('rebuttal') has been prepared in direct response to a number of points in the evidence of Mr Maiden-Brooks, acting for the Rule 6 party. This rebuttal also responds to two points raised by Mr Rainbow within his proof of evidence.
- 1.1.2 This rebuttal should also be read as an addendum to my proof of August 2023.
- 1.1.3 In preparing this rebuttal I have not addressed every point submitted in evidence by Mr Maiden-Brooks or Mr Rainbow, but this does not mean that I am in agreement with any point by virtue of omission.
- 1.1.4 This rebuttal has been prepared on the same terms as my proof of August 2023 and it remains the case that the opinions expressed are my true and professional opinions, given in accordance with the guidance of my professional institution.

2 The Evidence of Mr Maiden-Brooks

2.1 Introduction

- 2.1.1 Within Mr Maiden-Brooks' proof of evidence, he raises points around flood risk, relating to the sequential test, the flood risk from the ordinary watercourse flowing east-west through the site, which Mr Maiden-Brooks refers to as the Bird in Eye Shaw, groundwater, and safe access, and surface water drainage.
- 2.1.2 The majority of the points raised are addressed within my Proof of Evidence and have not been re-considered within this rebuttal.

2.2 Sequential Test

- 2.2.1 Mr Brown's Proof of Evidence explains why there is no need for a sequential test in this case, and I note that the Wealden District Council, Environment Agency (EA) or East Sussex County Council as Lead Local Flood Authority (LLFA) has at no time suggested otherwise. In any case, a sequential test has been prepared and is addressed within Mr Brown's Proof of Evidence from paragraph 8.63 onwards and within document SB2.
- 2.2.2 The sequential approach is discussed within Section 4.7 of my Proof of Evidence.
- 2.2.3 Within paragraph 3.2.7, Mr Maiden-Brooks notes that the red line boundary within the plans within the FRA (CDA.18) is limited to the northern half of the site and excludes the SANG area. The full development site including the SANG is considered within my Proof of Evidence and the plans within Appendix A of that document indicate the red line for the wider site.
- 2.2.4 Within paragraph 3.2.14 and footnote 28 of his proof, Mr Maiden-Brooks references a recent appeal decision for a site known as Little Bushey Lane in Hertsmere District. A greater proportion of the Little Bushey Lane development site is at risk of flooding from pluvial and fluvial sources, including approximately 7.9% of the site within Flood Zone 2 and 24.4% within the 1 in 1000 annual probability surface water extent. Furthermore, there is a surface water flow route that flows south-north through a parcel proposed for a primary school. The application proposals included significant land raising and roads proposed within the areas at risk of flooding, to the extent that the application was supported by both baseline and post-development pluvial modelling. Further, the LLFA called for a sequential test and the developer agreed that one had to be prepared. As such, the facts of that case are distinguishable, and the application of the sequential test as considered by the Inspector at Little Bushey Lane is not relevant for this appeal. Appendix A provides plans relevant to the flood risk and development proposals for the Little Bushey Lane site.

2.3 Flood Risk from the Ordinary Watercourse

- 2.3.1 Within Section 3.3 of his proof, Mr Maiden-Brooks raises concerns that the flood risk from the ordinary watercourse flowing east-west has not been considered adequately.
- 2.3.2 The risk of fluvial and pluvial flooding and the pedestrian accesses over this watercourse are considered within paragraphs 4.3.3, 4.4.2 and, 4.4.9-4.4.12 of my proof of evidence. These are matters in respect of which the LLFA appears to be entirely satisfied.
- 2.3.3 It is noted within paragraph 4.4.7 of my proof that the vast majority of the site lies over 5m above both the Framfield Stream and the ordinary watercourse. Within paragraph 3.3.5 of his proof, Mr Maiden-Brooks notes that no mapping or modelling has been provided to assess the impacts from the ordinary watercourse. It is considered that the risk to the majority of the development site from this watercourse is therefore negligible, given the small catchment of the minor watercourse and the topography of the site. During reserved matters and detailed design, hydraulic modelling can be undertaken to advise the design of any new footbridge

crossing if the LLFA requires and can be secured either through condition or as part of the land drainage consent application.

- 2.3.4 Within paragraphs 3.3.9-3.3.14, Mr Maiden-Brooks raises points around access to the SANG within times of flood. This is addressed within paragraph 4.4.11 of my proof of evidence. The footpath through the woodland will be self-binding gravel (paragraph 6.1.2 of my proof). The design of any new footbridge crossing would be the subject of a land drainage consent. If one or both of the pedestrian crossings is temporarily inaccessible due to flooding, there will still be safe, dry access to the area of the SANG to the north of the watercourse. If required by the Inspector, signage or a flood response management plan can be prepared for users of the SANG and secured through condition.

2.4 Groundwater

- 2.4.1 Mr Maiden-Brooks raises points relating to groundwater in paragraphs 3.3.17-3.3.29 of his proof. Groundwater is considered in Section 4.5 of my proof.
- 2.4.2 Mr Maiden-Brooks notes himself that *“it is unlikely the groundwater level will be significantly elevated across the parts of the site which are not directly adjacent to the existing watercourses. Consequently, providing a sufficient buffer between these watercourses and the development is maintained, it is unlikely any proposed SuDS features, such as soakaways or storage ponds, will intercept the natural groundwater table”*.
- 2.4.3 Stantec has recommended that a cautious approach is adopted regarding groundwater and maintains that further analysis of groundwater levels through additional monitoring would be beneficial as detailed design progresses.
- 2.4.4 Groundwater is considered further, specifically with regard to the surface water drainage strategy, in paragraphs 2.6.22- 2.6.26.

2.5 Safe Access

- 2.5.1 Within Section 3.4 of the Mr Maiden-Brooks' proof, points are raised regarding the existing flood risk to the Framfield Road. This is also considered within paragraphs 4.3.12-14, 4.4.13-14, 4.7.6 of my Proof of Evidence.
- 2.5.2 Mr Maiden-Brooks refers to a flood event on 3rd November 2022 which caused flooding to Framfield Road. This was a notable event and forecast to be such; the Met Office National Severe Weather Warning Service issued Yellow warnings for rain for this area on 2nd and 3rd November. The EA issued a Red flood warning in advance of this event. Mr Maiden-Brooks estimates this event to be between a 1 in 2.9 to 1 in 4.8 year return period within his proof.
- 2.5.3 Mr Maiden-Brooks does not provide any evidence as to the duration of flooding on Framfield Road. Given the size of the catchment, it is assumed that the duration was a matter of hours, as per 4.3.13 of my proof.
- 2.5.4 There is no gauged data on the Framfield Stream or near the site to advise on likely duration of flooding. Nearby flood warning gauges within the wider catchment have been interrogated to provide some understanding. The speed of the response of a catchment to heavy rainfall and the duration that high flows are maintained for are a function of catchment size and geometry. A small catchment will be flashier, responding more quickly, than a large catchment.
- 2.5.5 Observed level data at Isfield Weir on the River Uck, which the Framfield Stream flows into, is available at gaugemap.co.uk. Figure 2.1 below presents the levels recorded at Isfield during the November 2022 event. Following the rainfall on 3rd November, river levels are within the 'flooding possible' range for approximately 20hrs.

