Flood Risk and Drainage Appraisal (Stantec)

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DAVID LOCK ASSOCIATES

Stantec

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BOWBRIDGE LAND

Silfield Garden Village

Flood Risk and Drainage Appraisal

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	Name	Position	Signature	Date
Prepared by:	M Davison S Knowles	Graduate Principal	*MD /SK*	16/03/2020
Reviewed by:	S Knowles	Principal	*SK*	16/03/2020
Approved by:	A Soderberg	Associate	*AS*	16/03/2020
For and on behalf of Stantec UK Limited				

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Executive Summary

This report has been prepared by Stantec UK Limited, on behalf of our clients, Orbit Building Communities and Bowbridge Strategic Land, to support an emerging proposal for a proposed new Garden Village, located to the south of Wymondham, and west of Silfield, hereafter named Silfield Garden Village.

The vision for Silfield Garden village is to build a vibrant and NetZero sustainable garden village, creating a distinct, self-contained and sustainable community.

The site is located predominately in Flood Zone 1, Low Probability from fluvial (river) flooding. The topography indicates the land is at the head of a fluvial sub-catchment, with watersheds located predominately from the east to the west. The receiving watercourse from this land passes flow predominately to the west to the Bays River. Most of the site is also shown to be at low risk from Surface Water flooding. These areas relate to the existing watercourses traversing the site and along the western boundary (Bays River). This area is not vulnerable to groundwater flood risk or inundation from a registered reservoir.

As part of the delivery for this sustainable community it is proposed to include a fully integrated sustainable surface water management system, designed to not only manage flood risk and avoid detriment to offsite areas, but to also provide betterment to water quality and provide ecological enhancement. The premise of this report is to inform what will be used in the development of the masterplan and for promotion at the Local Plan Stage.

The surface water flood risk is manageable on site and the surface water drainage strategy give opportunity to provide some betterment to control rapid agricultural runoff which is likely to be present in the local catchment. Overall the site is well positioned to deliver the Garden Village community and will meet the requirements of both national and regional policy.

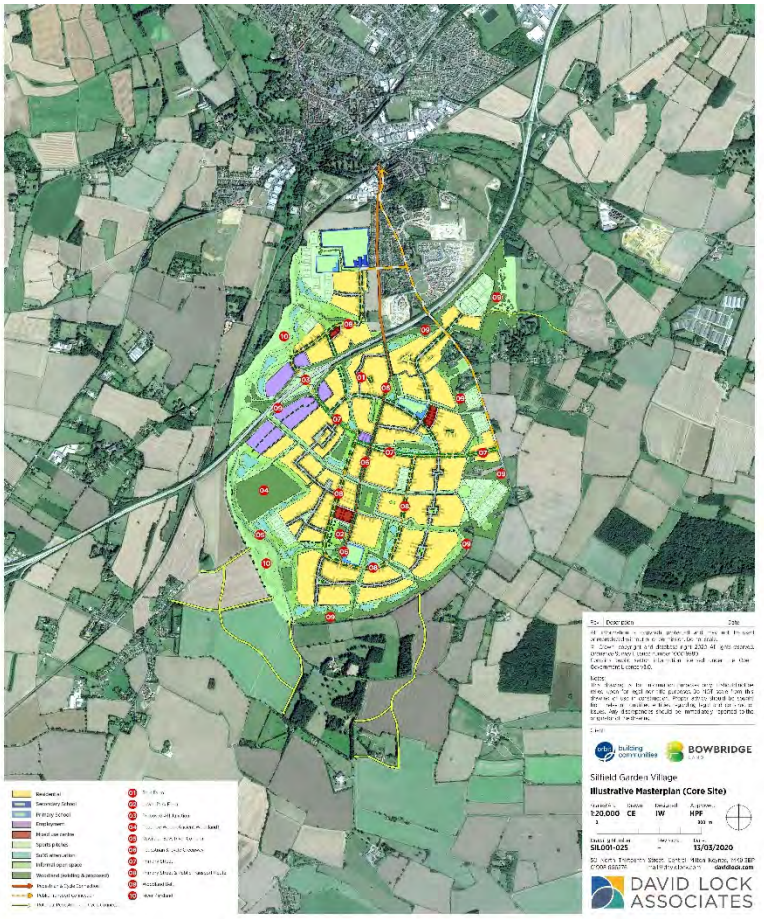


Figure 1: Masterplan

1 Introduction

1.1.1 This report considers the baseline conditions of the site, specifically impact of flooding, the constraints and the opportunities that this site affords and where necessary the potential suitable mitigation measures.

1.1.2 Whilst planning policy, both at a regional and local level, is often used to shape flood risk and drainage design for sites, this is seen as the foundation for the vision of this site, with the proposal to deliver a design which goes beyond the standard approach with regard to sustainability and in accordance with Garden Village Principles at its heart.

1.1.3 The details within the report are based on data available at the time of this study and is a high-level assessment. The findings are subject to change following receipt of further data, such as a site-wide topographical survey, details of any future ground investigations, and consultations with the statutory authorities, which are all proposed in support of a future planning application.

1.1.4 It should also be noted that this document is not a Flood Risk Assessment (FRA) or a supporting Sustainable Drainage Statement, both which are to be undertaken as part of a suite of technical documents in support of a future Planning Application. All proposals with respect to flood risk and drainage are therefore subject to agreement with stakeholders such as the Environment Agency (EA), Local Planning Authority (LPA), the Lead Local Flood Authority (LLFA) which for this site is Norfolk County Council (NCC) and Anglian Water (AW).

Purpose of this report

1.1.1 The purpose of this report is to explore how the strengths of a development in this location can be harnessed and developed to enable local flood risk and surface water drainage policy objectives to be met. A brief overview of the impacts associated with development in this location, both in terms of opportunities for sustainable surface water drainage and in terms of flood risk have also been provided.

1.1.2 The document has been prepared as a template for the future sustainable surface water drainage strategy but also to help inform the next stage of the Greater Norwich Local Plan process.

Report structure

1.1.3 The remainder of this report is structured as follows:

- **Section 2** sets out the existing site details and hydrological context of the site, from existing data sources and studies;
- **Section 3** summaries the existing flood risk and surface water drainage policies which have been and are to be considered in the future development;
- **Section 4** provides details on the existing flood risk conditions effecting the site from both existing data sources and studies;
- **Section 5** presents an early indication of a future surface water drainage strategy based on preliminary calculations and assumptions;
- **Section 6** summarises conclusions and recommendations.

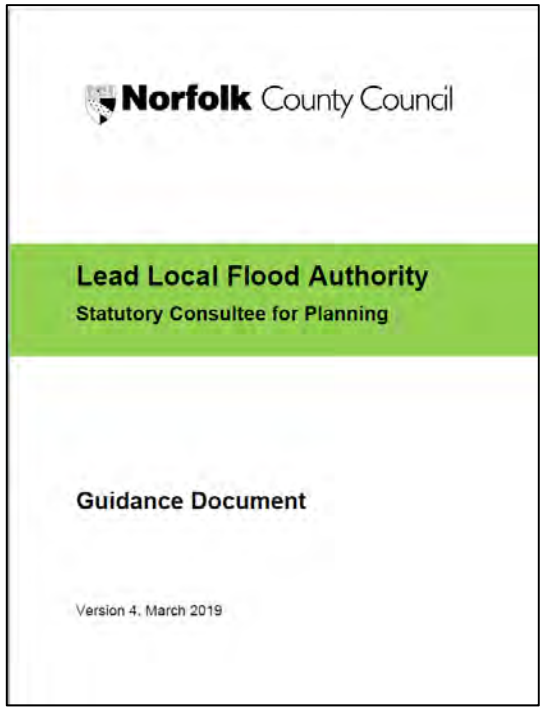
Baseline Data

The following documents are also relevant to the development and have been reviewed to inform the appraisal:

- Environment Agency (EA) published ‘Open Data’ datasets available online, reproduced with OS mapping under licence to PBA/ Stantec (contains Ordnance Survey data © Crown copyright and database right [2016/2018], contains Environment Agency information © Environment Agency and database right);

FLOOD RISK AND DRAINAGE

- Ordnance Survey (OS) Maps;
- National Soil Resources Institute (NSRI) Soilscape Viewer;
- British Geological Survey (BGS) Online Digital Viewer;
- Norfolk Local Flood Risk Management Strategy (July 2015);
- National Planning Policy Framework (February 2019);
- Norfolk County Council Preliminary Flood Risk Assessment Report (July 2011);
- South Norfolk Development Management Policies Document (October 2015)
- Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning, Guidance Document (Version 4 March 2019)



2 Existing Baseline Information

Site Location

2.1.1 Silfield Garden Village will be located to the south of Wymondham and west of Silfield. The site consists of four parcels of land. The largest parcel of land lies to the south of the A11 with two smaller parcels to its north east corner, collectively hereafter referenced as the Southern site and the remaining parcel is located to the north of the A11, hereafter referenced as the Northern site.

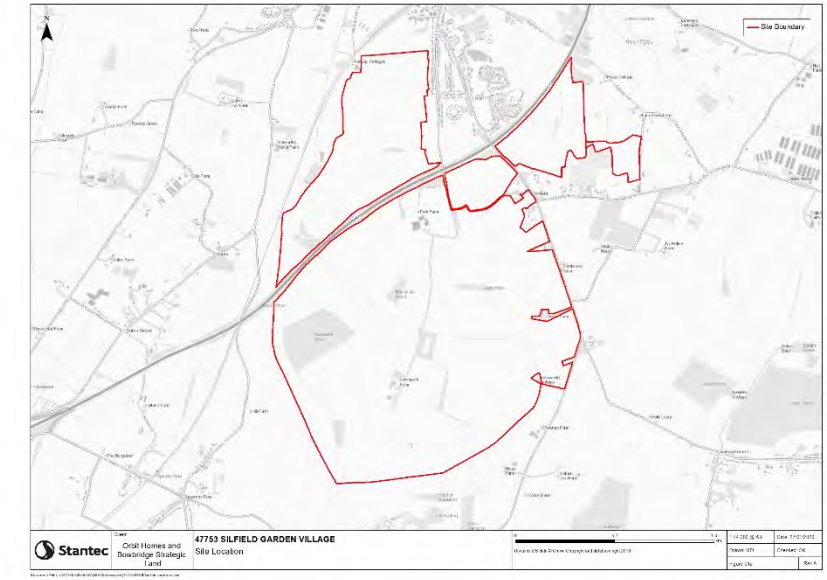


Figure 2: Site Location Plan

2.1.2 A Site Location Plan with Aerial Photography, reference Figure 01b, is contained in **Appendix A.** **Figure 2** above shows the site location.

Site Topography

2.1.3 Light Detecting And Ranging (LiDAR) topographical data indicate that the ground slopes towards the North West of the site. The highest side of the site lies on the south east side of the Southern site with an elevation of 89mAOD with the lowest level at approximately 30mAOD in the far west. The site slopes towards the Bays River (EA)on the north western edge of the site, as illustrated in **Figure 3 below**, also provided in **Appendix A**.

2.1.4 A topographical survey will be undertaken to help inform the production of a future FRA and Drainage Strategy for the site.

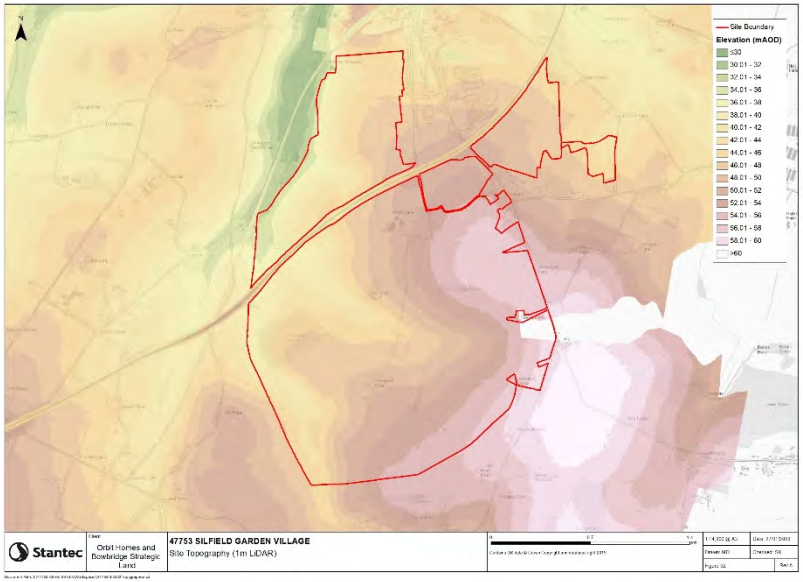


Figure 3: Area Topography

On Site Drainage

2.1.5 Based on the current baseline information available, the site is drained by existing watercourses.

2.1.6 A review of the OS mapping shows Bays River runs along the Western boundary of the Southern site, it is classed as an Ordinary Watercourse (OW) at this location, Bays River (OW). Before culverting under the A11. Following the culvert under the A11 the river follows the boundary of the Northern site before the confluence

with a tributary of the Bays River, where the River Bray is referred to as an EA Main River, Bays River (EA).

2.1.7 There are also two ordinary watercourses present at the site, these are as follows:

- Traversing through the central areas of the southern site an ordinary watercourse, which flows from the south east of the site to the north west where the watercourse is culverted under the A11. The culvert is located an estimated 1km east of Bays River (OW) culvert. The ordinary watercourse then follows the boundary of the North site along the A11 to Bays River (EA).
- An Ordinary watercourse lies to the north west of the south site along the western boundary of the Northern Site and flows towards the Bays River (EA).

2.1.8 The Northern and Southern site have a variety of small water bodies dotted within its perimeter. See **Figure 4** below. This is also included within **Appendix A**.

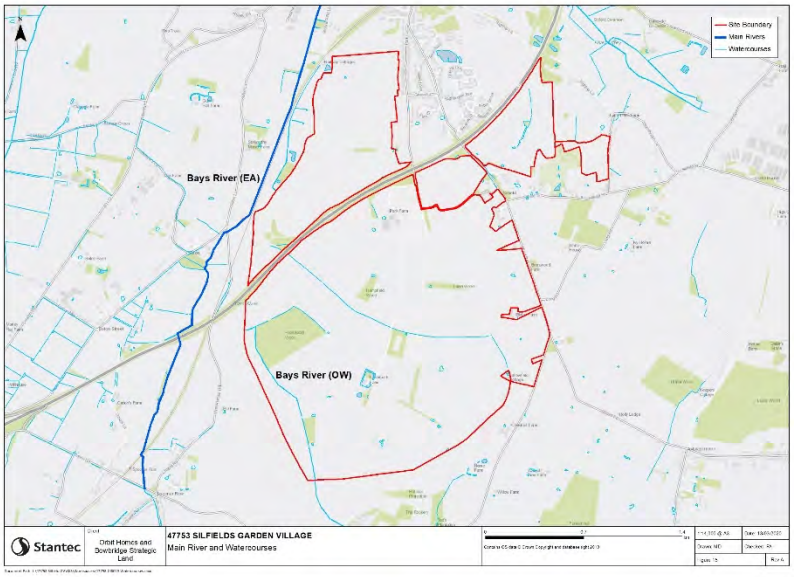


Figure 4: Existing Waterbodies

Public Sewers

2.1.9 AW asset plans have been obtained for the site and these show no sewers located within the site boundary. The closest foul water sewer lies at the junction between Green Lane and Silfield Lane to the north east of the site. Refer to **Appendix B** for a copy of the AW records.

2.1.10 The closest Water Recycling Centre (WRC) is the Wymondham WRC, located to the North East of Wymondham.

2.1.11 AW were contacted regarding the current capacity of the WRC works and it was acknowledged at the time of this assessment there is headroom available for 1000 new properties.

2.1.12 Whilst there is currently limited capacity for the total number of properties, AW have acknowledged their obligation to accept the necessary foul flows from the development should planning consent be granted. Therefore, as part of the planning application further consultation will be carried out with AW to ensure the necessary steps are undertaken to ensure there is enough treatment capacity following the planning consent.

