Land at Babraham

Flood Risk and Drainage Scoping Report

On behalf of: **Bidwells**

Project Ref: 332210692/4001 | Rev: - | Date: December 2021

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For and on behalf of Stantec UK Limited				

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1 Introduction

1.1 Scope of Report

1.1.1 This Flood Risk and Drainage Scoping Report has been prepared by Stantec UK Ltd, on behalf of our client, Bidwells, to assist with the promotion of the expansion and intensification of 'Land at Babraham' at the Regulation 18 'Preferred Options' stage of the emerging Greater Cambridge Local Plan, being prepared by Greater Cambridge Shared Planning.

1.1.2 This report sets out the existing and future flood risk constraints and opportunities for a residential-led mixed use development on 'Land at Babraham'.

1.1.3 The report is based on the available flood risk information for the site as detailed in **Section 1.2** and prepared in accordance with the planning policy requirements set out in **Section 1.3**.

1.1.4 Stantec has many years of experience in, amongst other areas, the assessment of flood risk, hydrology, flood defence and river engineering. The authors and reviewers of the document are all experienced engineers and members of chartered institutions such as the Chartered Institution of Water and Environmental Management (CIWEM) or the Institution of Civil Engineers (ICE).

1.2 Sources of Information

1.2.1 The report has been prepared based on the following sources of information:

- Environment Agency (EA) published '**Open Data'** datasets available online, reproduced with OS mapping under licence to Stantec (contains Ordnance Survey data © Crown copyright and database right [2021], contains Environment Agency information © Environment Agency and database right) – see **Appendix A;**
- **EA Product 4 Flood Data** (EA Ref. EAN/2021/235164, dated October 2021) including modelled flood levels and extents from the Cam Rural – Granta model – see **Appendix B**;
- Cambridgeshire County Council **Preliminary Flood Risk Assessment (PFRA)**, March 2011;
- South Cambridgeshire District council and Cambridge City council **Level 1 Strategic Flood Risk Assessment (SFRA)**, September 2010;
- Cambridgeshire County Council **Surface Water Management Plan (SWMP)**, September 2014;
- The **Cambridgeshire Flood and Water Supplementary Planning Document (SPD)**, November 2016;
- The **Great Ouse Catchment Flood Management Plan (CFMP)**, January 2011.

1.3 Relevant Planning Policy

1.3.1 This report has been prepared in accordance with the relevant national, regional and local planning policy and statutory authority guidance as follows:

- National policy contained within the **National Planning Policy Framework (NPPF)** updated July 2021, issued by Communities and Local Government, with reference to Section 14 'Meeting the challenge of climate change, flooding and coastal change';

- The **NPPF Planning Practice Guidance (PPG)** released in March 2014 ('Flood Risk and Coastal Change' section) and updated to incorporate the EA '**Flood Risk Assessments: Climate Change Allowances'** (updated July 2021);

- Design guidance for surface water drainage schemes contained within '**The SuDS Manual**' (CIRIA, reference C753 dated 2015) and the **DEFRA 'Sustainable drainage systems: non-statutory technical standards'** dated March 2015;

- Local planning policy contained within the **South Cambridgeshire Local Plan,** adopted September 2018, with reference to Policy CC/9: 'Managing Flood Risk' which states:

> ***1. In order to minimise flood risk, development will only be permitted where:***
> ***a. The sequential test and exception tests established by the National Planning Policy Framework demonstrate the development is acceptable (where required).***
> ***b. Floor levels are 300mm above the 1 in 100 year flood level plus an allowance for climate change where appropriate and where appropriate and practicable also 300mm above adjacent highway levels.***
> ***c. Suitable flood protection / mitigation measures are incorporated as appropriate to the level and nature of flood risk, which can be satisfactorily implemented to ensure safe occupation, access and egress. Management and maintenance plans will be required, including arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime;***
> ***d. There would be no increase to flood risk elsewhere, and opportunities to reduce flood risk elsewhere have been explored and taken (where appropriate), including limiting discharge of surface water (post development volume and peak rate) to natural greenfield rates or lower, and***
> ***e. The destination of the discharge obeys the following priority order:***
> ***i. Firtsly, to the ground via infiltration;***
> ***ii. Then, to a water body;***
> ***iii. Then, to a surface water sewer;***
> ***iv. Discharge to a foul water or combined sewer is unacceptable.***
>
> ***2. Site specific Flood Risk Assessments (FRAs) appropriate to the scale and nature of the development and the risks involved, and which takes account of future climate change, will be required for the following:***
> ***f. Development proposals over 1ha in size;***
> ***g. Any other development proposals in flood zones 2 and 3;***
> ***h. Any other development proposals in flood zone 1 where evidence, in particular the Strategic Flood Risk Assessment or Surface Water Management Plans, indicates there are records of historic flooding or other sources of flooding, and/or a need for more detailed analysis.***
>
> ***3. FRAs will need to meet national standards and local guidance (including recommendations of the South Cambridgeshire and Cambridge City Strategic Flood Risk Assessment (2010) and the Phase 1 and 2 Water Cycle Strategy or successor documents).***

1.4 Caveats and Exclusions

1.4.1 This report is not a Flood Risk Assessment or Drainage Strategy which is required for sites at the planning stages. But has been prepared in accordance with the NPPF and Local Planning Policy to assist in the production of the masterplan and inform a future planning submission. The recommended flood management (such as ground floor level recommendations) and surface water management recommendations are based on the relevant British Standards (BS8533), the standing advice provided by the EA or based on common practice.

1.4.2 The findings of this report are based on data available at the time of the study. As such, the report is accurate at time of issue, but we would recommend the end user reviews the validity of the flood data on an annual basis with the EA.

1.4.3 It should be noted that the insurance market applies its own tests to properties in terms of determining premiums and the insurability of properties for flood risk. Those that are undertaking development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencing development. Stantec does not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

2 Site Setting

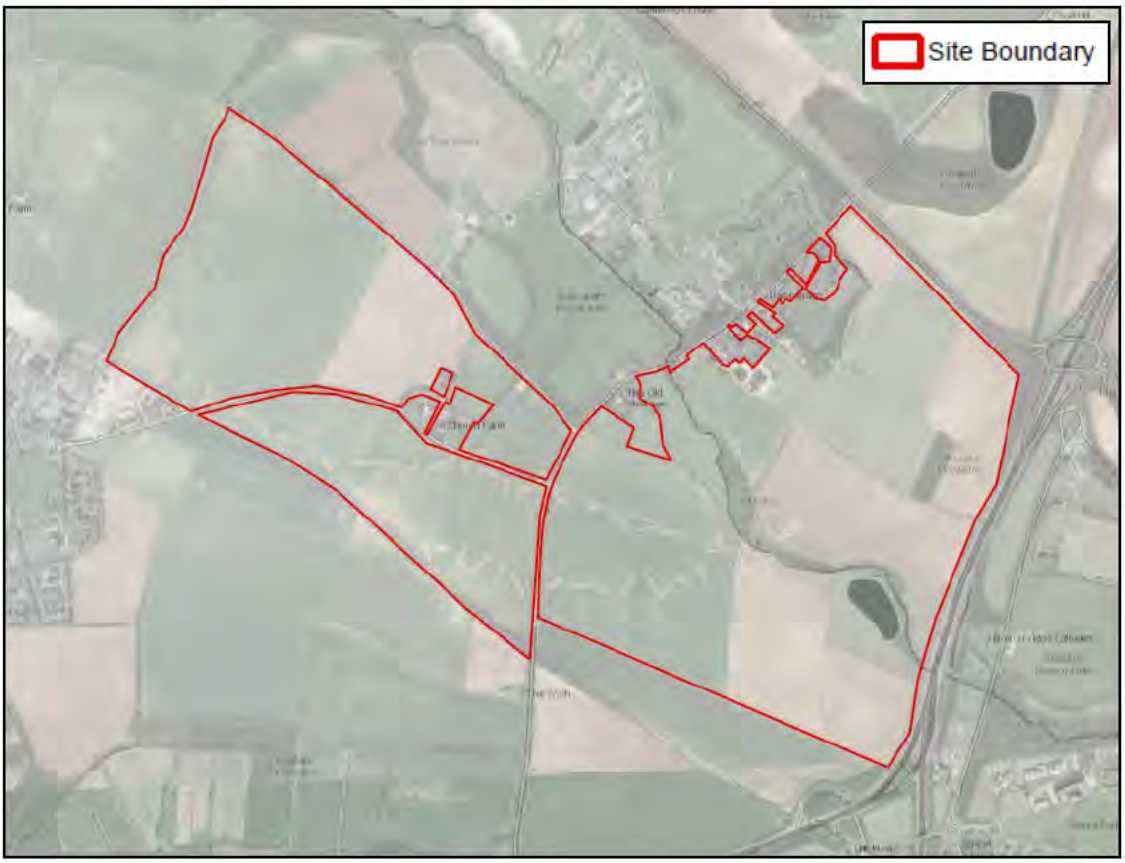
2.1 Site Description

2.1.1 The site is located on land south of the village of Babraham, Cambridgeshire (approximate site centre OS grid reference 550,930m E, 250,030m N, nearest postcode CB22 3AG – see Figure 2.1).

2.1.2 The site is approximately 560 hectares (ha) in size and lies within the administrative boundary of South Cambridgeshire District Council (SCDC).

2.1.3 The site currently comprises of greenfield land of agricultural use.

Figure 2.1: Site Location Plan



2.2 Topography

2.2.1 Light Detection and Ranging (LiDAR) data was obtained from the EA 'Open Data' dataset to identify the topography of the site.

2.2.2 The LiDAR data indicates a significant variation in ground levels across the site – see Figure 2.2.

2.2.3 Northern areas of the site fall in a direction towards the watercourse of the River Granta. High points are located in the north and south-eastern corner of the site at approximately 36m to 38m AOD. From the south-eastern point the land falls in a northerly direction towards the River Granta. The lowest ground levels are along the watercourse valley and towards the western edge of the site at approximately 30m AOD.

2.2.4 There is a ridge that protrudes southwards centrally through the site from the west to east in the southern parcels of the site. The high point of this ridge is approximately 38m AOD. To the south of the ridge land falls in a southerly direction towards Sawston, and to the north of the ridge towards the watercourse.

Figure 2.2: LiDAR Area Topography of the site

2.2.5 During the site walkover a topographic low was observed between the northeast site boundary and the A11 highway.

2.3 Hydrological Setting and Flood Defences

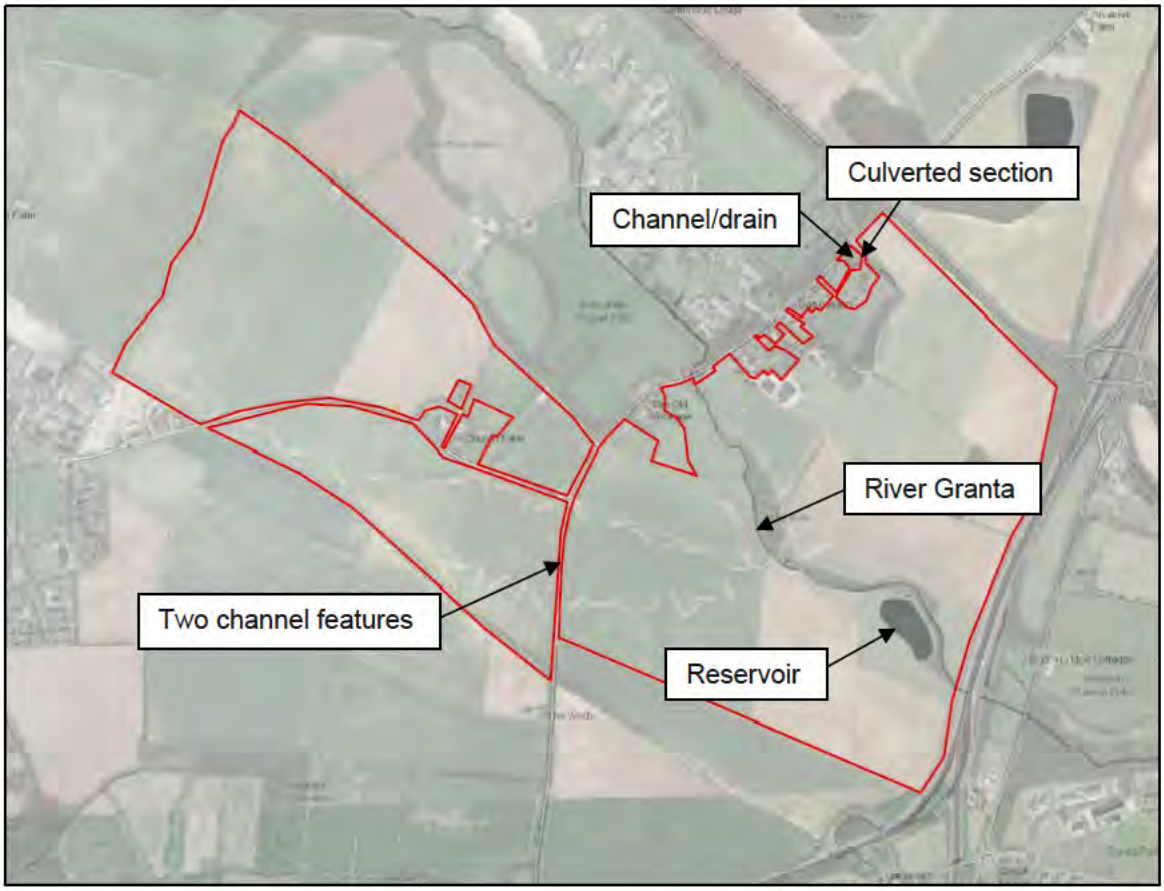
2.3.1 The **River Granta** flows from southeast to northwest, through the eastern part of the site. The River Granta is a chalk river that rises from springs near Bartlow. The river flows for approximately 29km through Babraham, before joining the River Cam at Stapleford. The river is designated as a 'main river' by the EA.

2.3.2 There is a lined waterbody (approximately 1.2 hectares) located towards the southeast corner of the site, see **Figure 2.3** and **Figure 2.4** below from the site walkover. Further details of this waterbody are currently unknown. It is anticipated this is a lined reservoir used for irrigation for the surrounding farmland subject to confirmation from the landowners.

Figure 2.3: Lined waterbody in the southeast of the site, looking eastwards

2.3.3 During the site walkover an open dry channel / drain was observed within the north of the site. The channel is not connected to a watercourse and does not extend off-site. A section of the channel, between and outside the site boundaries, is culverted beneath a road.

Figure 2.4: Hydrological features of the site



2.3.4 There are no other watercourses or waterbodies within the site.

2.3.5 The EA Product 4 data confirms the site benefits from informal high ground defences. However, there are no formal flood defences within the site or immediate vicinity.

2.4 Geology and Hydrogeology

2.4.1 The British Geological Survey (BGS) online viewer provides the following general outline of ground conditions on site:

- **Bedrock:** Holywell Nodular Chalk underlain the majority of the site, with a small area to the west which has Zag chalk formation. The Nodular Chalk belongs to the White Chalk Subgroup and the Zag belongs to the Grey Chalk Subgroup. See Figure 009a in **Appendix A** for an illustrative overview of the bedrock geology at the site.

- **Superficial Deposits**: Alluvium and River Terrace deposits across the centre of the site (correlating to the topographical valley associated with the watercourse). River Terrace deposits and the Lowestoft formation is also present in the north and southern extents of the site. Other areas of the site have no recorded deposits. See Figure 009b in **Appendix A** for an illustrative overview of superficial deposits at the site.

2.4.2 The Cranfield University 'Soilscapes' viewer indicates the soils across the site are classified as ***'freely draining slightly acid but base-rich soils'*** across the centre of the site; and ***'freely draining lime-rich loamy soils'*** to the south and west – see Figure 009c in **Appendix A**.

2.4.3 A review of relevant aquifer designations for the site (taken from the DEFRA 'MagicMap' website) is summarised below:

- The bedrock is classified as a 'Principal' aquifer by the EA;

- The superficial Alluvium and River Terrace deposits through the centre of the site is classified as a 'Secondary A' aquifer by the EA;

2.4.4 During the site walkover two short channels adjacent to the High Street road, (**Figure 2.4**) possibly used for infiltration, in the centre of the site and a dry channel in the north of the site were observed, indicating that infiltration could be feasible. However, pools of water collecting in topographic lows were observed on the fields, indicating that the topsoil was not infiltrating, see **Figure 2.5**.

Figure 2.5: Water pooling in the southwest of the site

2.4.5 The majority of the site lies within an EA Groundwater Source Protection Zone (SPZ) 2 'outer protection zone', however a small area to the north of the site is located within SPZ 1 'inner protection zone' – see Figure 008 in **Appendix A**.

3 Flood Risk

3.1 Fluvial Flood Risk

EA Flood Zone Map

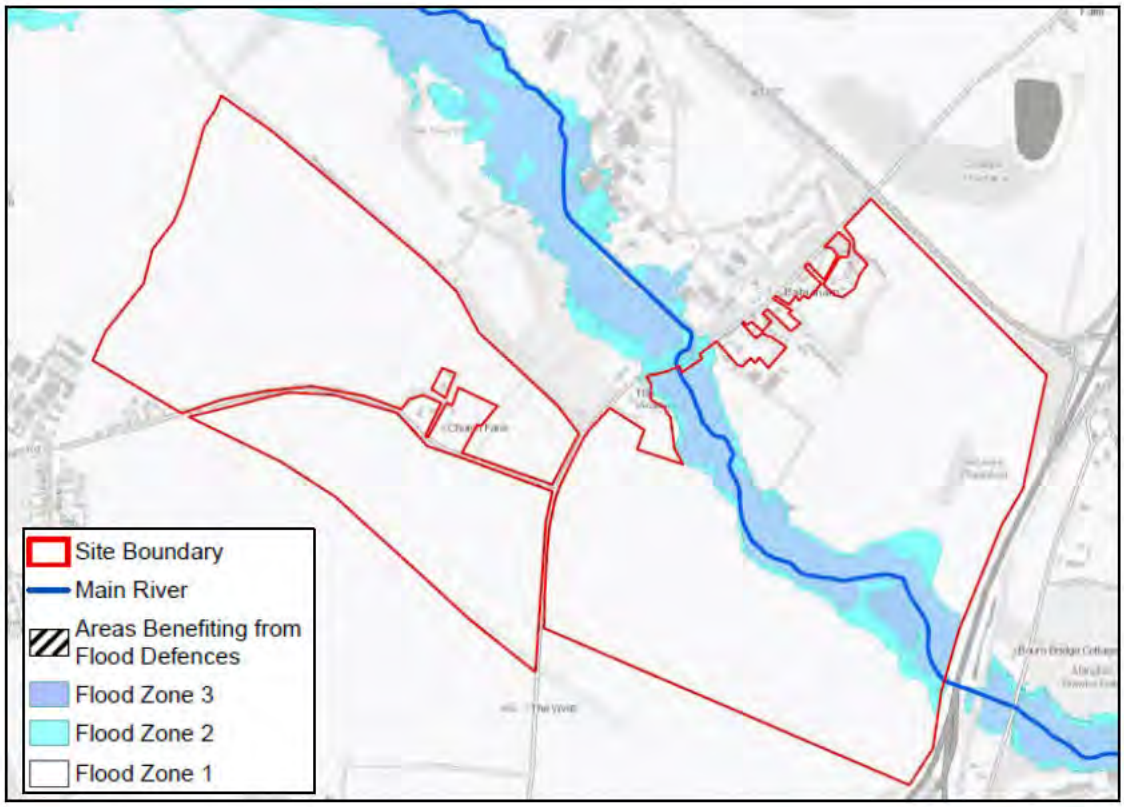
3.1.1 The first phase in identifying whether a site is potentially at risk of flooding is to consult the EA Flood Zone maps, available on the EA website. This provides an initial indication of the extent of the Flood Zones, which is more detailed site-specific level survey and modelled flood levels.