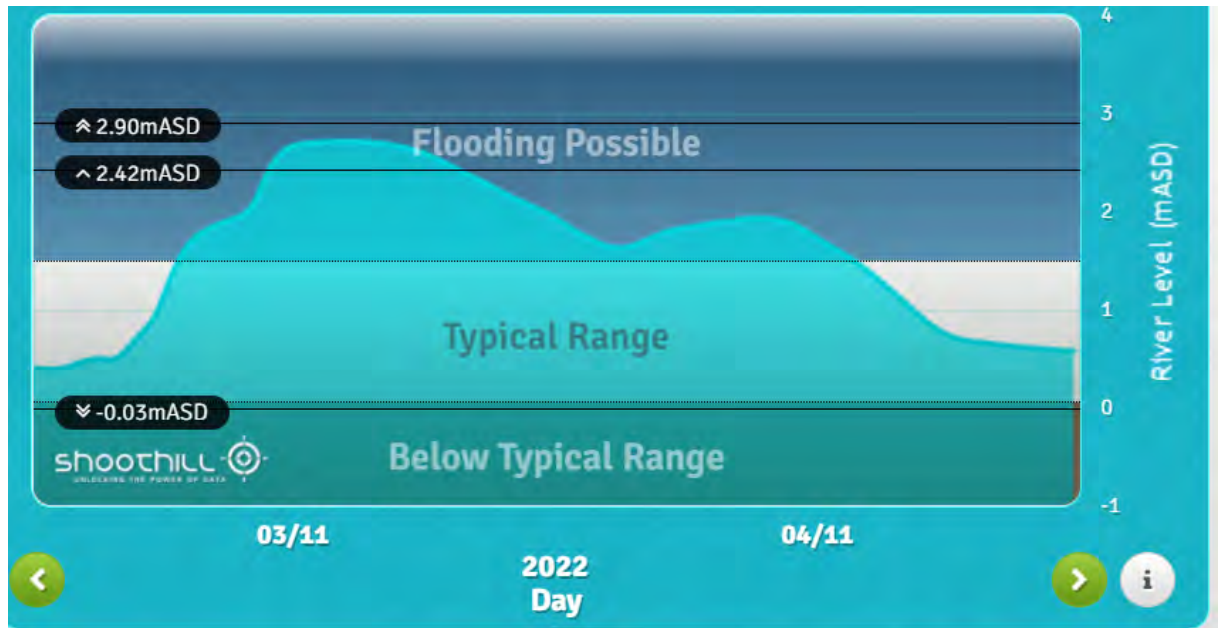


Figure 2.1: Gaugemap level data observed at Isfield Weir, 3rd November 2022.

- 2.5.6 Data is also available at Buxted, which is located on the River Uck upstream of Uckfield and the confluence of the Framfield Stream (Figure 2.2). Water levels here are within the 'Flooding possible' range for approximately 12 hours.

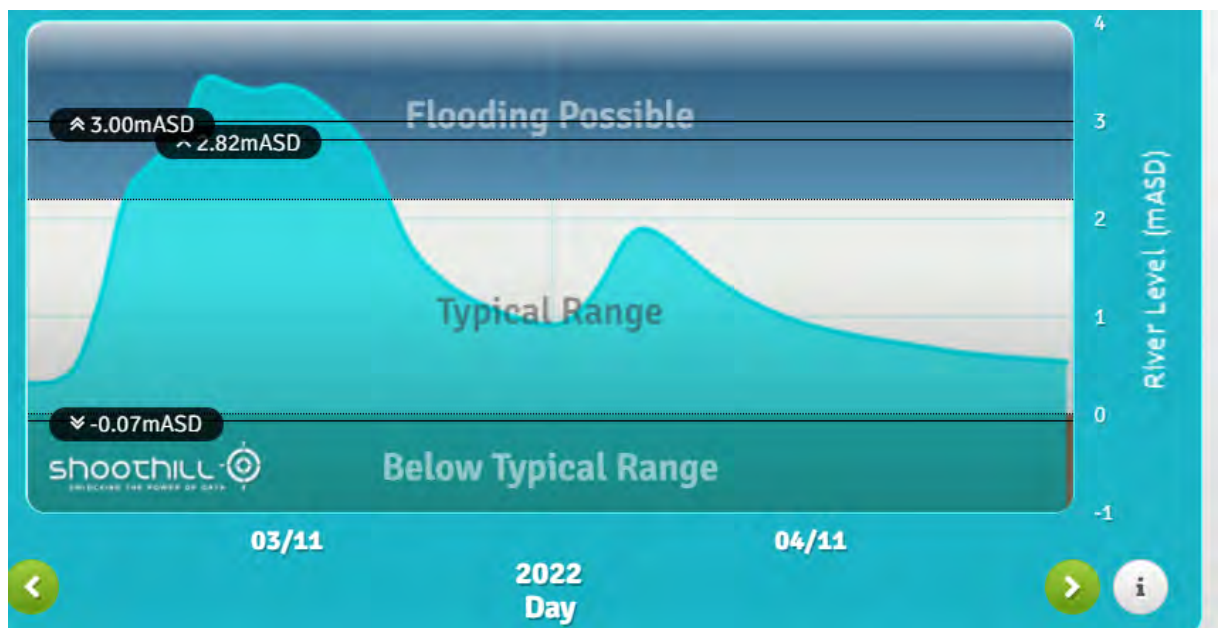


Figure 2.2: Gaugemap level data observed at Buxted, 3rd November 2022.

- 2.5.7 The River Uck catchment to Isfield Weir is approximately 88km². The catchment area of the River Uck to Buxted is approximately 34km². The Framfield Stream tributary has a catchment area of approximately 12km². As the Framfield Stream is only a small proportion of the River Uck catchment to Isfield (approx. 13.5%), it is anticipated that the duration of flooding to the Framfield Road was a matter of a few hours only, as it will be flashier than both the observations at both Isfield and Buxted, and peaks will recede quickly.

- 2.5.8 As per my proof, there is safe access from the development site to the east in the rare event of the Framfield Road being flooded. The duration of such flooding would be a matter of hours, not days. There are routes available to Uckfield in the event of a flood that, while further, will be safe and dry. Mr Maiden-Brooks indicates one of these alternative routes in Figure 12 of his proof. No anecdotal evidence has been found for any flooding on these roads (Brookhouse Lane or Pump Lane) or any road closures on these alternative routes in the event of a flood.
- 2.5.9 The issue of access into Uckfield along Framfield Road at the time of extreme, short duration flood events has not, so far as I am aware, been raised by WDC, the highways authority, EA, LLFA or emergency planners.
- 2.5.10 If considered necessary by the Inspector, a flood response management plan can be prepared to inform future residents of alternative travel options and secured through condition.
- 2.5.11 As set out within my proof of evidence, the development proposals will not increase the existing risk of flooding to Framfield Road.

