

The background image shows a row of terraced houses on the left, a road, and a grassy area with some trees on the right. A large blue triangular overlay covers the bottom half of the image.

Proposed Development Land north east of King George V Playing Fields, Northaw Road East, Cuffley, Hertfordshire.

Surface Water Flood Modelling Technical Note
To Support Discharge of Conditions 6 & 19

Document Control Sheet

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Project Number	10929
Client	Bellway Homes

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Fiona Flaherty – Bellway Homes Ltd (North London)	0	1				

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10929 Northaw Road East, Cuffley

Technical Note 01: Surface Water Modelling

3rd April 2023

1 Introduction

- 1.1** Brookbanks (BCL) is appointed by Bellway Homes to provide a surface water flood model for their proposed residential development at Cuffley. The model has been built in order to comply with Lead Local Flood Authority (LLFA) requirements.
- 1.2** The objective of the modelling, and this technical note detailing its findings, is to resolve the LLFA concerns regarding surface water flooding at the proposed development and to demonstrate that the proposed layout drains surface water effectively.
- 1.3** This technical note provides the modelling results for the existing baseline and post development conditions, for the 1 in 1000yr and 1 in 100yr+ 40%CC rainfall events, as requested by the LLFA.
- 1.4** In December 2022 and January 2023, the LLFA provided objection to the submitted reserved matters application relating to the surface water drainage strategy, Ref (6/2022/1774/RM). Brookbanks have subsequently built a surface water model (rainfall model) in order to address the LLFA concerns. The previous objection responses are provided in **Appendix A**.
- 1.5** This report should be read in conjunction with Drainage report 10929-SWDR

2 Hydrology

Location

- 2.1** The proposed development is situated on Land north east of King George V playing fields, Northaw Road East, Cuffley.
- 2.2** The site is bound to the north by a developed are of South Drive to the east by the Cuffley-Crews Hill connection railway, to the south by Cuffley Football Club and agricultural land and to the west by Northaw Road East (B156).
- 2.3** The site is currently undeveloped agricultural land.

Hydrology calculations and design rainfall

- 2.4** Brookbanks has acquire Flood Estimation Handbook (FEH) catchment descriptors (CD) for the catchment within which the development lies.
- 2.5** The development falls within the FEH catchment 530950 201600 draining in total 8.99km² for the Northaw Brook and Hempshill Brook towards Cuffley Brook.
- 2.6** Together with the FEH CD the rainfall depth-duration-frequency (DDF) curves for the FEH22 and FEH13 models were also obtained.
- 2.7** **Figure 2-1** below show the FEH13 DDF curve calculations for the Cuffley catchment.

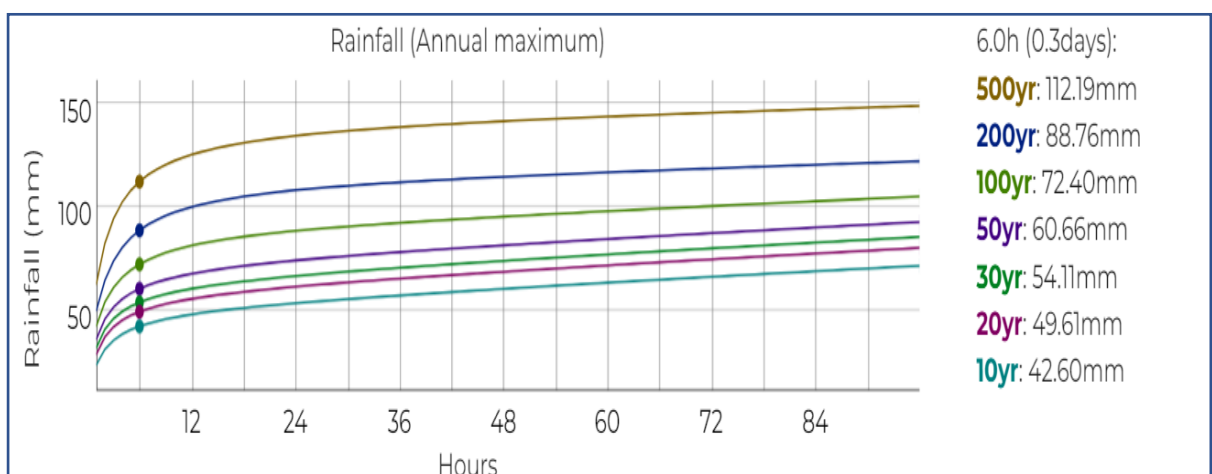


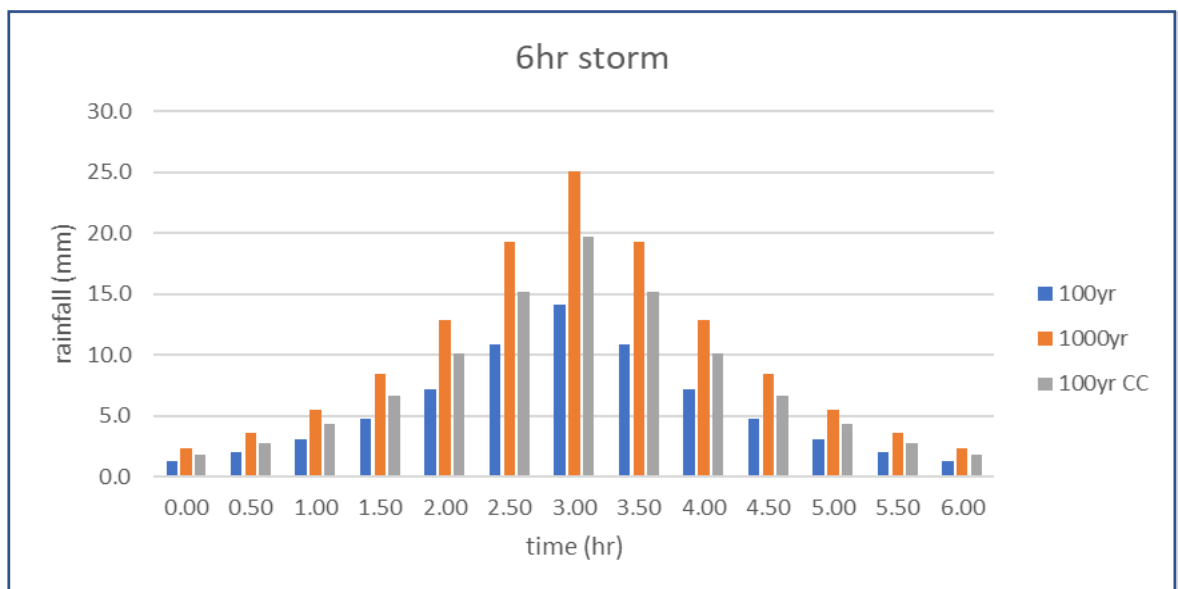
Figure 2-1 DDF calculations FEH13.

- 2.8** Using the DDF curve calculations rainfall depths for design storms of 100yr and 1 in 1000yr events with durations of 6hr and 12hr were obtained. Table 2.1 below shows the rainfall depths for these events.

Table 2-1 Rainfall depth from DDF calculations

Event	Rainfall model	6hr	+40%CC	12hr	+40%CC
100yr	<i>FEH13</i>	72.4	101.4	81.4	114.0
	<i>FEH22</i>	66.0	92.4	75.0	105.0
1000yr	<i>FEH13</i>	128.9	-	142.7	-
	<i>FEH22</i>	121.4	-	138.3	-

- 2.9** For the purpose of this report the FEH13 data has been used to build the design rainfall, as it will provide the most conservative modelling approach.
- 2.10** The hyetograph is a graphical representation of the distribution of rainfall density over time. To build the hyetographs for the 6 and 12hr rainfall durations, SCS Distribution were used. **Figure 2-2** below shows the 6h rainfall hyetograph for the 3 events.


Figure 2-2 Hyetograph for 6h rainfall duration.

3 Modelling Methodology

- 3.1** To build the Model TUFLOW modelling software, Version 2020-10-AF was used. TUFLOW has the capability to model direct rainfall approach within a delimited 2D active domain.

2D domain

- 3.2** The delimited area modelled includes Cuffley development and its surroundings. **Figure 3-1** below shows the 2D domain and the direct rainfall area.