3.1.2 The Flood Zones are defined in Table 1 of the NPPF Planning Practice Guidance (PPG) ('Flood Risk and Coastal Change' section) as follows:

- **Flood Zone 1 'Low Probability'** – Land at less than 1 in 1000 (<0.1%) annual probability of river or sea flooding;
- **Flood Zone 2 'Medium Probability'** – Land between 1 in 100 (1.0%) and 1 in 1000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of sea flooding;
- **Flood Zone 3 'High Probability'** – Land at 1 in 100 (1.0%) or greater annual probability of river flooding, or 1 in 200 (0.5%) or greater annual probability of sea flooding.

3.1.3 The EA Flood Zone map indicates that the majority of the site lies within **Flood Zone 1 'Low Probability'**. However, the central part of the site lies within **Flood Zone 2 'Medium Probability'** and **Flood Zone 3 'High Probability'** associated with the river corridor of the River Granta – see **Figure 3.1**.

Figure 3.1: EA Flood Zone Map



3.1.4 The Flood Zone map does not differentiate between Flood Zone 3a 'High Probability' and Flood Zone 3b 'Functional Floodplain'. The defined Flood Zone 3 is effectively a composite of Zone 3a and Zone 3b. Further review of the SFRA (2010) indicates that the area of Flood Zone 3 within the site is classified as Flood Zone 3b 'Functional Floodplain'.

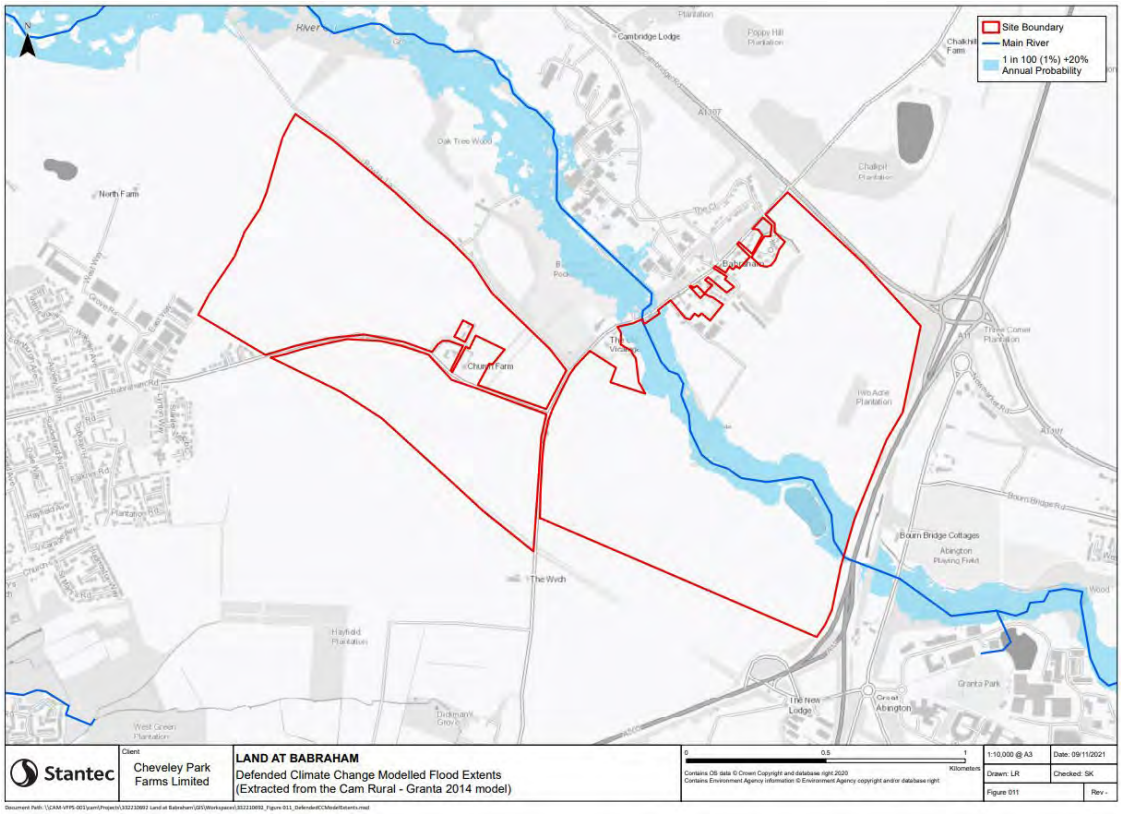
3.1.5 During the site walkover it was noted that the Granta River ford in the centre of the site was impassable. As there was no significant rain event prior to the site visit, this could indicate that the Granta River is at maximum capacity.

EA Modelled Flood Data

3.1.6 The EA have provided the outputs from the Cam Rural – Granta model for the site and immediate vicinity (**Appendix B**). The EA Product 4 data confirms the majority of the site is located within Flood Zone 1, with areas of the site located in Flood Zone 2, Flood Zone 3a and Flood Zone 3b.

3.1.7 The EA model output confirms the extent of the 1% AP plus 20% allowance for climate change extent, see **Figure 3.2**.

Figure 3.2: EA Flood Zone Map – Climate Change



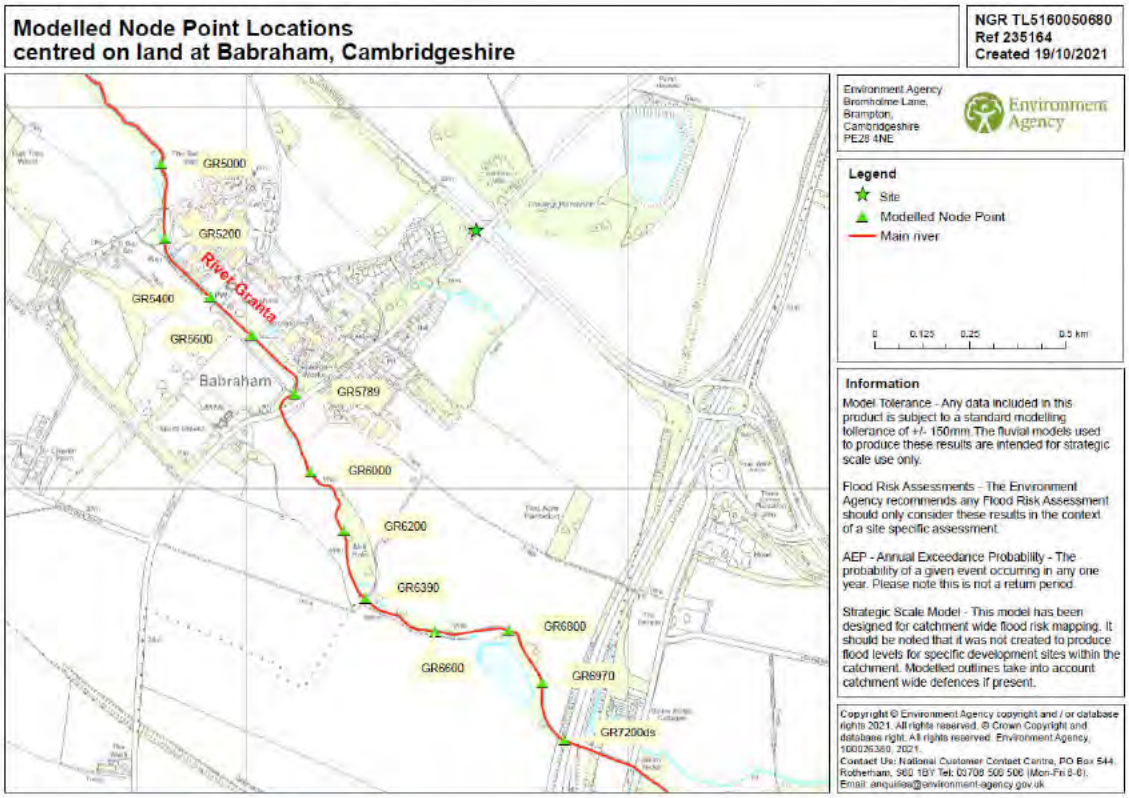
3.1.8 A summary of the flood levels at the site are included in **Table 3.1** below.

3.1.9 The location of where these flood levels have been extracted from the Cam Rural – Granta model are presented in **Figure 3.2** below and included in **Appendix B**.

Table 3.1: EA Modelled Flood Levels

Node Point	Modelled Flood Level (m. AOD)			
	4% AP	1% AP	1% AP + 20%	0.1% AP
GR6000	24.28	24.49	24.62	24.80
GR6200	24.50	24.62	24.79	24.93
GR6390	24.87	25.02	25.13	25.31
GR6600	25.51	25.02	25.69	25.31
GR6800	25.91	25.97	26.12	26.20
GR6970	26.48	26.66	26.75	26.90

Figure 3.2: EA Node Point Map



3.2 Flood Risk from Surface Water

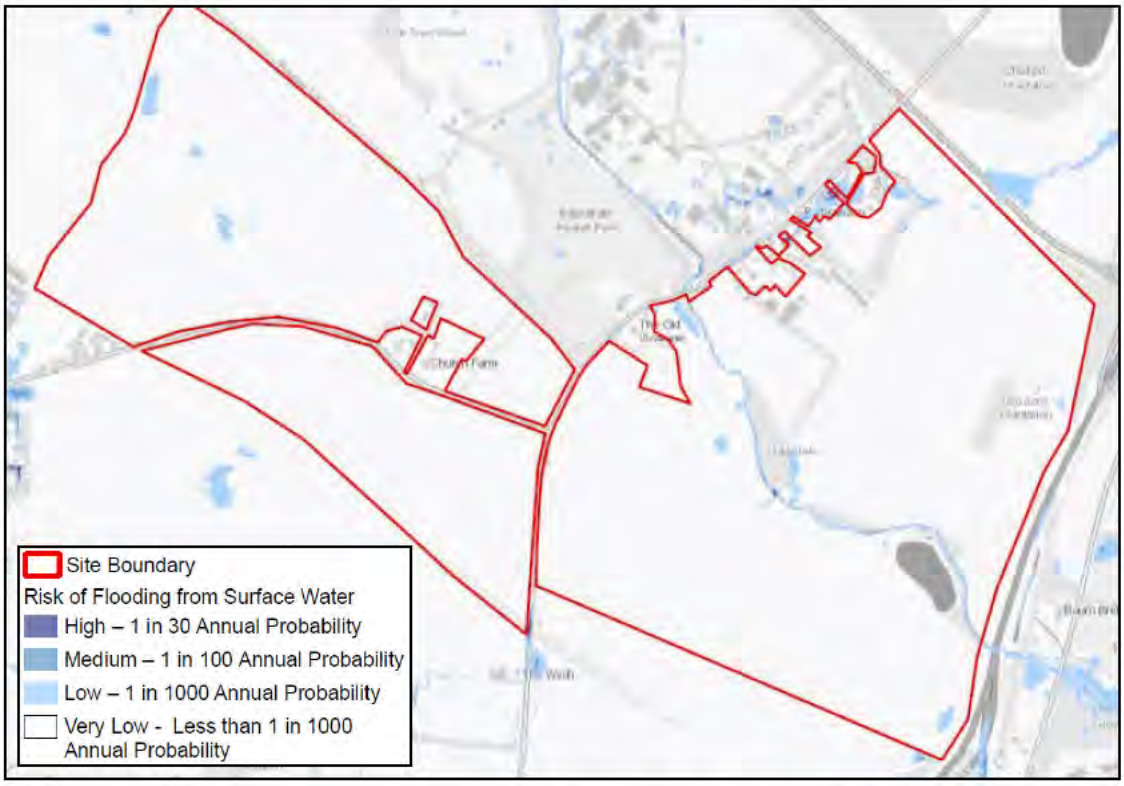
3.2.1 The EA 'Flood Map for Surface Water' ('FMfSW') shows where areas could be potentially susceptible to surface water flooding in an extreme rainfall event. The latest mapping assesses flooding resulting from severe rainfall events based on the following three scenarios:

- 1 in 30 (3.3%) annual probability rainfall event ('High' risk);
- 1 in 100 (1%) annual probability rainfall event ('Medium' risk);

- 1 in 1000 (0.1%) annual probability rainfall event ('Low' risk).

3.2.2 Land at lower than 1 in 1000 (0.1%) annual probability of flooding is considered to be 'Very Low' risk of flooding.

Figure 3.3: EA Flood Map for Surface Water



3.2.3 The Surface Water Flood Map indicates that the majority of the site is at 'Very Low' risk of surface water flooding (Figure 3.3).

3.2.4 The central part of the site is at a 'low' risk of surface water flooding, corresponding with the route of the River Granta.

3.2.5 The SFRA (2010) 'Surface Water Flood Risk' maps are consistent with the latest EA mapping.

3.2.6 It should be noted that these maps are generated using a relatively coarse methodology whereby rainfall inflows are routed over a ground surface model. The analysis assumes a suitable 'typical' approach to represent the effects of urban drainage infrastructure and highlights low lying area of topography and preferential flow paths that may be more susceptible to surface water flooding in the event of extreme rainfall. Consequently, the mapping provides a guide to potentially vulnerable areas based on the general topography of the area.

3.3 Flood Risk from a Reservoir Breach

3.3.1 The EA provides maps showing the risk of flooding in the event of a breach from reservoirs, based only on large reservoirs (over 25,000 cubic metres of water).

3.3.2 The EA reservoir maps show two flooding scenarios, a 'dry-day' and a 'wet-day'. The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme natural flood.

3.3.3 The mapping indicates that the central and northern part of the site is at risk of flooding from a reservoir breach during a 'dry-day' scenario. The mapping also confirms that the wider central part of the site is at risk during a 'wet-day' scenario – see Figure 006a in **Appendix A**.

3.3.4 It should be emphasised that the risk of flooding from a reservoir breach is very small. The EA are the enforcement authority for the Reservoirs Act (1975) and there is a mandatory requirement for all large raised reservoirs (where greater than 25,000m^3 of water is stored above natural ground level) to be inspected and supervised by reservoir panel engineers. The EA website states:

'Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, we ensure that reservoirs are inspected regularly and essential safety work is carried out'.

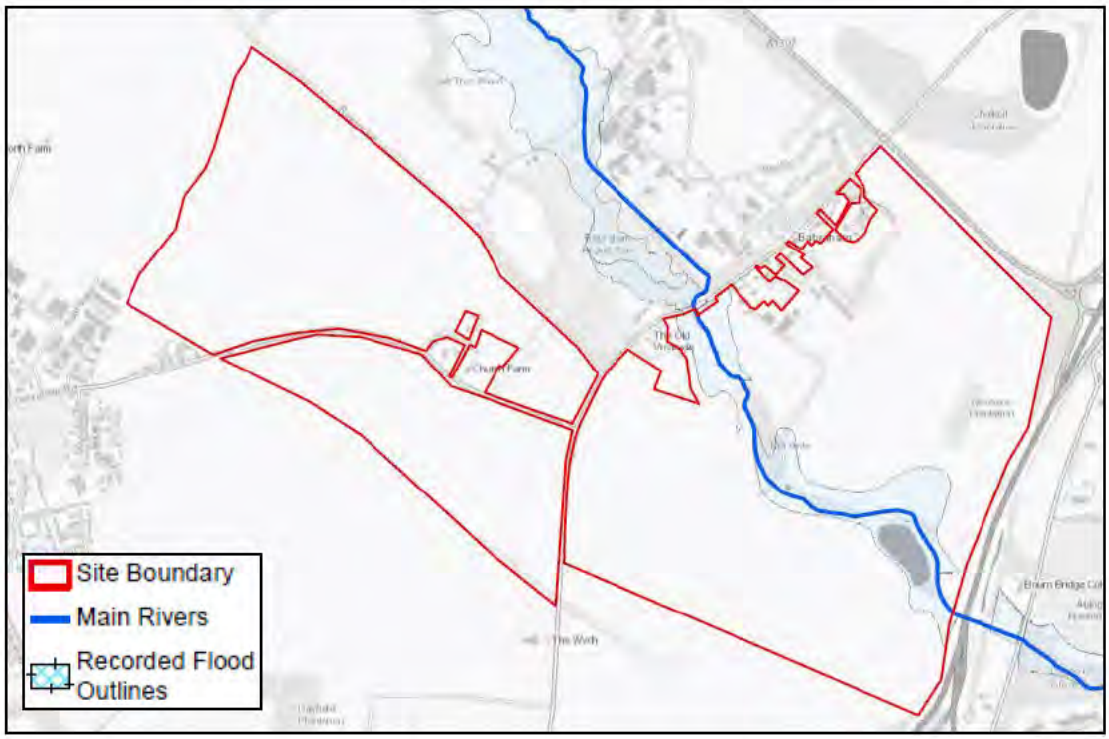
3.3.5 Whilst the consequences of a reservoir breach could be severe, the probability of such an occurrence is therefore considered to be **very low**.

3.4 Historic Flood Records

3.4.1 The EA 'Recorded Flood Outlines' map is a dataset showing the maximum extent of all individual recorded flood outlines from river, the sea and groundwater and shows areas of land that have previously been subject to flooding.

3.4.2 The mapping indicates that a flood event has been recorded through the central part of the site, associated with the route of the River Granta – see **Figure 3.4**.

Figure 3.4: EA Recorded Flood Outlines



3.4.3 The SFRA's (2010) 'Historic Flood' map is consistent with the EA Map (**Figure 3.4**), and further indicates that the historical flood event occurred in October 2001, whereby fluvial flooding impacted much of Cambridgeshire.

3.4.4 The EA Product 4 data, included within **Appendix B**, also shows this historic fluvial flood event, dated 21st to 24th October 2001.

3.5 Flood Risk from Groundwater

3.5.1 The SFRA (2010) or PFRA (2011) holds no record of groundwater flooding at the site or immediate vicinity.

3.6 Flood Risk from Sewers

3.6.1 The SFRA (2010) or PFRA (2011) holds no record of flooding from sewers at the site or immediate vicinity.

3.6.2 Furthermore, Anglian Water have confirmed that they also hold no record of flooding from the public sewerage system in the vicinity of the site (**Appendix C**).

4 Impact of Climate Change

4.1.1 It is necessary to fully consider the potential impacts of climate change for the lifetime of development within the mitigation measures. The EA released updated guidance on the application of climate change allowances in flood risk assessments in July 2021:

https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

4.1.2 This guidance provides contingency allowances for potential increases due to climate change in peak river flow, rainfall intensity and sea level rise.

4.1.3 The peak river flow allowances table provides a range of allowances based on percentile (i.e. the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The applicable values for a site are dependent on the 'River Management Catchment' in which the site is located, which can be confirmed via an online mapping tool embedded within the guidance.

4.1.4 The applicable allowances are subject to the Flood Zone classification of a site, and the vulnerability classification of the proposed use. The Central allowance is identified as the design standard for most forms of proposed development in all appropriate Flood Zones (the exception being 'Essential Infrastructure' which requires the 'Higher Central' value).

4.1.5 The peak river flow allowances to be considered for new development are as detailed in **Table 4.1** below. For most forms of development, a 100-year design life is considered an appropriate estimate and therefore the 2080s values (i.e. to the year 2115) are the design baseline.