2.1.13 AW consultation responses is provided in **Appendix B**.

Geological Context

2.1.14 Most of the site is underlain by the superficial geology of the 'Lowestoft Formations - Diamicton'. There are also areas located along the western Bays River Ordinary Watercourse (OW) corridor of the site which is underlain by alluvium clay, silt, sand and gravel. The 'Lowestoft Formations - Diamicton', deposits are classified as Secondary (undifferentiated) Aquifer by the EA, whilst the alluvium clay is classified as a Secondary A Aquifer by the EA.

2.1.15 The bedrock consists of a variety of chalks, Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations. The bedrock geology is classified as a Principle Aquifer by the EA.

2.1.16 A review of BGS boreholes indicates that there is potentially more than 20 meters of clay below ground level. As such, the use of infiltration for the proposed surface water drainage is unlikely. This is reinforced by the National Soil Resources Institute (NSRI) Soilscape viewer, which indicates that the site is situated on 'Slightly acid loamy and clayey soils with impeded drainage'.

2.1.17 **Figure 5** below and provided in **Appendix A,** shows the site is located in groundwater source protection zone (SPZ) 3. SPZ3 is defined by the EA and is also referred to as the total catchment. Whilst infiltration is not considered to be likely at the site, due to the underlying geology at the site, the protection of the underlying groundwater and aquifer will need to be considered at the design stage. The treatment of the surface water generated through the development will therefore be managed in accordance with the SuDS Manual Simple Index approach.

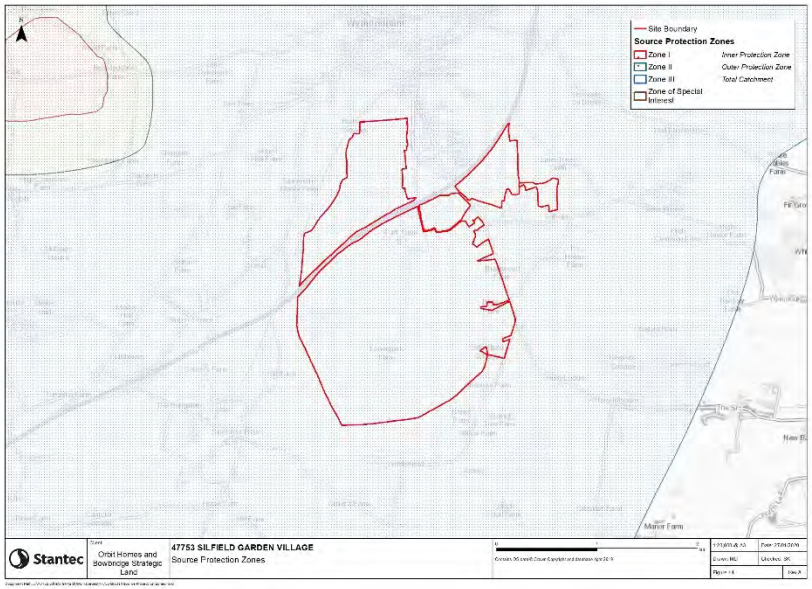


Figure 5: Source Protection Zone

3 Flood Risk and Surface Water Drainage Policy

3.1.1 This section provides an overview of national and local flood risk and surface water drainage policy objectives relevant to the area of study. These form the foundation to the emerging design of which the site will meet. However, it is proposed to assess the future site development in a more sustainable context than what is currently being promoted, both at a national and regional level.

National policy

3.1.2 The National Planning Policy Framework (NPPF) details the current national planning policy for flood risk in England. The NPPF has strict tests to protect people and property from flooding which all local planning authorities are expected to follow. The accompanying Planning Practice Guidance (PPG) to the NPPF advises on how planning can take account of the risk associated with flooding and coastal change.

3.1.3 The online Flood Maps are used to assign a flood risk classification to all land throughout England with the PPG defining the vulnerability of development and land use.

3.1.4 The PPG contains Table 3 (Flood Risk Vulnerability Classification and Flood Zone Compatibility) detailing appropriate development types within each of the flood zones based on the vulnerability classification in addition to further planning requirements (e.g. the Sequential and Exception Test), to assess if the development is at an acceptable risk of flooding.

3.1.5 In accordance with the NPPF and PPG, a Flood Risk Assessment (FRA) will be required as the site is greater than 1 hectare and located within Flood Zones 1, 2 and 3.

3.1.6 The undertaking of the sequential and exception test will also be assessed as part of the planning promotion for the site.

Local policy

Lead Local Flood Authority

3.1.7 Relevant local guidance for flood risk and drainage is contained within Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning, Guidance Document (Version 4 March 2019) The guidance outlines 8 key policies.

- Policy 1 (Local Flood Risk Guidance) outlines that flood risk must not be increased outside of the site and the most vulnerable development is located within the areas of lowest risk. Additional developments must be flood resilient and resistant with safe access where required.
- Policy 2 (Drainage Hierarchy) describes the hierarchy of drainage discharge types quoted from the NPPF. The hierarchy can be seen below from most preferable to least:
    a. Into the Ground (infiltration);
    b. To a surface water body;
    c. To a surface water sewer;
    d. To a combined sewer.
- Policy 3 (Infiltration Testing Guidance) refers to the BRE 365 Soakaway Design outlining the method of infiltration testing.
- Policy 4 (Runoff Rate) quotes SuDS Non-Statutory Technical Standards (2015) S2 and S3. Describing that the greenfield runoff must not be exceeded for the 1% AEP and 100% AEP.
- Policy 5 (Runoff Volume) Quotes the CIRIA SuDS Manual (C753) “Peak rates of surface water runoff discharged from a development (i.e. relatively impermeable) site, if left uncontrolled, are normally significantly greater than from the site in its greenfield state. This is because most of the runoff drains off the surfaces of the developed site much quicker than the greenfield site and there is much more runoff, as less water is able to penetrate the ground or be intercepted in other ways.”

- Policy 6 (Flood Risk Assessments: Climate Change Allowance) States that the PPG guidance must be followed.

- Policy 7 (Management and Maintenance) states that an appropriate standard of operation of the drainage features is required and that there is clear arrangement in place for ongoing maintenance over the lifetime of the development.

- Policy 8 (Flood Level and Flow Exceedance Management). Firstly, the policy states that the finished floor level and entrances to basements must be 300mm above the 1% AEP. Secondly the policy states that the design should assess the effect of blockages, failure of embankments and higher than standard rainfall events.

South Norfolk Council

3.1.8 The Development Management Policy Document October 2015 outlines the council's policy towards development. The document outlines a key policy, with three sections applicable to drainage and water management.

3.1.9 The first section states that surface water from a proposed development must be fully integrated within the design. The proposed development must also minimise the risk of flooding to the surrounding area and to the site. However, if the ground conditions are not acceptable or there are other exceptional circumstances, then an exception can be made.

3.1.10 The second section states the development must detail how it will contribute to biodiversity and amenity, showing how the drainage integrates with the design. The development must show improvement to amenity and biodiversity.

3.1.11 The final section describes four criteria that must be present within the proposed development:

i. The development must have a neutral or positive effect to surface water flooding and have a sewage capacity assessment. The development must contain drainage features that slow the movement of water.

ii. The development must not reduce water quality and the development must have methods to increase the water quality within the design.

iii. The water design must have separate surface water and foul water drainage systems. The surface water drainage must not discharge into the to a foul drainage connection or combined sewers, unless it can be demonstrated that there is no other option.

iv. The development must utilise soft landscaping and permeable surfaces unless the development can provide justification that it is not feasible.

4 Assessment of Flood Risk

Online Flood Maps

4.1.1 A review of the online Flood Map for Planning shows the site is predominantly located within Flood Zone 1 'Low Probability', as shown below, having less than a 1 in 1000 (0.1%) annual probability of river or sea flooding. However, an area along the western boundary of the site is located within Flood Zone 3 'High Probability'. This area is adjacent to the Bays River (EA) and Bays River (OW) and likely functions as a functional floodplain (see 6 below and **Appendix A**).

4.1.2 Consultation with the EA will be undertaken as part of the future planning application and in developing the vision as set out in Section 6. The flood zone areas are however to remain free from development.

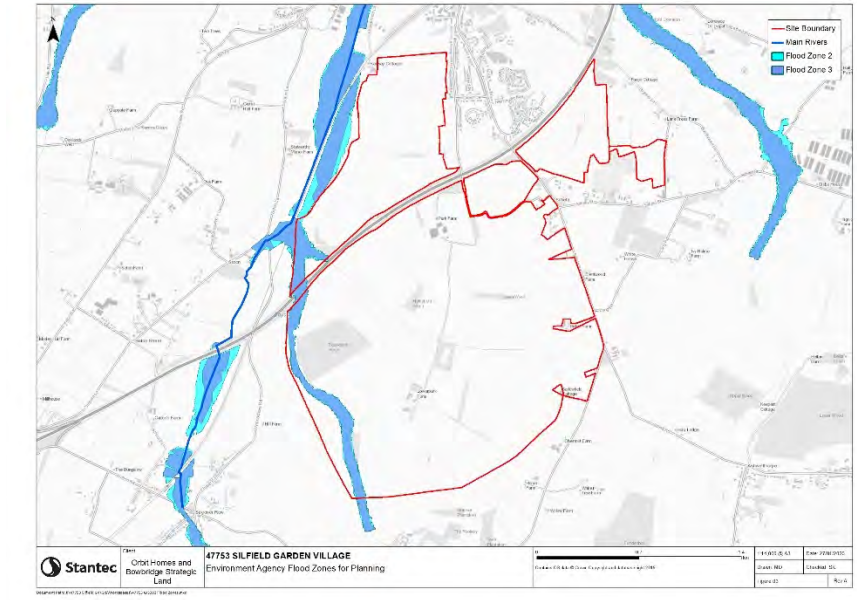


Figure 6: Flood Risk Map for Planning

Surface Water

4.1.3 Fluvial flooding is typically defined as flooding caused by waters in rivers rising above bank levels, while surface flooding (pluvial) is caused by heavy rainfall running off land and ponding in areas of low topography. Flooding is often caused by both sources.

4.1.4 The surface water flood maps from the Gov.UK website show the site has areas of 'low', 'medium' and 'high' risk of flooding. However, most of the site is considered at 'very low' risk to surface water flooding. This is defined as having less than a 1 in 1000 (0.1%) annual probability of flooding.

4.1.5 The definitions for each surface water flood risk category is defined in Table 1 below.

Risk of flooding	Probability
Very low	< 1 in 1000 (0.1%)
Low	1 in 1000 (0.1%) - 1 in 100 (1%).
Medium	1 in 100 (1%) - 1 in 30 (3.3%)
High	>1 in 30 (3.3%)

Table 1: Surface Water Flood Risk Categories

4.1.6 Areas illustrated as being at 'high' risk to surface water flooding are shown located along the channel of the watercourse which flows through the centre of the Southern site and the watercourse located along the western boundary of the Northern site (Bays River EA). This is defined as having more than 1 in 30 (3.3%) annual probability of flooding (refer to **Figure 7** below and **Appendix A**).

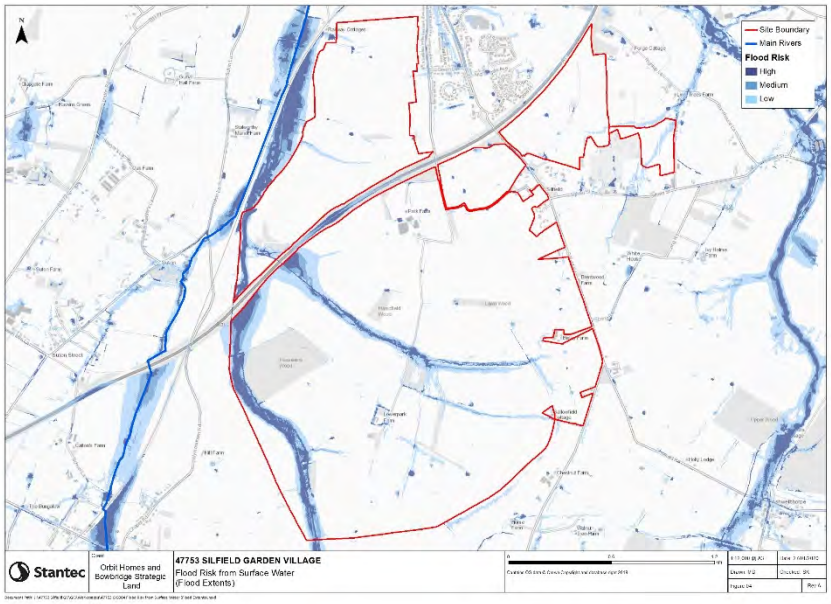


Figure 7: Surface Water Flood Risk Map

4.1.7 The online maps indicate that flood depths along the central ordinary watercourse, within the Southern site, and the ordinary watercourse along the western boundary of the Northern Site could be up to 900mm. The flood risk associated with the Bays River (EA and OW), in proximity to the Northern Site and along the western boundary of the Southern Site (Bays River OW) are shown to exceed 1200mm flood depths (Refer to **Figure 8** opposite and **Appendix A**).

4.1.8 Consultation with the LLFA will be undertaken at the planning application stage to determine if surface water modelling is required to quantify the risks and help inform the future masterplan.

4.1.9 The topography indicates the land is at the head of a fluvial sub-catchment, with watersheds predominately located from the east to the west. The receiving watercourse from this land passes flow predominately to the west to the Bays River (OW and EA). An existing catchment plan showing these watersheds is provided in section 5.

4.1.10 The proposed surface water strategy gives an opportunity to provide some betterment to control rapid agricultural runoff which is likely to be present in the local catchment. The flood risk extent will therefore be reviewed as part of a future planning application and potential modelling of the watercourses to access the surface water extents shown, depths and impact of climate change. It is considered that with the current catchment characteristics and the coarse modelling that tend to be used to inform the production of these flood maps that there is opportunity to reduce the extents shown and make land available as part of the master planning process. This will be confirmed as part of any future works and if necessary, space for flood risk areas will be provided within the emerging masterplan.

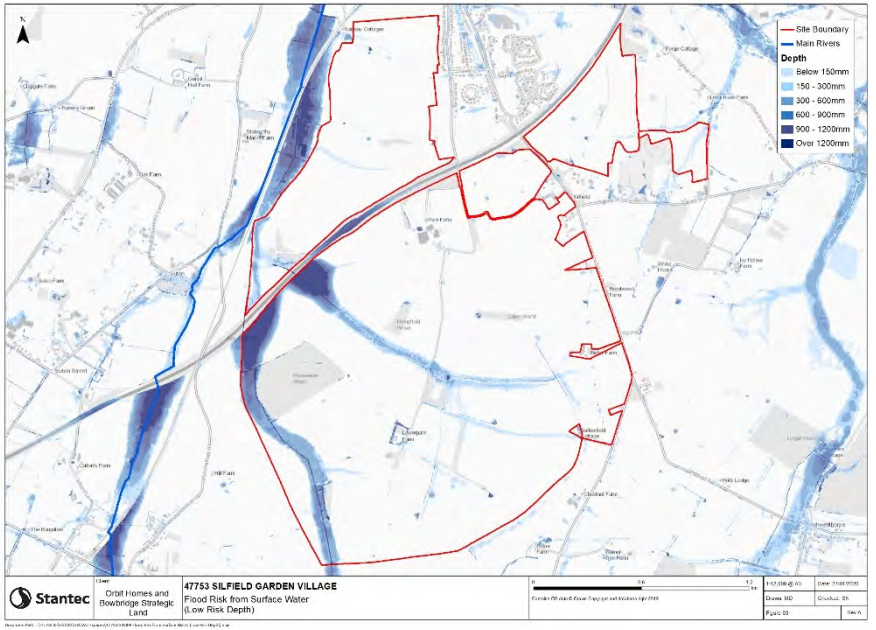


Figure 8: Flood Risk from Surface Water Depths for Low Risk Scenario

4.1.11 Appropriate easements and offsets to the existing watercourses will be incorporated within the emerging masterplan, in accordance with approving stakeholder requirements.

Flood Risk from Reservoirs

4.1.12 **Figure 9** overleaf, is an extract of the Flood Risk from Reservoirs (Also enclosed in **Appendix A**), shows the risk of flooding in the event of a breach from reservoirs containing 25,000 (or above) cubic metres of water. The maps indicate that the site is not located within an area which is considered at risk in the event of reservoir breach.