Figure 3-1 Active and direct rainfall area

- 3.3** LiDAR composite (2022) Digital Terrain Model (DTM) data, with a resolution of 1m was used to define the ground model within the 2D domain. A cell size of 1m has been used in order to achieve enough accuracy to define the rainfall model.
- 3.4** The direct rainfall was located within the 2D domain with the feature 2d_rf, the design rainfall was located in comma separated values (.csv) format as boundary condition data base (bc_dbase). This database included the hyetograph (design rainfall) for the following events:
- 1 in 100yr ; 6h and 12h duration,
 - 1 in 100yr +40%CC; 6h and 12h duration, and
 - 1 in 1000yr; 6h and 12h duration.
- 3.5** The downstream boundary condition was located at the Northaw Brook which slopes west to east with an approximate 2% grade.
- 3.6** Within the 2D domain the roughness associated with the various landscaped materials was determined according to their land-use classification which was defined using OS mapping and the Land Cover map 2019 (LANDIS).

- 3.7** Manning's roughness values within the Tuflow Materials File (.tmf) were set, with a general surface of 0.048, grass and open land of 0.040, railway of 0.040, roads and paved area of 0.025 and buildings with a high roughness value of 0.250.
- 3.8** As mentioned above the ground elevation at the Tuflow ground control (.tgc) was set with 1m resolution Lidar and the grid cell size selected was 1m, Figure 3-2 below illustrates the digital terrain model.

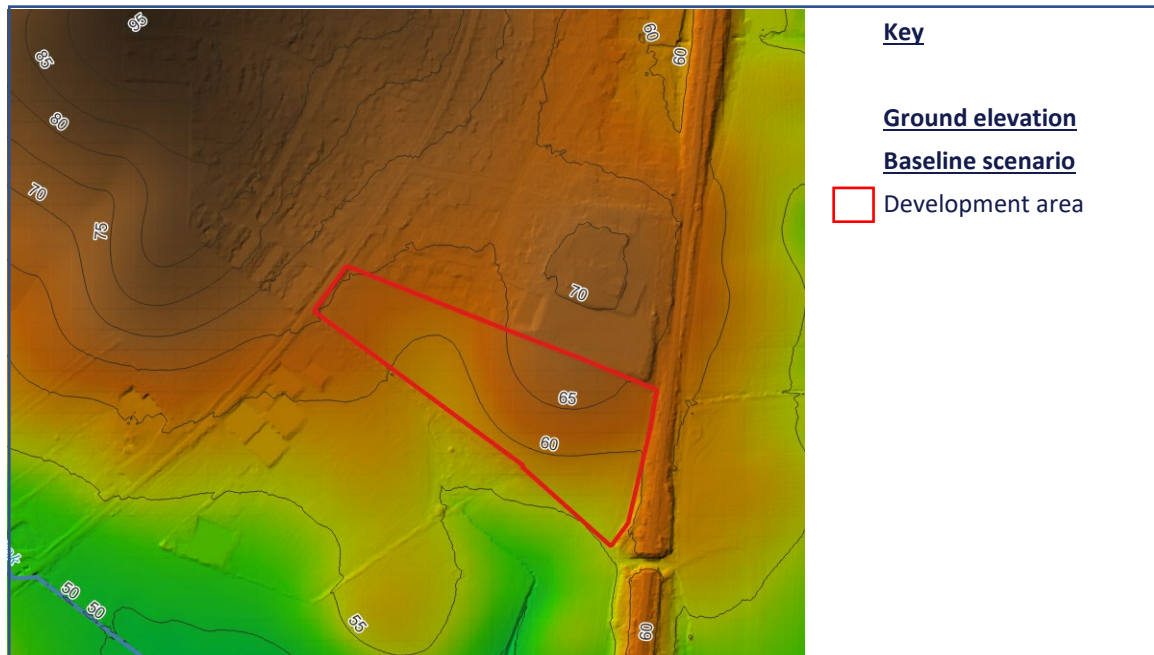


Figure 3-2 digital terrain model.

- 3.9** A digital elevation model of the proposed development site was built using the proposed house plot finish floor levels and ground levels and this was overlapped with the existing DTM.
- 3.10** The development area ground elevations are shown in **Figure 3-3**.



Figure 3-3 Development area patch -digital terrain model.

1D domain

- 3.11** The 1D domain refers to the surface water drainage system as hydraulic structures and includes for example, gullies, manholes, and pipes etc.
- 3.12** The 1D domain for the Baseline scenario was built to replicate the existing external site conditions and therefore includes the existing storm water drainage system located to the North of the site at the South Dr and Theobald's Rd.
- 3.13** Brookbanks were unable to obtain full drainage network details for the southern section of South Drive which exists immediately north of the proposed site as this appears to be an unadopted network. However information for the Thames Water assets further north on South Drive were obtained and used to represent the existing condition. For the remaining areas of South Drive, some assumptions regarding the dimensions and invert levels of the manholes were used. However, the location of manholes and storm gullies was verified using online mapping.
- 3.14** 1D structures were modelled within the Estry control file (.ecf) of the Tuflow modelling software. The storm drainage network was built using the 1d_nwke feature, the manholes were built using 1d_mh and the gullies using 1d_pit features.
- 3.15** The development scenario was built in detail with the hydraulic structures located as per the proposed development Drainage layout as detailed on drawings 10929-500-001C/002C, included in **Appendix B**.
- 3.16** The gullies, manholes and drainage network were built to match the proposed invert levels and dimensions, including the outfall, drainage swales and SuDS ponds..
- 3.17** **Figure 3-4** illustrates the proposed development surface drainage network.

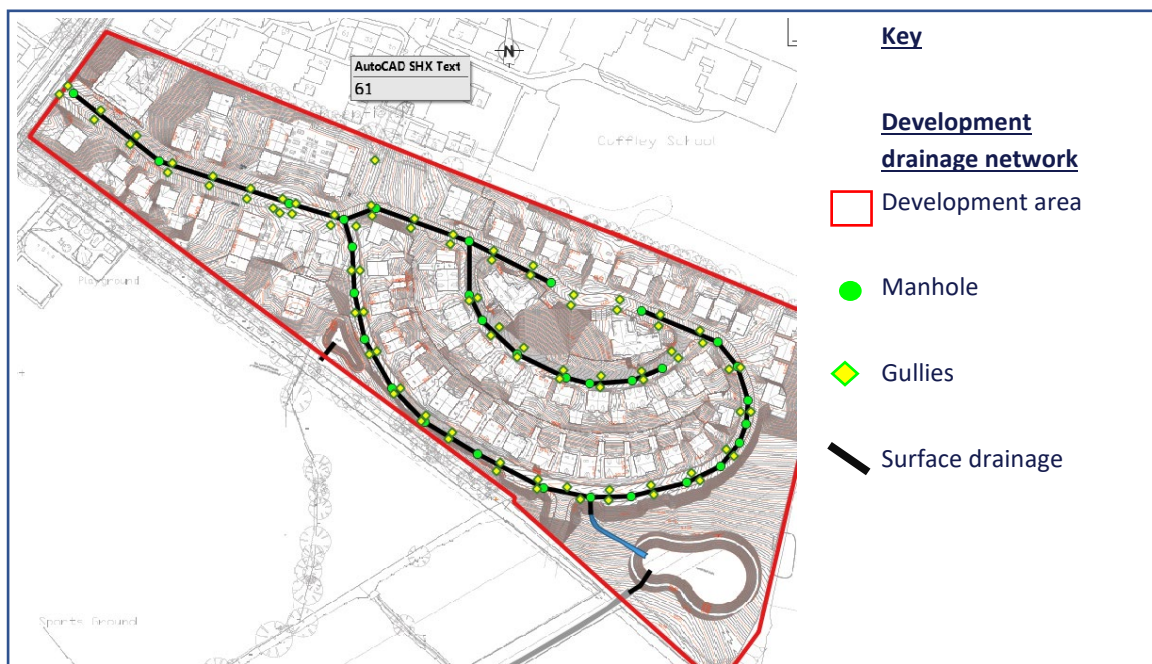


Figure 3-4 Development surface water drainage network.

4 Rainfall Modelling Results

Baseline Scenario

- 4.1** A baseline 1 scenario using existing site ground levels without the inclusion of any surface water drainage structures was built in order to identify the areas of the existing site with existing surface water flooding.
- 4.2** **Figure 4-1** shows the existing baseline 1 scenario, for a 1 in 100yr +40%CC event, 6h rainfall duration.