Table 4.1: Climate Change – Peak River Flow Allowances

Watercourse	River Management Catchment	River Basin District	'Central' Climate Change Allowance 2080s Epoch (2070-2115)
River Granta	Cam and Ely Ouse	Ouse	**+9%**

4.1.6 The Cam Rural - Granta model does not contain results for the +9% scenario. As such, the model will need to be rerun with revised hydrological input to reflect the applicable +9% climate change allowance to peak flows, to assess the implications and determine (i) how the site is affected in this scenario, and (ii) the associated flood levels in this 'design' flood event.

4.1.7 In the interim, and in absence of a reference +9% climate change scenario flood level, the +20% scenario has been used as a conservative proxy to consider the mitigation requirements as discussed in **Section 5**. The maximum 20% flood level (node reference GR6970) at the site is 26.75m AOD. Comparison with the topography of the site (**Section 2.2**) indicates that the majority of the site is outside the floodplain.

4.1.8 The peak river flow allowances to be applied to the surface wate drainage strategy are summarised in **Table 4.2**.

Table 4.2: Climate Change – Rainfall Allowances

	Total Potential Change Anticipated for the 2020s (2015 – 2039)	Total Potential Change Anticipated for the 2050s (2040 – 2069)	Total Potential Change Anticipated for the 2080s (2070 – 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

4.1.9 In accordance with Table 4.2, flood risk assessments for developments with a design life extending beyond the year 2070, the upper end allowances are to be assessed to understand the range of impact. As a result, a 40% allowance for climate change should be assessed.

5 Proposed Development and Sequential Test

5.1 Proposed Development

5.1.1 The proposal is for a residential-led mixed use development, comprising a new garden village settlement of approximately 3,000 dwellings, three schools, two local centres, an urban centre with retail, health, fitness and community facilities, a community hall and transport hub.

5.1.2 **Figure 5.1** shows the concept masterplan for the development (a copy is provided in **Appendix D**).

Figure 5.1: Concept Masterplan for Land at Babraham

5.2 Flood Risk Vulnerability

5.2.1 NPPF PPG 'Flood Risk and Coastal Change' Table 2 confirms the *'Flood risk vulnerability classification'* of a site, depending upon the proposed usage. This classification is subsequently applied to PPG Table 3 to determine whether:

- The proposed development is suitable for the Flood Zone in which it is located, and;
- Whether an Exception Test is required for the proposed development.

5.2.2 The NPPF encourages the application of the 'sequential approach' in the master-planning process for new development, i.e. locating the more sensitive/vulnerable elements of new development in the areas which lie at lowest probability of flooding and, conversely, reserve the areas of the site at greatest risk of flooding for the least vulnerable elements of the development.

5.2.3 The concept masterplan (**Figure 5.1**) indicates that all built development is located within **Flood Zone 1** 'Low Probability'. All forms of development are acceptable in Flood Zone 1, and, as the

Flood Zone with the lowest probability of flooding, the Sequential Test is de facto passed. The Exception Test is not required.

6 Opportunities and Mitigation Requirements

6.1 Sequential Approach

6.1.1 The NPPF encourages the application of the 'sequential approach' in the master-planning process for new development, i.e. locating the more sensitive / vulnerable elements of new development in areas which lie at the lowest probability of flooding and, conversely, reserve the areas of the site at greatest risk of flooding for the least vulnerable elements of the development (or preferably, leave such areas undeveloped or as soft landscaping).

6.1.2 The concept masterplan (**Figure 5.1**) indicates that all built development is to be located within Flood Zone 1. As such, the proposed development complies with the 'sequential approach' encouraged by the NPPF.

6.2 Building Ground Floor Levels

6.2.1 Standard requirements for ground floor levels of new development are set out in BS8533:2017 'Assessing and Managing Flood Risk in New Development – Code of Practice'. This recommends floor levels are set a minimum of 300mm above the modelled 1 in 100 (1%) annual probability plus applicable allowance for climate change (+9%) flood level.

6.2.2 The Cam Rural - Granta model does not contain data for the +9% fluvial climate change scenario. As such, the model would need to be re-run in order to generate the applicable climate change 'design benchmark' floodplain extents and flood levels. Based on a conservative flood level of 26.75m AOD (1 in 100 annual probability +20% flood level at the site), finished floor levels will be designed to be set a minimum of 27.05 m AOD, which includes a freeboard of 300mm.

6.2.3 Ground floor levels will be designed to be set a suitable freeboard (minimum 150mm) above surrounding ground to mitigate the residual flood risk associated with excess surface water runoff in an extreme rainfall event. Similarly, exterior ground levels across the site will look to be also be appropriately contoured to direct flood flow routes away from buildings in such a scenario.

6.3 Watercourse Corridor

6.3.1 The EA require a minimum buffer of 8m from the Granta River to be provided and must be maintained with no built development.

6.3.2 It is required that crossings over the Granta River have a soffit level a minimum 300mm above the 1%AP plus climate change design event flood level. It is also required that crossings have a clear span structure, with limited footings in the floodplain.

6.3.3 As the River Granta is designated as a 'main river', a Flood Risk Activity Permit (FRAP) will be required for any new outfalls to the River Granta or any works within 8m.

6.4 Floodplain Storage and Flow Routes

6.4.1 Any new development located in the vicinity of a watercourse will be constructed such that it does not detrimentally impact on flow routes or reduce the available floodplain storage over a site; either of which could potentially cause an increase in flood levels on-site or elsewhere. This is considered up to the benchmark of the 1 in 100 (1%) annual probability plus allowance for climate change fluvial flood level.

6.4.2 Based on the EA latest climate change guidance the +9% climate change allowance for peak river flows is considered the 'design' flood event (**Section 4**) and requires consideration for flood mitigation measures at the site.

6.4.3 The concept masterplan indicates that all built development will be located outside Flood Zones 2 and 3 (i.e. outside the 1 in 1000 (0.1%) flood extent of the River Granta). As such, the proposals will have no detrimental impact on floodplain storage capacity at the site.

6.5 Safe Access

6.5.1 It is necessary to consider and incorporate safe access arrangements as part of the mitigation strategy, to ensure the users/occupants of the development are safe in times of flooding.

6.5.2 A review of the wider EA Flood Map for Planning indicates that the surroundings roads (A11, A1307, High Street) are largely unaffected by flooding and provide a continuous safe access / egress route from all parts of the site to the wider South Cambridgeshire area.

7 Outline Surface Water Drainage Strategy

7.1 Overview

7.1.1 This section outlines how surface water run-off from the development could be managed in accordance with national and regional policy requirements, and best practice. The design aims to mitigate the risk of surface water flooding on the site as discussed in the previous sections.

7.2 Design Principles

7.2.1 The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites. The NPPF recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development, this being complementary to the control of development within the floodplain.

7.2.2 The Non-Statutory Technical Standards for SuDS set out general recommendations for control of development runoff, including the requirement to ensure that runoff from the site is not increased by development, and the requirement to manage surface water runoff for events up to the 1 in 100 (1%) Annual Probability event (including an additional allowance for the projected impacts of climate change).

7.2.3 PPG advises that climate change allowances should be determined with reference to the guidance provided in the EA document 'Flood Risk Assessments: Climate Change Allowances (February 2016, updated July 2021). As most of the site is proposed for residential purposes, with an assumed design life of 100 years, an additional allowance on rainfall intensity has been incorporated into the surface water management strategy, as discussed in **Section 4**.

7.2.4 As the intention of SuDS is to mimic the natural drainage regime of the undeveloped site, the NPPF PPG states the following (consistent with the Building Regulations H3 hierarchy):

> ***...the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:***
>
> ***- into the ground (infiltration),***
>
> ***- to a surface water body,***
>
> ***- to a surface water sewer, highway drain or another drainage system,***
>
> ***- to a combined sewer***

7.2.5 The Lead Local Flood Authority (LLFA) has become the statutory consultee for surface water management on planning applications for 'major development'. As the LLFA, Cambridgeshire County Council are therefore responsible for the approval of surface water drainage systems within such development.

7.3 Existing Drainage Strategy

7.3.1 The site is currently greenfield land, therefore it is assumed to currently drain via infiltration and/or runoff into the River Granta.

7.3.2 During the site walkover, two channels between approximately 2 and 5 m in length were observed adjacent to the High Street in the centre south of the site (**Figure 2.4**).

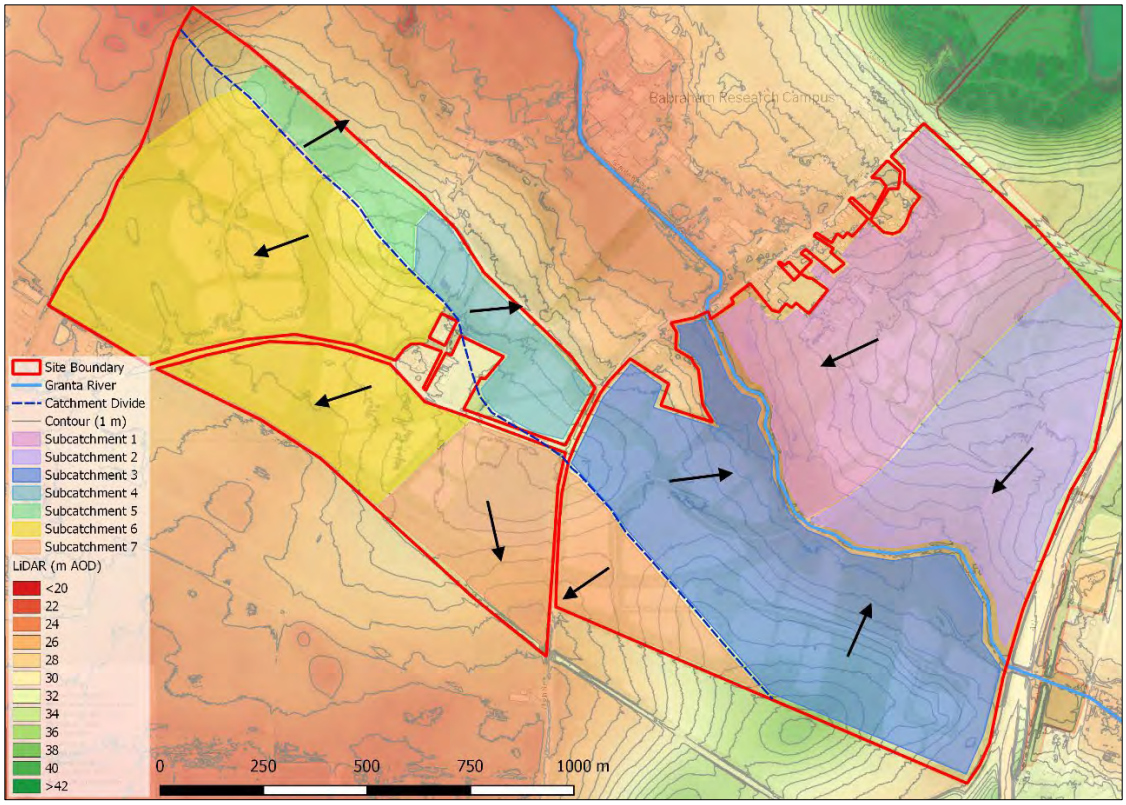
7.3.3 Further south of the site boundary it was noted during the site walkover that there is a topographic low where flows could potentially flow into an underground soakaway beneath the

High Street which could possibly also be utilised as a hydrant. This could be used to drain and infiltrate water from the highways, further investigations may be required.

7.3.4 It is noted during the site walkover that there were no drainage ditch features or watercourses observed along the south and southwest boundary of the site.

7.3.5 The site can be divided into two distinct catchments based on generic topographic data, either falling toward the central and northern part of the site towards the River Granta or falling South towards the settlement of Sawston. These two catchments can be further divided into sub-catchments (7 catchments) based on the current redline boundary. **Figure 7.1** below shows each sub-catchment and the estimated direction of runoff based on existing ground levels. The total impermeable area calculated for sub-catchment has been based on the current masterplan.

Figure 7.1: Site Catchments



7.4 Method of Surface Water Discharge

7.4.1 The most appropriate method of surface water discharge has been determined based on the hierarchy of surface water disposal as set out within Building Regulation – Approved Document H, as described below:

- Infiltration;
- Watercourse; and
- Sewer.

Infiltration

7.4.2 BGS mapping shows that the site lies on a bedrock of the Holywell Nodular Chalk bedrock across the site with a small area to the west which has Zag Chalk formation. The Nodular Chalk belongs to the White Chalk Subgroup and the Zag belongs to the Grey Chalk Subgroup. (**Section 2.4**).

7.4.3 The presence of Terrace deposits and underlying Chalk bedrock indicates that aspects of infiltration drainage may be feasible at the site for future development. However, this will be confirmed through intrusive site investigations in due course.

7.4.4 The potential exists for unidentified dissolution features to be present in the underlying chalk bedrock. In addition, it is known from the historic map record that the chalk has locally been worked. There is therefore the possibility of further unrecorded small chalk pit workings occurring. Further research is required to assess the potential of chalk mining on this site. In addition, density testing of the chalk will be required to help inform other engineering works, such the offset from infiltration feature, if infiltration is to be utilised.

7.4.5 The density of the chalk will have an impact on the offset associated with any emerging infiltration features. In accordance with the CIRIA 574 Guidance engineering in chalk, a maximum offset of 20 metres could be required if dissolution features are likely and, in this circumstance, soakaways would not be recommended. The offset from the infiltration features would apply to both buildings and highways. Generally, at this very outline stage a minimum offset of 10m would be recommended.

Watercourse

7.4.6 If infiltration drainage is not feasible, the next preference in the drainage hierarchy is to discharge to a surface water body (i.e. lake or watercourse), and lastly discharge to sewer. In this case, controlled discharge to the River Granta is likely to be feasible for the northern sub-catchments and will replicate the existing drainage characteristics of this area of the site.

7.4.7 Following the site visit it was noted no ditch or watercourse is present within the southern part of the site and therefore a positive outfall for the southern catchment will be carefully considered as part of a future planning application. If through further testing it is concluded that these basins cannot drain via infiltration, a positive connection to the sewer via a requisitioned route will therefore be required and this would be subject to stakeholder consultation and approval.

7.5 Proposed Discharge Limits and Attenuation Requirements

Discharge Limits

7.5.1 In accordance with the South Cambridgeshire SPD document, the requirement is for surface water runoff from new developments on greenfield land to discharge runoff from the impermeable areas at the same greenfield rate.

7.5.2 The site has been considered as 100% greenfield. Greenfield runoff rates were estimated using FEH 2008 Statistical Method. In accordance with the South Cambridgeshire SPD document discharge rates should be limited to QBAR:

- QBAR = 0.2l/s/ha
- Q1 = 0.2l/s/ha

7.5.3 The discharge rates are very low, likely because of the infiltration potential at the site. WinDes Quick Storage Estimates (QSE) have been undertaken using these indicative rates to provide an indication of the volume of storage that would likely be required on site to provide the necessary attenuation. This is for rainfall events up to the 1% annual probability (1 in 100 year)

event plus, an additional allowance of 40% on rainfall intensity, which is to account for the potential impacts of climate change. The climate change allowance is based on the latest Environment Agency Flood Risk Assessments: Climate Change Allowances.

Attenuation Requirements

7.5.4 It is recognised that surface water attenuation will need to be provided within the surface water drainage system to restrict runoff during rainfall events up to the 1 in 100 (1%) annual probability plus 40% allowance for climate change.

7.5.5 WinDes Quick Storage Estimates (QSE) have been undertaken using these indicative rates to provide an indication of the volume of storage that would likely be required on site to provide the necessary attenuation. The amount of storage required for every 1ha of impermeable area has been calculated to be 1392 m^3 to 1478 m^3, see **Appendix E**. This is based on the conservative site greenfield QBAR runoff rate of 0.2l/s/ha and a 1% annual probability rainfall event including an allowance for climate change of 40%. This volume of storage is high and should be reviewed subject to further infiltration tests and assessment.

7.5.6 An indicative infiltration rate has been obtained from a drainage strategy on a neighbouring site from the South Cambridge Planning Portal (application ref S/3886/17/DC). Geotechnical information was not made available, including ground water levels and details on the infiltration testing (i.e if in full accordance with BRE 365). However, to give an indication on the potential impact of using infiltration measures on the volume of attenuation required, the rate of $4.88x10^{-5}$ m/s when applied to our site, showed a reduction of basin size by approximately 70%. This will be further reduced if infiltration at source (such as porous paving and soakaways) is also used. Please note this reduction is very indicative, as BGS information does not confirm the type of underlying superficial deposits within the location, and there is no test data available. Therefore, it is assumed, based on the rate provided, that the infiltration tests were likely to have been conducted directly into the chalk strata.

7.5.7 The post-development runoff attenuation volumes calculations have been based on the following assumptions:

- A typical residential development would likely have impermeable areas of 65% impermeable across the site, and an urban creep of 10% applied;
- A typical commercial development would likely have impermeable areas of 80%; and,
- Roads would likely have impermeable areas of 100%.

7.5.8 Indicative storage requirements per basin for each sub-catchment are included below in **Table 7.1**, assuming no infiltration, and **Table 7.2**, assuming a degree of infiltration.

Table 7.1: Proposed Post-Development Attenuation Requirements (Assuming No Infiltration)

Sub - catchment ID	Total Impermeable Area (ha)	Basins Required	Discharge rate per basin at QBAR (l/s)	1 in 100 (1%) plus 40% climate change event per basin (m^3)
1	8.29	2	0.8	5963
2	3.05	1	0.6	4383
3	14.45	3	1.0	6898
4	3.39	1	0.7	4858
5	1.68	1	0.3	2422
6	14.41	3	1.0	6878
7	8.13	2	0.8	5839

Table 7.2: Proposed Post-Development Attenuation Requirements (Assuming Infiltration)

Sub - catchment ID	Total Impermeable Area (ha)	Basins Required	Discharge rate per basin at QBAR (l/s)	1 in 100 (1%) plus 40% climate change event per basin (m^3)
1	8.29	1	1.7	3565
2	3.05	1	0.6	1312
3	14.45	2	1.4	3105
4	3.39	1	0.7	1458
5	1.68	1	0.3	721
6	14.41	2	1.4	3097
7	8.13	1	1.6	3494

7.5.9 It should be noted that these estimates are indicative and do not take into account any potential storage within the wider drainage network. It is possible that the volumes will be reduced through the preparation of a more detailed drainage strategy and the incorporation of additional SuDS measures.

7.5.10 Indicative storage requirements are illustrated on Figure 7.2 assuming no infiltration, and Figure 7.3 assuming infiltration. No consideration of earthworks has been undertaken at this stage and the land take associated with any basin is likely to increase when ground levels taken into consideration.