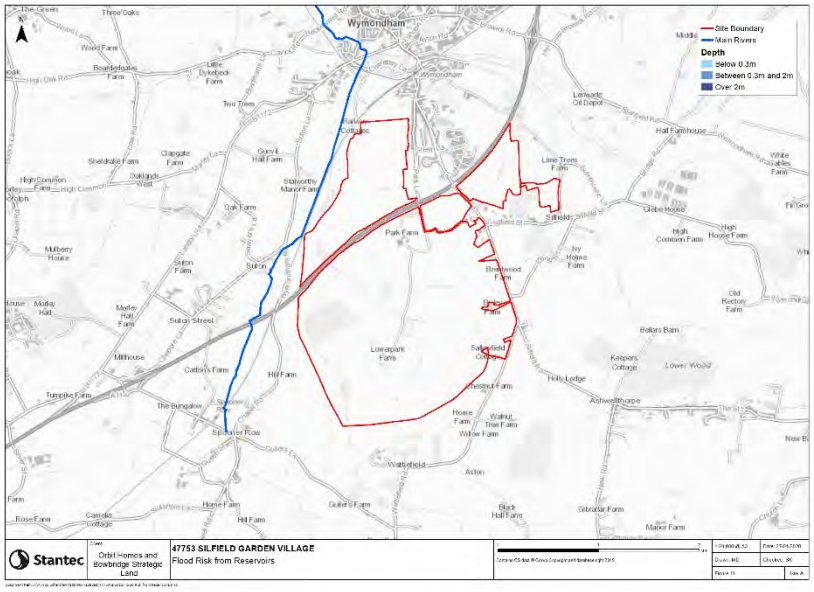


Figure 9: Flood Risk from reservoirs

Groundwater

4.1.13 The Preliminary Flood Risk Assessment (PFRA) does not list ground water flooding within the local area. The Strategic Flood Risk Assessment (SFRA) mentions historic groundwater flooding within Norwich and states that other areas of South Norfolk could also be at similar risk, but this is not specific to a location within South Norfolk.

4.1.14 A review of BGS borehole logs, taken from within the site boundary, shows groundwater levels varies from between 1.4m to 10.8m below ground level. This data only shows a snapshot of the current ground water conditions at the site and does not consider the changes possible due to seasonal variations, or the potential for perched ground water levels within the river terrace deposits which are present at the site.

Borehole Reference	Location	Depth (m)	Water Level (mBGL)	Geological classification of groundwater
TM19NW41	London-Norwich Trunk Road A11 (Centre)	30.00	5.50	Boulder Clay
TM19NW48	London-Norwich Trunk Road A11 (East)	20.50	1.40	Glacial Sands and Gravels
TM19NW36	London-Norwich Trunk Road A11 (West)	12.00	2.10	Boulder Clay
TM19NW12	Wattlefield Hall	45.72	3.66	Boulder Clay
TM19NW8	Stalworthy Farm	26.82	2.74	Glacial Drift (Sand, Clay and Stone)
TG10SW125	East of St. Thomas Drive (North of Site)	20.00	10.80	Chalk
TM19NW22	Bixley Farm	79.25	9.14	Boulder Clay

Table 1: BGS Borehole Records in the vicinity of the site

4.1.15 The possibility for further monitoring will need to be reviewed as part of any future works and discussed with stakeholders. Based on the current information made available it is considered that the site is at a low risk of groundwater flooding, however this will be confirmed as part of any future studies for the site.

Sewer Flooding

4.1.16 Anglian Water plans for the site indicate there are no surface water or foul sewers located within the site. The asset plans are provided in **Appendix B**. It is therefore considered that the risk of flooding from sewers is low.

Canals, Ponds and other water features

4.1.17 There are no canals or other artificial watercourses located within the site boundary or immediate vicinity. The risk posed by the ordinary watercourses in the site is assessed in the surface water section detailed above.

4.1.16 Some waterbodies such as ponds are noted within the redline boundary and are generally confined within proximity to existing buildings within the site. These are considered to be of low risk but will be investigated further as part of a future planning application.

Climate Change

4.1.17 The north west area of the site is in Flood Zones 2 and 3, medium and high probability of flooding due to the Bays River and an ordinary watercourse which runs parallel to the western site boundary. It is being proposed for this part of the site to remain free from development as it does not currently consider the impact from climate change.

4.1.18 With regards to anticipated changes in peak rainfall intensity due to climate change, NCC require a 20% increase in rainfall intensities to be used for design purposes to assess the impact on the surface water drainage network. A 40% increase in rainfall intensities will be used to assess the potential flood risk implications in the design rainfall event including whether there is any increased flood risk to third parties as a result of the development.

4.1.19 The proposed drainage strategy (see section 6) will be designed to consider climate change. There will betterment in runoff rates leaving the site in high order rainfall events as the current proposal is to limit to Qbar, which is equivalent to approximately the 1in 2.33 annual probability event.

5 Surface Water Strategy Vision

Overview

5.1.1 As the LLFA, Norfolk County Council are responsible for the approval of surface water drainage systems within new major development.

5.1.2 Major development, as defined within the Town and Country Planning Act (1990), consists of any of the following:

a) the provision of dwelling houses where residential development of 10 or more units; or where the development is to be carried out on a site having an area of 0.5 hectares or more and the number of units is not known;

b) the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or

c) development carried out on a site having an area of 1 hectare or more.

5.1.3 The following section provides an overview of the existing surface water drainage arrangements and the proposed strategy for the management of surface water from the new development.

Overview

5.1.4 The National Planning Policy Framework (NPPF) Planning Practice Guidance (PPG) sets out a hierarchy for surface water disposal (consistent with the Building Regulations H3) as follows:

a. Into the Ground (infiltration);

b. To a surface water body;

c. To a surface water sewer;

d. To a combined sewer.

Suitability for Infiltration

5.1.5 The site is assumed to have poor infiltration potential based on the identified soil association type and recorded geology. However, consultation will be carried out with the LLFA at planning stage to establish whether infiltration testing is required.

Suitability for Discharge to Waterbody

5.1.6 When infiltration is not deemed to be feasible, discharge to a watercourse is the next preferred option. There are two watercourses within the site which the development can discharge to. At this stage, an outfall to these watercourses is considered the most appropriate method of surface water disposal. As this is a greenfield site the LLFA will require the discharge rates to be restricted to equivalent greenfield rates.

5.1.7 As the watercourses are not considered to receive external offsite flow, there is some increased flexibility to realign these features to allow for the development of the site but to also facilitate opportunities to drain to these features and make them enhanced green and blue corridors through the site and align with the emerging ecological strategy for the site.

5.1.8 Any works to the form of the watercourses will be undertaken in agreement with the approving authorities and ensure there is no detriment to offsite areas, but they will be designed to manage the existing Surface Water risk and will provide conveyance, attenuation and enhanced biodiversity.

Suitability to a Surface Water Sewer/ Combined

5.1.9 The sewer plans show there is no local surface sewers / combined sewers within the site. It is proposed to discharge surface water to the existing watercourses and waterbodies located throughout or adjacent to the site. If it is determined at the planning stage that discharge to the local surface water sewers are required, this will be in agreement with Anglian Water.

Greenfield Runoff Rates

5.1.10 The greenfield runoff rate was estimated using the FEH Statistical method based on catchment descriptors for the site. This method resulted in a Q_{BAR} (approximately 1 in 2.33 annual probability event) greenfield runoff rate of the following:

- 1.4 l/s/ha for the Northern Site
- 1.7 l/s/ha for the Southern Sites.

5.1.11 Refer to **Appendix C** for the supporting Greenfield Runoff calculations. The LLFA will expect this to be applied to the site.

5.1.12 The catchments and watersheds applicable to the existing site are illustrated in **Figure 10** below:

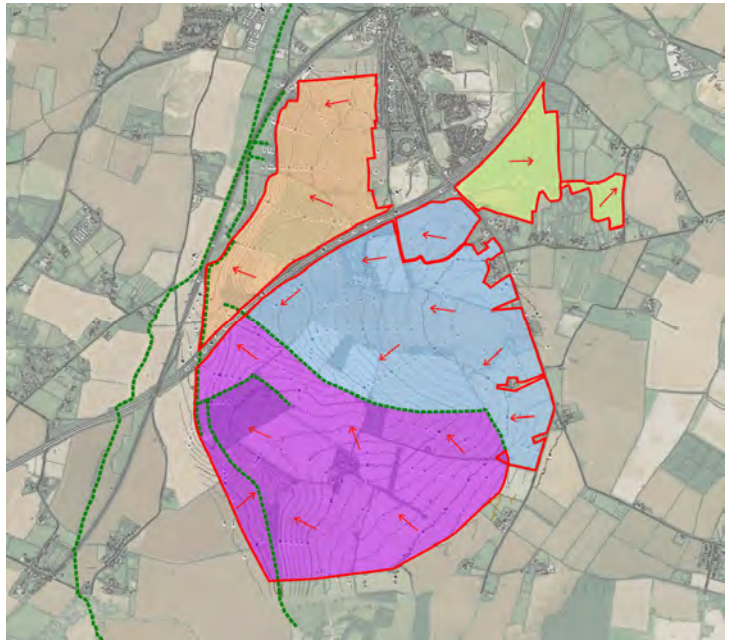


Figure 10: Existing Catchment Plan

Sustainable Drainage Systems (SuDS)

5.1.13 It is a requirement of the NPPF that SuDS are used in all major developments, if feasible. The LLFA also advocates the use of appropriate SuDS in new developments as detailed in the Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning, Version 4 March 2019.

5.1.14 CIRIA report C753 'The SuDS Manual' outlines the various types of SuDS, their benefits and limitations, and design considerations associated with each. Not all SuDS components/methods are feasible or appropriate for all developments, factors such as available space, ground conditions and site gradient will influence the feasibility of different methods for a development.

5.1.15 The proposal is for a NetZero Garden Community, therefore the SUDS will play an important role as part of helping to achieve this target. Key to this will be to reduce the amount of water use on the site and therefore rainwater harvesting and grey water reuse will form an integral part of the development proposals.

5.1.16 At this stage it is anticipated the SuDS features proposed at the site will be widely dispersed throughout the development.

5.1.17 The design and the integration of proposed SuDS features within the wider landscape strategy and proposals will be carefully considered as part of the masterplanning process and shall themselves, provide an element of Public Open Space use.

5.1.18 The site already has a number of landscape features including woodlands, ponds and watercourses which are proposed to be retained and enhanced where possible therefore, the SuDS proposals shall be designed to ensure they enhance and support the landscape proposals going forward.

5.1.19 The proposed SuDS seek to deliver long term mitigation by attenuating and treating the development generated surface water runoff and where possible provide betterment to the receiving watercourse. SuDS will be designed so they are integrated within the wider landscape proposals and will provide opportunities, where possible, to enhance biodiversity and recreation facilities.

5.1.20 As well as providing a drainage function, the SuDS will also form an important part of the project's biodiversity strategy. The proposed SuDS features will be designed so that they maximise opportunities for habitat creation.

5.1.21 The prevailing surface water strategy to be adopted is a network of positive drainage, where feasible consisting of and not limited to:

- Open swales / rills, that can be effectively integrated into the landscape / streetscape and be wet, dry, or for storage purposes. As shown in **Figure 11**, these can be combined with residential roads to intercept and treat runoff at source, and both provide ecological and amenity benefits as well as effective water quality treatment.

Figure 11: Open swale / Rills Examples

- Attenuation Basins, **Figure 12**, 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 12: Attenuation Basin Examples

- Wetland planting and Ponds, **Figure 13**, ideally incorporated as part of the green / blue corridors within the development. 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 treatement can be effectively managed using these features through apporiate planting and used as part of a wider SuDS Management Train.

Figure 13: Wetland planting and Ponds Examples

- Porous Paving, as shown in **Figure 14**, 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;

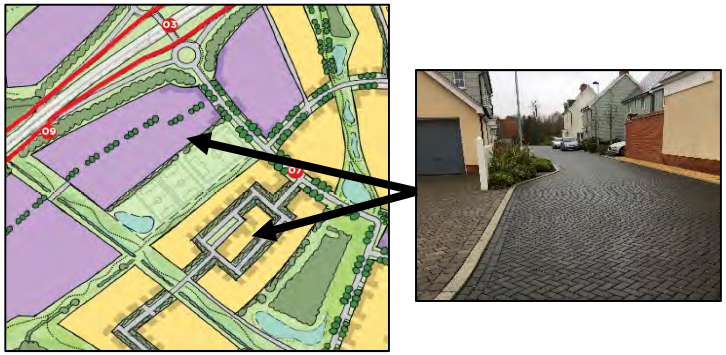


Figure 14: Porous Paving Examples

- Bio-retention areas (**Figure 15),** included in development areas and strategic landscaping areas. Planting effectively provides benefits to the communities through amenity, biodiversity and water quality treatment.

Figure 15: Bio-retention Areas Examples

5.1.22 Piped networks may still be utilised in areas subject to LLFA, Highways and Sewerage undertaker adoption requirements.

5.1.23 Opportunities will also be explored at the planning stage for green roofs and the containment of any commercial/ industrial 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.

5.1.24 Rainwater harvesting and greywater reuse will be assessed as part of the planning application stages to ensure NetZero targets are being achieved and the demand on water supplies are reduced.

Attenuation Storage Requirements

5.1.25 The percentage of impermeable area has been taken as 55% for residential areas. This will be reviewed as development proposals progress.

5.1.26 WinDes Quick Storage Estimates have been undertaken to provide an indication of the volume of storage that would likely be required on site to provide the necessary attenuation based upon rainfall events up to the 1% (1 in 100) annual probability event plus, an additional allowance of 20% and 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* (February 2016, updated Dec 2019).

5.1.27 The proposed final developable area for the future works is not yet known as this is a high-level review in support of the local plan promotion stage. Therefore the amount of storage approximately required for every 1ha of impermeable area has been calculated to be the following:

- $1425m^3$ per ha for the Northern Site
- $1425m^3$ per ha for the Southern Site

5.1.28 This is based on the site applicable greenfield Q_{BAR} runoff rate of 1.4 l/s/ha for the northern site and 1.7l/s for the southern site for a 1% annual probability rainfall event including an allowance for climate change of 40% (see calculations in **Appendix C**).

5.1.29 The calculations are only approximate estimates which can only be used at this high-level stage. The locations of strategic attenuation basins are illustrated indicatively. It is anticipated this storage will be supported with more dispersed storage once a masterplan is progressed in the planning stages.

5.1.30 The maximum stored water depth to achieve a gravity outfall will also need to be confirmed at planning stage requiring a review of survey data of the local land drainage network.

5.1.31 The size of any proposed attenuation features will be affected by earthworks that may take place as part of the development proposals and further drainage modelling.

Exceedance

5.1.32 To demonstrate that in an exceedance event any flooding does not negatively affect the development or offsite areas, flows up to the 1 in 100 (1%) annual probability plus climate change rainfall event will be managed and contained onsite. Furthermore, the attenuation will be designed to accommodate surface water runoff with no flooding for all events up to and including the 1 in 100 (1%) annual probability plus 40% climate change event.

Water Quality and Pollution Control

5.1.33 Appropriate pollution control measures must be included in the surface water drainage system to minimise the risk of contamination or pollution entering the receiving watercourse and aquifer from surface water runoff from the development.

5.1.34 The drainage system will be designed to comply with the requirements of the SuDS treatment train as laid out in CIRIA C753 'The SuDS Manual', described as the 'Simple Index' Approach, in addition to the Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning, Guidance Document (Version 4 March 2019) document and the Local Plan.

5.1.35 A SuDS treatment train will be applied for each catchment whereby runoff passes through a variety of SuDS techniques to control volumes of runoff and reduce pollution before discharge to a watercourse.

5.1.36 The treatment of surface water runoff will be designed to ensure it meets the requirements of the Water Framework Directive (WFD) with not detriment to the receiving watercourses.

Works to or diversion of Ordinary watercourse

5.1.37 The watercourses which crosses through the Southern Site are proposed to remain and be enhanced through suitable planting.

5.1.38 It might be necessary to cross these watercourses or divert in some areas to suit the development proposals. The LLFA will be consulted over these proposals and it is understood this may require a formal land drainage consent in accordance with Section 23 of the Land Drainage Act 1991.