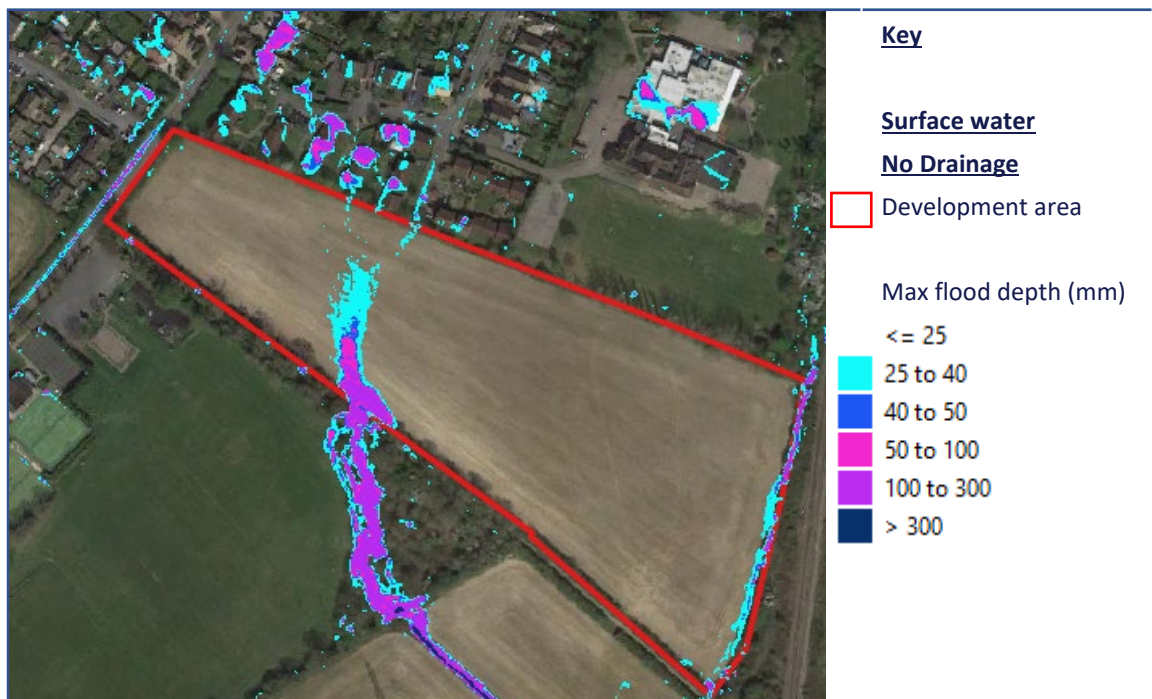


Figure 4-1 Maximum flood depth Surface water, No Drainage, 6h duration 1 in 100yr+40%CC

- 4.3** The baseline scenario represents the as existing condition and shows the current flood risk at the development area without any changes in ground levels or any surface water drainage systems implemented on the development site.
- 4.4** The baseline scenario correlates with the EA Surface water flood mapping included in Figure 2.5 of our previously issued drainage report 10929/SWDR rev3. An area of the development site at the southern boundary shows an area of ponding is anticipated due to the low topography and sloping site levels towards this location.
- 4.5** Minimal cross boundary flow across the northern boundary is observed in the baseline model and again, this correlates with EA surface water mapping for the 1 in 100 year scenario. The modelling also indicates some reduction in ponding areas at the developed area north of the site, South Dr when compared with EA surface water mapping.
- 4.6** The above aligns with findings outlined in the FRA submitted at outline planning stage (10710 FRA01 Rv1), which detailed figures (Figure 5-3) which combined extracts from the Welwyn Hatfield Borough Council Strategic Flood Risk Assessment (SFRA) and additional information obtained from Hertfordshire Highways

flooding database which showed a low frequency of flooding events along the roads adjacent to the north and west of the site. Figure 5.3 of the FRA report has been replicated in figure 4.2 below for ease of reference

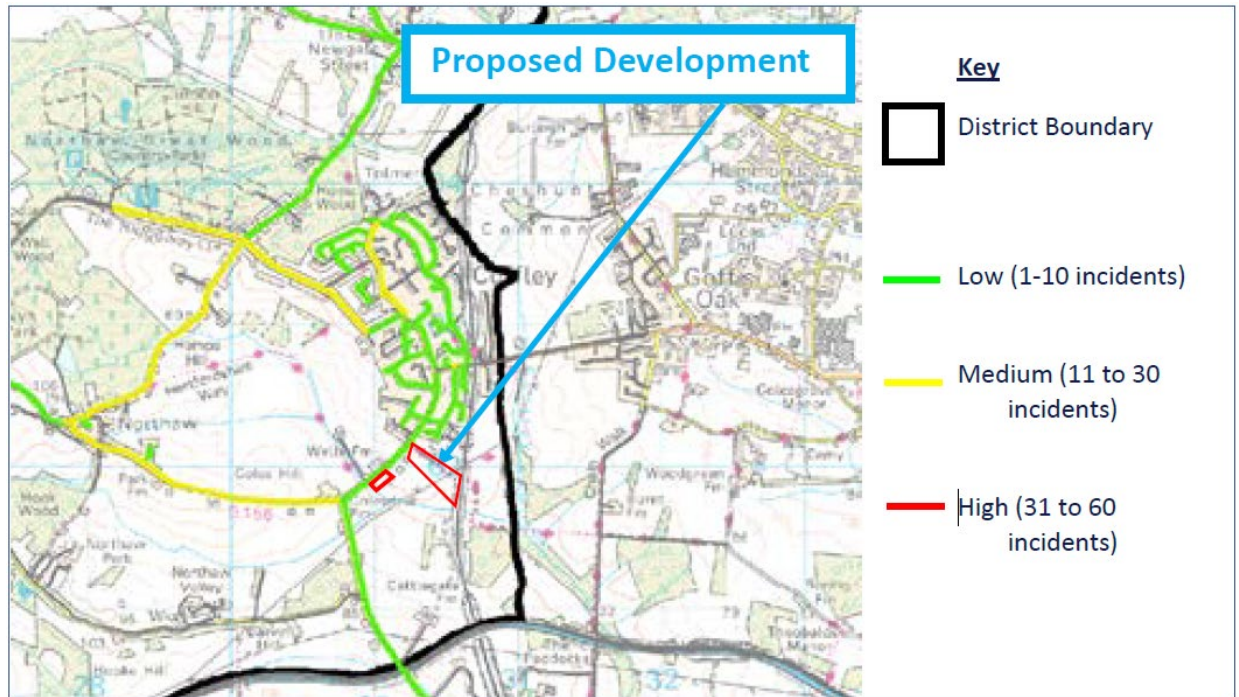


Figure 4-2 Frequency of road flooding events adjacent to the proposed development site

4.7 As outlined in the modelling methodology of the 1D domain, Section 3, in order to provide a more accurate representation of the baseline surface water situation, the existing stormwater drainage features located within South Drive where modelled. This created an alternative baseline 2 scenario which is considered to be more representative of the existing scenario.

4.8 **Figure 4-2** illustrates the baseline 2 scenario for 6h duration and 1 in 100yr +40CC event.

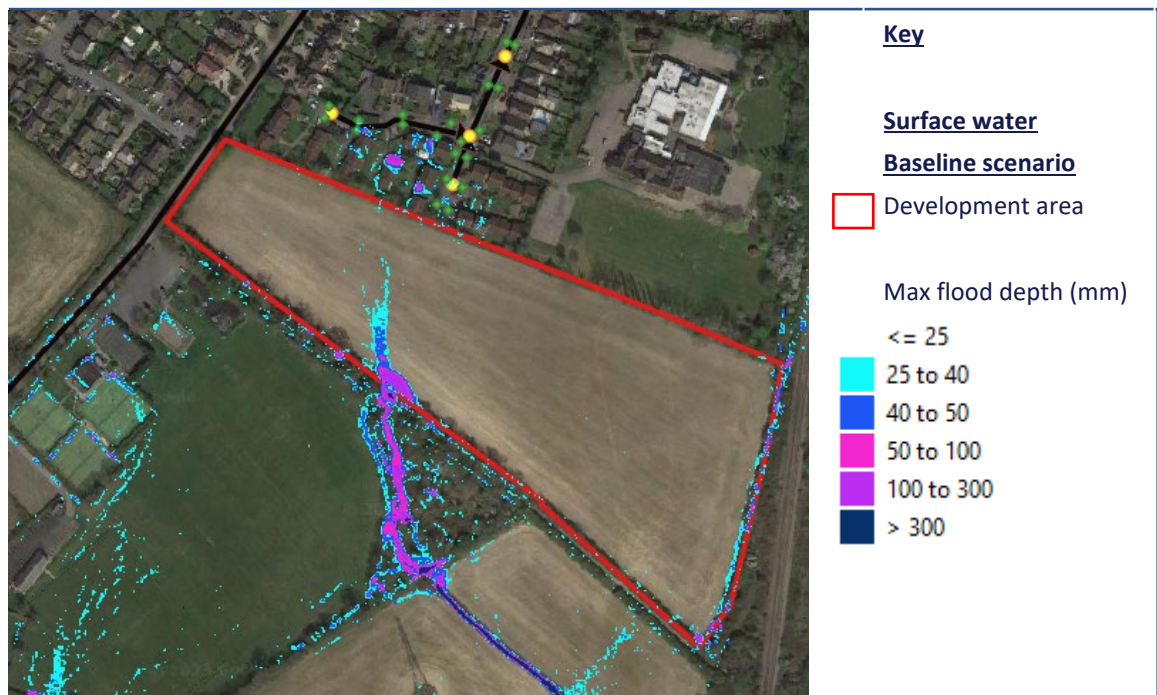


Figure 4-3 Maximum flood depth Surface water Baseline scenario, 6h duration 1 in 100yr+40%CC