Figure 7.2: Indicative Sub-catchment Strategic Attenuation Features (Assuming No Infiltration)

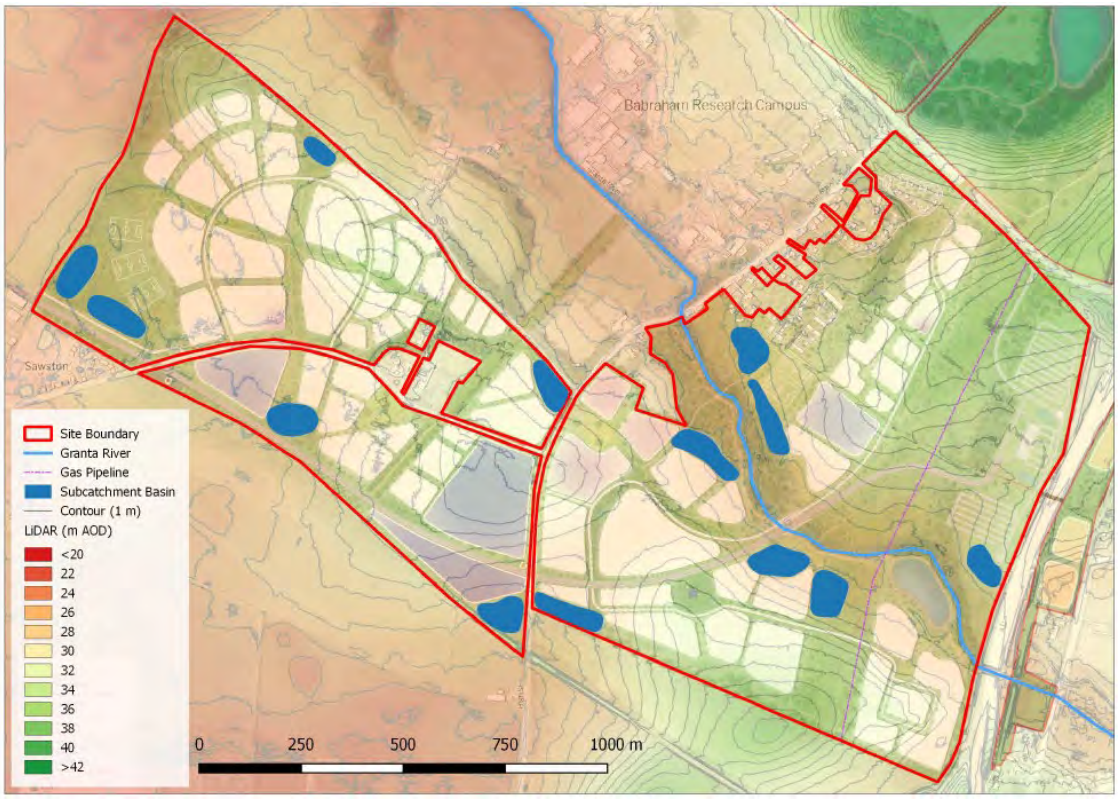
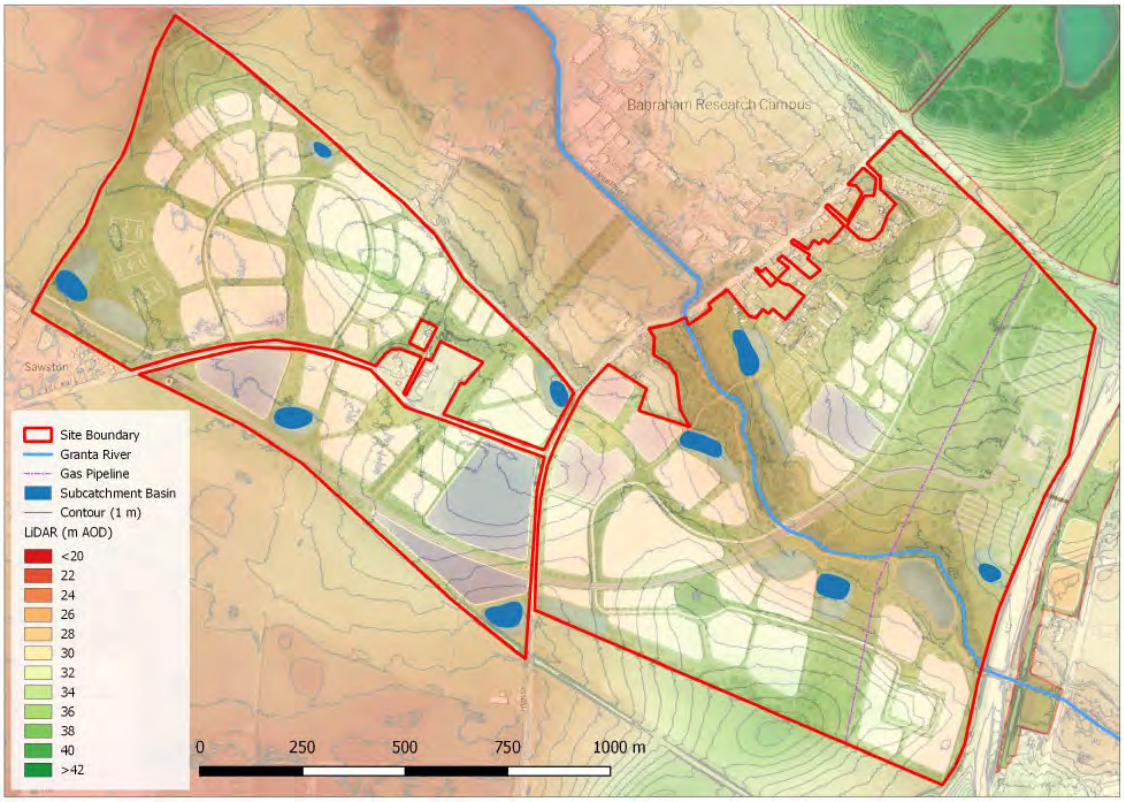


Figure 7.3: Indicative Sub-catchment Strategic Attenuation Features (Assuming Infiltration)



7.6 Proposed Drainage Strategy

7.6.1 At this stage it is anticipated a mixture of on plot solutions (for water quality treatment, attenuation, and if feasible at source infiltration) could be used in addition to strategic attenuation features dispersed and integrated across the wider landscape of the site. Therefore, subject to future infiltration, ground water monitoring and chalk density tests, either infiltration or attenuation basins are likely to provide a suitable solution for managing surface water runoff as part of any development of the site.

7.6.2 The development of the surface water drainage strategy is an iterative process alongside the evolving proposals. In general, a minimum allowance of approximately 10% of the proposed development parcel area is recommended to allow for a strategic attenuation measures, which would potentially be further supplemented by local measures to increase the storage provision and provide a conveyance function.

7.6.3 There are many forms for this on-site attenuation, and the strategy is likely to incorporate a range of measures that are integrated into a water network across the site, it is recommended that emphasis is placed on the incorporation of surface features as these provide an amenity benefit, have less long-term maintenance concerns, and could further promote the ecological enhancement credentials of the development through incorporation into any wider ecological enhancement strategy.

7.6.4 Surface water attenuation features will be located outside of the reference fluvial floodplain and outside the extent of any areas identified as at risk of surface water flooding otherwise their capacity would be compromised in a major river flood event.

7.6.5 In addition to providing a drainage function, the SuDS will be utilised to create bio-diversity opportunities, ecological enhancement, amenity benefits and water quality treatment. The surface water strategy that will be considered for the site, to be adopted as part of a network of positive drainage, consisting of, and not limited to; open swales/rills, attenuation basins, ponds, wetlands, infiltration SuDS, porous paving, bio-retention areas, green roofs and rainwater harvesting.

a. Open swales / rills, that can be effectively integrated into the development and be wet, dry, or for storage purposes. As shown in **Figure 7.4**, these can be combined with roads to intercept and treat runoff at source, and both provide ecological and amenity benefits as well as effective water quality treatment.

Figure 7.4: Open Swale / Rills Example

b. Attenuation Basins, **Figure 7.5**, are designed to hold back stormwater to prolong the event and reduce peak flows, then slowly release flows into the system. They are multifunctional features that can additionally be used for community spaces and increase amenity and biological value;

Figure 7.5: Attenuation Basin Examples

c. Wetland planting and Ponds, **Figure 7.6**, ideally incorporated as part of the green / blue corridors within the development and surrounding areas of the attenuation basins. Opportunities will be explored to locate these features within the existing watercourse boundaries. They can provide multiple uses, such as for amenity space, biological enhancement and can be integrated with other SuDS or blue / green infrastructure. Water quality treatment can be effectively managed using these features through appropriate planting and used as part of a wider SuDS Management Train;

Figure 7.6: Wetland Planting and Ponds Examples

d. Porous Paving, as shown in **Figure 7.7**, to allow water to infiltrate into the ground (where feasible) to feed into groundwater aquifers or can be lined to aid water quality treatment and reduce runoff intensity into the drainage system. This is likely to be feasible for car parking areas, with a lined tank system beneath, to reduce the attenuation basin storage requirements. Porous paving should be avoided in loading and commercial vehicle areas;

Figure 7.7: Porous Paving

7.6.6 Opportunities will also be explored for green roofs and the containment of any commercial surface water re-use, such as rainwater harvesting (for either internal or external uses) and

water cooling-systems. This is subject to the development end use, the effectiveness and viability of such systems and regulatory requirements.

7.6.7 Further refinement of the size, form and location of the SuDS measures will be required during the layout design process.

7.7 Exceedance

7.7.1 Exceedance flows shall be managed within the site and no cause increased risk to people or buildings.

7.7.2 Site levels shall be set so that they are designed to direct flows away from the buildings and guide overland flow towards less vulnerable areas such as roads and car parking area.

7.7.3 Proposed site levels and flow paths for exceedance flows shall be determined at detailed design stage however, shall be set so that the effect on people and property is minimised in a exceedance event above the 1 in 100 annual probability event include 40% allowance for climate change.

8 Summary and Recommendations

8.1.1 This Flood Risk Scoping Report has been prepared by Stantec to identify the flood risk constraints and opportunities for a residential-led mixed use development on 'Land at Babraham'.

8.1.2 The EA Flood Map for Planning indicates that the majority of the site lies within **Flood Zone 1 'Low Probability'**. However, the central part of the site lies within Flood Zone 2 'Medium Probability' and Flood Zone 3 'High Probability' associated with the river corridor of the River Granta.

8.1.3 The concept masterplan indicates that all built development is to be located within Flood Zone 1. As such, the proposed development complies with the 'sequential approach' encouraged by the NPPF. All forms of development are acceptable in Flood Zone 1. As such, the Sequential Test is de facto passed and the Exception Test is not required.

8.1.4 The risk of flooding from all other sources is considered to be either '**low**' or '**very low'**.

8.1.5 National climate change guidance set out in the Planning Practice Guidance (PPG) confirms that the site requires consideration of increases in peak river flow on the River Granta of +9%. The 1 in 100 (1%) annual probability +9% flood event is considered the 'design event' and requires consideration for mitigation measures at the site. The Cam Rural - Granta model does not contain data for the +9% fluvial climate change scenario. As such, the model would need to be re-run in order to generate the applicable climate change 'design benchmark' floodplain extents and flood levels. The existing model includes a +20% climate change allowance and therefore provides a conservative estimate of flood levels at the site.

8.1.6 The concept masterplan indicates that all built development will be located outside Flood Zones 2 and 3 (i.e. outside the 1 in 1000 (0.1%) flood extent of the River Granta). As such, the proposals will have no detrimental impact on floodplain storage capacity at the site.

8.1.7 A review of the wider EA Flood Map for Planning indicates that the surrounding roads (A11, A1307, High Street) are largely unaffected by flooding and provide a continuous safe access / egress route from all parts of the site to the wider South Cambridgeshire area.

8.1.8 The surface water drainage strategy for any development will be designed using SuDS measures where appropriate and in accordance with the Building Regulations hierarchy. Initial indications of the geology suggests that infiltration drainage may be feasible at the site for future development. However, this will be confirmed through intrusive site investigations in due course. If infiltration drainage is not feasible, the next most likely approach to the surface water drainage strategy will be the provision of on-site attenuation measures (temporary surface water storage).

8.1.9 The surface water strategy that will be considered for the site, to be adopted as part of a network of positive drainage, will consist of, and not be limited to; open swales/rills, attenuation basins, ponds, wetlands, infiltration SuDS, porous paving, bio-retention areas, green roofs and rainwater harvesting. It is considered that a suitable surface water drainage strategy is technically feasible and should not be an impediment to the proposed development.

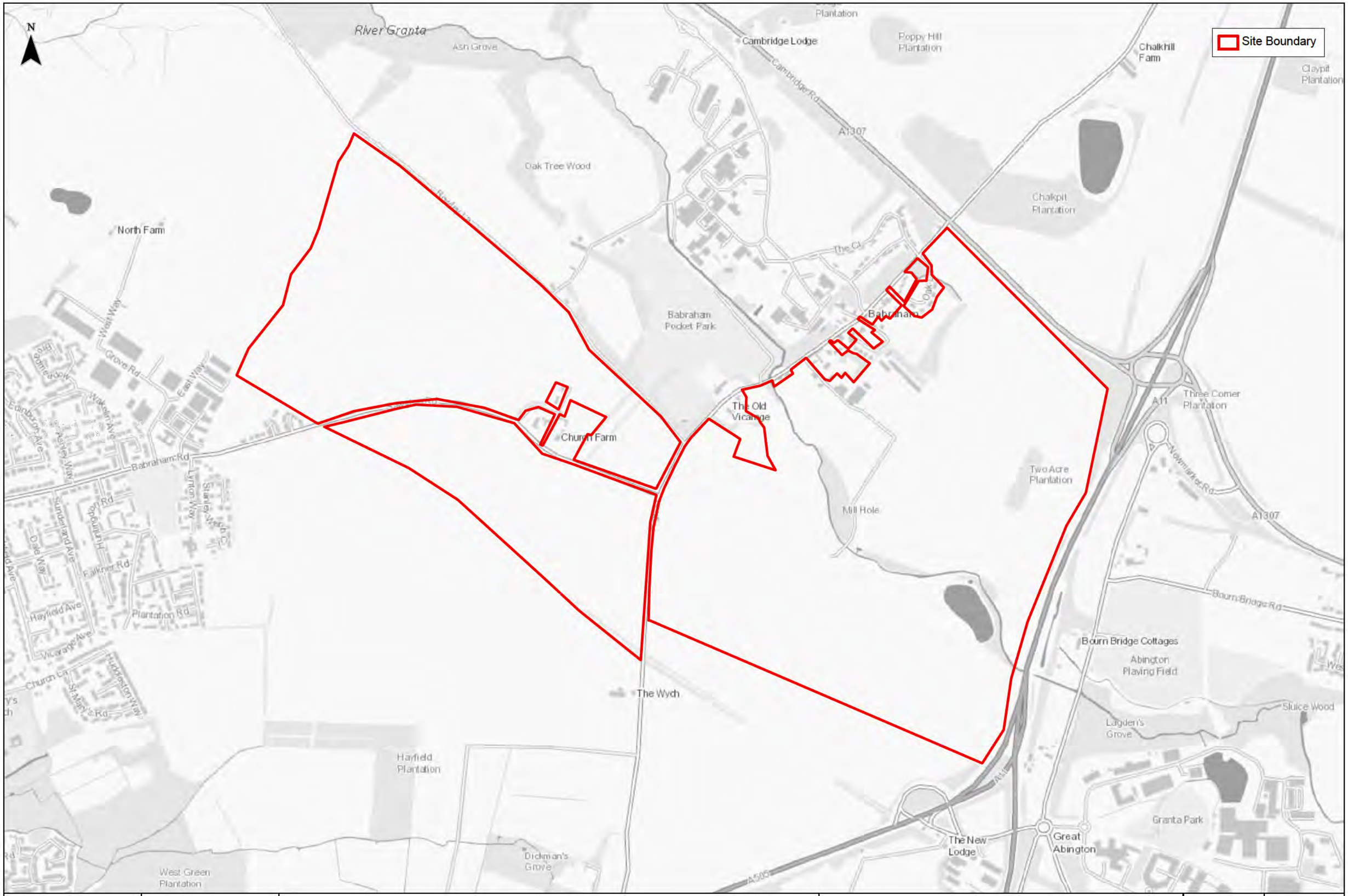
8.1.10 Following the site visit it was noted no ditch or watercourse is present within the southern part of the site and therefore a positive outfall for the southern catchment will be carefully considered as part of a future planning application. If through further testing it is concluded that these basins cannot drain via infiltration, a positive connection to the sewer via a requisitioned route will therefore be required and this would be subject to stakeholder consultation and approval

8.1.11 A detailed Flood Risk Assessment (FRA) and surface water drainage strategy will be required to accompany any future planning application.

8.1.12 In conclusion, the proposals at ‘Land at Babraham’ complies with the National Planning Policy Framework (NPPF) and local planning policy with respect to flood risk and is an appropriate development at this location. There are no significant constraints in relation to flood risk and drainage, although ground investigation is required to confirm the feasibility of infiltration drainage at the site and further investigation is required to confirm positive drainage outfalls for the southern sub-catchments.

Appendix A Open Data Flood Maps

- Site Location Plan
- Site Location (Aerial)
- Topography
- EA Flood Zone Map
- EA Surface Water Flood Risk Maps
- EA Groundwater Source Protection Zones
- EA Recorded Historic Flood Extents



Stantec

Client [redacted]

LAND AT BABRAHAM

Site Location

0 0.5 1 Kilometers

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Figure 001	Rev -

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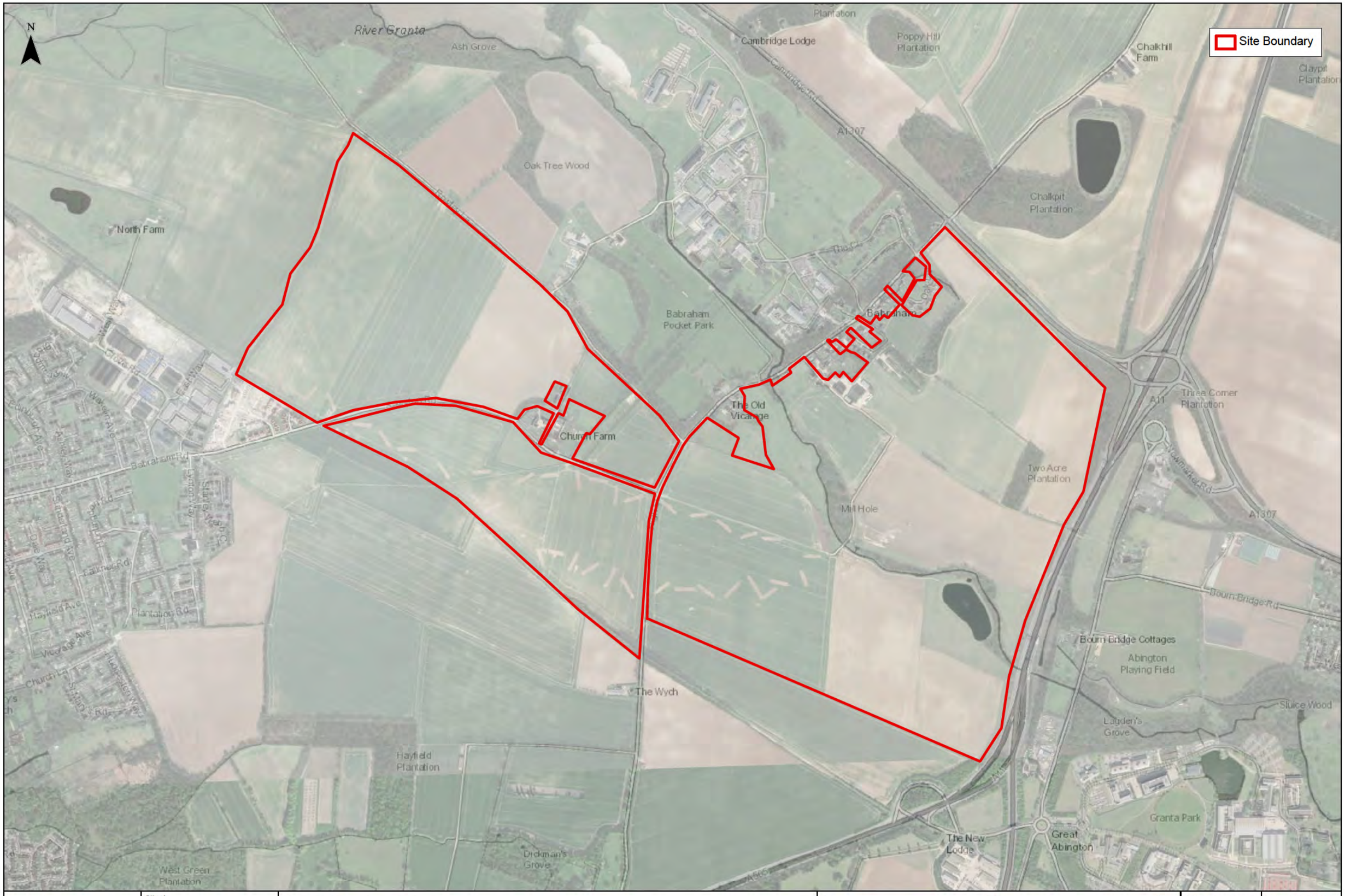