Adoption and Maintenance

5.1.39 It is assumed that the surface water infrastructure will be designed to adoptable standards and adopted either by Anglian Water, ICOSA or a private management company. The upcoming release of Sewers for Adoption 8th Edition highlights a change in approach whereby sewerage companies including Anglian Water are open to adopting SuDS features provided they meet expected design standards.

5.1.40 Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning, Guidance Document (Version 4 March 2019) provides outline guidance on how SuDS features should be designed.

6 Conclusions and Recommendations

6.1.1 Silfield Garden Village presents an opportunity to deliver strategic growth without causing a detriment to flood risk. The site provides the opportunity to deliver sustainable growth considering the following:

- A large portion of the site is located within Flood Zone 1 of the "Flood Map for Planning", which is appropriate for all types of development.
- Flood Zones 2 and 3, medium and high probability of flooding are shown at the site but are mainly constrained to the north-west area of the site and within watercourse extents along the western boundary.
- The sequential approach is to be adopted at the site whereby development is located in areas with the lowest risk of flooding. It is proposed for the flood zone areas to remain free from development. Appropriate easements will also be applied to the watercourses within the site to ensure they remain free from development and future maintenance access can be retained.
- Infiltration drainage is unlikely to be feasible and this will be confirmed as part of the future works in consultation with the NCC as LLFA.
- The site has the potential to support a range of sustainable measures to manage and control surface water run-off, with the view to deliver an integrated Sustainable Drainage System (SuDS). These features will be fully joined up with ecology/habitat areas, green infrastructure, and public open space. Rather than creating simple functional 'drainage features', this integrated approach will contribute to habitat creation and enhance biodiversity, provide multi-functional amenity space, and preserve water quality. This is in line with national and local guidance.
- The volume of surface water being discharged from the development will be carefully controlled to replicate the drainage regime of the existing site in accordance with the Lead Local Flood Authority (Norfolk County Council) surface water drainage design requirements and local planning authority, so as not to cause any increase in on- or off-site flood risk.
- The SuDS will ensure there is no increase in discharge rates from the site but will also improve water quality discharge, using the principles from the SuDS Manual. Provisional rates have been provided within this appraisal.
- The proposal is for a NetZero Garden Community, therefore the SUDS will play an important role as part of helping to achieve this target. Key to this will be to reduce the amount of water use on the site and therefore rainwater harvesting and grey water reuse will form an integral part of the development proposals.
- It is estimated attenuation storage in the order of 1425m^3 for the northern site and 1370m^3 for the southern sites per impermeable hectare could be required to attenuate runoff up to the 1 in 100 annual probability plus 40% climate change event prior to discharge.

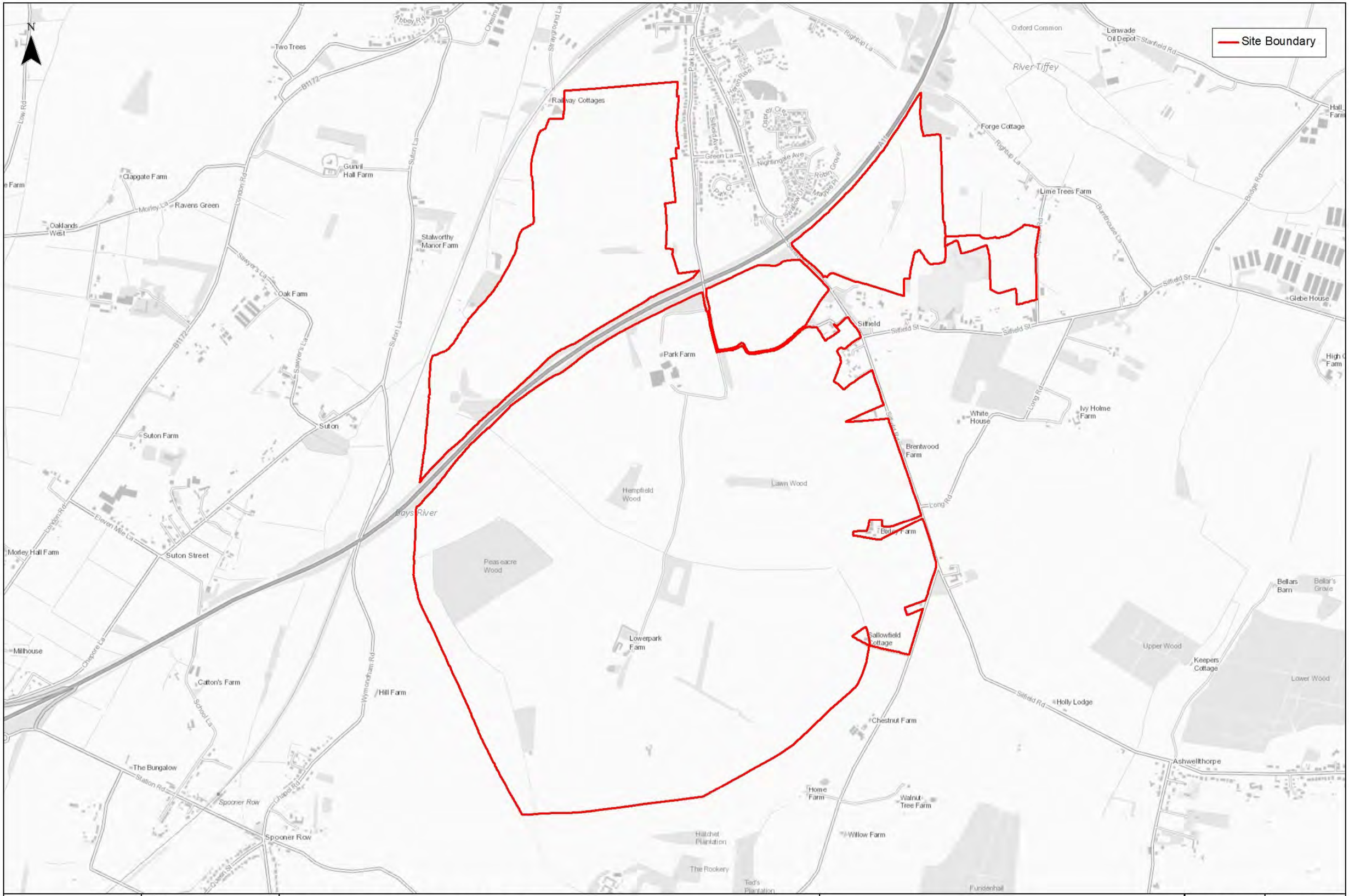
6.1.2 The site generated surface water flows are attenuated and managed on site and can provide betterment to existing flood risk in the receiving watercourses. Space for water are highlighted in the indicative masterplan, which can be developed and delivered in accordance with the relevant SuDS guidance, the approving stakeholder requirements and normal flood prevention design parameters.

6.1.3 Anglian Water have acknowledged their obligation to accept the necessary foul flows from the development should planning consent be granted. Therefore, as part of the planning application further consultation with Anglian Water will be undertaken to ensure the necessary steps are taken to ensure there is enough treatment capacity following the planning consent.

6.1.4 Overall the site is well positioned to deliver housing and commercial needs and the development will meet the requirements of both national and regional planning policy.

7 Appendices

Appendix A - Figures



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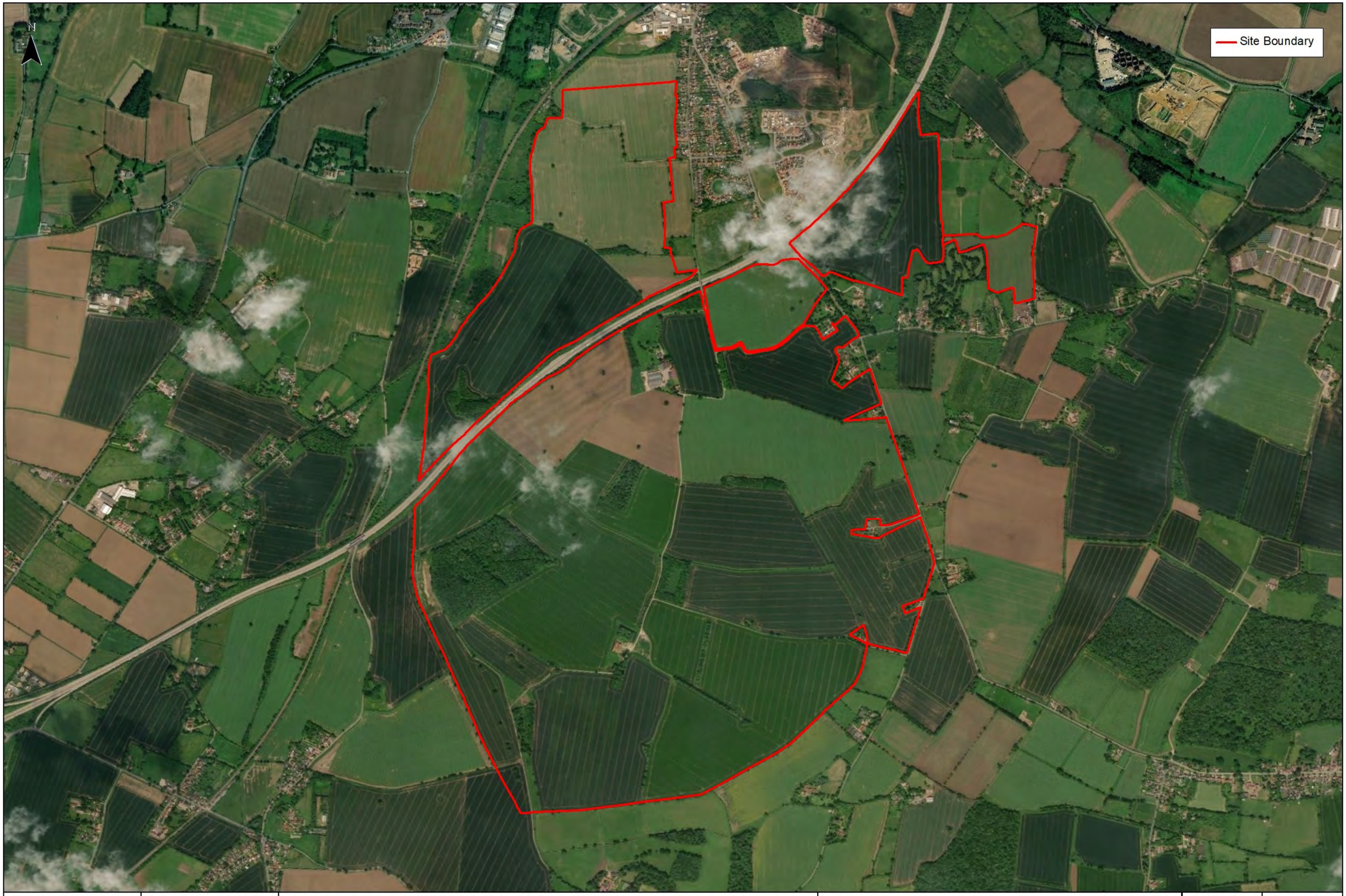

Stantec

Client: Orbit Homes and Bowbridge Strategic Land

47753 SILFIELD GARDEN VILLAGE

Site Location (Aerial)

0 0.7 1.4 km

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure 01b	Rev A

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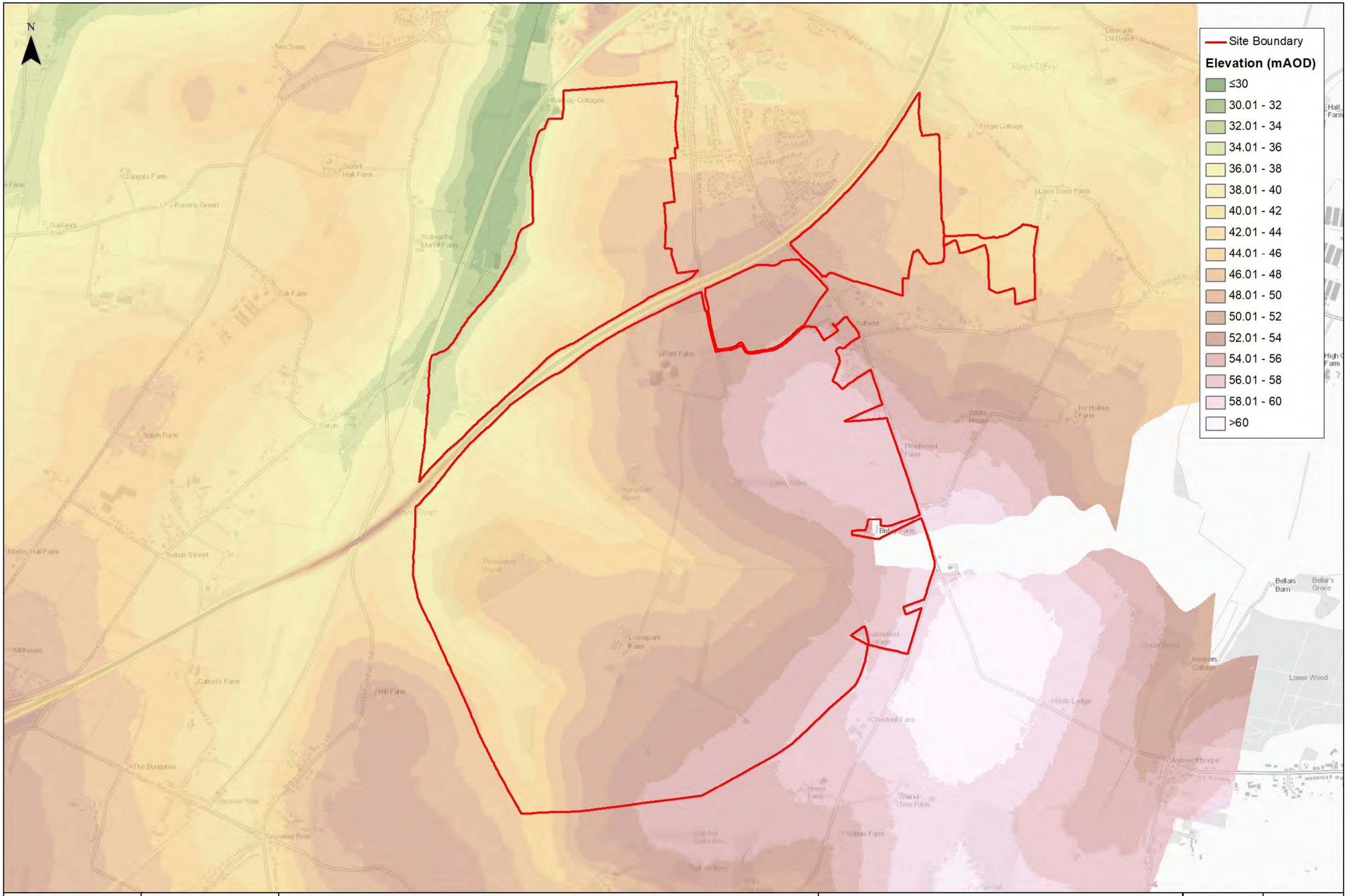