- 4.9** **Figure 4-3** identifies some low spots at the South Dr developed area where the surface water accumulates, but demonstrates improvement over the original baseline 1 shown in Figure 4.1 and is more representative of the low frequency flooding events dictated by data capture of real life occurrences.
- 4.10** The baseline 2 scenario also shows a reduced area of ponding on the south boundary of the proposed development area for 1 in 100yr+CC event with the flood depths remaining below 300mm.
- 4.11** For 1 in 1000yr events the flood extent increases slightly at the south boundary of the proposed development area due to flood accumulation, however the flood depths will remain below 300mm.
- 4.12** All modelled events and durations for the baseline 2 scenario are shown in **Appendix C**.

Development Scenario

- 4.13** The Modelling results of the proposed Development scenario represent the proposed surface water flood risk within the area of the proposed development.
- 4.14** The development model used the baseline 2 scenario combined with the proposed development changes in ground level and the proposed surface water drainage network.
- 4.15** As outlined in the Methodology section 3, Gullies, manholes, drainage pipes, outfalls, swales and SuDS ponds are all modelled as part of this proposed development scenario, to fully represent the developed scenario.
- 4.16** **Figure 4-2** illustrates the development scenario for 6h duration and 1 in 100yr +40CC event.

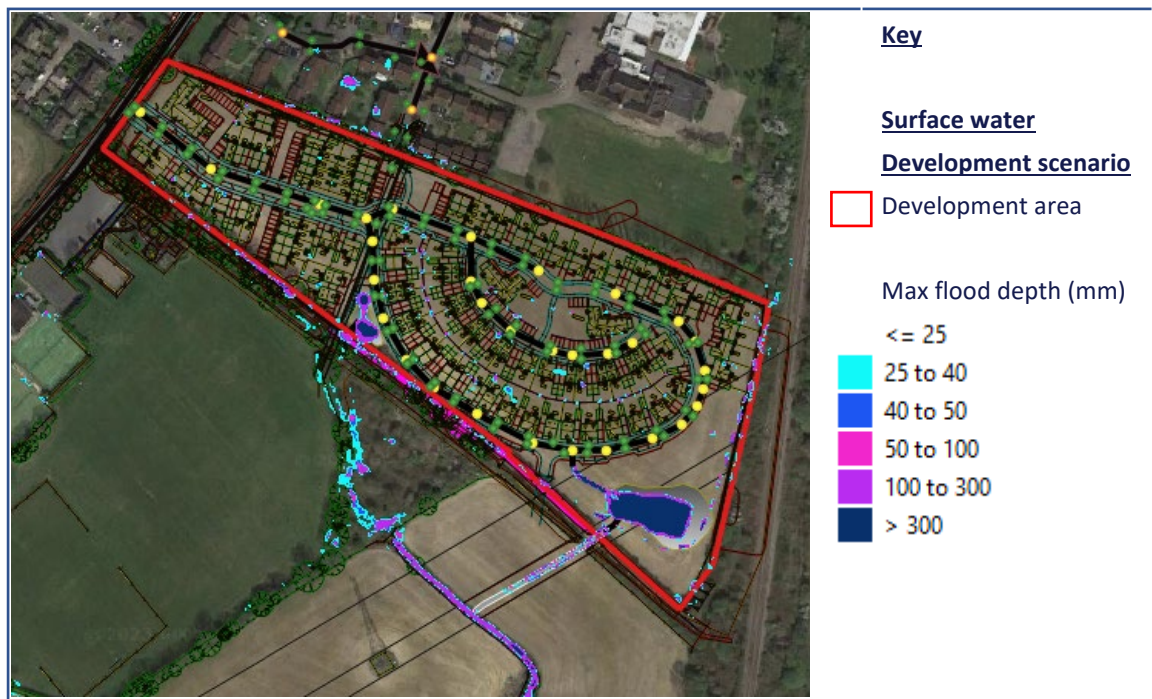


Figure 4-2 Maximum flood depth Surface water Development scenario, 6h duration 1 in 100yr+40%CC

- 4.17** Modelling of the proposed development scenario shows that due to the changes in ground levels and the strategic location of the SuDS ponds, the previous accumulation areas no longer exists, instead the ponds retain the surface water and drain towards the drainage ditches.
- 4.18** The development scenario also shows that the development of the site removes flow accumulation at the north boundary with the proposed drainage network capable of dealing with up to 1 in 1000 yr events.
- 4.19** All modelled events and durations for the development scenario are shown in **Appendix C**.

| 5 Summary and Conclusions

- 5.1** The design rainfall duration and DDF calculation used for this report comply with the regulations and for this case represent conservative scenarios.
- 5.2** The No Drainage Baseline 1 scenario shows that without any surface water management system the flooding waters will accumulate in some sections of the South Dr developed area north of the site and at the south boundary of the proposed development due to the existing site topography.
- 5.3** The baseline 2 scenario shows that the existing drainage network within the South Dr developed area manages the existing surface water correctly and this is supported by the low frequency of flooding events recorded in the original FRA. Within the proposed development area the surface water accumulation is mostly located at the low spot of the southern boundary with flood levels remaining below 300mm.
- 5.4** The proposed development will change ground levels and will implement a surface water drainage network throughout the development area. The proposed development will also include SuDS swales and ponds to retain surface water.
- 5.5** The modelling of the proposed development scenario shows that the proposed surface water drainage network and SuDS management features work effectively. The modelling also demonstrates a reduction in the flood extent downstream as the development drainage will control the flow towards Northaw Brook.

| 6 Limitations

Limitations

- 6.1** The conclusions and recommendations contained herein are limited to those given the general availability of background information and the planned usage of the site.
- 6.2** Third party information has been used in the preparation of this report, which Brookbanks, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.
- 6.3** The benefits of this report are provided solely to Bellway for the proposed development at Northway Road East, Cuffley only.
- 6.4** Brookbanks excludes third party rights for the information contained in the report.

Appendix A

Ashley Ransome
Local Planning Authority
Welwyn Hatfield Borough Council
The Campus
Welwyn Garden City
Hertfordshire
AL8 6AE

**Lead Local Flood Authority
Post Point CHN 215
Hertfordshire County Council
County Hall, Pegs Lane
HERTFORD SG13 8DN**

Contact Jessica Christie
Email FRMConsultations@hertfordshire.gov.uk

Date: 23 December 2022

Dear Ashley Ransome

**RE: 6/2022/1774/RM – Land to the North-East of King George V playing fields,
Northdaw Road East, Hertfordshire, Cuffley, EN6 4RD**

Thank you for consulting us on the above application received on 24 November 2022, for the submission of Reserved Matters (appearance, landscaping, layout, and scale) and for the discharge of condition 6 (Surface water drainage scheme) for the residential development of up to 121 dwellings, associated infrastructure, and a change of use from agricultural land to an extension of the King George V playing field.

We **maintain our objection** to the reserved matters of the appearance, landscaping, layout and scale as they layout of the development cannot be effectively assessed without sufficient information relating to condition 6 being provided. We object to discharging condition 6 and note that condition 19 is related to condition 6.

Reason

To prevent flooding in accordance with National Planning Policy Framework paragraph 167, 169 and 174 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage, and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development.