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LAND AT BABRAHAM

Site Location (Aerial)

0 0.5 1 Kilometers

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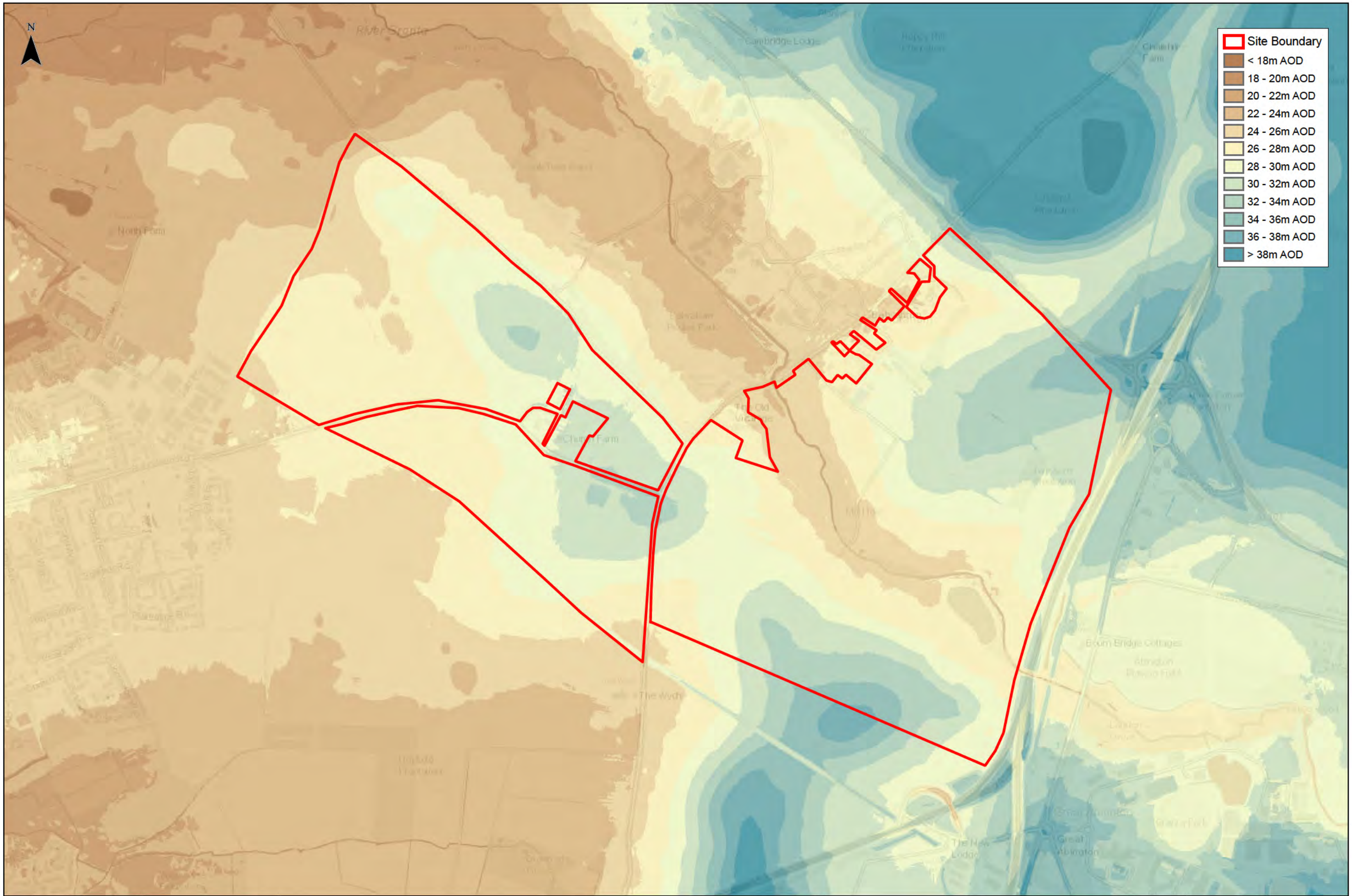

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LAND AT BABRAHAM
Site Topography (EA LiDAR)

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Kilometers

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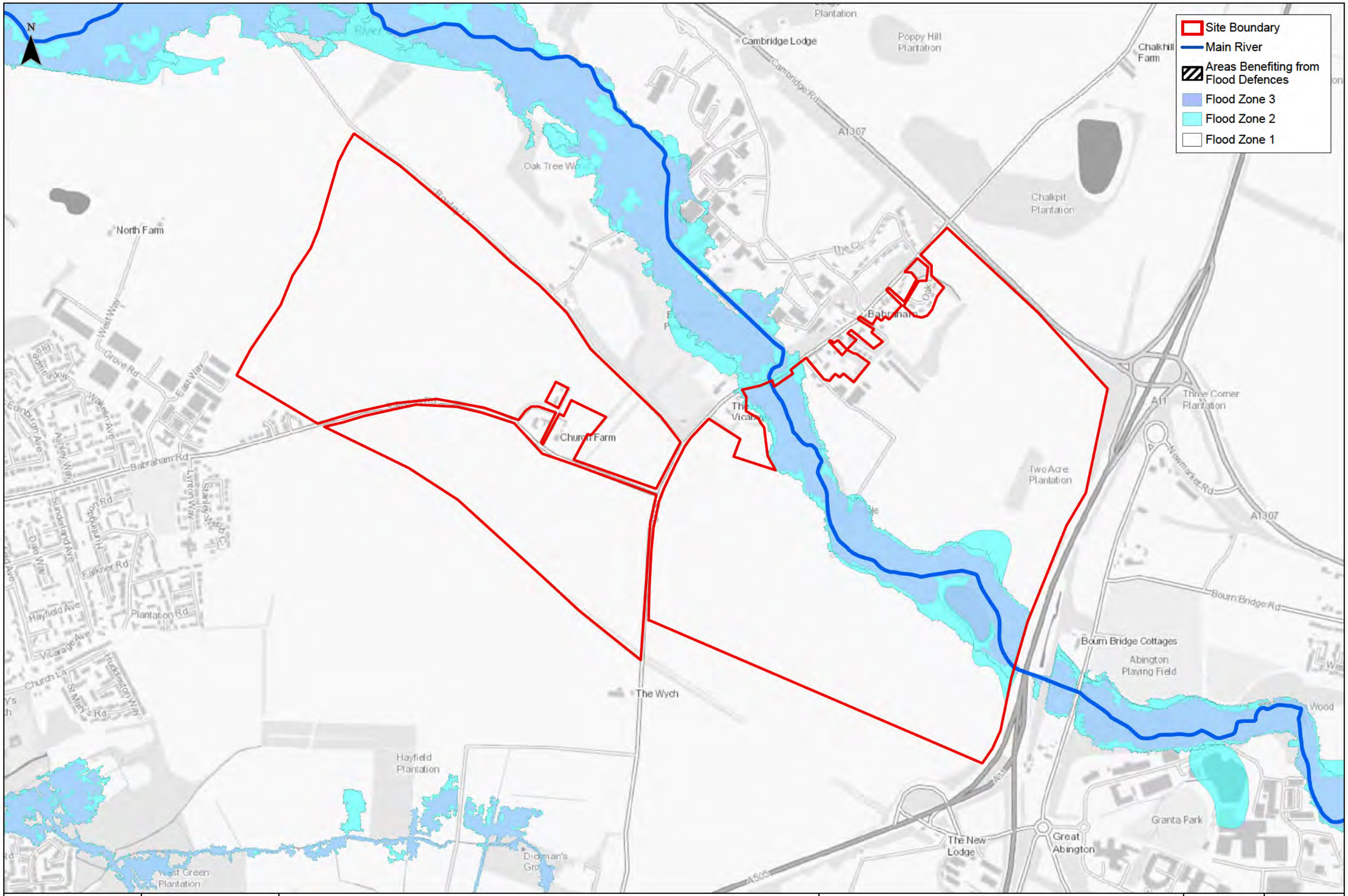

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LAND AT BABRAHAM
EA Flood Zone

0 0.5 1

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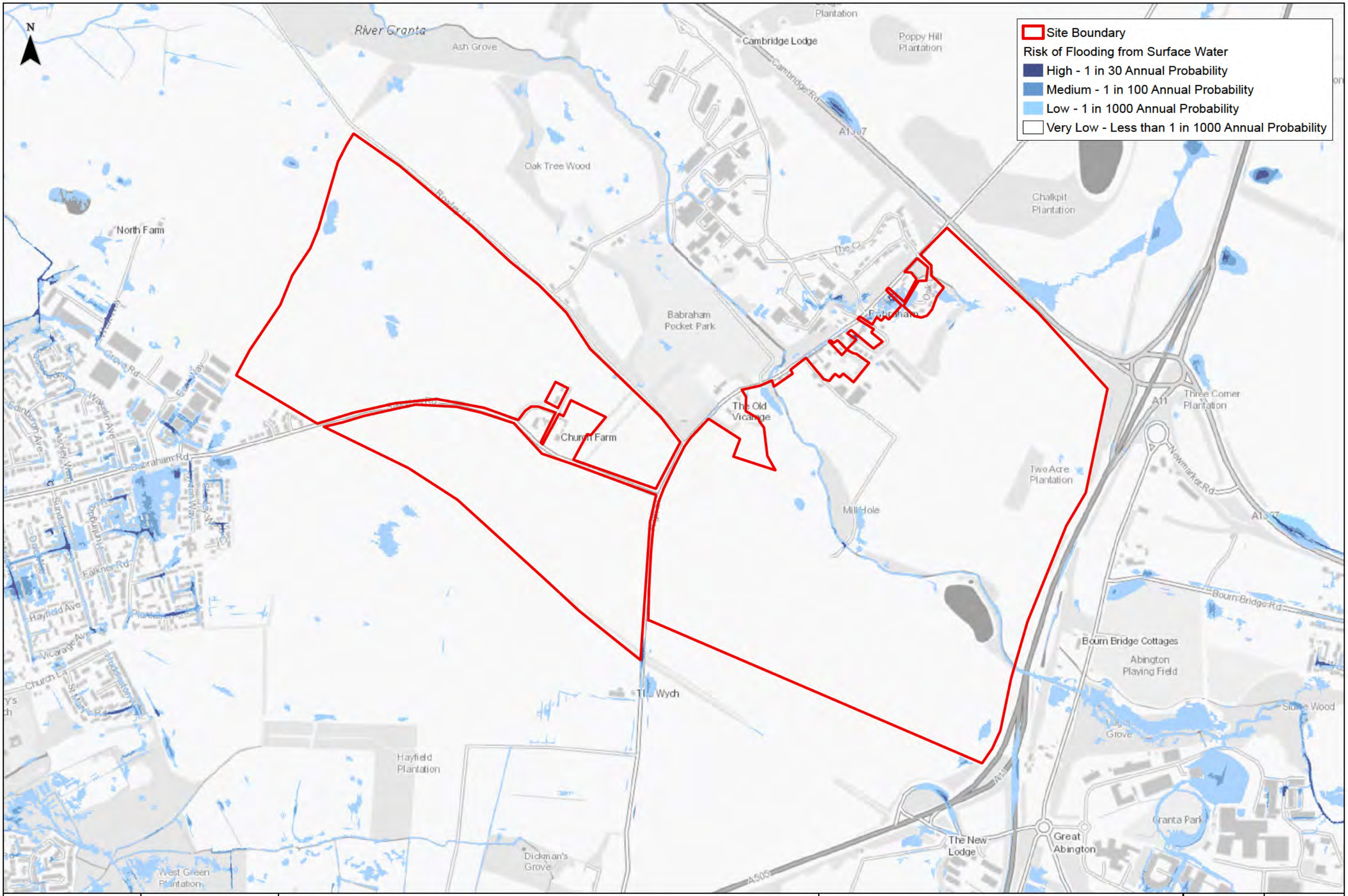

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LAND AT BABRAHAM

Flood Risk from Surface Water (Flood Extents)

0 0.5 1 Kilometers

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LAND AT BABRAHAM

Flood Risk from Surface Water (High Risk Depth)

0 0.5 1 Kilometers

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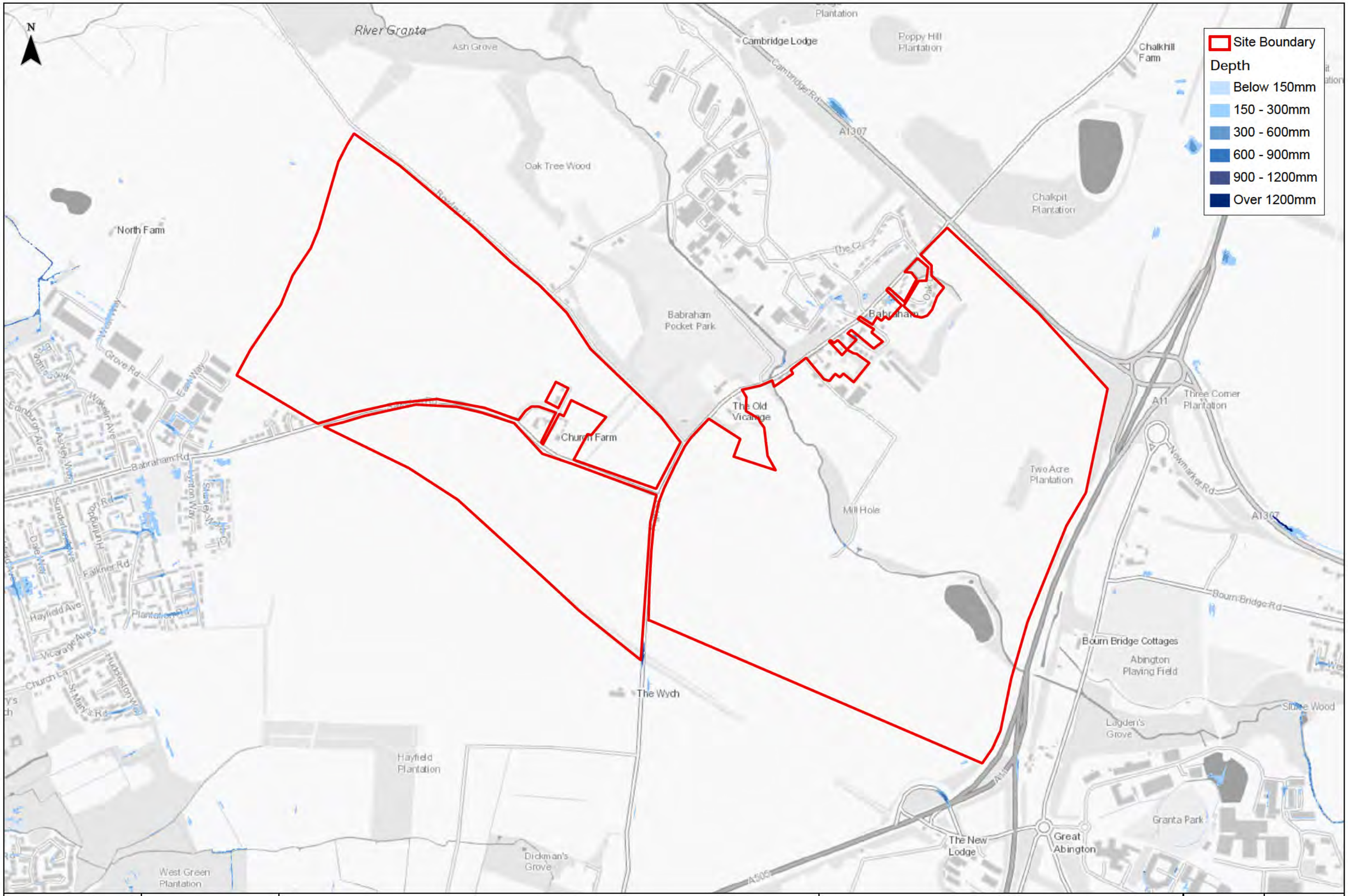

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LAND AT BABRAHAM

Flood Risk from Surface Water (Medium Risk Depth)

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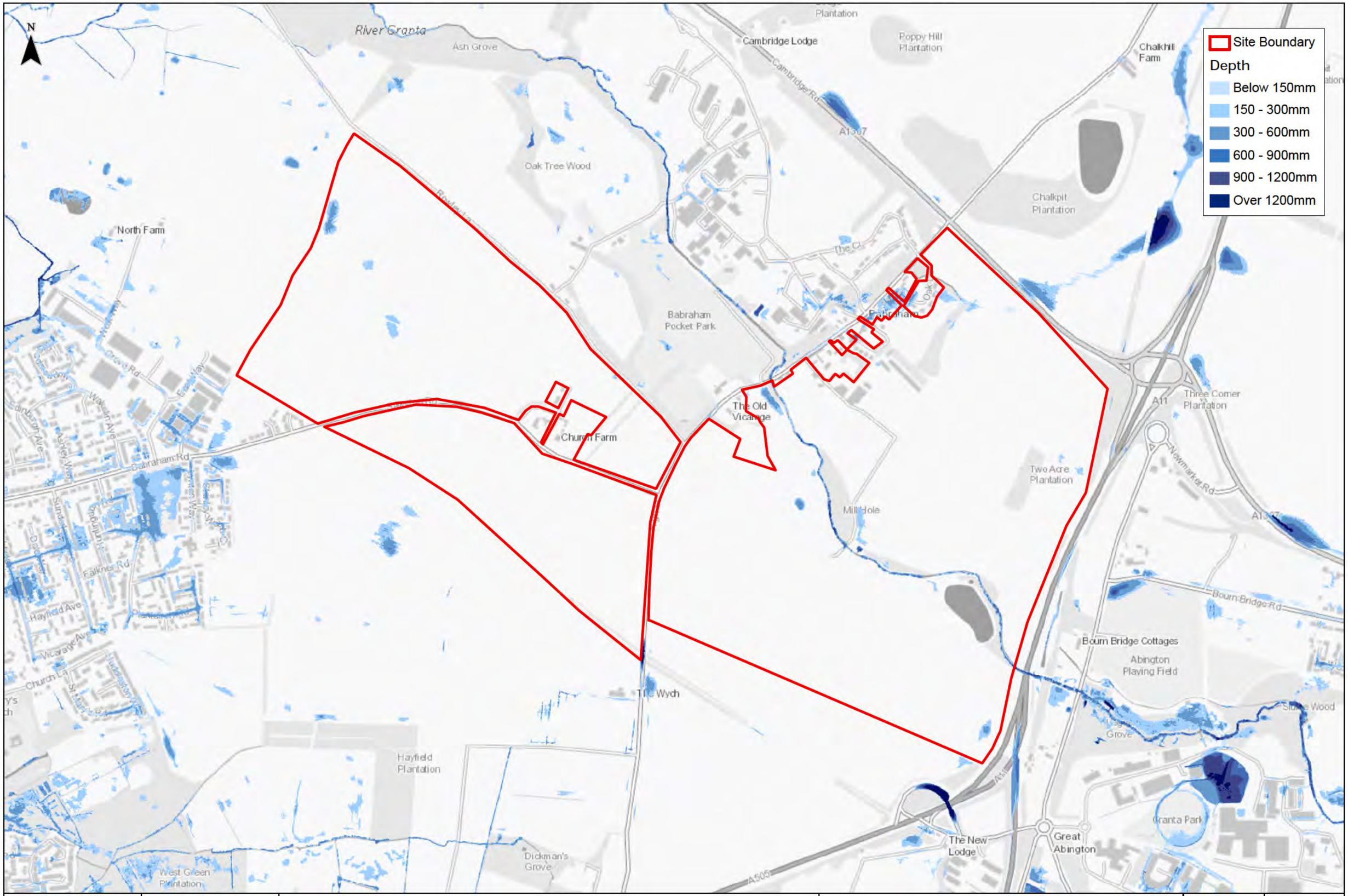