2.6 Surface Water Drainage

- 2.6.1 Bird in Eye Farm has a surface water management system comprising soakaways and tanks, as confirmed by the landowner. There is no evidence, such as erosion or rills, onsite of any uncontrolled surface water runoff flowing from the built development of Bird in Eye Farm downstream into the development site. As such, there is no need to consider the upstream catchment of Bird in Eye Farm within any surface water drainage measures for the development. The concern raised by Mr Maiden-Brooks in his paragraphs 4.1.29-32 is therefore unfounded.
- 2.6.2 Mr Maiden-Brooks has noted in paragraph 4.1.38 that the surface water drainage strategy calculations in the FRA appear to exclude green spaces, despite agreeing with the LLFA that the green spaces upstream of the proposed basin would be assumed to be impermeable at this outline stage. Stantec can confirm that this is correct, and the green spaces have been mistakenly omitted from the impermeable areas' calculations. However, additional calculations are presented below which demonstrate that a drainage strategy can be provided that supports the 290 dwellings regardless of this omission.
- 2.6.3 Gardens have (consistent with the pre-application discussions with the LLFA) been intentionally omitted from impermeable area calculations as these are generally acknowledged to remain largely permeable post-development. Gardens may have increased water demand post-development, when compared to the undeveloped condition, due to changes to their management and vegetation in place. Additionally, the likely presence of obstructions such as fences and hedges would limit runoff from gardens.
- 2.6.4 Urban creep is an allowance made within the surface water drainage calculations for where the reverse is true, and a 10% allowance has been made for this. Stantec can confirm that urban creep has been considered within the drainage calculations, in accordance with standard practice i.e. 10% increase of residential impermeable areas. Association of SuDS Authorities guidance indicates that the percentage of urban creep can be varied depending on the density of the proposed development, as the scope for urban creep depends on the space available. However, this is capped at 10%, therefore applying a 10% urban creep represents a robust assessment. As such, the concern raised by Mr Maiden-Brooks in 4.1.25-4.1.27 is unfounded.
- 2.6.5 The impermeable area within the green spaces has been calculated by applying a 40.4% impermeability to these areas, in accordance with the SPR value derived from the Flood Estimation Handbook webservice and utilised in the Long Term Storage calculation within the FRA. The basin and swales have also been considered 40.4% impermeable as these will be typically dry, vegetated structures mimicking greenfield conditions.

- 2.6.6 All other surfaces (e.g. residential roofs and driveways, highways, permeable paving etc.) have been considered 100% impermeable within Stantec's calculations.
- 2.6.7 In paragraph 4.1.2, Mr Maiden-Brooks states that he has measured the area downstream of the basin to be 1ha less than calculated by Stantec. It should be noted that his Figure 13 is based on a superseded drainage strategy. Figure 48494/2002/SK08 in Appendix B illustrates the impermeable areas utilised in the calculations presented in this rebuttal proof. Based on the above discussion, Stantec has revised these calculations to include the green spaces, including the swales and basin, within the impermeable areas, to address paragraph 4.1.4 in Mr Maiden-Brooks' proof. Using the figures provided by Mr Maiden-Brooks, the area upstream of the basin and swales is measured to decrease from 12.090ha to 11.654ha and the assumed impermeable area increases from 5.192ha to 7.142ha. This has been calculated by measuring the area upstream of and including the basin and swales and then allocating the stated impermeability percentages to the land use type.
- 2.6.8 The increased impermeable area would require an attenuation basin of 4,750m³, larger than the 3,455m³ presented within Table 3 in Appendix C of my proof. This increased attenuation storage volume also takes account of a 45% climate change allowance for peak rainfall intensity increase over the lifetime of the proposed development.
- 2.6.9 Two plans are provided in Appendix B (Figures 48494/2002/SK09 and 48494/2002/SK010) which indicate how a basin of 4750m³ can be provided, presented with the illustrative layout. In both cases, the basin does not encroach into the Ancient Semi-Natural Woodland (ASNW) or the 15m buffer zone around it. No changes have been made to depths, freeboard, side slopes etc. of the basin proposals i.e. changes are limited to footprint only. For the avoidance of doubt, in both plans the invert level of the basin has remained as 26.860mAOD, with a 0.600m freeboard included and maximum side slopes of 1:3, in accordance with the FRA.
- 2.6.10 Sketch 48494/2002/SK09 indicates how the basin could be accommodated whilst maintaining a 5m construction width outside of the ASNW 15m buffer. This additional 5m construction width ensures that the basin can be constructed and maintained in perpetuity without entering or disturbing the ASNW 15m buffer zone. This results in the basin encroaching marginally onto the illustrative road alignment by approximately half the highway width. Such minor encroachment could easily be addressed by minor changes to the illustrative layout in support of a reserved matters application without negatively impacting the number of residential units delivered or other technical constraints.
- 2.6.11 Sketch 48494/2002/SK10 indicates how an enlarged basin could be accommodated but without further enlargement south or westwards i.e. maintain the same downstream position as the basin in the FRA. This results in further encroachment into the net developable area, with approximately four buildings affected based on the illustrative layout. Again, this minor encroachment could easily be addressed by minor changes to the illustrative layout in support of a reserved matters application without negatively impacting the number of residential units delivered or other technical constraints. The land within the development areas which the basin shown in SK10 occupies is 1580m². This falls to be considered in the context of development areas comprising around 15.2 hectares and an illustrative scheme which I am informed by Mr Brown is proposed at a net density of 19dph.
- 2.6.12 It should be noted that the assumptions within the calculations for the outline drainage strategy, are conservative, as is typical at this design stage. In the Source Control calculations to date, there has been no allowance made for any attenuation within the network as surface water is routed through, for example attenuation within the permeable paving which each have a flow control device, or for the lag as rainfall is conveyed more slowly through the swales than a traditional piped system. Rather, the calculations assume rainwater is instantly conveyed to the basin, which would not be the case in reality. Including these factors at detailed design stage will result in a reduction in the required attenuation storage volume.
- 2.6.13 For information purposes, an assessment has been carried out based on less conservative parameters that better represent the reality in which the basin will be delivered. In this

assessment, The Source Control method has still been used but the impermeable area has been set at the total impermeable area upstream of the basin and swales rather than modelling for one impermeable hectare and then scaling. In addition, the area contributed by permeable paving has also been removed given that these measures each have their own flow control device and as such runoff discharged from them will be at a significantly reduced rate. This gives a total impermeable area of 6.705ha. Other parameters have remained the same to reflect the requirements previously agreed with the LLFA as well as maintaining a peak discharge rate of 199.5 l/s.

- 2.6.14 Sketch 48494/2002/SK11 illustrates the outcome of this assessment, which indicates that 4,010m³ of storage may be required. This can be accommodated without any encroachment on the net developable area or the ASNW 15m buffer zone.
- 2.6.15 Full network modelling of plot-level drainage and routing through the pipes, permeable paving and swales would be required at detailed design and can be secured through condition, and this is a typical approach for residential development across the country whereby more detailed site information is available to refine the surface water drainage strategy. At this time, the high level assumptions made would therefore be refined and it is expected that the required attenuation volume would fall significantly, particularly as the attenuation of the permeable paving and swales are accounted for, whilst still complying with consented discharge rates and volumes.
- 2.6.16 Paragraph 4.1.40 of Mr Maiden-Brooks' proof relates to the volumetric runoff coefficient C_v , noting that Sewers for Adoption (7th edition) recommends a C_v of 1.0. However, this has been superseded by the 'Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code") Approved Version 2.2 (dated: 29 June 2022) which makes no reference to this coefficient. Further, there is no reference to recommended parameters within the East Sussex County Council guidance (as the LLFA), Association of SuDS Authorities guidance or CIRIA C753 'The SuDS Manual'. Neither the LLFA nor the WDC Senior Engineer has raised the assumed C_v parameter by Stantec as an issue. As such, this assumption is considered to be robust.
- 2.6.17 In paragraphs 4.1.17-18, Mr Maiden-Brooks has noted that Stantec has only provided model files for the 1 in 100 plus climate change event, demonstrating that this can be restricted to equivalent existing greenfield rates. As is standard for an outline drainage strategy, modelling of other return periods not been carried out, assessing only the worst case in design to establish the drainage principles at this stage. Consideration of other return periods would be undertaken at detailed design, secured through condition, as it is dependent on the detailed design of the outfall. The detailed design will be required to comply with the proposed discharge rates given in Table 6.1 of the FRA. As such, Mr Maiden-Brooks' concern is unfounded.
- 2.6.18 Mr Maiden-Brooks states in paragraph 4.1.45 that drainage is not a reserved matter. This is incorrect.
- 2.6.19 Paragraphs 4.1.49-50 of Mr Maiden-Brooks' proof raise points regarding the outfall level and the depth of the outfall pipe. As per paragraph 5.1.3 of my proof, topographic survey of the outfall location was carried out in August 2023, removing the need to assume an outfall level. Stantec drawing 48494-2002-SK05B confirms that the manhole depths are less than the maximum adoptable depth. The maximum manhole depth required for the outfall is indicated to be approximately 4.850m below ground level, however "the Code" makes provision for adoptable manholes to be up to 6.000m deep below ground level. Therefore, the concern raised by Mr Maiden-Brooks in 4.1.49-50 is unfounded.
- 2.6.20 The surface water drainage outfall principle illustrated in drawing 48494-2002-SK05B (attached to my proof of evidence) remains adaptable for each of the basins assessed in sketches 48494-2002-SK09 to SK11. The basin invert level and watercourse level remain unchanged, as does the alignment and pipe diameter. Where the basins assessed in sketches