We will consider reviewing this objection if the following issues are adequately addressed in relation to condition 6:

- We require all drainage modelling calculations are resubmitted using FEH 2013 rainfall data instead of FSR and FEH 1999.
- It is unclear from the drainage strategy and Microdrainage calculations if the surface water flow path has been included within the calculations. Further information required.
- We note that the applicant has updated drawing 10929-500-004 stating FFL will be 300mm above ground level. However, we request that finished floor levels be labelled

on each plot with a minimum of 300mm above the max flood level of any expected flooding, either overland flow paths or calculated within drainage network.

- We request that it is clarified that the overland flood flows and volumes have been calculated and incorporated into the drainage network modelling as inflows. We would also require information to support the sizing of the cut of ditches proposed at the north of the site to ensure that all overland flow coming onto the site would be managed accordingly. We request that a catchment plan of the overland flow route and the development drainage is provided showing the flood volumes and flows from each area.

The following information is required in order to discharge condition 19 but is also required to support the discharge of condition 6:

- We require evidence of how greenfield runoff rates were calculated. Furthermore, please recalculate critical storm events using FEH 2013 during the 1 in 100-year event plus 40% climate change event.
- We require drainage calculations up to and including the 1 in 100 years plus climate change (40%) event for all storage features used within the drainage strategy. As previously agreed with the LLFA storage features should have a minimum storage capacity of 1,494 m³.
- Please update detailed drawings for storage, size, volume, and depth to be included with all SuDS storage features.

All other information provided as part of the reconsultation are satisfactory and need no further action.

Informative

At discharge of conditions, we recommend that the applicant provides written assurance that a third-party contractor will be appointed for the maintenance and management for the lifetime of the development.

For further advice on what we expect to be contained within the FRA to support an outline planning application, please refer to our Developers Guide and Checklist on our surface water drainage webpage <https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx> this link also includes HCC's policies on SuDS in Hertfordshire.

Please note if the LPA decide to grant planning permission, we wish to be notified for our records.

Yours sincerely

Jessica Christie
SuDS and Watercourses Support Officer
Environment & Transport and Sustainable Growth

Annex

The applicant has provided the following documents as part of the application:

- Drainage report prepared by Brook Banks, July 2022, Ref: 10929/SWDR rev2, Rev 2, Revised 17 November 2022
- Response to LLFA objection, November 2022

Condition 6 states:

No development shall take place until a detailed surface water drainage scheme for the site based on the approved drainage strategy and sustainable drainage principles, has been submitted to and approved in writing by the local planning authority. The drainage strategy should demonstrate the surface water run-off generated up to and including 1 in 100 years + climate change critical storm will not exceed the run-off from the undeveloped site following the corresponding rainfall event. The scheme shall also include:

- a) Detailed engineered drawings of the proposed SuDS features including cross section drawings, their size, volume, depth and any inlet and outlet features including any connecting pipe runs.*
- b) Final detailed post-development network calculations for all storm events up to and including the 1 in 100 year + 40% climate change storms with half drain down times no greater than 24 hours.*
- c) Assessment of the surface water flow path and the volumes to be managed as part of the development.*
- d) Exceedance flow routes for storm events greater than the 1 in 100 year + 40% climate change storm.*
- e) Final detailed management plan to include arrangements for adoption and any other arrangements to secure the operation of the scheme throughout its lifetime.*

The mitigation measures shall be fully implemented prior to occupation and maintained in accordance with the timing / phasing arrangements embodied within the scheme, or within any other period as may subsequently be agreed, in writing, by the Local Planning Authority.

REASON: To reduce the risk and impact of flooding by ensuring the satisfactory storage and disposal of surface water from the site; and to ensure surface water can be managed in a sustainable manner in accordance with Policy R7 and R10 of the Welwyn Hatfield District Plan 2005; Policy SADM14 of the draft Local Plan Proposed Submission August 2016; and the National Planning Policy Framework.

Condition 19 States:

The development hereby permitted must be carried out in accordance with the approved Flood Risk Assessment prepared by Brookbanks reference 10710 FRA01 Rv0 dated 11 June 2021 and the following mitigation measures detailed within the Flood Risk Assessment:

- *Limiting the surface water run-off generated by the critical storm events so that it will not exceed the surface water run-off rate of 8.2 l/s during the 1 in 100-year event plus 40% climate change event.*
- *Providing storage to ensure no increase in surface water run-off volumes for all rainfall events up to and including the 1 in 100 years + climate change event providing a minimum of 1,494 m³ (or such storage volume agreed with the LLFA) of total storage volume in attenuation basin and swale.*
- *Discharge of surface water from the private drain into the ordinary watercourse south of the site.*

The mitigation measures shall be fully implemented prior to occupation and maintained in accordance with the timing / phasing arrangements embodied within the scheme, or within any other period as may subsequently be agreed, in writing, by the Local Planning Authority.

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Ashley Ransome
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Lead Local Flood Authority
Post Point CHN 215
Hertfordshire County Council
County Hall, Pegs Lane
HERTFORD SG13 8DN

Contact Jessica Christie
Email FRMConsultations@hertfordshire.gov.uk

Date 31 January 2023

Dear Ashley,

**RE: 6/2022/1774/RM – Land to the North-East of King George V playing fields,
Northaw Road East, Hertfordshire, Cuffley, EN6 4RD**

Thank you for consulting us on the above application received on 13 January 2022, for the submission of Reserved Matters (appearance, landscaping, layout, and scale) and for the discharge of condition 6 (Surface water drainage scheme) for the residential development of up to 121 dwellings, associated infrastructure, and a change of use from agricultural land to an extension of the King George V playing field.

We **maintain our objection** to the reserved matters of the appearance, landscaping, layout and scale as they layout of the development cannot be effectively assessed without sufficient information relating to condition 6 being provided. We object to discharging condition 6 and note that condition 19 is related to condition 6.

Reason

To prevent flooding in accordance with National Planning Policy Framework paragraph 167, 169 and 174 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage, and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development.

We will consider reviewing this objection if the following issues are adequately addressed in relation to condition 6:

- In regard to condition 6 point 3 we require further information. We require justification as to whether the overland surface water flow path is considered separate from the drainage strategy or whether it will be accounted for in the strategy. In the applicants response to the LLFA objection, it is suggested that the 'overland surface water flows will be independent from the adoptable drainage system'. However, the applicant further states that a 'low flow risk path flowing south from South Drive has been

considered in the drainage strategy'. Despite being low risk, we would require suitable attenuation and storage to be accounted for with these volumes and flows to be accounted for in the drainage network modelling. If the overland surface water flow path from South Drive is not part of the strategy, please clarify how this will be drained separately off the road and how it will not impact the proposed development and vulnerable areas such as residential dwellings.

- It is noted that cut off ditches are not being used, its noted these were included to assist in the capture and management the surface water overland flow path originating off site that travels from north to south through the site. We request information how the flow path will be managed in detail; this is likely to require pre and post development modelling to demonstrate that there is no adverse risk of flooding and that the proposed development is safe for its lifetime.
- It is noted that the updated drainage calculations clarify that the sites discharge is limited to a surface water runoff rate of 8.2 l/s. However, in regard to the overland surface water flow path, the drainage storage calculations may need to be updated if the overland flow will be adopted to the strategy.
- Insufficient detail has been added to basin and swale drawings. We require, storage, volume, area and discharge rate to be included on these drawings.

Additional information has been submitted that addresses some of our concerns, these are:

- It is noted that FEH 2013 has been used, no further information is required.
- It is noted that finished floor levels have been added to drainage design, no further information is required.

Informative

For further advice on what we expect to be contained within the FRA to support a planning application, please refer to our Developers Guide and Checklist on our surface water drainage webpage <https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/surface-water-drainage/surface-water-drainage.aspx> this link also includes HCC's policies on SuDS in Hertfordshire.

Erection of flow control structures or any culverting of an ordinary watercourse requires consent from the appropriate authority, which in this instance is Hertfordshire Lead Local Flood Authority and the Local Council (if they have specific land drainage bylaws). It is advised to discuss proposals for any works at an early stage of proposals.

In December 2022 it was announced FEH rainfall data has been updated to account for additional long term rainfall statistics and new data. As a consequence, the rainfall statistics used for surface water modelling and drainage design has changed. In some areas there is a reduction in comparison to FEH2013 and some places an increase (see [FEH22 - User Guide \(hydrosolutions.co.uk\)](#)). Any new planning applications that have not already commissioned an FRA or drainage strategy to be completed, should use the most up to date FEH22 data. Other planning applications using FEH2013 rainfall, will be

accepted in the transition period up to the 1 April 2023. This includes those applications that are currently at and advanced stage or have already been submitted to the Local Planning Authority. For the avoidance of doubt the use of FSR and FEH1999 data has been superseded by FEH 2013 and 2022 and therefore, use in rainfall simulations are not accepted.