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LAND AT BABRAHAM

Flood Risk from Surface Water (Low Risk Depth)

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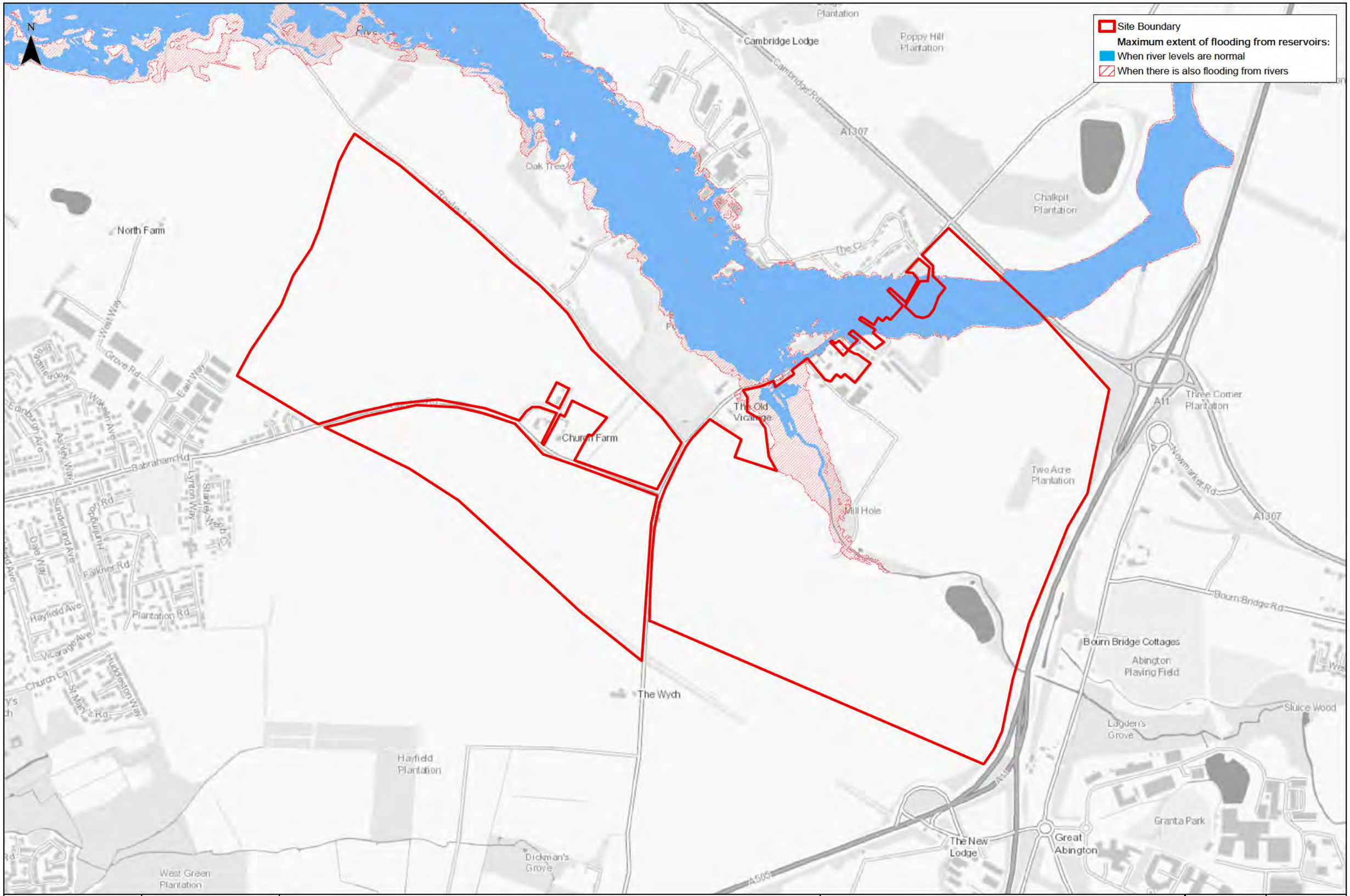

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LAND AT BABRAHAM

Flood Risk from Reservoirs
(Maximum Extent of Flooding)

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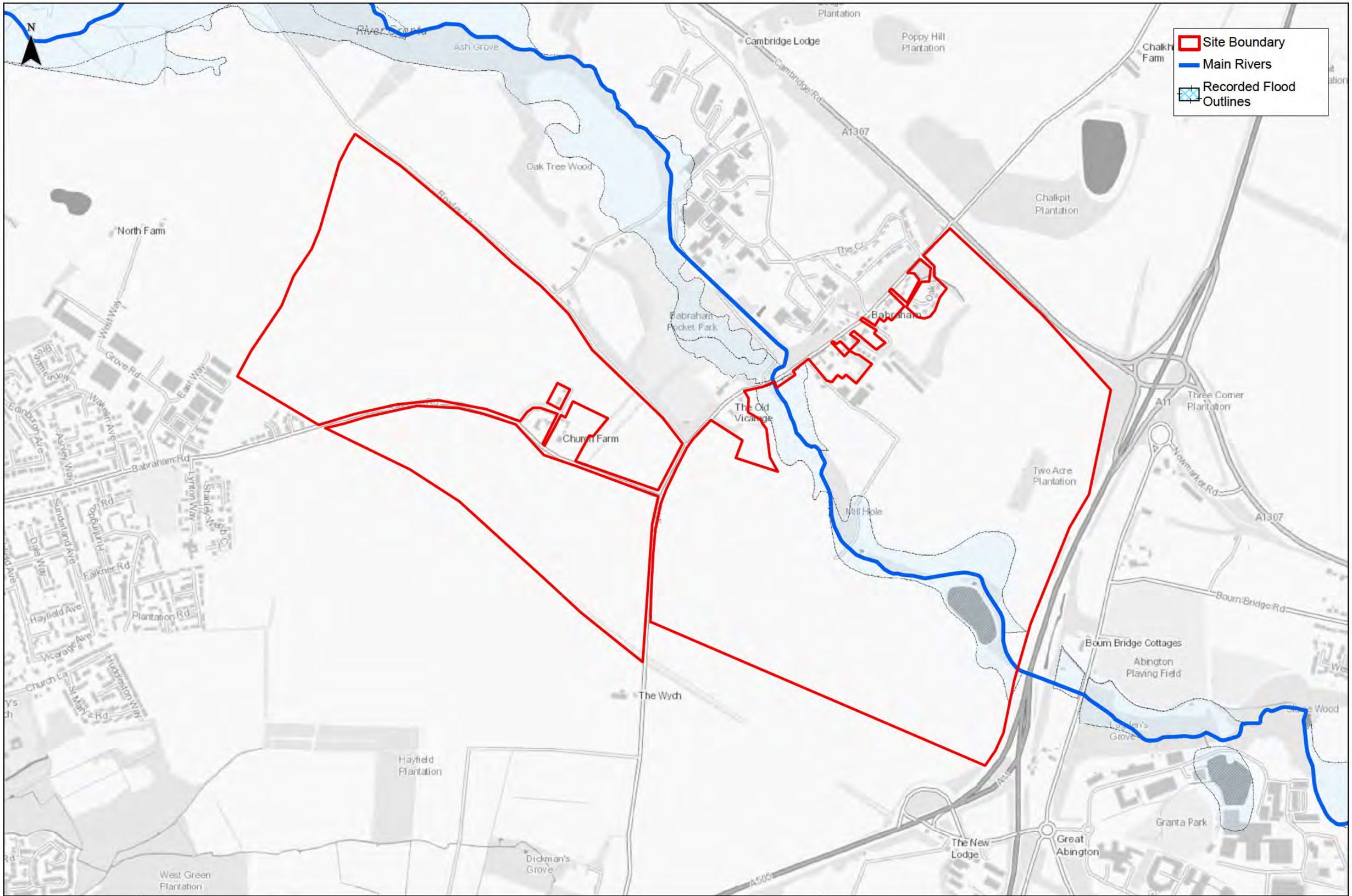

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LAND AT BABRAHAM
Recorded Flood Outlines

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Site Boundary

Source Protection Zones

Zone I	*Inner Protection Zone*
Zone II	*Outer Protection Zone*
Zone III	*Total Catchment*
Zone of Special Interest	

Stantec

Client [redacted]

LAND AT BABRAHAM
Source Protection Zones

0 0.5 1 Kilometers

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Figure 008	Rev -

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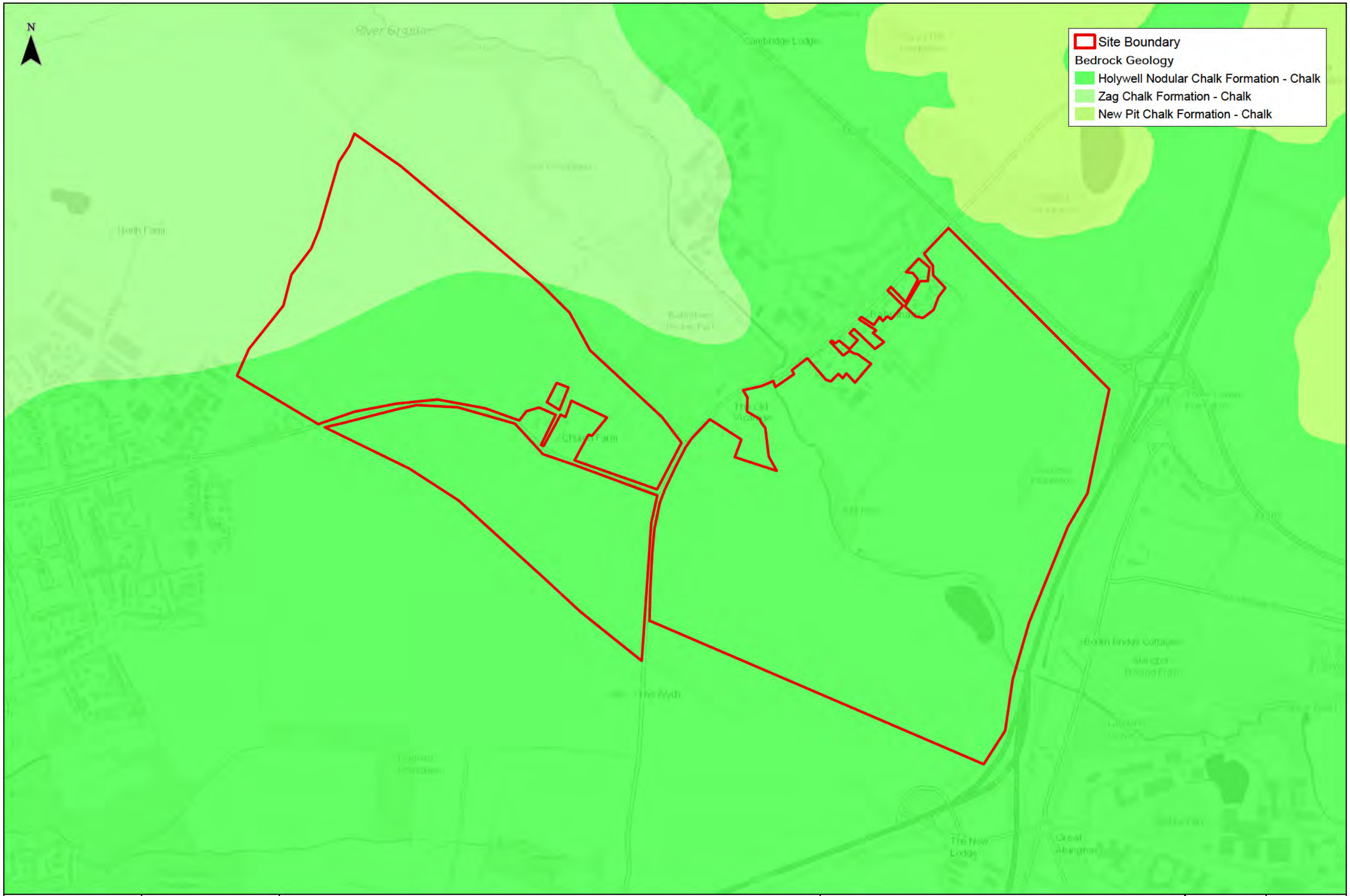


Stantec

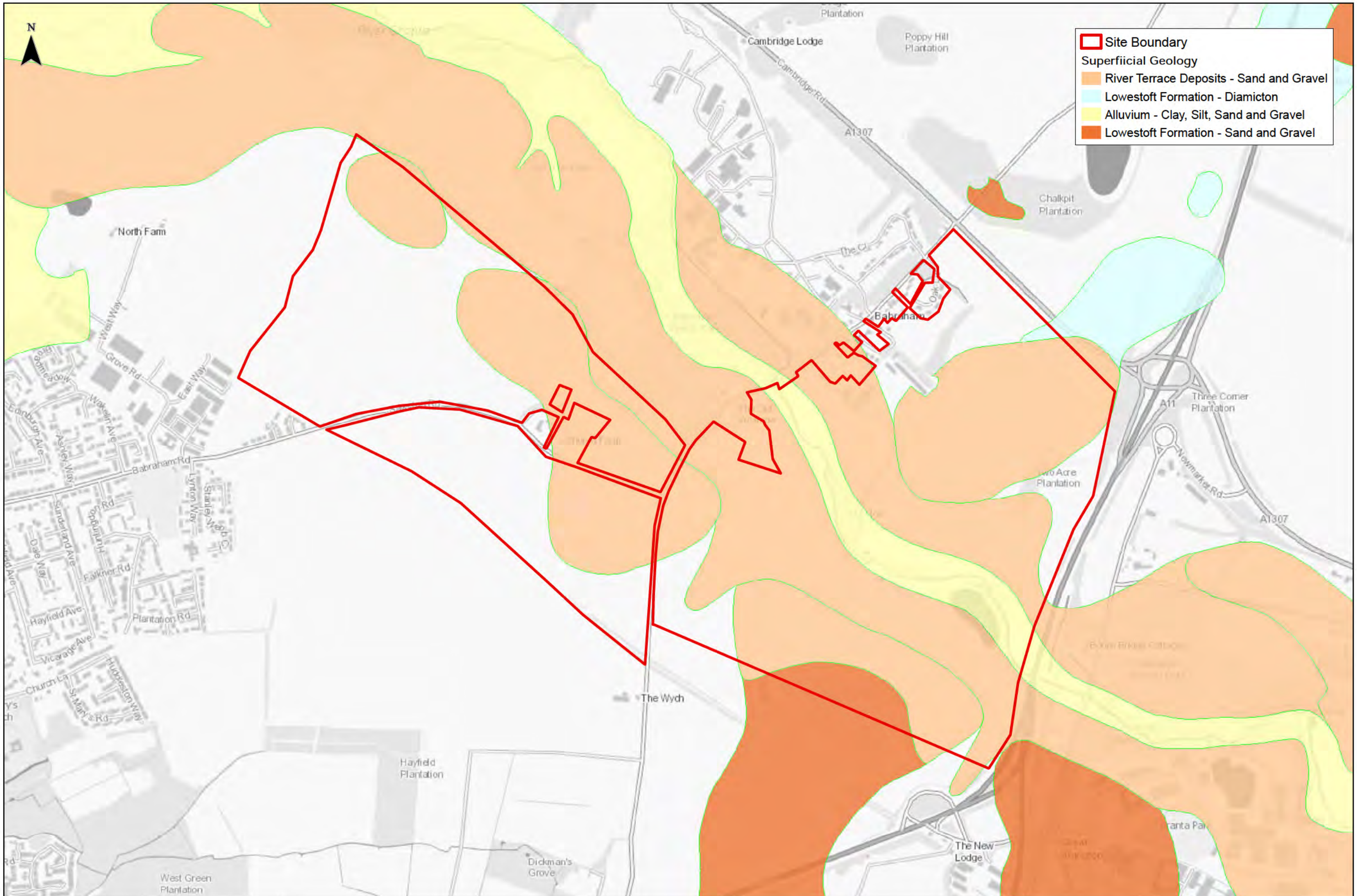
Client [redacted]

LAND AT BABRAHAM
BGS 1:50,000 Bedrock Geology

0 0.5 1 Kilometers

1:10,000 @ A3	Date: 01/10/2021
Drawn: LR	Checked: SK
Figure 009a	Rev -

Document Path: \\CAM-VFPS-001\cam\Projects\332210692 Land at Babraham\GIS\Workspaces\332210692_Figure 009a_Bedrock Geology.mxd



Stantec

Client [redacted]

LAND AT BABRAHAM

BGS 1:50,000 Superficial Geology

0 0.5 1 Kilometers

1:10,000 @ A3	Date: 01/10/2021
Drawn: LR	Checked: SK
Figure 009b	Rev -

Document Path: \\CAM-VFPS-001\cam\Projects\332210692 Land at Babraham\GIS\Workspaces\332210692_Figure 009b_Superficial Geology.mxd

N

Site Boundary

Soilscapes Classification

- Freely draining lime-rich loamy soils
- Freely draining slightly acid but base-rich soils
- Loamy and clayey floodplain soils with naturally high groundwater
- Shallow lime-rich soils over chalk or limestone
- Water

Stantec

Client [redacted]