48494-2002-SK09 to SK11 may require adaptation is the length of individual pipe runs, particularly at the upstream, basin-end of the outfall. This may require amendments to manhole depths and pipe gradients, however the changes are likely to be very minor and therefore the outfall can still be delivered in accordance with sewerage adoption criteria as currently given in by the 'Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code") Approved Version 2.2 (dated: 29 June 2022). The outfall arrangement shown in sketch 48494-2002-SK05B is not at the limit of this adoption criteria, which is what affords the flexibility for any adaptations required to the basin as illustrated in sketches 48494-2002-SK09 to SK11.

- 2.6.21 Mr Maiden-Brooks states in paragraph 4.1.47 that groundwater is high at the location of the proposed basin. Report GI1789 by Geotechnical Investigations Ltd (dated 23 November 2022) indicated that two out of the three trial pits excavated at the location of the basin encountered seepage at depths less than a metre. However, the same report also acknowledges that this was preceded by two days of significant rainfall, on 3rd and 4th November, for which weather and flood warnings were issued.
- 2.6.22 It should be noted that ground investigation in January 2022 (see Appendix C) recorded that groundwater was encountered at 3m below ground level in the location that the basin is proposed. Further, during the testing in November 2022 that Mr Maiden-Brooks refers to, at the start of the testing there was no groundwater observed at the start of the test despite the pit being excavated to 3.6m. While further groundwater monitoring is recommended, to be secured through condition, to fully understand the below-ground hydraulics, it is considered that the seepage at 0.8m below ground level observed on 8th November 2022 was likely to be interflow following the rainfall event a few days prior. The proposed basin would not intercept that flow route, as the basin is not proposed to be lined. Any interflow entering the basin would be able to leave the basin through the same mechanism. This will be addressed at detailed design.
- 2.6.23 Neither the LLFA nor the WDC Senior Engineer has raised the potential groundwater levels as an issue in relation to the proposed attenuation basin. However, Stantec recognise that the presence of groundwater would influence the detailed design of the basin, whether through resisting ingress or intercepting groundwater and diverting it away from the basin.
- 2.6.24 If groundwater monitoring did indicate that groundwater ingress may affect the storage capacity of the basin, this can be readily addressed at detailed design through standard methods, none of which would have any material effect on water flows to the ancient woodland, as addressed in my main proof of evidence. Such methods may include counterfort and cut off drains, but this would be determined following analysis of the groundwater monitoring, if required.
- 2.6.25 Any mitigation would be informed by further groundwater monitoring. It is assumed that this could be secured through an appropriately worded condition. Therefore, the FRA and subsequent assessments robustly establish a principle of attenuation on site, but that the detailed design is a reserved matter.
- 2.6.26 An outline drainage strategy has been agreed with the LLFA, subject to conditions. The information presented within this proof further confirms that a credible surface water drainage strategy can be delivered which can support the 290 proposed dwellings.

3 The Evidence of Mr Rainbow

3.1 Introduction

- 3.1.1 Within Mr Rainbow's proof of evidence regarding biodiversity and arboriculture, he raises two points around the surface water drainage strategy and potential impacts on the ancient woodland.
- 3.1.2 These two points are clarified here.
- 3.1.3 Within his paragraph 7.7, concerns are raised about potential impacts relating to light and sound reflection from the surface water attenuation basin.
- 3.1.4 This drainage feature is a basin and not a pond and it will not be permanently wet and will be vegetated with marginal plants. During normal rainfall, depths will be very shallow and well below the height of the vegetation, so reflection of light or sound will be negligible. In larger, rare events, the planting may be submerged for a short amount of time; however the basin will be designed to have a 600mm freeboard above the 1 in 100 annual probability event including allowance for climate change and the embankment and planting will shield any reflection during the short durations that the basin is full.
- 3.1.5 Within paragraph 7.8, there is concern that the piped outfall from the attenuation basin to the Framfield Stream may create a vector to spread invasive Himalayan balsam to the ancient woodland.
- 3.1.6 The outfall to the Framfield Stream is downstream of the ancient woodland and the 15m buffer. The outfall will therefore not have any impact on the ancient woodland, as set out within Section 5.3 of my proof.

Appendix A Information Regarding Little Bushey Lane Appeal

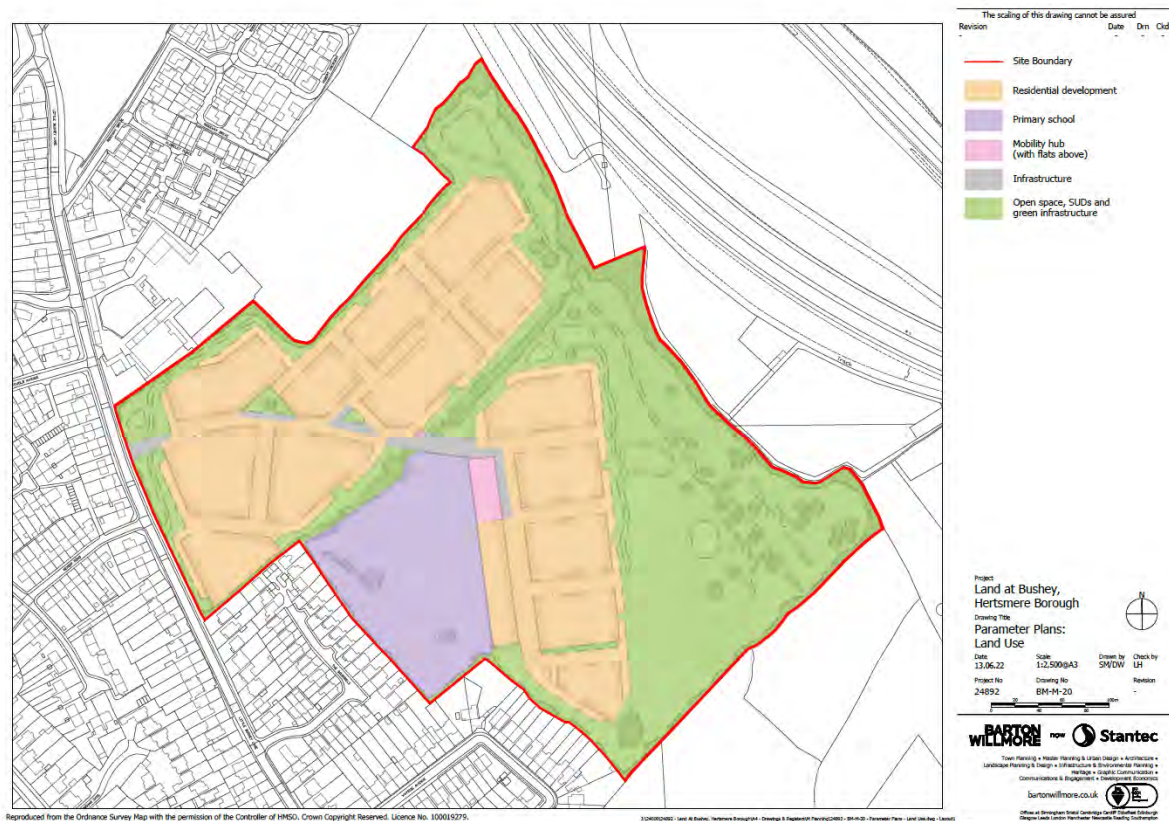


Figure A1: Little Bushey Lane Parameter Plan.