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				Figure 02	Rev A

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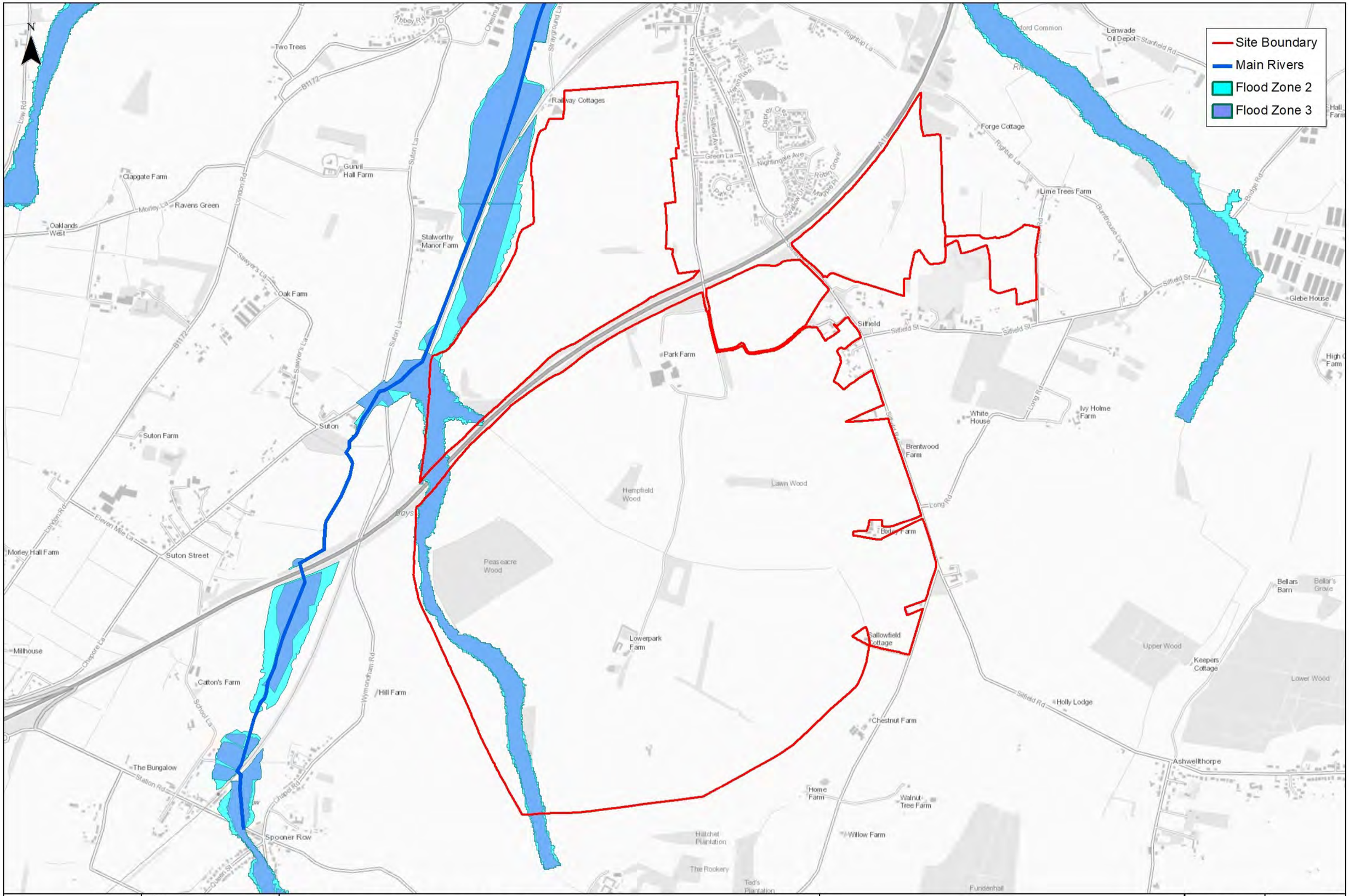

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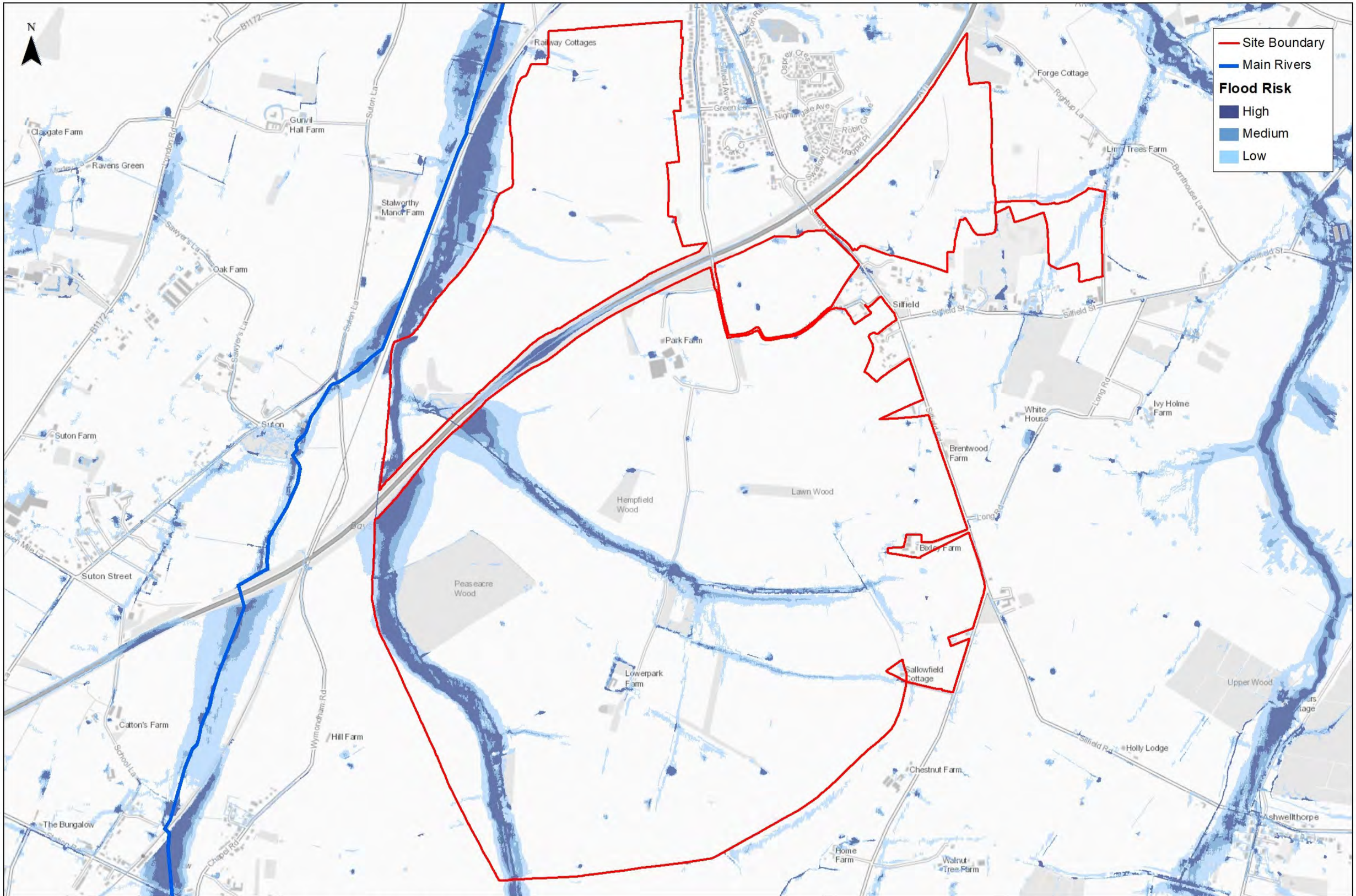

Stantec

Client: Orbit Homes and Bowbridge Strategic Land

47753 SILFIELD GARDEN VILLAGE

Flood Risk from Surface Water (Flood Extents)

0 0.6 1.2 km

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Figure 04 | Rev A

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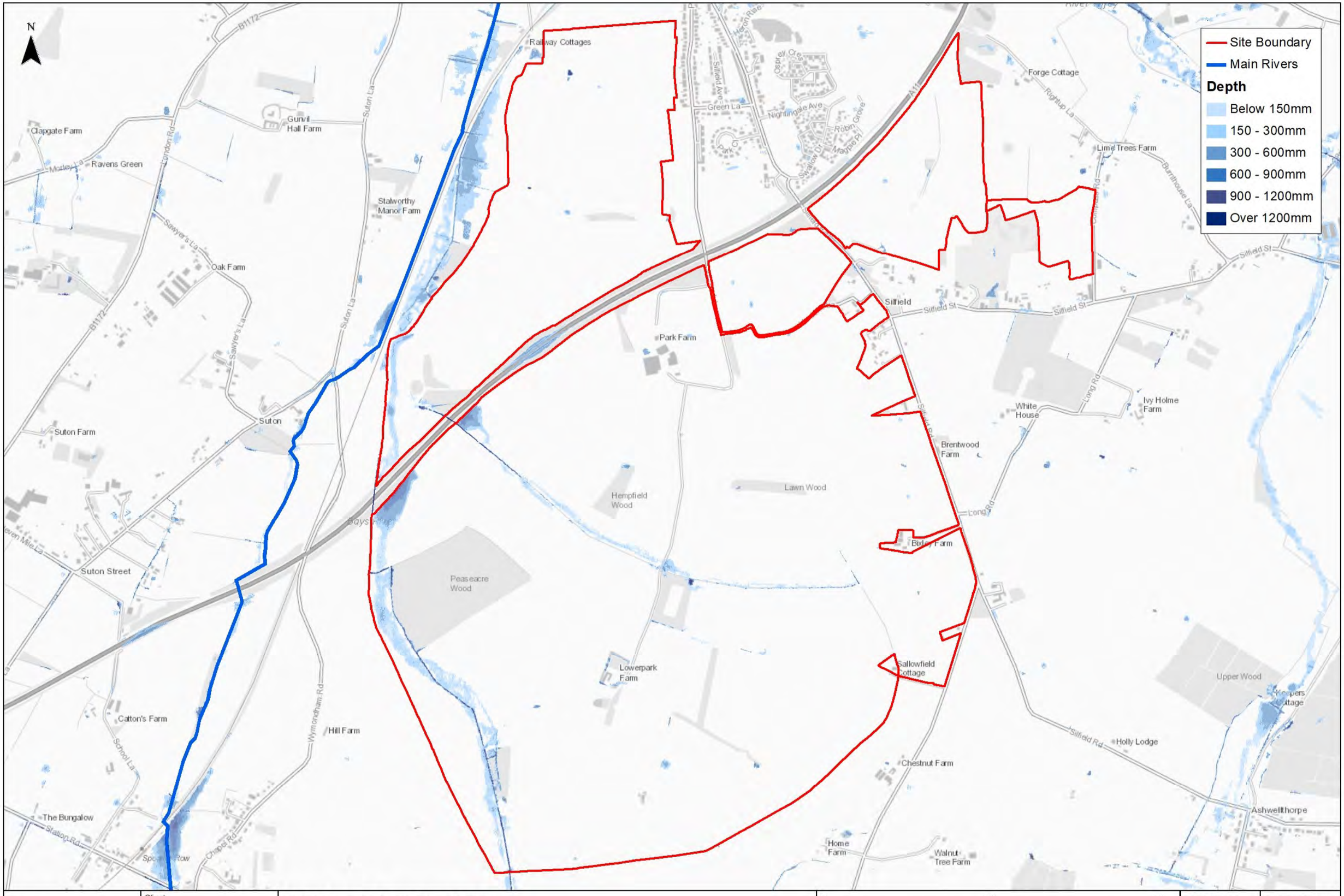

Stantec	Client: Orbit Homes and Bowbridge Strategic Land	**47753 SILFIELD GARDEN VILLAGE** Flood Risk from Surface Water (High Risk Depth)	0 0.6 1.2 km Contains OS data © Crown Copyright and database right 2019	1:12,000 @ A3 | Date: 27/01/2020 Drawn: MD | Checked: SK Figure 05 | Rev A

Document Path: J:\47753 Silfield GV\GIS\Workspaces\47753 GIS005 Flood Risk from Surface Water (High Risk Depth).mxd

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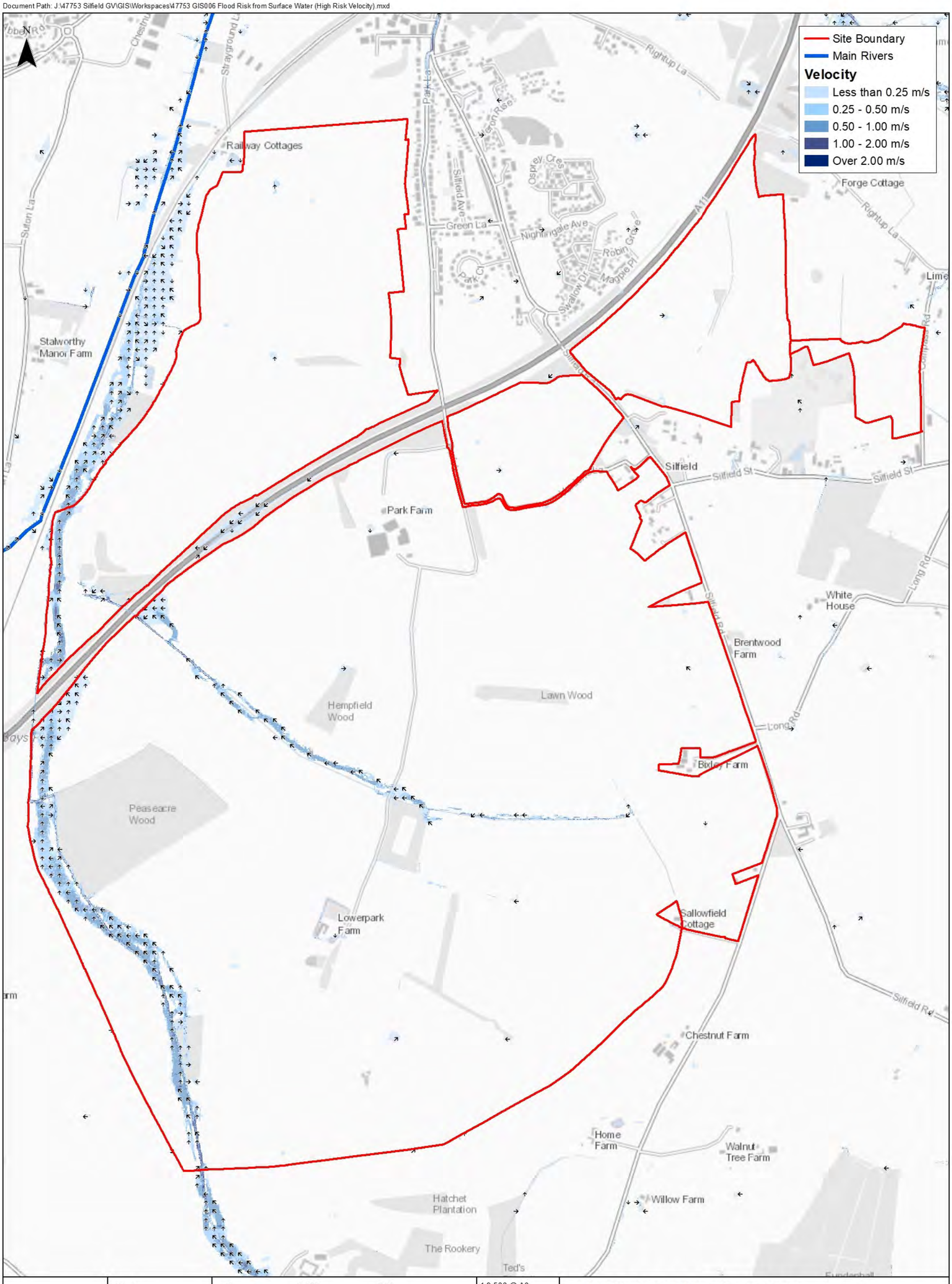