LAND AT BABRAHAM

Soilscapes in England and Wales

0 0.5 1 Kilometers

1:10,000 @ A3 | Date: 01/10/2021

Drawn: LR | Checked: SK

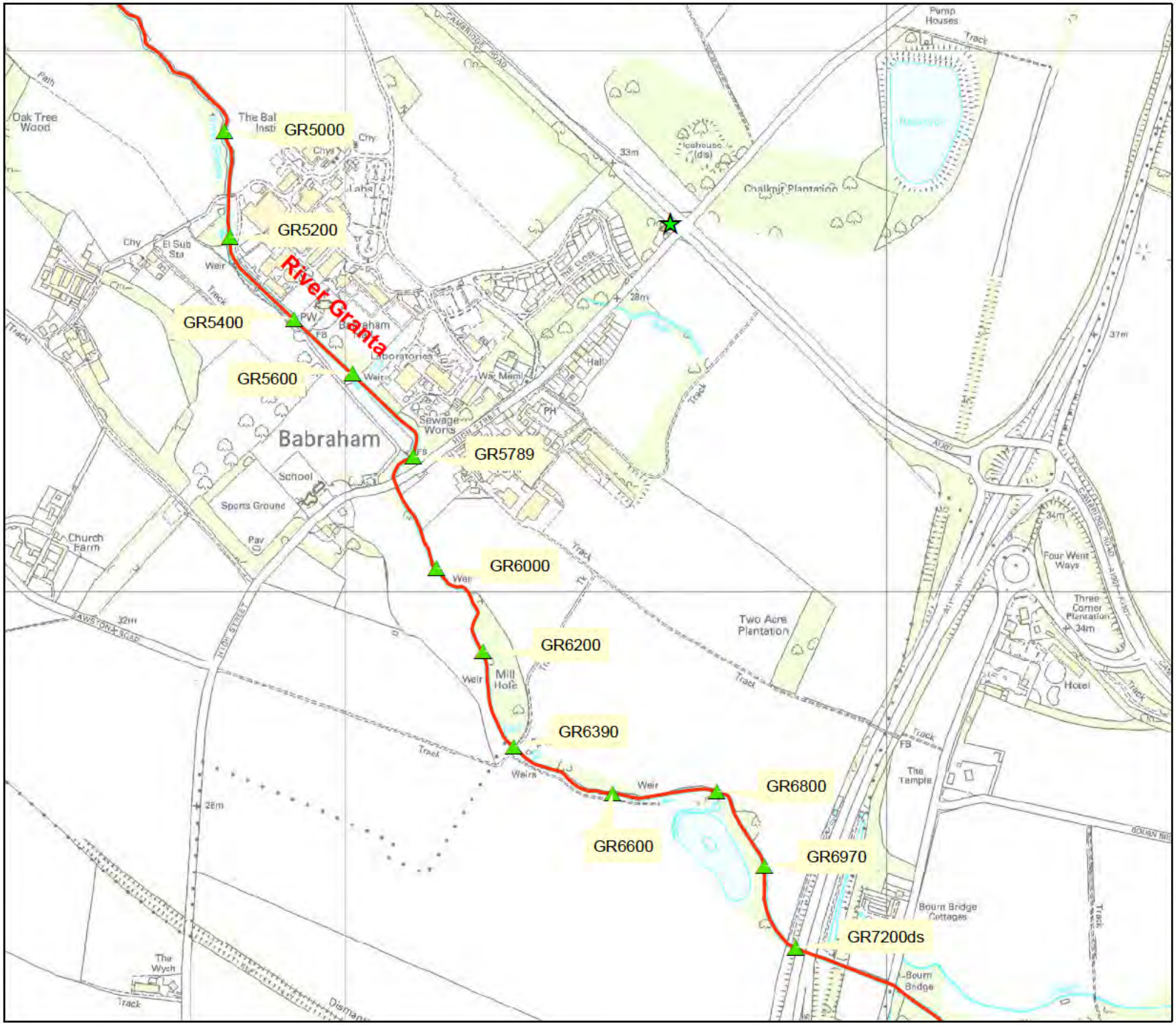
Figure 009c | Rev -

Document Path: \\CAM-VFPS-001\cam\Projects\332210692 Land at Babraham\GIS\Workspaces\332210692_Figure 009c_Soil.mxd

Appendix B EA Product 4 & 6 Flood Data

Modelled Node Point Locations centred on land at Babraham, Cambridgeshire

NGR TL5160050680
Ref 235164
Created 19/10/2021



Environment Agency
Bromholme Lane,
Brampton,
Cambridgeshire
PE28 4NE

Environment Agency

Legend

- Site
- Modelled Node Point
- Main river

0 0.125 0.25 0.5 km

Information

Model Tolerance - Any data included in this product is subject to a standard modelling tollerance of +/- 150mm.The fluvial models used to produce these results are intended for strategic scale use only.

Flood Risk Assessments - The Environment Agency recommends any Flood Risk Assessment should only consider these results in the context of a site specific assessment.

AEP - Annual Exceedance Probability - The probability of a given event occurring in any one year. Please note this is not a return period.

Strategic Scale Model - This model has been designed for catchment wide flood risk mapping. It should be noted that it was not created to produce flood levels for specific development sites within the catchment. Modelled outlines take into account catchment wide defences if present.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY Tel: 03708 506 506 (Mon-Fri 8-6).
Email: enquiries@environment-agency.gov.uk

Datasheet - Product 4

19 October 2021

Reference Number	235164
Site	Land at Babraham, Cambridgeshire
Customer	[redacted]
NGR	TL5160050680

This datasheet provides supporting information for your Product 4. It will be clearly indicated if we are unable to provide information to fulfil any part of your request.

Model Summary

Model Name	Model Code
Cam Rural - Granta	EA052370

Important Information

The following information should considered when using the material provided to fulfil this request.

Information	
Limited Modelled Extents Provided	We have only provided a limited number of modelled flood extents for clarity. If you require further extents we will be happy to provide them.
Climate Change Allowances	The 1%+CC AEP flood level in the tables will be based on the 1% annual probability flood event including an additional 20% increase in peak flows to account for climate change impacts. Guidance on climate change allowances for the purpose of flood risk assessments is available on our website at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. You may need to undertake further assessment / modelling of future flood risk using different climate change allowances to ensure your assessment of future flood risk is based on the best available evidence.

Modelled Water Levels and Flows

The following tables provide modelled in channel water level and flow values. Values are provided for Annual Exceedence Probability (AEP) events, which is the probability of a given event occurring in any one year. This is not a return period.

The fluvial models used to produce these results are intended for strategic scale use only.

If the tables show a value of -9999, this indicates that we have no level or flow data for that particular AEP or node point.

Level Data

Level values are measured in metres above Ordnance Datum (m aOD).

All level data included are subject to standard modelling tolerance of +/-150 millimetres.

Present Day Levels

Node	Model	Easting	Northing	20%	10%	5%	4%	2%	1.33%	1%	0.5%	0.1%
GR5000	EA052370	550775	250851	22.03	22.19	-9999	22.37	22.44	22.47	22.49	22.54	22.57
GR5200	EA052370	550785	250655	22.18	22.38	-9999	22.63	22.79	22.85	22.89	22.96	23.06
GR5400	EA052370	550904	250503	22.95	23.03	-9999	23.13	23.20	23.23	23.26	23.31	23.45
GR5600	EA052370	551012	250403	23.14	23.26	-9999	23.38	23.45	23.49	23.51	23.57	23.73
GR5789	EA052370	551125	250250	23.85	23.96	-9999	24.05	24.09	24.11	24.13	24.16	24.29
GR6000	EA052370	551167	250043	24.00	24.13	-9999	24.28	24.38	24.44	24.49	24.62	24.80
GR6200	EA052370	551253	249889	24.34	24.42	-9999	24.50	24.56	24.59	24.62	24.71	24.93
GR6390	EA052370	551310	249713	24.65	24.75	-9999	24.87	24.95	24.99	25.02	25.07	25.31
GR6600	EA052370	551493	249626	25.39	25.44	-9999	25.51	25.55	25.57	25.59	25.63	25.78
GR6800	EA052370	551686	249630	25.81	25.86	-9999	25.91	25.94	25.96	25.97	26.00	26.20
GR6970	EA052370	551774	249492	26.21	26.33	-9999	26.48	26.58	26.63	26.66	26.75	26.90
GR7200ds	EA052370	551831	249342	26.38	26.46	-9999	26.58	26.69	26.75	26.79	26.89	27.08

Climate Change Level

Node	Model	Easting	Northing	1%+20%cc	1%+25%cc	1%+35%cc	1%+65%cc	0.5%+20%cc	0.1%+20%cc
GR5000	EA052370	550775	250851	22.52	-9999	-9999	-9999	-9999	-9999
GR5200	EA052370	550785	250655	22.94	-9999	-9999	-9999	-9999	-9999
GR5400	EA052370	550904	250503	23.35	-9999	-9999	-9999	-9999	-9999
GR5600	EA052370	551012	250403	23.62	-9999	-9999	-9999	-9999	-9999
GR5789	EA052370	551125	250250	24.23	-9999	-9999	-9999	-9999	-9999
GR6000	EA052370	551167	250043	24.62	-9999	-9999	-9999	-9999	-9999
GR6200	EA052370	551253	249889	24.79	-9999	-9999	-9999	-9999	-9999
GR6390	EA052370	551310	249713	25.13	-9999	-9999	-9999	-9999	-9999
GR6600	EA052370	551493	249626	25.69	-9999	-9999	-9999	-9999	-9999
GR6800	EA052370	551686	249630	26.12	-9999	-9999	-9999	-9999	-9999
GR6970	EA052370	551774	249492	26.75	-9999	-9999	-9999	-9999	-9999
GR7200ds	EA052370	551831	249342	26.93	-9999	-9999	-9999	-9999	-9999

Flow Data

Flow values are measured in cubic metres per second (cumecs - m3/s).

Present Day Flows

Node	Model	Easting	Northing	20%	10%	5%	4%	2%	1.33%	1%	0.5%	0.1%
GR5000	EA052370	550775	250851	6.36	7.94	-9999	10.15	11.66	12.36	12.86	14.37	15.60
GR5200	EA052370	550785	250655	6.359	7.94	-9999	9.96	11.08	11.37	11.61	12.31	15.26
GR5400	EA052370	550904	250503	6.362	8.01	-9999	9.895	10.95	11.48	11.89	12.86	16.00
GR5600	EA052370	551012	250403	6.362	8.01	-9999	9.779	10.67	11.13	11.48	12.34	15.29
GR5789	EA052370	551125	250250	6.322	7.965	-9999	10.35	12.36	13.59	14.60	17.27	19.31
GR6000	EA052370	551167	250043	6.061	7.114	-9999	8.335	8.575	8.592	8.606	8.589	10.07
GR6200	EA052370	551253	249889	6.312	7.946	-9999	10.20	11.76	12.42	12.79	13.49	19.42
GR6390	EA052370	551310	249713	6.271	7.789	-9999	9.625	10.91	11.61	12.01	13.29	12.9
GR6600	EA052370	551493	249626	3.805	4.502	-9999	5.396	6.068	6.474	6.788	7.577	8.659
GR6800	EA052370	551686	249630	5.682	6.755	-9999	8.141	8.999	9.462	9.814	10.72	13.20
GR6970	EA052370	551774	249492	4.556	4.589	-9999	4.613	4.611	4.659	5.02	6.318	10.61
GR7200ds	EA052370	551831	249342	6.359	8.059	-9999	10.57	12.61	13.91	15.00	18.37	22.73

Climate Change Flows

Node	Model	Easting	Northing	1%+20%cc	1%+25%cc	1%+35%cc	1%+65%cc	0.5%+20%cc	0.1%+20%cc
GR5000	EA052370	550775	250851	13.72	-9999	-9999	-9999	-9999	-9999
GR5200	EA052370	550785	250655	13.08	-9999	-9999	-9999	-9999	-9999
GR5400	EA052370	550904	250503	13.89	-9999	-9999	-9999	-9999	-9999
GR5600	EA052370	551012	250403	13.52	-9999	-9999	-9999	-9999	-9999
GR5789	EA052370	551125	250250	16.35	-9999	-9999	-9999	-9999	-9999
GR6000	EA052370	551167	250043	10.03	-9999	-9999	-9999	-9999	-9999
GR6200	EA052370	551253	249889	14.95	-9999	-9999	-9999	-9999	-9999
GR6390	EA052370	551310	249713	11.02	-9999	-9999	-9999	-9999	-9999
GR6600	EA052370	551493	249626	7.187	-9999	-9999	-9999	-9999	-9999
GR6800	EA052370	551686	249630	11.38	-9999	-9999	-9999	-9999	-9999
GR6970	EA052370	551774	249492	8.59	-9999	-9999	-9999	-9999	-9999
GR7200ds	EA052370	551831	249342	17.43	-9999	-9999	-9999	-9999	-9999

Recorded Flood Events

Where included, the Recorded Flood Event Outlines map provides an indication of areas which have flooded. Not all properties shown to be within the outline will have flooded.

Flood Event	Start	End	Source	Cause
Oct 2001	21/10/2001	24/10/2001	Main River	Channel Capacity Exceeded (no raised defences)

General Information

Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) indicates the area at risk of flooding for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring in any year for fluvial (river) flooding (Flood Zone 3).

It also shows the extent of the Extreme Flood Outlines (Flood Zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The Flood Zones refer to the land at risk of flooding and do not refer to individual properties.

The Flood Map for Planning (Rivers and Sea) can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-map-for-planning.service.gov.uk or downloaded in GIS format under an open data licence from the following address: https://data.gov.uk/publisher/environment-agency

The Flood Map is updated on a quarterly basis to account for any amendments required.

Surface Water, Ordinary Watercourses and Groundwater Flooding

Lead Local Flood Authorities (LLFA) are responsible for managing local flood risk from ordinary watercourses, surface water flooding and groundwater flooding. You should check with the LLFA as they may have more up to date information regarding this type of flooding.

The Risk of Flooding from Surface Water Flood Map can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-warning-information.service.gov.uk/long-term-flood-risk

Information on how to reduce the impact of flooding from groundwater can be found online by the following link: https://www.gov.uk/government/publications/flooding-from-groundwater

Flooding from Reservoirs

The Risk of Flooding from Reservoirs Flood Map can be viewed and downloaded as a PDF file on GOV.UK by following this link: https://flood-warning-information.service.gov.uk/long-term-flood-risk

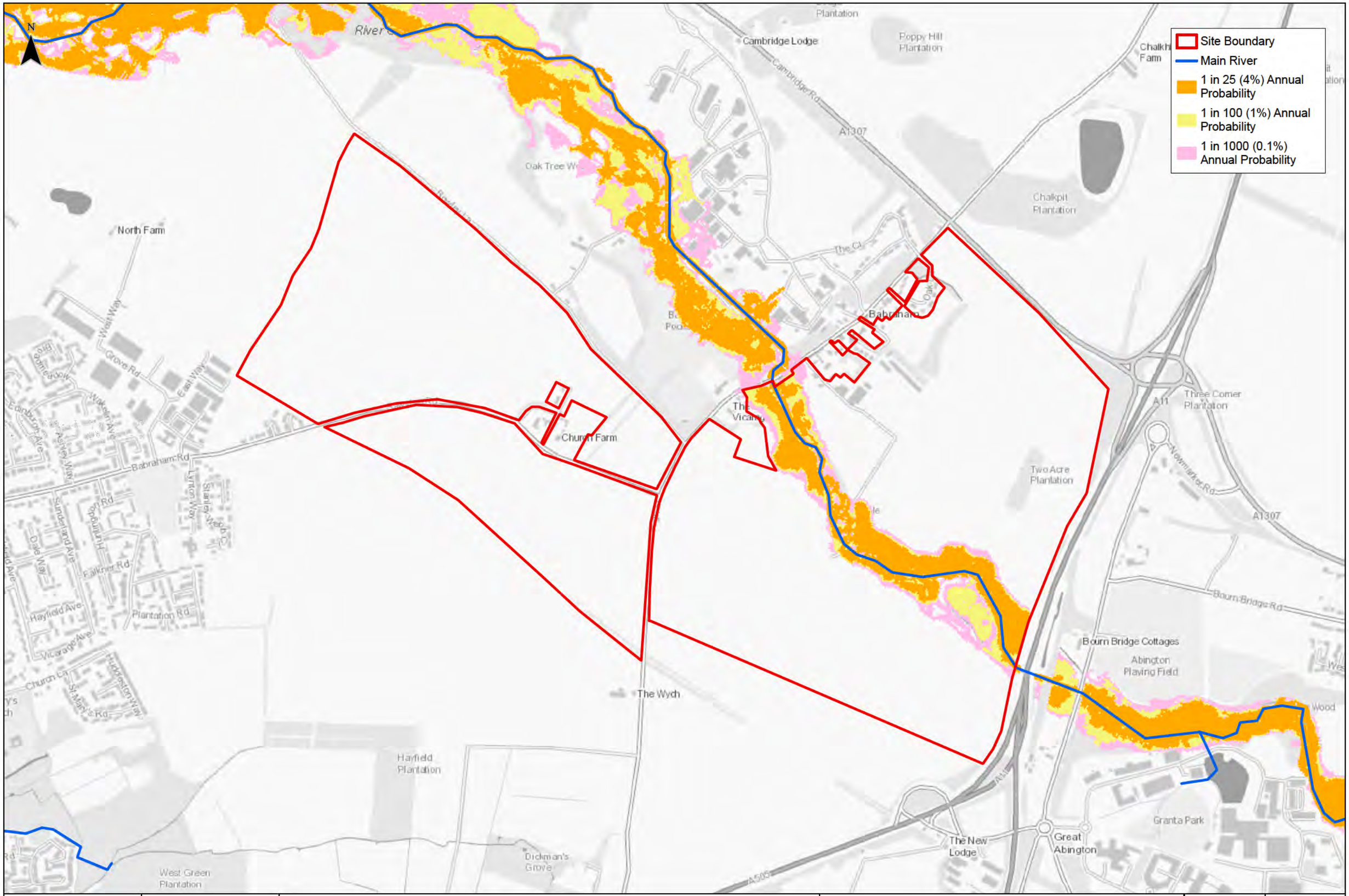
Sewer Flooding

Your local water company may have information on sewage flooding in your area of interest.

Areas Benefitting from Defence

Areas Benefitting from Defences show the area benefiting from defences from a 1 in 100 (1% AEP) year fluvial event or a 1 in 200 (0.5% AEP) tidal/coastal event.