Figure 4.1: Environment Agency 'Flood map for planning'

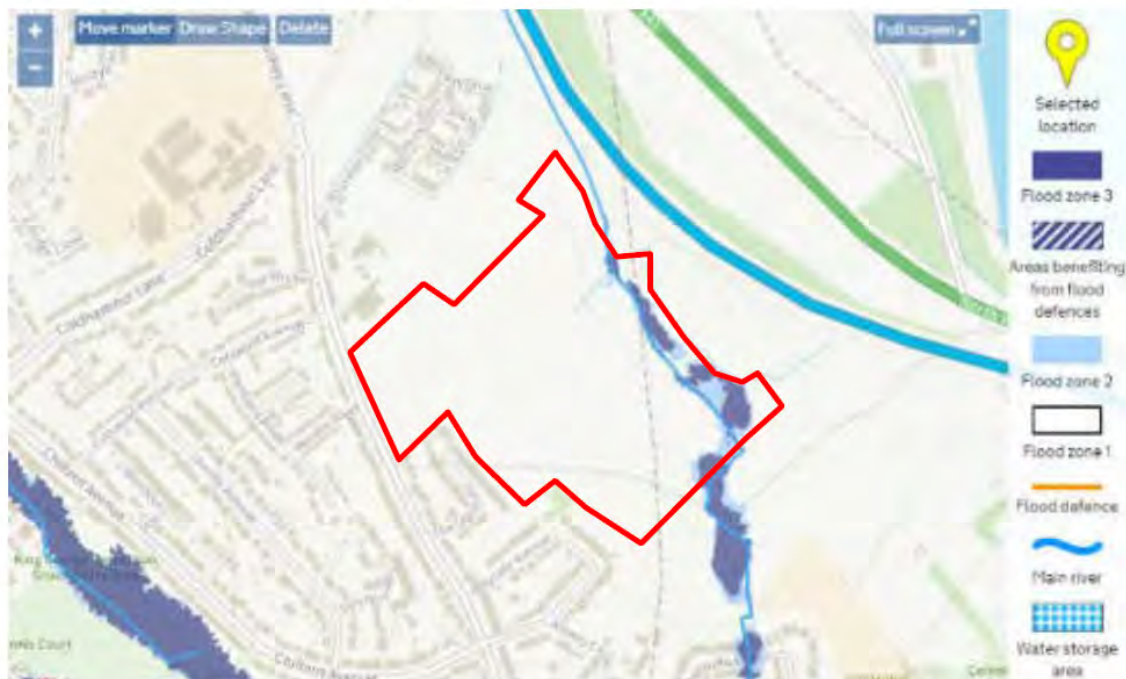


Figure A.2: Little Bushey Lane Flood Map for Planning taken from the FRA (RSK June 2022) Figure 4.1.

Figure 4.3: Environment Agency 'Flood risk from surface water' map

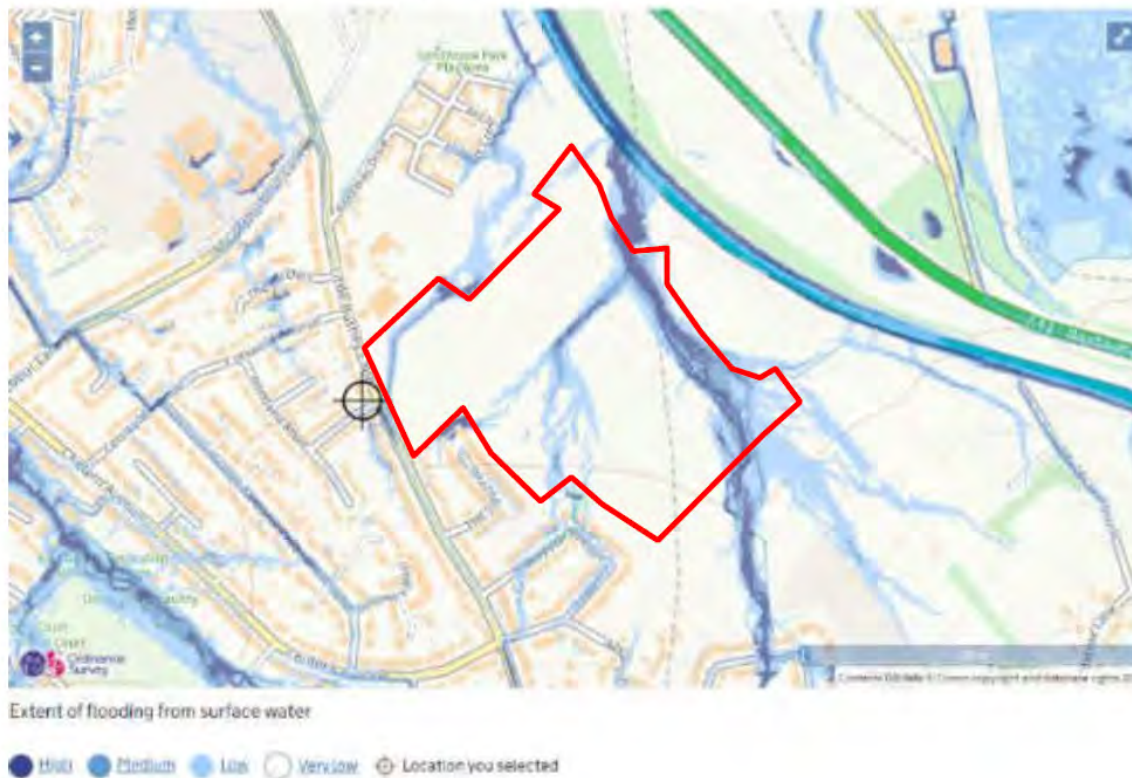


Figure A.3: Little Bushey Lane Flood Map for Planning taken from the FRA (RSK June 2022) Figure 4.3.

Appendix B Surface Water Drainage Sketches



- | Key: | |
|---|--|
|  | Application Boundary |
|  | Area Upstream of Basin and Swale (11.654ha) |
|  | Residential Roofs and Driveways @ 100% PIMP (plus 10% Urban Creep) (2.092ha) |
|  | Highways @ 100% PIMP (3.005ha) |
|  | Permeable Paving @ 100% PIMP (0.437ha) |
|  | Gardens (excluded from Impermeable Area) (2.332ha) |
|  | Bird in Eye Farm (excluded from Impermeable Area) (1.623ha) |
| | Green Space @ 40.4% PIMP (1.608ha) |

Mark	Revision	Date	Drawn	Chkd	Appd

SCALING NOTE: Do not scale this drawing - any errors or omissions shall be reported to Stantec without delay.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Drawing Issue Status	For Information
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Land at Bird in Eye Farm
South of Bird in Eye Hill, Uckfield
Impermeable Areas
Post-Development Site

Client	
Croudace Homes Limited	

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A1 Scale 1:1000	Checked AH	Approved AH	

Drawing Number	Revision	authorised by Stantec is forbidden.
48494/2002/SK08	-	TAUNTON Tel: 01823 218 940