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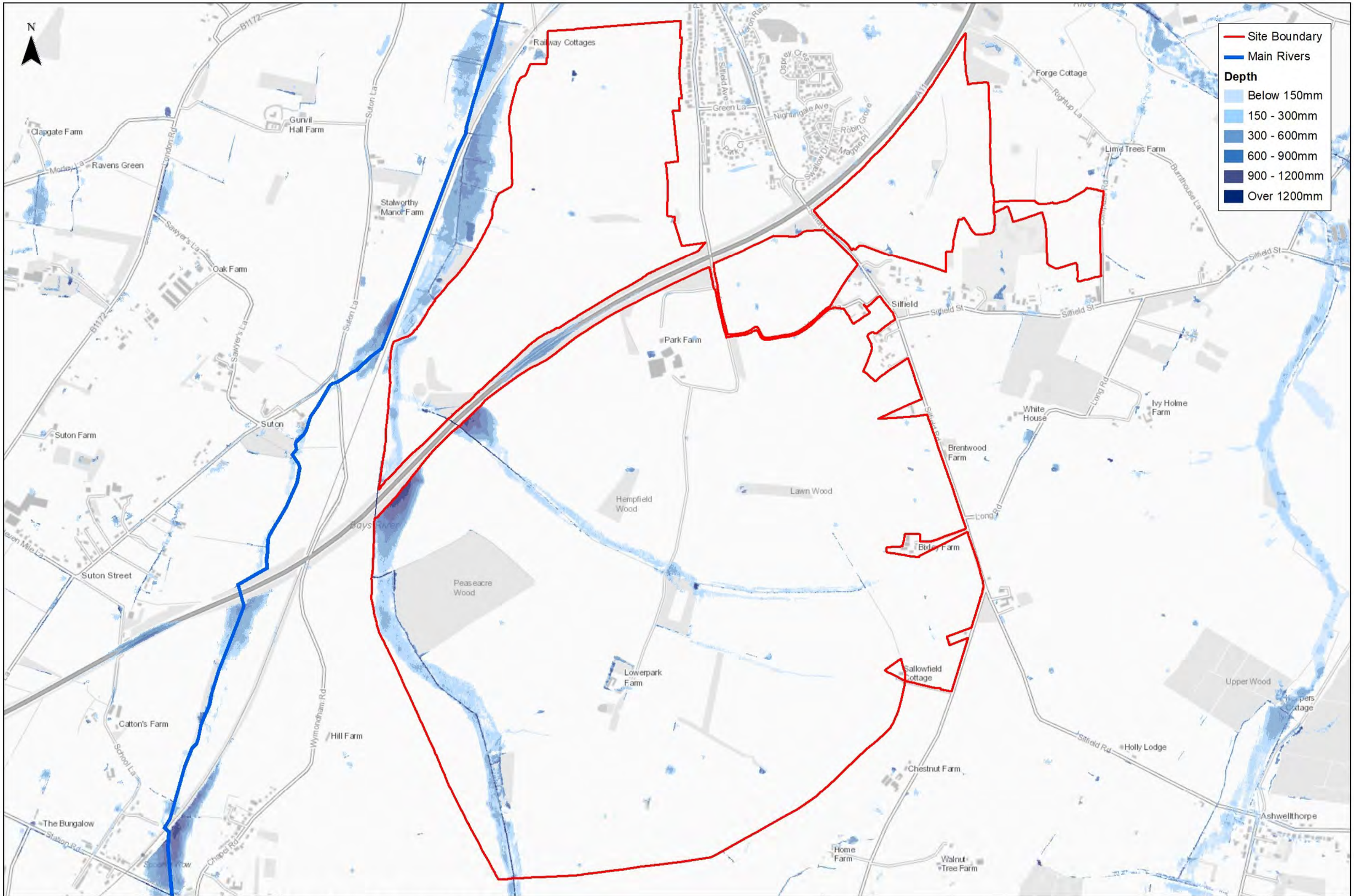

Stantec

Client: Orbit Homes and Bowbridge Strategic Land

47753 SILFIELD GARDEN VILLAGE

Flood Risk from Surface Water (Medium Risk Depth)

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Figure 07 | Rev A

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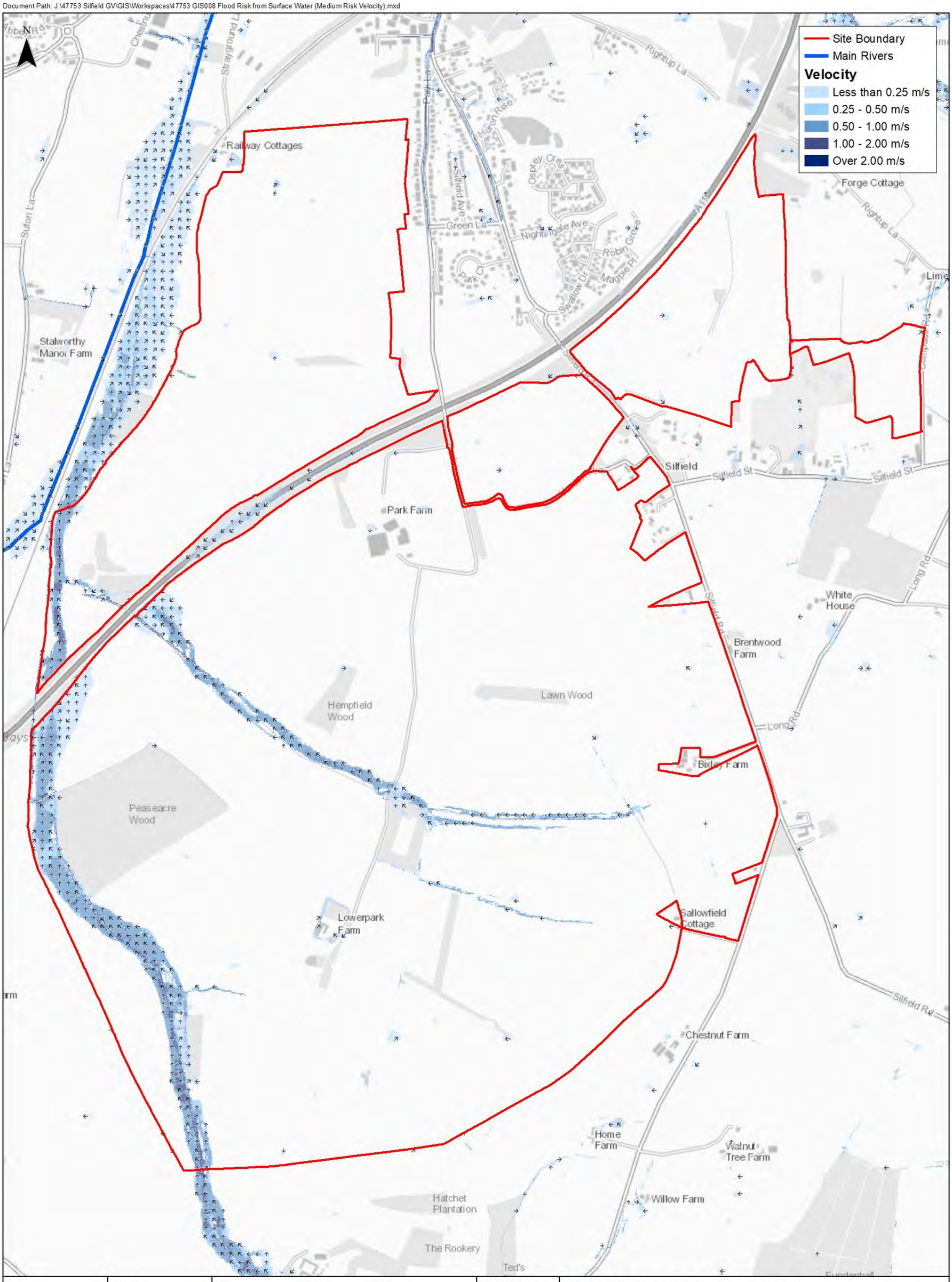

Stantec

Client: Orbit Homes and Bowbridge Strategic Land

0 0.225 0.45 Km

Service Layer Credits: Contains OS data © Crown Copyright and database right 2019

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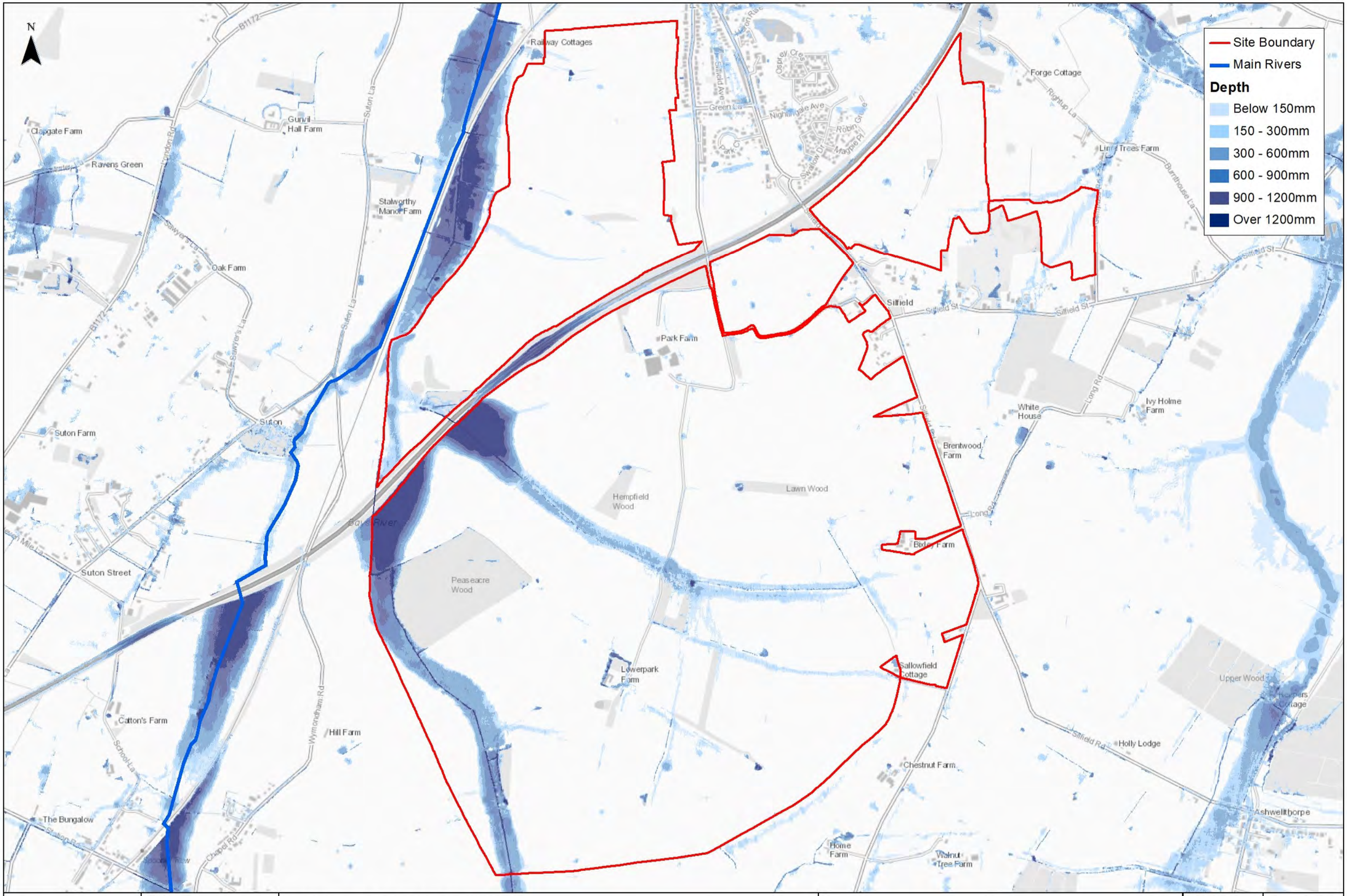
47753 SILFIELD GARDEN VILLAGE

Flood Risk from Surface Water (Medium Risk Velocity)

Figure 08 | Rev A



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Document Path: J:\47753 Silfield GV\GIS\Workspaces\47753 GIS009 Flood Risk from Surface Water (Low Risk Depth).mxd

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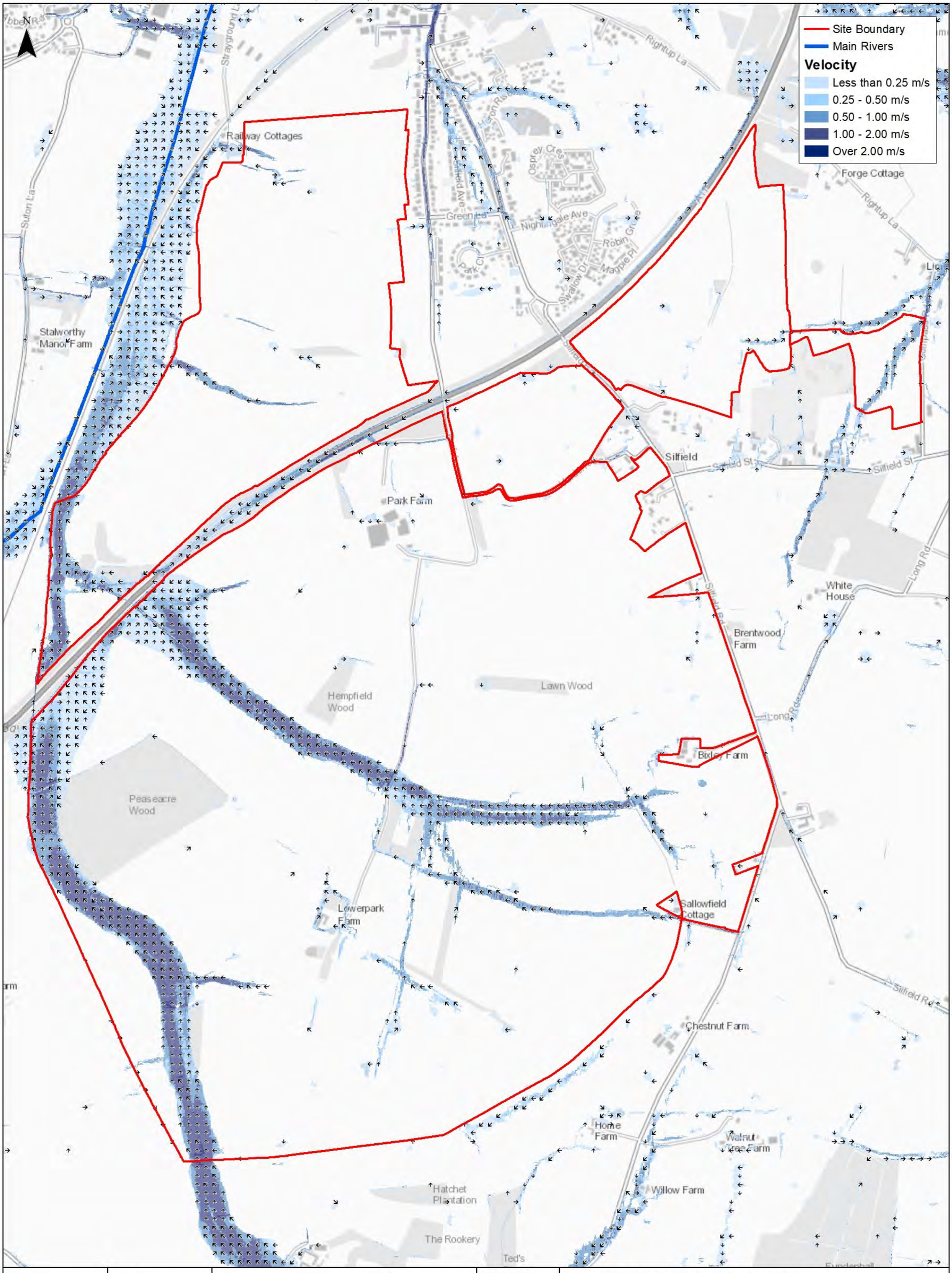
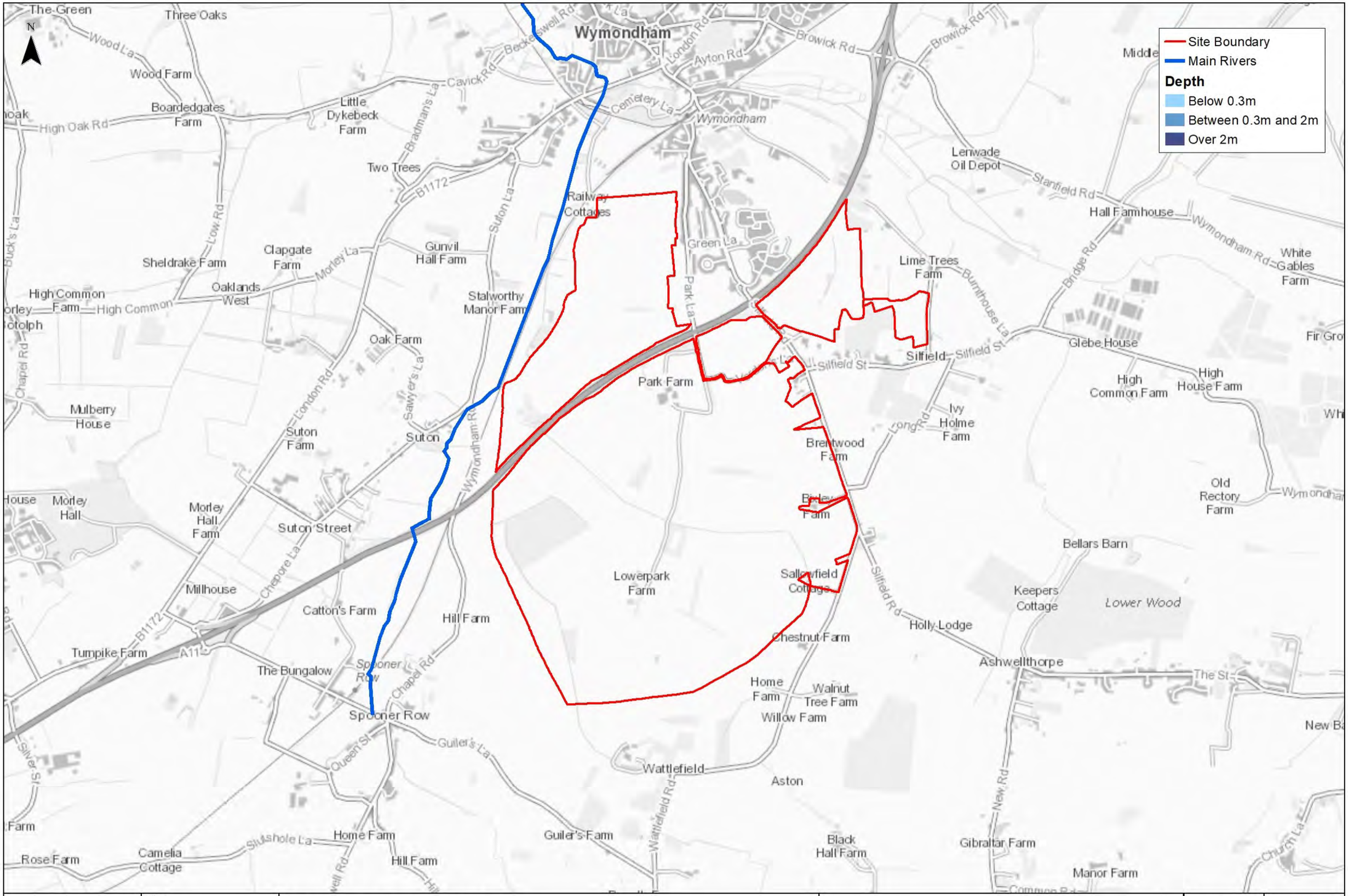