The associated dataset can be downloaded in GIS from the following link: https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences



Stantec

Client [redacted]

LAND AT BABRAHAM

Defended Modelled Flood Extents
(Extracted from the Cam Rural - Granta 2014 model)

0 0.5 1 Kilometers

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Drawn: LR	Checked: SK
Figure 010	Rev -

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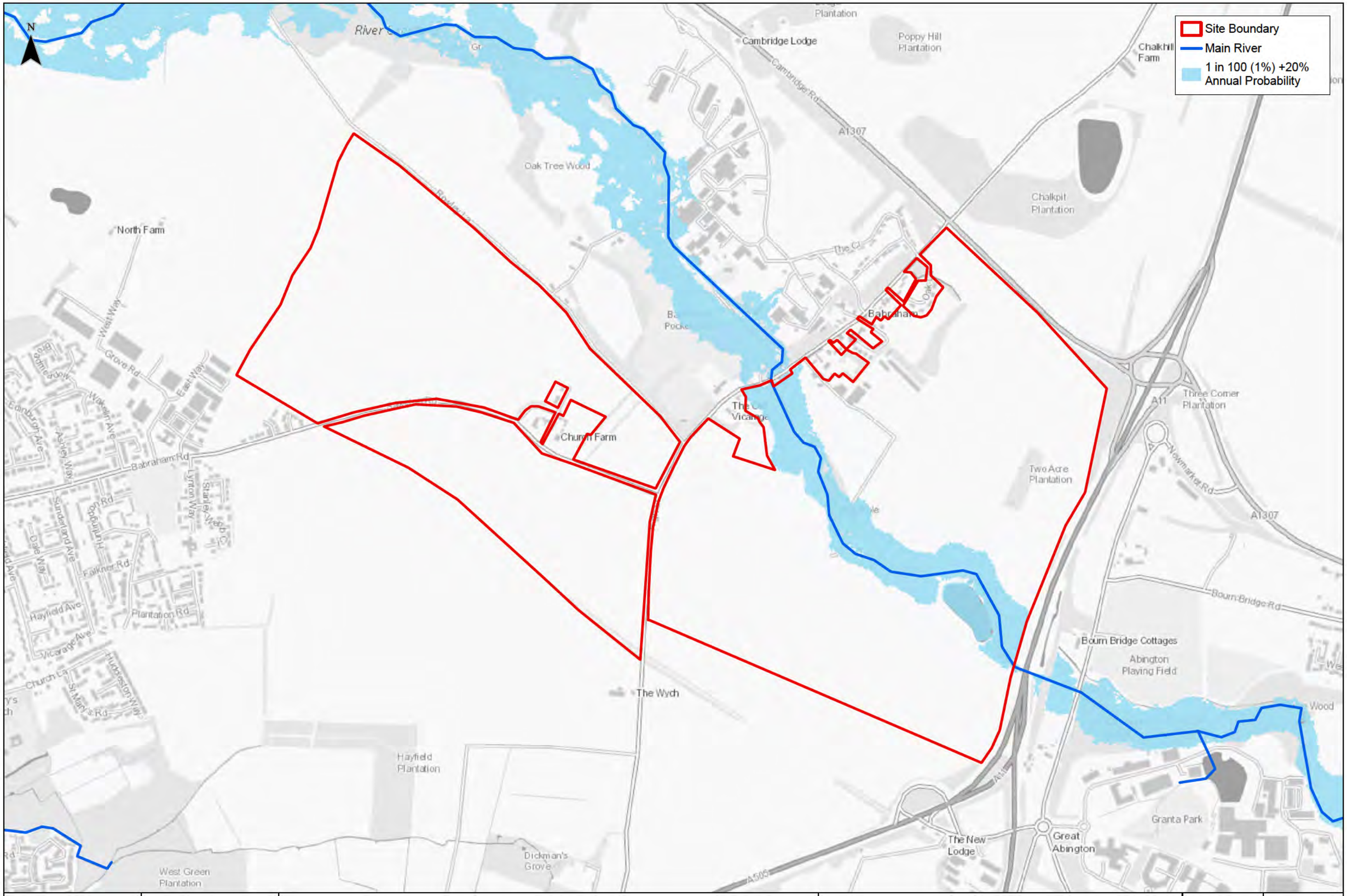

Stantec

Client [redacted]

LAND AT BABRAHAM

Defended Climate Change Modelled Flood Extents
(Extracted from the Cam Rural - Granta 2014 model)

0 0.5 1 Kilometers

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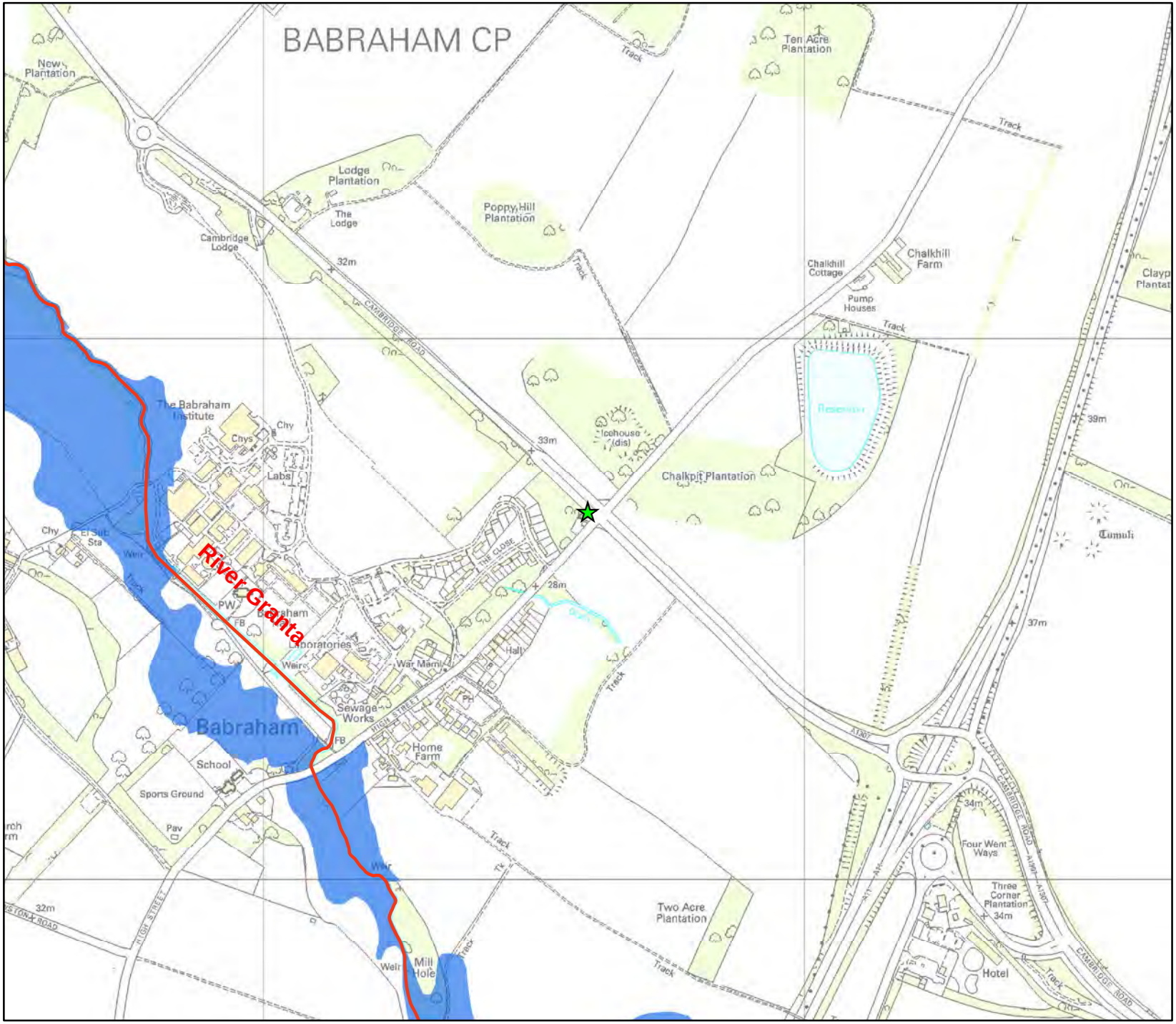
Drawn: LR	Checked: SK
Figure 011	Rev -

Document Path: \\CAM-VFPS-001\cam\Projects\332210692 Land at Babraham\GIS\Workspaces\332210692_Figure 011_DefendedCCModelExtents.mxd

Recorded Flood Event Outlines centred on land at Babraham, Cambridgeshire

NGR TL5160050680
Ref 235164
Created 19/10/2021



Environment Agency
Bromholme Lane,
Brampton,
Cambridgeshire
PE28 4NE

Environment Agency

Legend

- Site
- Main river
- October 2001

0 0.125 0.25 0.5 km

Information

Recorded Outlines - The recorded flood outlines provided are only indicative and may not accurately represent the area that flooded in the named events. Our historic flood event outlines do not provide a definitive record of flooding. It is possible that there will be an absence of datail in places where we have not been able to record the extent of flooding. It is also possible for errors occur in the digitisation of historic records of flooding.

Recorded Outlines - There may be other flood events that have occurred that we have not been able to produce an outline for.

Recorded Outlines - The historic flood event outlines are based on a combination of anecdotal evidence, Environment Agency staff observations and survey.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

235164 Product 4 Map

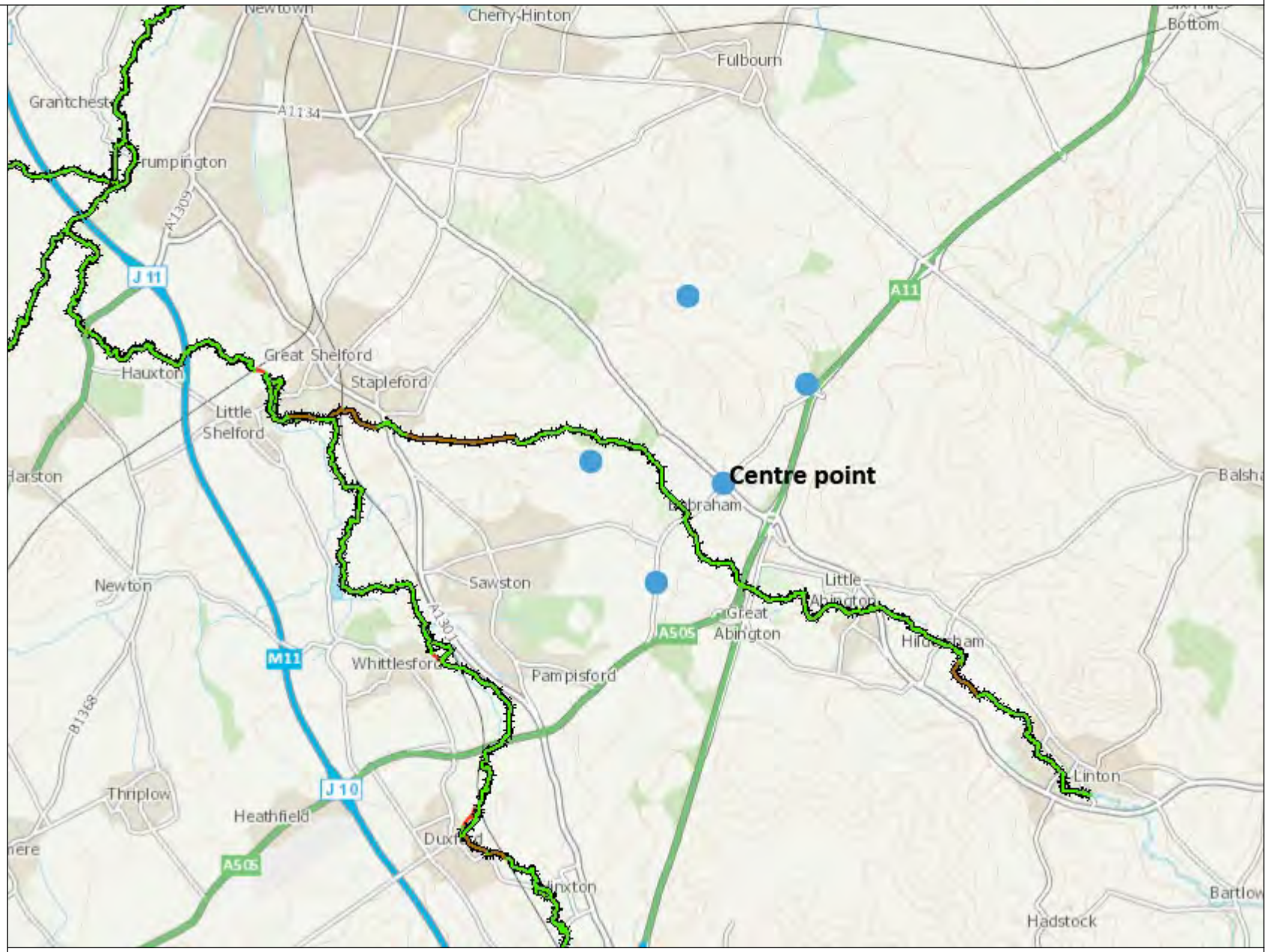
Environment Agency

Legend

Defences (EA maintained)

- Asset type not defined
- Embankment
- Wall
- Flood Gate
- Demountable Defence
- Bridge Abutment
- High Ground
- Beach
- Barrier Beach
- Promenade
- Quay
- Cliff
- Dunes

Statutory Main Rivers



1: 75,000

0 1,875

Metres

N W E S

Appendix C Anglian Water Correspondence

[redacted]

From: Planning Liaison <planningliaison@anglianwater.co.uk>
Sent: 24 September 2021 16:03
To: [redacted]
Subject: RE: Request for Flood Risk Information - Babraham, Cambridgeshire

Good afternoon Luke

Thank you for your email

Anglian Water is able to confirm that we have no records of flooding in the vicinity that can be attributed to capacity limitations in the public sewerage system. It is possible that other flooding may have occurred that we do not have records of, other organisations such as the Local Authority, Internal Drainage Board or the Environment Agency may have records.

Kind regards

Sandra

Sandra De Olim
Pre-Development Advisor
Mobile: [redacted]
Team: [redacted]
Email: planningliaison@anglianwater.co.uk
Website: https://www.anglianwater.co.uk/developing/planning--capacity/

Anglian Water Services Limited
Thorpe Wood House, Thorpe Wood, Peterborough, Cambridgeshire, PE3 6WT

From: Rogers, Luke <L[redacted]>
Sent: 24 September 2021 12:14
To: Planning Liaison <planningliaison@anglianwater.co.uk>
Subject: Request for Flood Risk Information - Babraham, Cambridgeshire

Dear Sir / Madam,

RE: REQUEST FOR FLOODING INFORMATION – LAND AT BABRAHAM, CAMBRIDGESHIRE

Stantec has been instructed to complete a Flood Risk Assessment (FRA) for a site located at Babraham, Cambridgeshire.

To ensure a comprehensive appraisal of flood risk related constraints we would be grateful if you would provide information as requested in the attached data request letter. The letter includes a site location plan and a National Grid Reference location.

Please get in touch should you have any queries regarding our request.

Kind Regards,

[redacted]
BSc MSc
Graduate Water Engineer

Waterloo House, Victoria Square, Birmingham, B2 5TB
Direct: [redacted]
[redacted]

Stantec

Please consider the environment before prin ing this email.

Appendix D Development Proposals

Babraham Resea ch Campus

Sawston

A

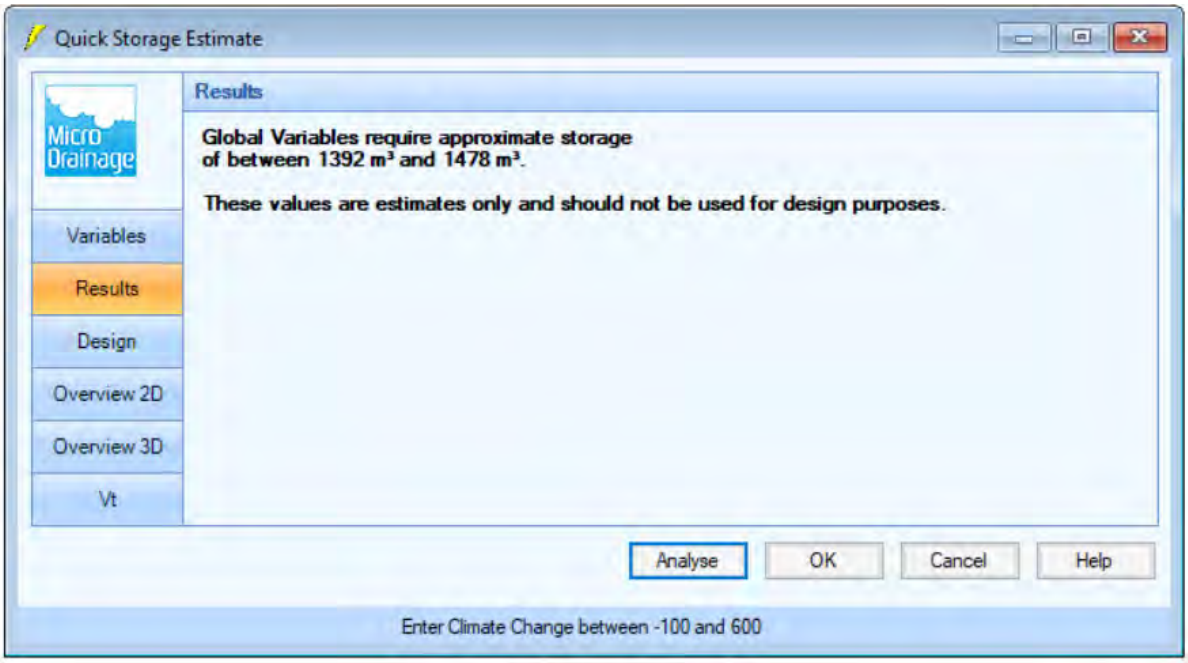
Key

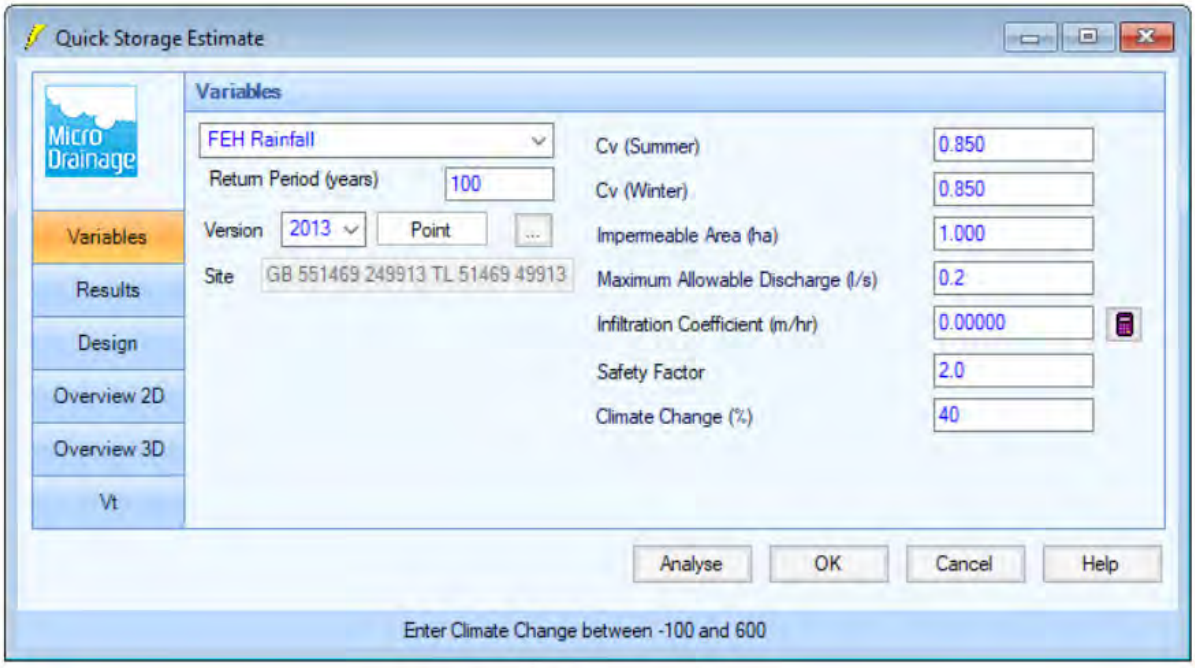
- i b d
- D l l
- S T h b d l
- P b
- Pi h l
- S d h l
- L
- L l
- E l
- Hi i b k i
- A hi i l R)
- U S

0mm 50m 100m 150m 200m

PRP

Appendix E Attenuation Storage Requirements


Quick Storage Estimate
Micro Drainage
Results
Global Variables require approximate storage of between 1392 m³ and 1478 m³.
These values are estimates only and should not be used for design purposes.
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600


Quick Storage Estimate
Micro Drainage
Variables
FEH Rainfall
Return Period (years) 100
Version 2013
Point
Site GB 551469 249913 TL 51469 49913
Cv (Summer) 0.850
Cv (Winter) 0.850
Impermeable Area (ha) 1.000
Maximum Allowable Discharge (l/s) 0.2
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 40
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Analyse
OK
Cancel
Help
Enter Climate Change between -100 and 600