Please note if, you the Local Planning Authority review the application and decide to grant planning permission, you should notify the us, the Lead Local Flood Authority, by email at FRMConsultations@hertfordshire.gov.uk.

Yours sincerely

Jess

Jessica Christie
SuDS and Watercourses Support Officer
Environment & Transport and Sustainable Growth

Annex

The following documents have been reviewed, which have been submitted to support the application;

- Surface Water Drainage report (Rev 3), prepared by Brookbanks, Ref: 10929/SWDR rev3, 12 January 2023

Condition 6 states:

No development shall take place until a detailed surface water drainage scheme for the site based on the approved drainage strategy and sustainable drainage principles, has been submitted to and approved in writing by the local planning authority. The drainage strategy should demonstrate the surface water run-off generated up to and including 1 in 100 years + climate change critical storm will not exceed the run-off from the undeveloped site following the corresponding rainfall event. The scheme shall also include:

- a) Detailed engineered drawings of the proposed SuDS features including cross section drawings, their size, volume, depth and any inlet and outlet features including any connecting pipe runs.*
- b) Final detailed post-development network calculations for all storm events up to and including the 1 in 100 year + 40% climate change storms with half drain down times no greater than 24 hours.*
- c) Assessment of the surface water flow path and the volumes to be managed as part of the development.*
- d) Exceedance flow routes for storm events greater than the 1 in 100 year + 40% climate change storm.*
- e) Final detailed management plan to include arrangements for adoption and any other arrangements to secure the operation of the scheme throughout its lifetime.*

The mitigation measures shall be fully implemented prior to occupation and maintained in accordance with the timing / phasing arrangements embodied within the scheme, or within any other period as may subsequently be agreed, in writing, by the Local Planning Authority.

REASON: To reduce the risk and impact of flooding by ensuring the satisfactory storage and disposal of surface water from the site; and to ensure surface water can be managed in a sustainable manner in accordance with Policy R7 and R10 of the Welwyn Hatfield District Plan 2005; Policy SADM14 of the draft Local Plan Proposed Submission August 2016; and the National Planning Policy Framework.

Condition 19 States:

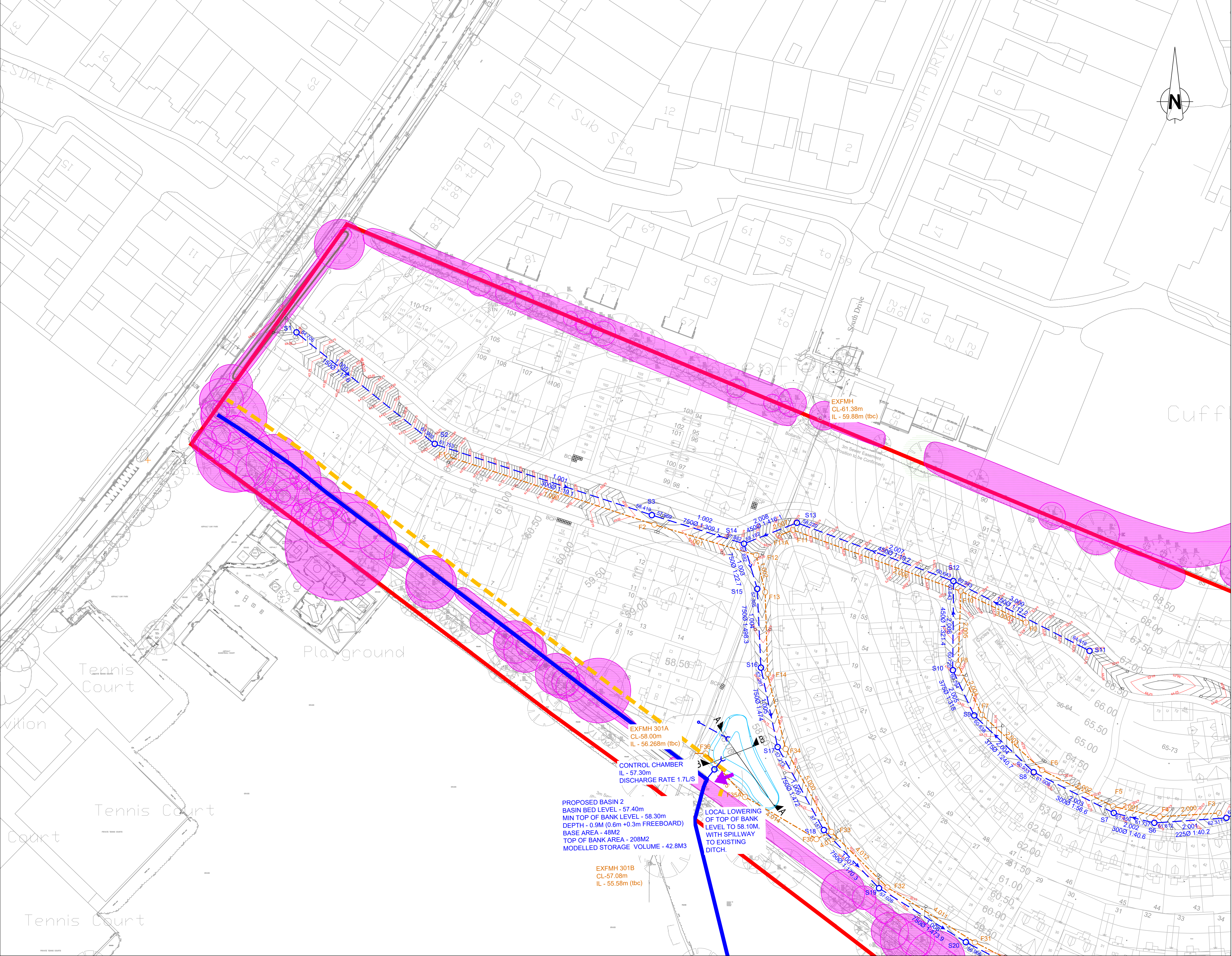
The development hereby permitted must be carried out in accordance with the approved Flood Risk Assessment prepared by Brookbanks reference 10710 FRA01 Rv0 dated 11 June 2021 and the following mitigation measures detailed within the Flood Risk Assessment:

- *Limiting the surface water run-off generated by the critical storm events so that it will not exceed the surface water run-off rate of 8.2 l/s during the 1 in 100-year event plus 40% climate change event.*
- *Providing storage to ensure no increase in surface water run-off volumes for all rainfall events up to and including the 1 in 100 years + climate change event providing a minimum of 1,494 m³ (or such storage volume agreed with the LLFA) of total storage volume in attenuation basin and swale.*
- *Discharge of surface water from the private drain into the ordinary watercourse south of the site.*

The mitigation measures shall be fully implemented prior to occupation and maintained in accordance with the timing / phasing arrangements embodied within the scheme, or within any other period as may subsequently be agreed, in writing, by the Local Planning Authority.

REASON: To reduce the risk and impact of flooding by ensuring the satisfactory storage and disposal of surface water from the site; and to ensure surface water can be managed in a sustainable manner in accordance with Policy R7 and R10 of the Welwyn Hatfield District Plan 2005; Policy SADM14 of the draft Local Plan Proposed Submission August 2016; and the National Planning Policy Framework.

Appendix B



NOTES:

- Do not scale from this drawing.
- All dimensions are in metres unless otherwise stated.
- Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
- No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting Ltd.
- Precise line and level of the existing foul water sewer are to be notified to the Engineer prior to the commencement of the works.