Stantec UK Ltd		Page 1
Caversham Bridge House	BIRD IN EYE	
Waterman Place	UCKFIELD	
Reading, RG1 8DN	HYDROBRAKE AND ORIFICE	
Date 24/08/2023 10:48	Designed by lderrick	
File 230824_DB-1_Detention Basin_100...	Checked by	
Innovyze	Source Control 2020.1	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.503	0.503	31.7	2072.2	O K
30 min Summer	0.654	0.654	74.5	2741.5	O K
60 min Summer	0.797	0.797	127.6	3394.4	O K
120 min Summer	0.867	0.867	157.0	3722.0	O K
180 min Summer	0.887	0.887	165.5	3815.3	O K
240 min Summer	0.900	0.900	170.8	3873.8	O K
360 min Summer	0.914	0.914	176.7	3940.6	O K
480 min Summer	0.917	0.917	177.9	3955.0	O K
600 min Summer	0.914	0.914	176.9	3944.1	O K
720 min Summer	0.909	0.909	174.6	3918.7	O K
960 min Summer	0.895	0.895	168.7	3851.2	O K
1440 min Summer	0.861	0.861	154.3	3691.9	O K
2160 min Summer	0.820	0.820	137.0	3498.7	O K
2880 min Summer	0.787	0.787	123.4	3348.4	O K
4320 min Summer	0.739	0.739	103.8	3126.9	O K
5760 min Summer	0.704	0.704	89.6	2968.1	O K
15 min Winter	0.559	0.559	43.5	2318.7	O K
30 min Winter	0.725	0.725	97.9	3062.5	O K
60 min Winter	0.880	0.880	162.3	3781.3	O K
120 min Winter	0.958	0.958	189.4	4149.9	O K
180 min Winter	0.981	0.981	194.8	4263.2	O K
240 min Winter	0.992	0.992	197.2	4315.2	O K
360 min Winter	1.000	1.000	199.1	4354.3	O K
480 min Winter	0.992	0.992	197.3	4317.4	O K
600 min Winter	0.978	0.978	194.1	4250.5	O K
720 min Winter	0.962	0.962	190.5	4172.7	O K
960 min Winter	0.930	0.930	182.8	4016.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	156.136	0.0	1722.5	19
30 min Summer	104.690	0.0	2304.6	33
60 min Summer	67.106	0.0	3428.2	62
120 min Summer	39.513	0.0	4057.3	120
180 min Summer	28.923	0.0	4465.1	160
240 min Summer	23.142	0.0	4769.4	188
360 min Summer	16.859	0.0	5216.9	250
480 min Summer	13.431	0.0	5541.2	318
600 min Summer	11.253	0.0	5799.7	386
720 min Summer	9.739	0.0	6016.1	454
960 min Summer	7.763	0.0	6370.1	588
1440 min Summer	5.638	0.0	6834.2	850
2160 min Summer	4.140	0.0	7881.0	1232
2880 min Summer	3.346	0.0	8475.9	1612
4320 min Summer	2.495	0.0	9380.2	2336
5760 min Summer	2.037	0.0	10424.2	3112
15 min Winter	156.136	0.0	1923.5	19
30 min Winter	104.690	0.0	2595.8	33
60 min Winter	67.106	0.0	3855.5	62
120 min Winter	39.513	0.0	4561.3	118
180 min Winter	28.923	0.0	5018.6	170
240 min Winter	23.142	0.0	5359.9	190
360 min Winter	16.859	0.0	5862.2	266
480 min Winter	13.431	0.0	6226.6	340
600 min Winter	11.253	0.0	6517.5	412
720 min Winter	9.739	0.0	6761.4	484
960 min Winter	7.763	0.0	7161.2	618

Stantec UK Ltd		Page 2
Caversham Bridge House	BIRD IN EYE	
Waterman Place	UCKFIELD	
Reading, RG1 8DN	HYDROBRAKE AND ORIFICE	
Date 24/08/2023 10:48	Designed by lderrick	
File 230824_DB-1_Detention Basin_100...	Checked by	
Innovyze	Source Control 2020.1	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
1440 min Winter	0.874	0.874	160.0	3753.4	O K
2160 min Winter	0.814	0.814	134.5	3472.6	O K
2880 min Winter	0.771	0.771	116.7	3274.2	O K
4320 min Winter	0.712	0.712	92.6	3002.1	O K
5760 min Winter	0.668	0.668	78.6	2802.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
1440 min Winter	5.638	0.0	7691.4	882
2160 min Winter	4.140	0.0	8837.9	1276
2880 min Winter	3.346	0.0	9506.1	1644
4320 min Winter	2.495	0.0	10515.1	2420
5760 min Winter	2.037	0.0	11679.6	3168

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 548274 120643 TQ 48274 20643	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 7.142

Time (mins)	Area
From:	To: (ha)
0	4 7.142

Model Details

Storage is Online Cover Level (m) 1.600

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3895.0	0.425	4280.2	1.000	4830.2	1.600	5439.6

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0223-2420-0425-2420
Design Head (m) 0.425
Design Flow (l/s) 24.2
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 223
Invert Level (m) 0.000
Minimum Outlet Pipe Diameter (mm) 300
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.425	24.2	Kick-Flo®	0.392	23.3
Flush-Flo™	0.293	24.2	Mean Flow over Head Range	-	16.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.5	0.800	32.7	2.000	50.9	4.000	71.3	7.000	93.6
0.200	22.2	1.000	36.5	2.200	53.4	4.500	74.7	7.500	96.9
0.300	24.2	1.200	39.8	2.400	55.7	5.000	78.8	8.000	100.1
0.400	23.5	1.400	42.9	2.600	57.9	5.500	82.8	8.500	103.3
0.500	26.2	1.600	45.7	3.000	62.0	6.000	86.5	9.000	106.3
0.600	28.5	1.800	48.4	3.500	66.8	6.500	90.1	9.500	109.2