Stantec	Client: Orbit Homes and Bowbridge Strategic Land	0 0.225 0.45 Km Service Layer Credits: Contains OS data © Crown Copyright and database right 2019	1:9,500 @ A3 13/03/2020 Drawn: MD Checked: SK	**47753 SILFIELD GARDEN VILLAGE** Flood Risk from Surface Water (Low Risk Velocity) Figure 10 | Rev A



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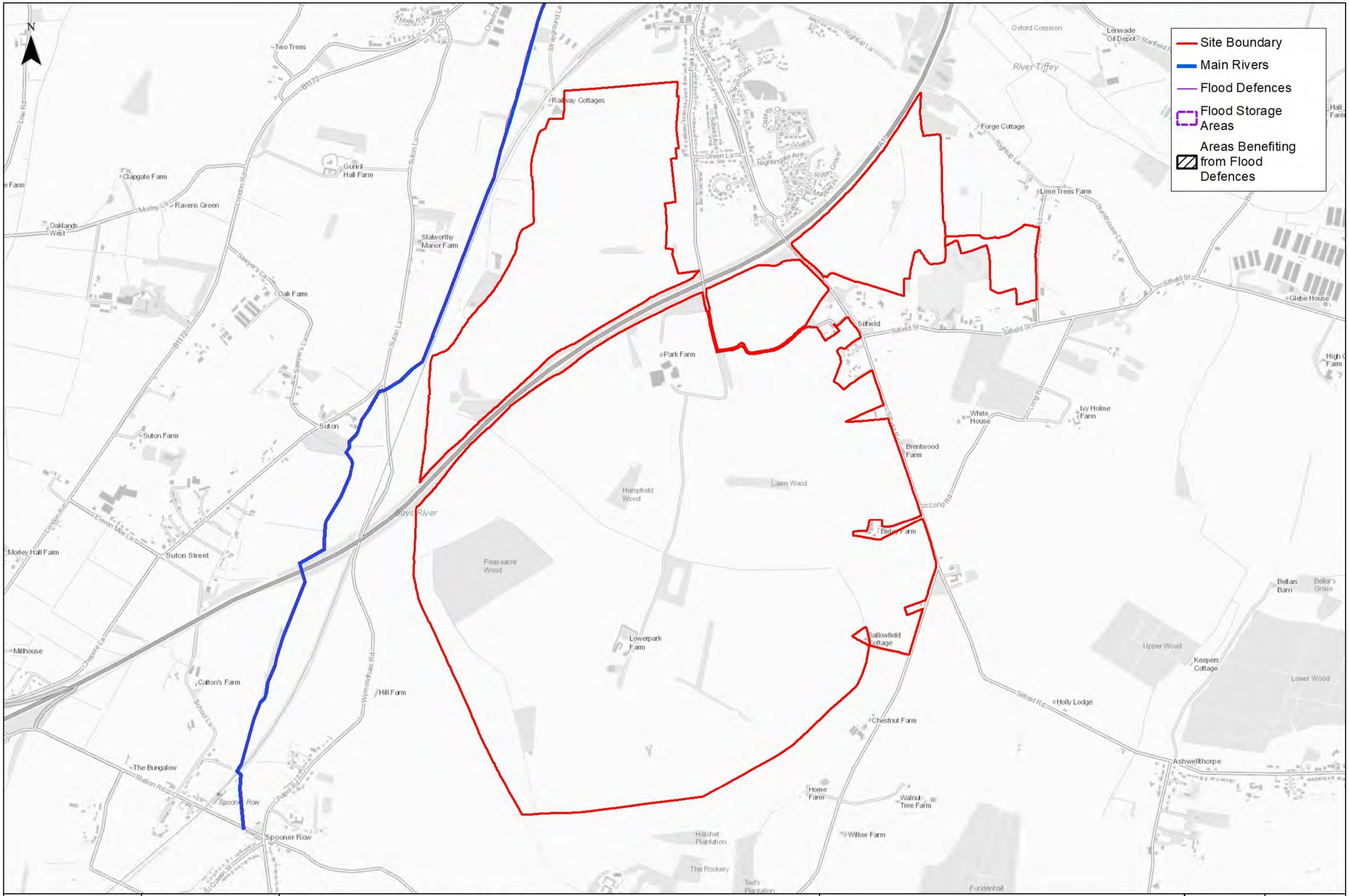

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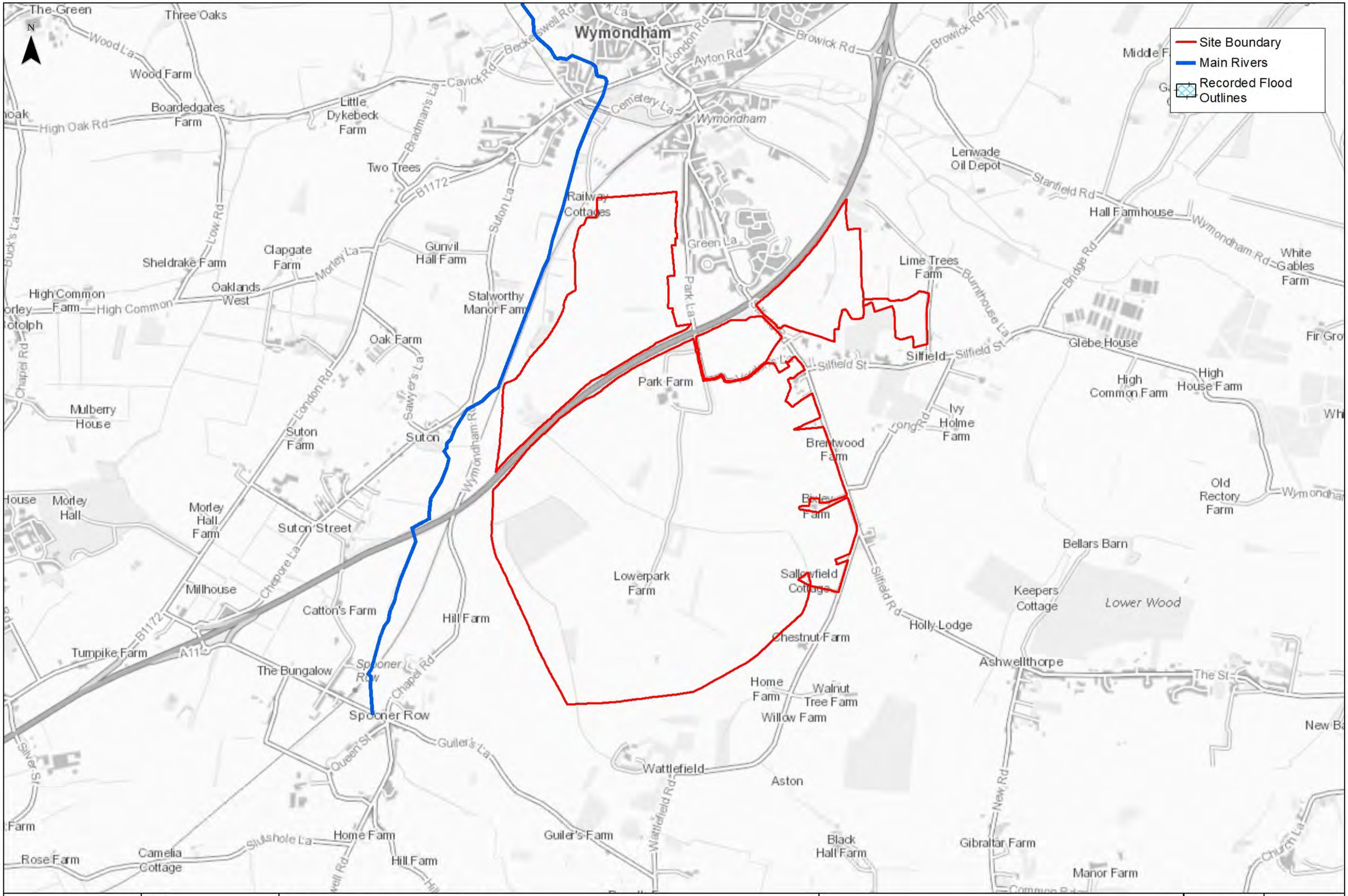
Document Path: J:\47753 Silfield GV\GIS\Workspaces\47753 GIS012 Flood Defences, Areas Benefiting & Storage Areas.mxd



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N

Site Boundary

Source Protection Zones

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

Wymondham

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0 1 2 km

Stantec	Client: Orbit Homes and Bowbridge Strategic Land	**47753 SILFIELD GARDEN VILLAGE** Source Protection Zones	1:20,000 @ A3	Date: 27/01/2020
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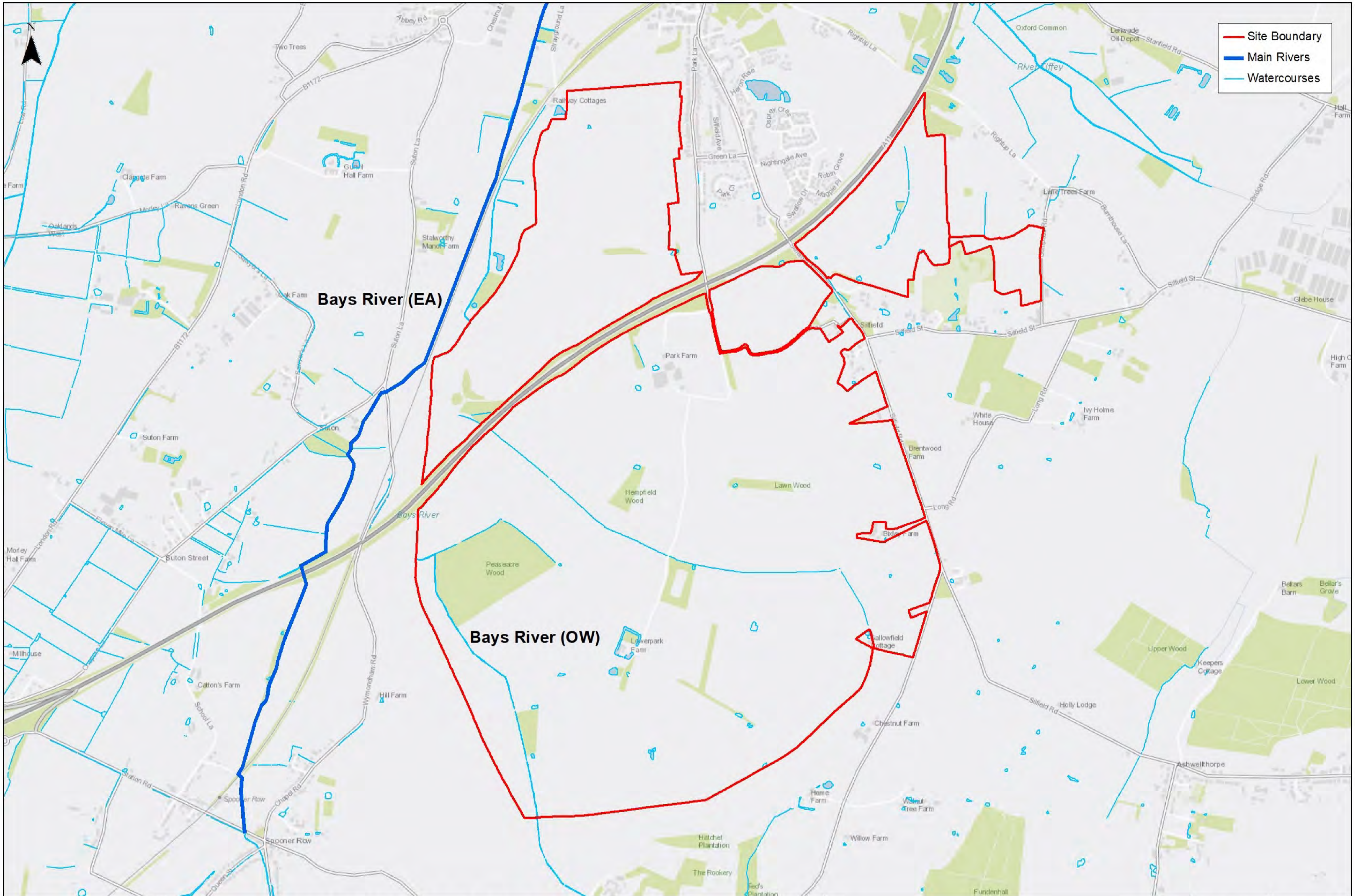