KEY:

- Site Boundary
- Existing Foul water
- Proposed Foul water sewer
- Proposed Surface water sewer
- Existing Watercourse
- Watercourse 5m offset
- Proposed SuDS Basin 1 in 3 slopes
- Basin spillway
- Proposed Basin 1 Outfall Route
- Root protection zones
- Proposed Swale

D	Basin 2 Volume amended	NO	TM	TM	18.04.23
C	PN1.002 & 1.003 amended. Basin notes amended.	NO	TM	TM	12.01.23
B	Amended to comply with LLFA comments	NO	DC	TM	08/11/22
A	Drainage and Basins amended	HG	DC	RM	17.10.22
-	First Issue	HG	DC	TM	16.06.22

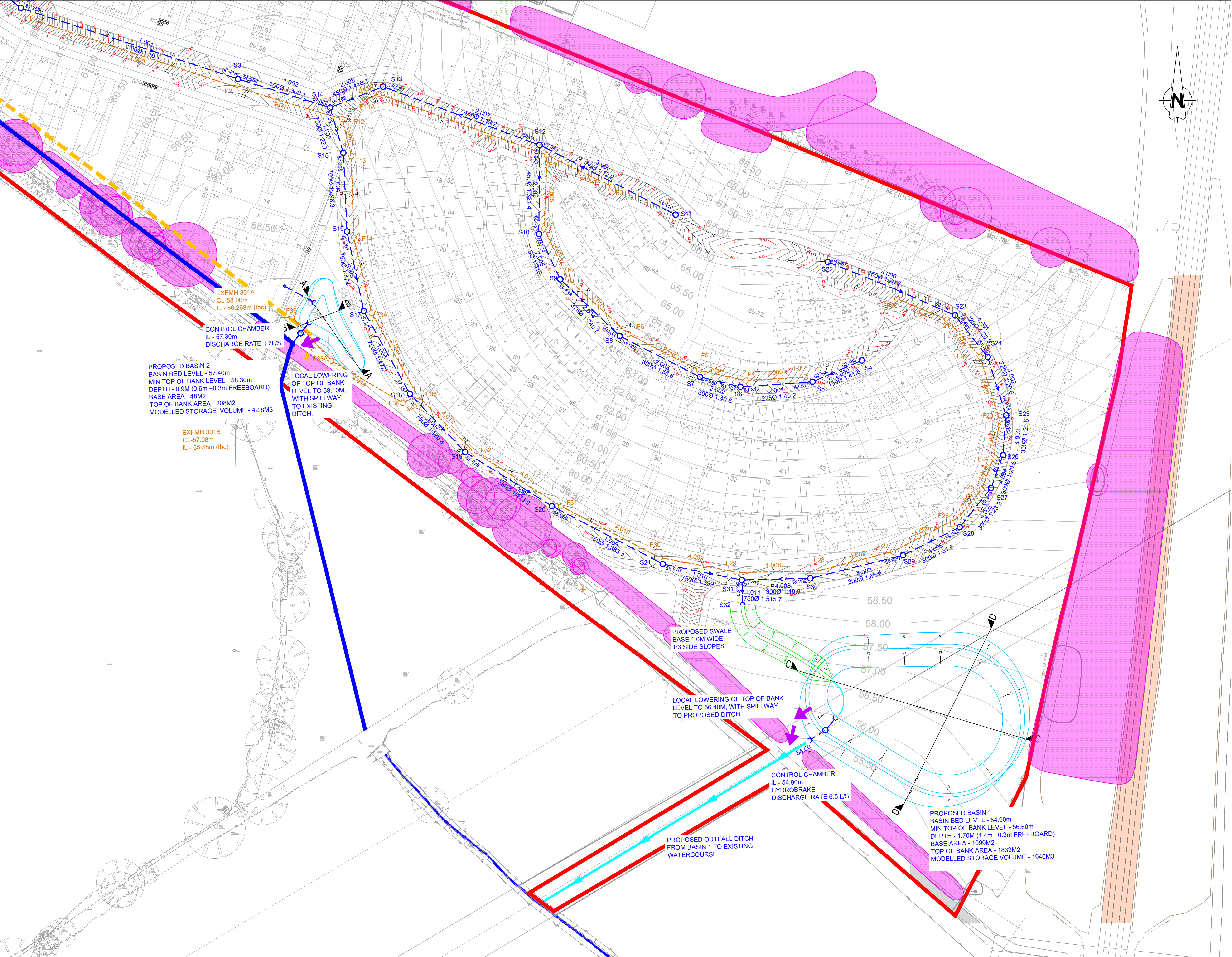
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Land at Cuffley
Hertfordshire

Foul & Surface Water
Drainage Strategy

Status		Status Date
Approval		June 2022
Drawn	Checked	Date
HG	DC	16.06.22
Scale	Number	Rev
1:500	10929-500-001	D
0 10 20 30 40 50		
METRES		

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.



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A	Drainage and Basins amended	HG	DC	RM	17.10.22
-	First Issue	HG	DC	TM	16.06.22

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Bellway

Land at Cuffley
Hertfordshire

Foul & Surface Water
Drainage Strategy 2

Status		Status Date
Approval		June 2022
Drawn	Checked	Date
HG	DC	16.06.22
Scale	Number	Rev
1:500	10929-500-002	D
0 10 20 30 40 50		
METRES		

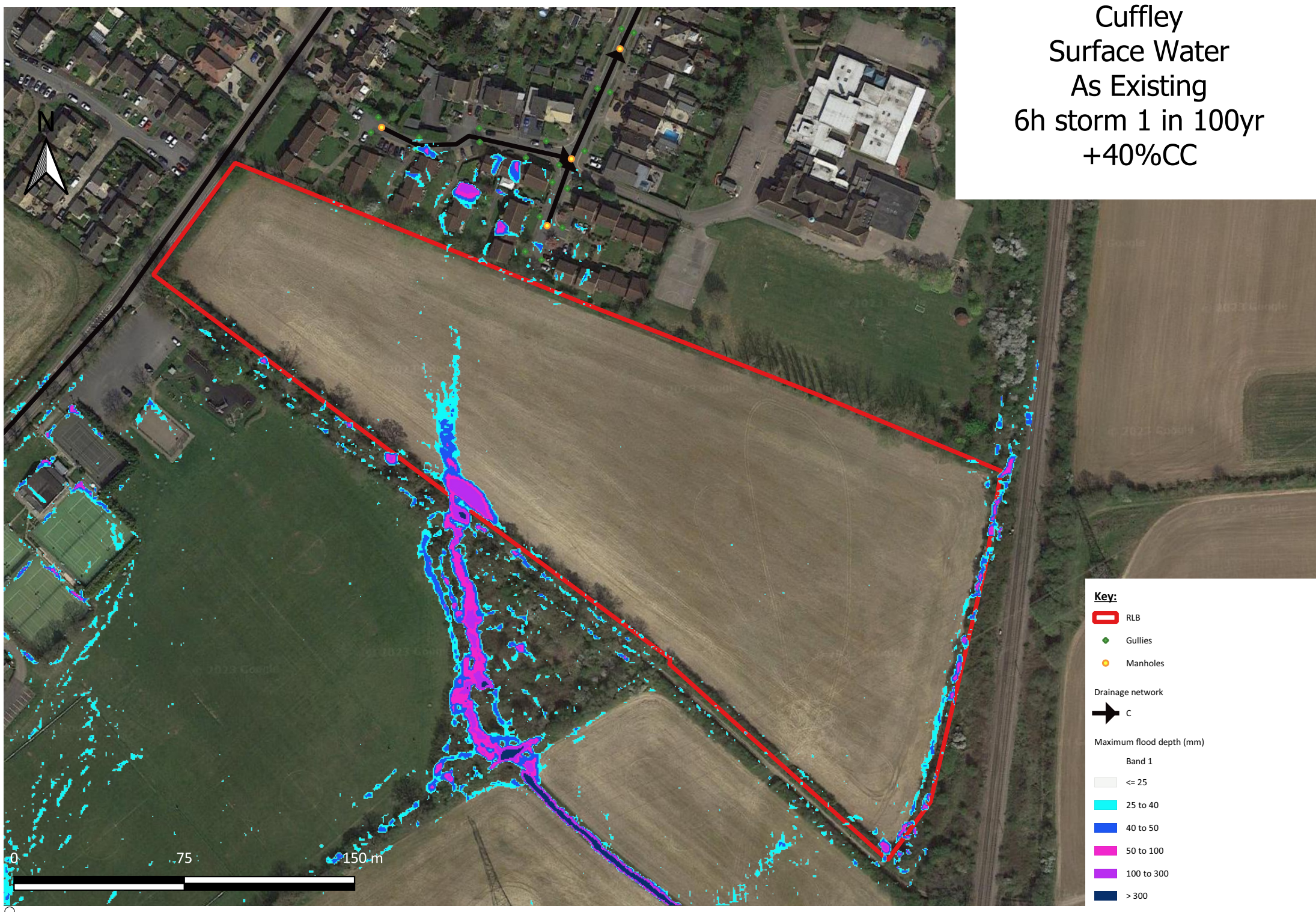
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Appendix C