Orifice

Diameter (m) 0.351 Discharge Coefficient 0.600 Invert Level (m) 0.425

Stantec UK Ltd		Page 1
Caversham Bridge House	BIRD IN EYE	
Waterman Place	UCKFIELD	
Reading, RG1 8DN	HYDROBRAKE AND ORIFICE	
Date 31/08/2023 12:26	Designed by lderrick	
File 230824_DB-1_Detention Basin_100...	Checked by	
Innovyze	Source Control 2020.1	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.513	0.513	33.5	1943.6	O K
30 min Summer	0.665	0.665	77.8	2567.2	O K
60 min Summer	0.807	0.807	131.8	3167.2	O K
120 min Summer	0.873	0.873	159.4	3450.4	O K
180 min Summer	0.891	0.891	167.2	3530.4	O K
240 min Summer	0.904	0.904	172.5	3584.3	O K
360 min Summer	0.916	0.916	177.7	3640.4	O K
480 min Summer	0.918	0.918	178.4	3646.1	O K
600 min Summer	0.914	0.914	176.7	3628.4	O K
720 min Summer	0.907	0.907	173.7	3598.2	O K
960 min Summer	0.890	0.890	166.8	3525.1	O K
1440 min Summer	0.853	0.853	151.1	3364.9	O K
2160 min Summer	0.810	0.810	132.9	3176.6	O K
2880 min Summer	0.776	0.776	118.8	3035.1	O K
4320 min Summer	0.728	0.728	99.1	2828.3	O K
5760 min Summer	0.691	0.691	85.5	2674.6	O K
15 min Winter	0.570	0.570	46.0	2174.3	O K
30 min Winter	0.737	0.737	102.7	2866.9	O K
60 min Winter	0.891	0.891	167.0	3527.2	O K
120 min Winter	0.964	0.964	190.8	3849.8	O K
180 min Winter	0.984	0.984	195.4	3937.7	O K
240 min Winter	0.996	0.996	198.1	3990.5	O K
360 min Winter	1.000	1.000	199.1	4011.0	O K
480 min Winter	0.989	0.989	196.6	3963.0	O K
600 min Winter	0.973	0.973	193.0	3890.2	O K
720 min Winter	0.955	0.955	188.7	3809.5	O K
960 min Winter	0.920	0.920	179.4	3656.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	156.136	0.0	1659.5	19
30 min Summer	104.690	0.0	2236.0	33
60 min Summer	67.106	0.0	3240.0	62
120 min Summer	39.513	0.0	3832.6	120
180 min Summer	28.923	0.0	4216.8	154
240 min Summer	23.142	0.0	4503.7	182
360 min Summer	16.859	0.0	4926.1	246
480 min Summer	13.431	0.0	5232.8	314
600 min Summer	11.253	0.0	5478.1	382
720 min Summer	9.739	0.0	5684.0	448
960 min Summer	7.763	0.0	6023.6	580
1440 min Summer	5.638	0.0	6483.6	838
2160 min Summer	4.140	0.0	7411.2	1216
2880 min Summer	3.346	0.0	7973.5	1588
4320 min Summer	2.495	0.0	8844.3	2336
5760 min Summer	2.037	0.0	9792.2	3064
15 min Winter	156.136	0.0	1859.2	19
30 min Winter	104.690	0.0	2520.5	33
60 min Winter	67.106	0.0	3642.1	60
120 min Winter	39.513	0.0	4306.7	116
180 min Winter	28.923	0.0	4737.4	166
240 min Winter	23.142	0.0	5059.1	188
360 min Winter	16.859	0.0	5533.1	262
480 min Winter	13.431	0.0	5877.6	338
600 min Winter	11.253	0.0	6153.4	408
720 min Winter	9.739	0.0	6385.3	478
960 min Winter	7.763	0.0	6768.1	614

Stantec UK Ltd		Page 2
Caversham Bridge House	BIRD IN EYE	
Waterman Place	UCKFIELD	
Reading, RG1 8DN	HYDROBRAKE AND ORIFICE	
Date 31/08/2023 12:26	Designed by lderrick	
File 230824_DB-1_Detention Basin_100...	Checked by	
Innovyze	Source Control 2020.1	

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
1440 min Winter	0.862	0.862	154.9	3403.6	O K
2160 min Winter	0.801	0.801	129.1	3139.6	O K
2880 min Winter	0.758	0.758	111.2	2955.9	O K
4320 min Winter	0.697	0.697	87.5	2701.7	O K
5760 min Winter	0.654	0.654	74.5	2521.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
1440 min Winter	5.638	0.0	7291.5	880
2160 min Winter	4.140	0.0	8309.7	1256
2880 min Winter	3.346	0.0	8940.9	1644
4320 min Winter	2.495	0.0	9911.6	2416
5760 min Winter	2.037	0.0	10971.0	3120

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 548274 120643 TQ 48274 20643	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 6.705

Time (mins)	Area
From:	To: (ha)
0	4 6.705

Model Details

Storage is Online Cover Level (m) 1.600

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	3570.0	0.425	3939.2	1.000	4467.5	1.600	5054.2

Complex Outflow Control

Hydro-Brake® Optimum

Unit Reference MD-SHE-0223-2420-0425-2420
Design Head (m) 0.425
Design Flow (l/s) 24.2
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 223
Invert Level (m) 0.000
Minimum Outlet Pipe Diameter (mm) 300
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.425	24.2	Kick-Flo®	0.392	23.3
Flush-Flo™	0.293	24.2	Mean Flow over Head Range	-	16.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.5	0.800	32.7	2.000	50.9	4.000	71.3	7.000	93.6
0.200	22.2	1.000	36.5	2.200	53.4	4.500	74.7	7.500	96.9
0.300	24.2	1.200	39.8	2.400	55.7	5.000	78.8	8.000	100.1
0.400	23.5	1.400	42.9	2.600	57.9	5.500	82.8	8.500	103.3
0.500	26.2	1.600	45.7	3.000	62.0	6.000	86.5	9.000	106.3
0.600	28.5	1.800	48.4	3.500	66.8	6.500	90.1	9.500	109.2

Orifice

Diameter (m) 0.351 Discharge Coefficient 0.600 Invert Level (m) 0.425



- | Key: | |
|---|---|
|  | Ancient Woodland 15m Buffer Zone |
|  | Tree Root Protection Area |
|  | Proposed Surface Water Drainage Sewer (indicative only) |
|  | Proposed Surface Water Drainage Headwall |
|  | Proposed Permeable Paving |
|  | Proposed Swale |
|  | Proposed Detention Basin |
|  | MicroDrainage Model Reference Code |

Mark	Revision	Date	Drawn	Chkd	Appd
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SCALING NOTE: Do not scale this drawing - any errors or omissions shall be reported to Stantec without delay.

UTILITIES NOTE: The position of any existing public or private services, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Drawing Issue Status

For Information

Land at Bird in Eye Farm
South of Bird in Eye Hill, Uckfield

Revised Basin Assessment 1

Client	
Croudace Homes Limited	

Date of 1st Issue 30.08.2023	Designed LWD	Drawn LWD	stantec.com/uk Copyright reserved The copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that
A1 Scale 1:1000	Checked AH	Approved AH	

Drawing Number	Revision	authorised by Stantec is forbidden.
48494/2002/SK09	-	TAUNTON Tel: 01823 218 940



- | Key: | |
|---|---|
|  | Ancient Woodland 15m Buffer Zone |
|  | Tree Root Protection Area |
|  | Proposed Surface Water Drainage Sewer (indicative only) |
|  | Proposed Surface Water Drainage Headwall |
|  | Proposed Permeable Paving |
|  | Proposed Swale |
|  | Proposed Detention Basin |
|  | MicroDrainage Model Reference Code |

SCALING NOTE: Do not scale this drawing - any errors or omissions shall be reported to Stantec without delay.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Land at Bird in Eye Farm
South of Bird in Eye Hill, Uckfield

Revised Basin Assessment 2





- | Key: | |
|---|---|
|  | Ancient Woodland 15m Buffer Zone |
|  | Tree Root Protection Area |
|  | Proposed Surface Water Drainage Sewer (indicative only) |
|  | Proposed Surface Water Drainage Headwall |
|  | Proposed Permeable Paving |
|  | Proposed Swale |
|  | Proposed Detention Basin |
|  | MicroDrainage Model Reference Code |

SCALING NOTE: Do not scale this drawing - any errors or omissions shall be reported to Stantec without delay.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Land at Bird in Eye Farm
South of Bird in Eye Hill, Uckfield

Client	<p>Croudace Homes Limited</p> 
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File Location: \\nt-dns-001\ntf\projects\48494 bird in eye_arkfield\001_hydro task_ba\ba\arkfield\dw\48494_2002_ark11 - revised basin assessment 3 dw

Appendix C

Groundwater Monitoring January 2022

TECHNICAL NOTE

Job Name: Bird in Eye Farm, Uckfield
Job No: 332510180/3500
Note No: 332510180/3500/tn001/Rev0
Date: 28th January 2022
Prepared By: Arie Zamler
Subject: Ground Conditions and Infiltration Assessment

1. Introduction

- 1.1. Stantec UK Limited (Stantec) was appointed by Croudace Homes Ltd (the Client) to provide advice with regards to the ground conditions at the site in particular reference to the proposed surface water drainage strategy and the suitability of the near surface soils for the use of shallow infiltration systems for the discharge of surface water into the ground.
- 1.2. A ground investigation was carried out at the site by Geotechnical Investigations Limited (GIL) between the 10th and 13th January 2022 under instruction of the Client. It should be noted that Stantec were not present at the site during the ground investigation works. The factual results of the investigation are presented in a separate letter report prepared by GIL (GIL, 2022)¹.
- 1.3. This technical note presents a summary of the ground investigation and infiltration testing and provides an assessment of the infiltration conditions at the site in relation to the use of shallow infiltration for the disposal of surface water as part of the proposed development of the site.