Client

Orbit Homes and Bowbridge Strategic Land

47753 SILFIELDS GARDEN VILLAGE

Main River and Watercourses

0 0.7 1.4 km

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Figure 15	Rev A

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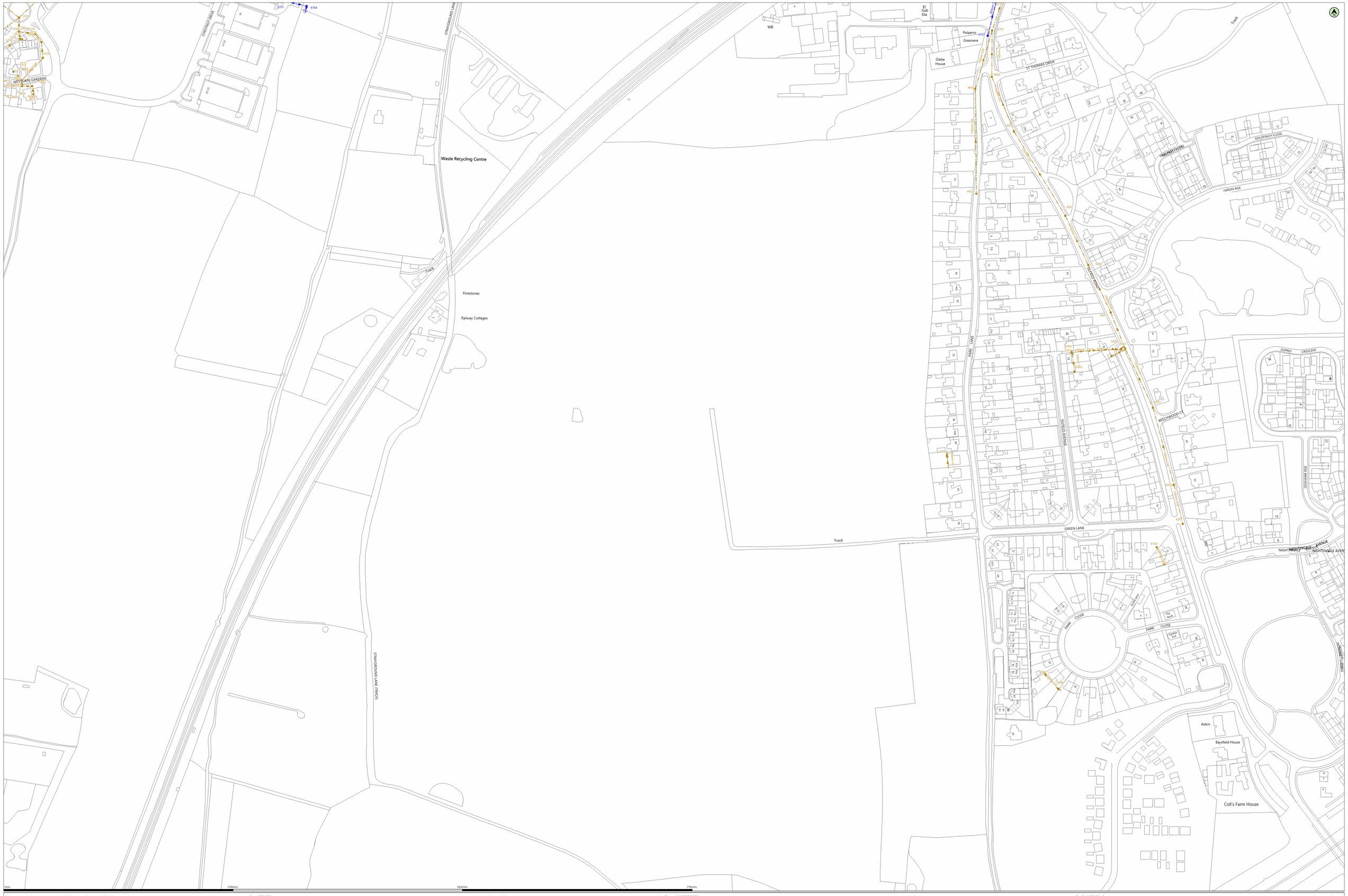
Appendix B – Anglian Water Correspondence



Date: 30/01/20

Scale: 1:1250

Map Centre: 611097,300290

Data updated: 02/12/19

Our Ref: 366126 - 2

Wastewater Plan A0

Foul Sewer		Outfall*		Sewage Treatment Works	
Surface Sewer					
Combined Sewer					
Final Effluent		Inlet*		Public Pumping Station	
Rising Main*					
Private Sewer*		Manhole*		Decommissioned Pumping Station	
Decommissioned Sewer*					

*(Colour denotes effluent type)

freek.vanarkel@stantec.com

1

love every drop
anglianwater

Pre-Planning Assessment Report

83 SILFIELD RD **146950/904297835/1/0077317**

Report published 17/02/2020

Section 1: Proposed development

Thank you for submitting a pre-planning enquiry. This has been produced for Stantec UK. Your reference number is **146950/904297835/1/0077317**. If you have any questions upon receipt of this report, please contact the Pre-Development team on 03456 066087 or email planningliaison@anglianwater.co.uk.

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	**No. Of units**
Dwellings	7500

The anticipated residential build rate is:

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12
Build rate	50	50	50	50	50	50	50	50	50	50	50	6950

Site grid reference no.

TM1134099074

Development type

Greenfield

Planning application status

Unknown

The comments contained within this report relate to the public water mains and sewers indicated on our records. Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2: Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used water easement information		
Asset type	Pipe size (mm)	Total easement required (m)
Water mains	247	6.00 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	72	4.50 m either side of the centre line
Water mains	77	4.50 m either side of the centre line
Water mains	73	4.50 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	77	4.50 m either side of the centre line
Water mains	Unknown	3.00 m either side of the centre line
Water mains	109	4.50 m either side of the centre line
Water mains	Unknown	3.00 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	10	4.50 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	251	6.00 m either side of the centre line
Water mains	197	6.00 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	77	4.50 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	77	4.50 m either side of the centre line
Water mains	109	4.50 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	76	4.50 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	77	4.50 m either side of the centre line
Water mains	251	6.00 m either side of the centre line
Water mains	251	6.00 m either side of the centre line

Water and Used water easement information		
Water mains	Unknown	3.00 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	251	6.00 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	Unknown	3.00 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	109	4.50 m either side of the centre line
Water mains	197	6.00 m either side of the centre line
Water mains	77	4.50 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	76	4.50 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Water mains	0	4.50 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	Unknown	3.00 m either side of the centre line
Water mains	102	4.50 m either side of the centre line
Water mains	73	4.50 m either side of the centre line
Water mains	73	4.50 m either side of the centre line
Water mains	207	6.00 m either side of the centre line
Water mains	81	4.50 m either side of the centre line
Water mains	Unknown	3.00 m either side of the centre line
Water mains	207	6.00 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	251	6.00 m either side of the centre line
Water mains	247	6.00 m either side of the centre line
Water mains	258	6.00 m either side of the centre line
Sewer mains	150	3.00 m either side of the centre line
Sewer mains	150	3.00 m either side of the centre line
Sewer mains	150	3.00 m either side of the centre line

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3: Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and influent quality arising from your development.

Water recycling centre

The foul drainage from this development is in the catchment of Wymondham Water Recycling Centre, which currently does not have capacity to treat the flows from your development site. Anglian Water are obligated to accept the foul flows from your development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.

At the time of assessment there is headroom available for additional flow broadly equivalent to 1000 houses

Used water network

There is insufficient capacity within the existing foul water sewerage network serving Wymondham for a development of this size. It is recommended that a foul water drainage strategy for this development considers the option to convey all flows to the Wymondham WRC, which is located on the northwest edge of the town at approx 2.6km from the northern boundary of the development site. As an interim strategy it may be possible to connect initial phases locally. Further analysis will be required in order to evaluate the potential for an interim foul water drainage strategy and enable Anglian Water to provide you with an indicative desktop solution for draining the foul flows from the proposed development. There is no additional charge for this work. Richard Lyon, our Pre-Development Senior Engineer for this area, will be responsible for undertaking this additional work. Richard will contact you shortly to ensure we have sufficient information to evaluate option. For your reference, Richard can be contacted at rlyon@anglianwater.co.uk Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

As you have not requested a connection for surface water flows from the development we assume that your proposed method of surface water management does not relate to Anglian Water operated assets, therefore, we have not assessed the impact of surface water flow. Should the proposed method of surface water management change to include interaction with Anglian Water operated assets, we would wish to be re-consulted to ensure that an effective surface water drainage strategy is prepared and implemented.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website at http://www.anglianwater.co.uk/developers/suds.aspx. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating than the assets can be maintained both now and

in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website at: http://www.anglianwater.co.uk/developers/suds.aspx

The proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

As a result of the recent charging rules published by Ofwat, our charging regime has changed. Your development site will be required to pay a Zonal charge for each new property connecting to the public sewer that benefits from Full planning permission.

Payment of the Zonal charge must be made before premises are connected to the public sewer. More information on the Zonal charge can be found at http://www.anglianwater.co.uk/developers/charges

The Zonal charge consists of two elements. The first is called the 'Fixed Element' which is the same in nature to the Infrastructure charge applied prior to April 2018. The second is called the 'Variable Element' which may vary each financial year.

The elements are combined together to create the 2018/19 Zonal charge for Sewerage:

Fixed Element	£ 370
Variable Element	£ 101

In most circumstances zonal charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non-household premises, the fixed element is calculated according to the number and type of water fittings in the premises.This is called the "relevant multiplier" method of calculating the charge. Details of the relevant multiplier for each fitting can be found at our web-page: http://www.anglianwater.co.uk/developers/charges/

The total Zonal charge payable for your site for Sewerage is:

Zonal charge per new connection - Sewerage	No. Of Units	Total amount payable
£ 471	7500	£ 3,532,500.00

It has been assumed that the onsite used water network will be provided under a section 104 Water Industry Act application.

It is recommended that you also budget for connection costs. Please note that we offer alternative types of connections depending on your needs and these costs are available at our website.

Section 4: Useful Information

Used water

Water Industry Act – Key Used Water Sections:

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185:

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website at http://www.anglianwater.co.uk/developers or via our Development Services team on 03456 066087.

Sustainable drainage systems:

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. Therefore our preferred method of surface water disposal is through the use of Sustainable Drainage Systems (SuDS). SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website at http://www.anglianwater.co.uk/developers/suds.aspx . We also recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for the area to discuss your application.

Private sewer transfers:

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

- Surface water sewers and lateral drains that did not discharge to the public sewer, e.g. those that discharged to a watercourse.
- Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.
- Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

Encroachment:

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website at http://anglianwater.co.uk/developers/encroachment.aspx

Locating our assets:

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from . All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge. We have more information on our website at: http://www.anglianwater.co.uk/developers/our-assets/

Summary of charges:

A summary of this year's water and used water connection and infrastructure charges can be found at http://www.anglianwater.co.uk/developers/charges

Disclaimer:

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water, or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).

Appendix C – Greenfield Runoff Calculations

FEH Greenfield Runoff
Per Hectare

Using 2008 QMED Equation

Project Title	Silfield GV
Project No	47753

Methodology as set out in SuDS Manual 24.3.2 — SUDS Manual Chapter 24

1 Retrieve FEH Catchment Information

Export catchment data from FEH CDROM as .csv file and save in FEH data export

Catchment Descriptors	**BFIHOST**	0.663	*see note 1*
	SAAR	630.0	*see note 1*
	FARL	1.0	*see note 2*

2 Derive QBAR (mean annual flood)

Define area	**Site Area**	1.0	ha	
	Applied Area	50.0	ha	*see note 3*
FEH Index Flood (SuDS Manual Equation 24.2)	**QMED (Q_2)**	1.2	l/s	*see note 4*
Calculate QBAR by dividing QMED by 2yr growth factor	**QBAR**	1.4	l/s	*see note 5*

3 Select appropriate growth factors

FSR Hydrological Region		5	*(refer to FSR Hydrological Region tab)*
100yr Growth Curve Factor	GQ_{100}	3.56	
30yr Growth Curve Factor	GQ_{30}	2.55	
10yr Growth Curve Factor	GQ_{10}	1.65	
2yr Growth Curve Factor	GQ_2	0.89	
1yr Growth Curve Factor	GQ_1	0.87	

4 Derive Flood Frequency

Greenfield Runoff per 1ha

100yr Peak Runoff Rate	Q_{100}	4.9	l/s	Q_{100}	4.9	l/s/ha
30yr Peak Runoff Rate	Q_{30}	3.5	l/s	Q_{30}	3.5	l/s/ha
10yr Growth Curve Factor	Q_{10}	2.3	l/s	Q_{10}	2.3	l/s/ha
QBAR Peak Runoff Rate	QBAR	1.4	l/s	Q_{BAR}	1.4	l/s/ha
2yr Peak Runoff Rate	Q_2	1.2	l/s	Q_2	1.2	l/s/ha
1yr Peak Runoff Rate	Q_1	1.2	l/s	Q_1	1.2	l/s/ha

Location of FEH Data (as Hyperlink)

DOCUMENT ISSUE RECORD

Rev	Comments	Prepared	Date	Checked	Date
		MH	21.11.19	CW	

Sheet created by Alex Bearne

Last updated 03.01.18 Recommended Review 01.07.18

Notes This spreadsheet has been created to allow derivation of greenfield runoff rates using the FEH statistical method applied in a manner consistent with the recommendations of the SuDS Manual. If you have recommendations to improve this spreadsheet please contact the owner.

Note 1 FEH Web version 3 allows extraction of BFIHOST and SAAR values for each square kilometre grid If you do not think the BFIHOST value is representative of your site then it is possible to derive it manually. This should only very occasionally be necessary. BFI can be derived manually using the the methodology set out in the Flood Estimation Handbook (see *Manual Derivation of BFIHOST tab).*

Note 2 FARL value is a measure of attenuation from reservoirs and lakes for the majority of studies this should be set to 1 (representing no attenuation). If your site includes a large water body with an attenuating affect on runoff please consult a hydrologist.
FARL is a measurement of studies water bodies in the catchment so that their attenuation effects so this term becomes 1.0 and therefore drops out. (see page 23 of the Preliminary rainfall runoff management for developments EA/Defra 2013)
Rainfall runoff management for developments.pdf

Note 3 If the site area is less than 50 hectare the spreadsheet will calculate QMED for 50ha and scale the results automatically to the defined Site Area

Note 4 QMED is calculated using the statistical equation as revised by Kjeldsen in 2008

$$Q_{MED} = 8.3062AREA^{0.8510} .0.1536^{(1000/SAAR)} .FARL^{3.4451} .0.0460^{BFIHOST\wedge 2}$$

Rainfall runoff management for developments.pdf
It is reproduced as Equation 24.2 in the SUDS Manual (pg 512)

Note 5 QBAR is calculated by dividing QMED by the growth factor for the 2 year event, as per the methodology set out in paragraph 6.2.2 of 'Rainfall runoff management for developments' . QBAR is then used as the index flood for the basis of applying the growth factors.

Checked by Natasha Vaughan, Clare Waller, David Collis

FEH Greenfield Runoff
Per Hectare

Using 2008 QMED Equation

Project Title	Silfield GV
Project No	47753

Methodology as set out in SuDS Manual 24.3.2 — SUDS Manual Chapter 24

1 Retrieve FEH Catchment Information

Export catchment data from FEH CDROM as .csv file and save in FEH data export

Catchment Descriptors	**BFIHOST**	0.600	*see note 1*
	SAAR	627.0	*see note 1*
	FARL	1.0	*see note 2*

2 Derive QBAR (mean annual flood)

Define area	**Site Area**	1.0	ha	
	Applied Area	50.0	ha	*see note 3*
FEH Index Flood (SuDS Manual Equation 24.2)	**QMED (Q_2)**	1.5	l/s	*see note 4*
Calculate QBAR by dividing QMED by 2yr growth factor	**QBAR**	1.7	l/s	*see note 5*

3 Select appropriate growth factors

FSR Hydrological Region		5
100yr Growth Curve Factor	GQ_{100}	3.56
30yr Growth Curve Factor	GQ_{30}	2.55
10yr Growth Curve Factor	GQ_{10}	1.65
2yr Growth Curve Factor	GQ_2	0.89
1yr Growth Curve Factor	GQ_1	0.87

(refer to FSR Hydrological Region tab)

4 Derive Flood Frequency

Greenfield Runoff per 1ha

100yr Peak Runoff Rate	Q_{100}	6.1	l/s	Q_{100}	6.1	l/s/ha
30yr Peak Runoff Rate	Q_{30}	4.4	l/s	Q_{30}	4.4	l/s/ha
10yr Growth Curve Factor	Q_{10}	2.8	l/s	Q_{10}	2.8	l/s/ha
QBAR Peak Runoff Rate	QBAR	1.7	l/s	Q_{BAR}	1.7	l/s/ha
2yr Peak Runoff Rate	Q_2	1.5	l/s	Q_2	1.5	l/s/ha
1yr Peak Runoff Rate	Q_1	1.5	l/s	Q_1	1.5	l/s/ha

Location of FEH Data (as Hyperlink)

DOCUMENT ISSUE RECORD

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Note 2 FARL value is a measure of attenuation from reservoirs and lakes for the majority of studies this should be set to 1 (representing no attenuation). If your site includes a large water body with an attenuating affect on runoff please consult a hydrologist.
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Note 4 QMED is calculated using the statistical equation as revised by Kjeldsen in 2008

$$Q_{MED} = 8.3062AREA^{0.8510} .0.1536^{(1000/SAAR)} .FARL^{3.4451} .0.0460^{BFIHOST\wedge 2}$$

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Note 5 QBAR is calculated by dividing QMED by the growth factor for the 2 year event, as per the methodology set out in paragraph 6.2.2 of 'Rainfall runoff management for developments' . QBAR is then used as the index flood for the basis of applying the growth factors.

Checked by Natasha Vaughan, Clare Waller, David Collis