Cuffley Surface Water As Existing 6h storm 1 in 100yr



Cuffley
Surface Water
As Existing
6h storm 1 in 100yr
+40%CC



Cuffley
Surface Water
As Existing
6h storm 1 in 1000yr



Cuffley
Surface Water
As Existing
12h storm 1 in 100yr
+40%CC



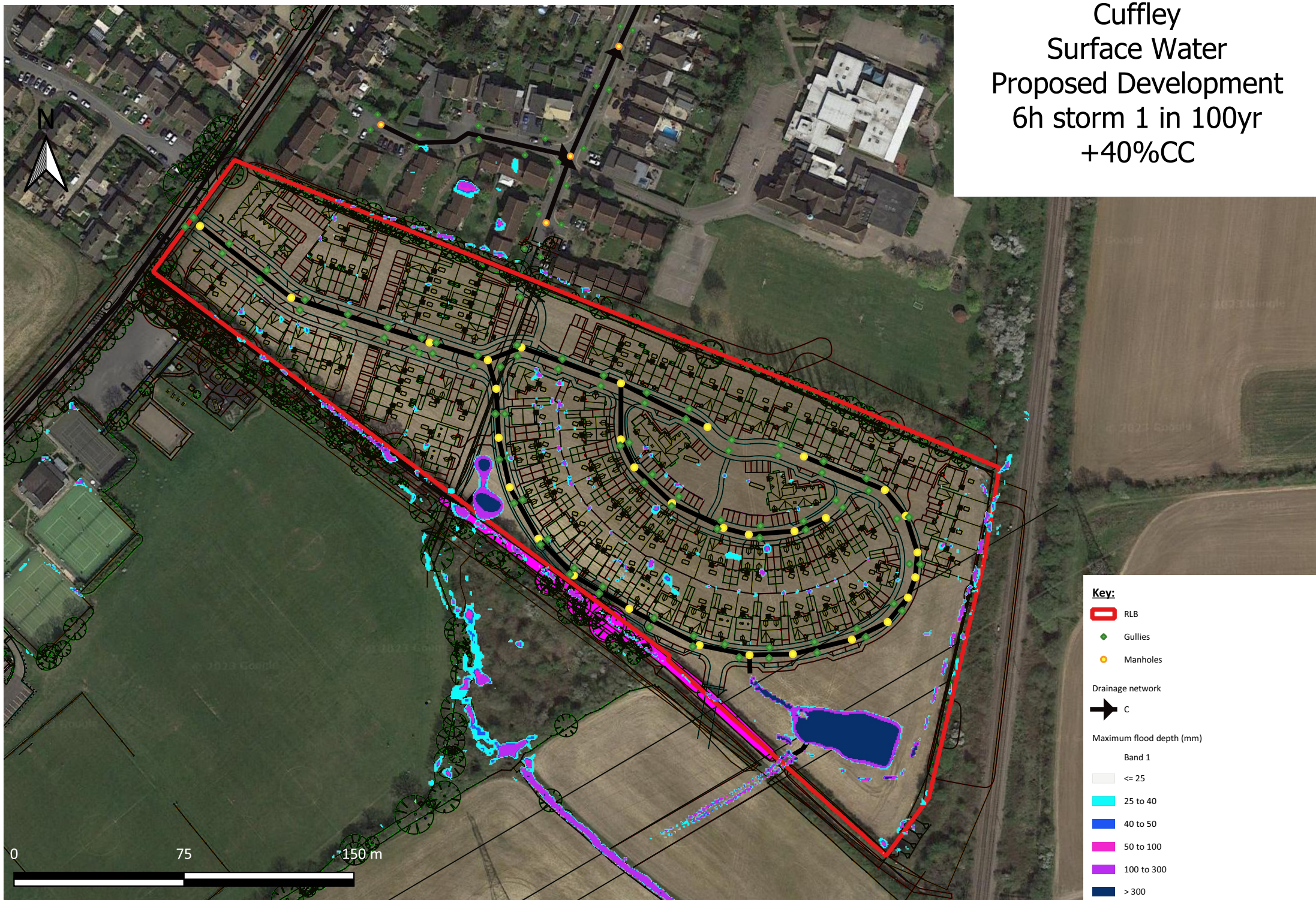
Cuffley
Surface Water
As Existing
12h storm 1 in 1000yr



Cuffley Surface Water Proposed Development 6h storm 1 in 100yr



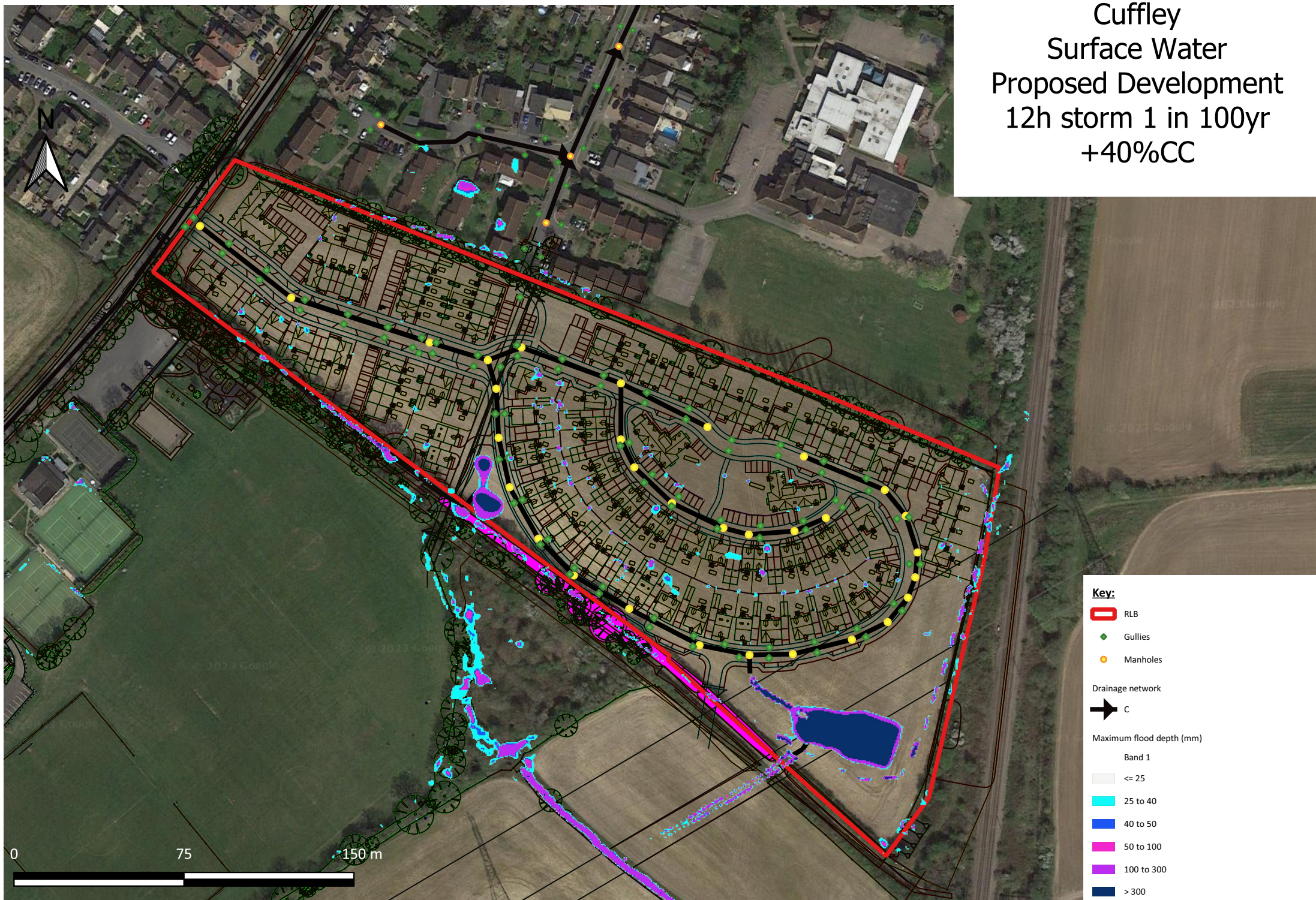
Cuffley
Surface Water
Proposed Development
6h storm 1 in 100yr
+40%CC



Cuffley
Surface Water
Proposed Development
6h storm 1 in 1000yr



Cuffley
Surface Water
Proposed Development
12h storm 1 in 100yr
+40%CC



Cuffley Surface Water Proposed Development 12h storm 1 in 1000yr





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