2. Site Description

- 2.1. The site comprises principally open fields around Bird in Eye Farm used for grazing with semi mature trees and hedges along field boundaries.
- 2.2. The ground level falls from the north-eastern part of the site to the south and west towards a stream along the southern boundary and towards Framfield Stream along the western boundary. According to the topographical survey carried out by Encompass Surveys Ltd dated March 2020, the ground level in the north-eastern corner of the site is about 55 m OD falling to the south towards the stream along the southern boundary where the ground level is about 30 m OD with a maximum gradient of about 1 vertical in 10 horizontal, and towards the north-western corner of the site where the ground level is about 23 m OD with a maximum gradient of about 1 vertical in 5 horizontal.

3. Geology

- 3.1. According to the geological map of the area (BGS, 2006)² the site lies directly on the Lower Tunbridge Wells Sand Formation which is underlain by Wadhurst Clay Formation and Ashdown Formation at depth. Superficial Deposits are not recorded within the site boundaries. Alluvium is recorded along the stream recorded to the west of the site.

4. Ground Investigation

- 4.1. A ground investigation was carried out at the site by GIL between the 10th and 13th January 2022 and comprised the excavation of 13 trial pits referenced TP01 to TP13 to between 1.0 and 2.0 m depth with an infiltration test carried out at each location investigated.

¹ GIL (2022) Bird in Eye Farm, Uckfield – GI1770. Geotechnical Investigations Limited. Fairford, Gloucestershire.

² BGS (2006) Geological Map Sheet 319/334 Lewes and Eastbourne, 1: 50,000 scale Bedrock and Superficial Deposits Edition. British Geological Survey, Keyworth, Notts

TECHNICAL NOTE

- 4.2. An additional trial pit reference TP05A was excavated to 3.0 m depth adjacent to TP05 to determine the ground conditions at depth and the potential presence of groundwater. The trial pit was excavated at 09:30 am and water ingress was monitored on an hourly basis throughout the day until 14:30 pm when the trial pit was backfilled.
- 4.3. The trial pits were situated across the site where shallow infiltration is proposed. Trial Pit TP05 and TP05A were situated within the proposed infiltration basin in the southern part of the site.

5. Ground Conditions

- 5.1. The ground conditions encountered were in line with the BGS geological map and the known history of the site and comprise the Lower Tunbridge Wells Sand Formation to a maximum investigated depth of 3.0 m below ground level (bgl).
- 5.2. A copy of the exploratory hole records is presented in the factual report by GIL (2022) and the ground conditions are summarised in the table below.

Formation	Base of Stratum, m bgl ⁽¹⁾	Typical Description
Lower Tunbridge Wells Sand Formation	1.0	Variable proportions of brown and orange SILT and SAND with occasional gravel and cobble size fragments of weak siltstone and sandstone.
	1.0 to >3.0 ⁽²⁾	Weak light greyish-brown locally stained dark brown SILTSTONE recovered as angular and subangular gravel and occasional cobbles of weak siltstone.

Note 1) bgl denotes below ground level
2) recorded only in TP05 and TP05A.

- 5.3. All of the trial pit excavations remained stable for the duration of the investigation.

Groundwater

- 5.4. Groundwater was not encountered in any of the locations investigated with the exception of TP13 where a seepage was recorded at about 1.0 m bgl.
- 5.5. Trial pit TP05A was excavated to 3.0 m depth. Water level was recorded just above the base of the excavation during the monitoring period of 5 hours when the trial pit remained open.

6. Infiltration Testing

- 6.1. GIL report that infiltration testing was undertaken in accordance with the guidance presented in BRE DG 365 (2016)³. Most tests were terminated after one fill owing to the very low infiltration rate observed. Higher infiltration rates were observed in TP05 and TP07 and tests were repeated to give a total of 3 tests in TP05 and a total of 2 tests in TP07.
- 6.2. Negligible infiltration was recorded at most of the locations investigated.

³ BRE (2016) Soakaway design. Digest 365. Building Research Establishment, Garston, Watford.

TECHNICAL NOTE

- 6.3. A summary of the calculated infiltration rates in trial pits TP05 and TP07 is summarised in the table below:

Location	Base of Test Pit (m bgl)	Test No.	Infiltration Rate (m³/m²/s)	Lowest Infiltration Rate (m³/m²/s)
TP05	2.0	1	1.1 x 10 ⁻⁵	1.0 x 10 ⁻⁵
		2	1.2 x 10 ⁻⁵	
		3	1.0 x 10 ⁻⁵	
TP07	1.0	1	1.0 x 10 ⁻⁵	5.1 x 10 ⁻⁶
		2	5.1 x 10 ⁻⁶ ⁽¹⁾	
Note: (1) Infiltration rate extrapolated by Stantec				

7. Conclusion and Recommendations

- 7.1. Surface water drainage using shallow infiltration systems ("soakaways") is unlikely to be suitable across the majority of the site at the near surface soils owing to the very low infiltration rate observed at the weathered near surface soils.
- 7.2. However, shallow infiltration may provide a suitable drainage solution for the proposed drainage basin within the less weathered Turnbridge Wells Sand Formation in the southern part of the site as recorded in Trial Pit TP05. Based on the infiltration test results it is recommended that a soil infiltration rate of 1.0x10⁻⁵ m/s is used for the design of infiltration basin. Soakaway design should be carried out in accordance with BRE DG 365 and CIRIA Report 156⁴.
- 7.3. It is likely that the LLFA will require at least 1 m of unsaturated zone between the base of the infiltration basin and the highest groundwater level at this location. It is recommended that a groundwater monitoring well is installed at this location with groundwater monitoring undertaken during the winter months to confirm the long term groundwater level at this location.
- 7.4. The concentrated ingress of water into Lower Tunbridge Wells Sand Formation could trigger surface instability as this material can be eroded easily which could lead to surface instability. Signs of instability were not noted during the ground investigation works undertaken. Nevertheless, it would be prudent to situate any infiltration basins a minimum of 5.0 m away from any structures or infrastructure to minimise the risk of surface collapse and the potential adverse impact on infrastructure and structures.

DOCUMENT ISSUE RECORD

Technical Note No	Rev	Date	Prepared	Checked	Reviewed (Discipline Lead)	Approved (Project Director)
332510180/3500/tn001	00	28/01/2022	AZ	RF	RF	ET

This report has been prepared by Stantec UK Limited ('Stantec') on behalf of its client to whom this report is addressed ('Client') in connection with the project described in this report and takes into account the Client's particular instructions and requirements. This report was prepared in accordance with the professional services appointment under which Stantec was appointed by its Client. This report is not intended for and should not be relied on by any third party (i.e. parties other than the Client). Stantec accepts no duty or responsibility (including in negligence) to any party other than the Client and disclaims all liability of any nature whatsoever to any such party in respect of this report.

⁴ Bettess (1996) Infiltration drainage – manual for good practice. CIRIA Report 156. Construction Industry Research and Information Association, London.