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NPPF: Flood Risk Assessment

Swanstree Avenue, Sittingbourne

Gladman Developments Ltd

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Swanstree Avenue, Sittingbourne

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Executive Summary

This report presents an FRA in accordance with the NPPF and NPPG ID: 7 guidance, for a proposed residential development located on land south of Swanstree Avenue, Sittingbourne.

The report includes an assessment of the surface water drainage requirements of the Site and details the flood risk and how this could be managed and mitigated to allow the Site to be developed in support of the outline planning application.

The FRA has demonstrated the following:

- The 5.9-hectare (ha) Site is comprised of an agricultural arable and grassed land.
- The Site slopes in a northernly direction and is underlain by loamy soils, clayey-silty superficial deposits and two types of bedrock with high and variable infiltration potential.
- There are no drains observed or mapped on the Site.
- The risk of flooding is assessed as followed:
  - The risk of flooding from all sources is assessed as negligible.
- Flood risk mitigation methods are not required however the following approach is still advised:
  - Adoption of a surface water management strategy.
- The proposed residential dwellings use is classified as more vulnerable. More vulnerable uses are considered acceptable in terms of flood risk in Flood Zone 1. Subject to the implementation of the above mitigation measures, the Sequential Test would be passed, and the Exception Test would not be required.

A SuDS drainage scheme is proposed to manage excess runoff from the development, comprising a range of SuDS features to improve water quality, before discharging to ground via borehole soakaways. Attenuation volumes have been designed to maintain runoff at pre-development rates.

The FRA demonstrates that the proposed development would be operated with minimal risk from flooding and would not increase flood risk elsewhere. The development should therefore not be precluded on the grounds of flood risk and surface water drainage.

1.0 Introduction

1.1 Background

1.1.1 Enzygo Ltd was commissioned by Gladman Developments Ltd to carry out a site-specific flood risk assessment (FRA) including a surface water drainage strategy in support of an outline planning application for a proposed residential development, located on land south of Swanstree Avenue, Sittingbourne, Kent (the 'Site').

1.1.2 The proposal is for residential development, with associated landscaping, parking and open space on the 5.9-hectare (ha) Site.

1.1.3 A site-specific FRA assesses the current and future flood risk to and from a development site. It demonstrates how flood risk will be managed now and over the development's lifetime, taking climate change, drainage, and the vulnerability of its intended users into account.

1.1.4 The objectives of a site-specific FRA are to:

- assess whether a proposed development is likely to be affected by current or future flooding from a range of sources;
- assess whether the development will increase flood risk elsewhere;
- decide on measures to deal with these effects and risks and assess their appropriateness;
- provide enough evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- decide whether the development will be safe and will pass the Exception Test if applicable.

1.1.5 In England, planning applications for development need an FRA[1] for most developments including:

- In flood zones 2 and 3 including minor development and change of use;
- Sites of 1ha or larger in flood zone 1;
- Sites of less than 1ha in flood zone 1, including change of use to a more vulnerable class (for example from commercial to residential), and where they could be affected by sources of flooding other than rivers and the sea;
- Land in flood zone 1 in a critical drainage area (CDA) as notified by the Environment Agency;
- Land in flood zone 1 identified in a strategic flood risk assessment as being at increased flood risk in future.

1.1.6 An FRA is required for this development, as initial site screening using Environment Agency online indicative flood mapping shows that the Site is located in flood zone 1 (low risk), is more than 1ha, and is at risk of surface water flooding.

1.1.7 The purpose of this FRA is to assess the risk of flooding to the proposed development and where possible provide sufficient mitigation to demonstrate that future users of the development would remain safe throughout its lifetime, that the development would not

[1] https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications 2014 (as updated February 2017) https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

increase flood risk on Site and elsewhere and, where practicable, would reduce flood risk overall.

1.2 Scope

1.2.1 Government policy on development and flood risk is set out in the National Planning Policy Framework (NPPF) [2] and is supported by National Planning Practice Guidance: Flood Risk and Coastal Change [NPPG ID7] [3].

1.2.2 NPPF paragraphs 148-169 set out the need for an appropriate assessment of flood risk at all levels of the planning process and require the application of a sequential risk-based approach to assess the suitability of land for development in flood risk areas.

1.2.3 The FRA should also make allowances for climate change [4] to minimise vulnerability and provide resilience to flooding and coastal change in the future. The allowances are predictions of anticipated change in

- peak river flow by river basin district;
- peak rainfall intensity;
- sea level rise; and
- offshore wind speed and extreme wave height.

1.2.4 They are based on climate change projections and different scenarios of carbon dioxide emissions to the atmosphere. There are different allowances for different periods of time over the next century.

1.2.5 Site-specific FRAs are categorised according to level. Simple Level 1 Screening studies give a general indication of the potential flood risk to a site and identify whether more detailed Level 2 assessment is required or not. A Level 2 assessment is a qualitative appraisal to develop understanding of flood risk to a site and the effects of the site on flooding elsewhere including recommended mitigation measures. Level 3 assessments are more detailed quantitative studies, for example modelling to establish flood levels at a site in the absence of Environment Agency or other data or providing detailed outline drainage designs.

1.2.6 This report is a Level 2 qualitative FRA but includes a Level 3 assessment of the surface water drainage requirements for the proposed development.

1.3 Aims

1.3.1 This FRA aims to provide enough flood risk information to satisfy the requirements of the NPPF, PPG ID7 and regional/local government plans and policies. It describes the potential for the Site to be impacted by flooding, the impacts of the proposed development on flooding elsewhere near the Site, and the proposed measures that could be incorporated into the development to mitigate the identified risks.

[2] Department for Communities and Local Government (2018) Revised National Planning Policy Framework (as updated February 2019).
[3] Department for Communities and Local Government (2014) Planning Practice Guidance ID7-030-20140306; Flood Risk & Coastal Change.
[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

1.4 Planning Context

National Policy

1.4.1 The FRA was prepared in accordance with the NPPF and NPPG ID7.

Regional/Local Policy

1.4.2 The FRA also considers the following policies within the Swale Borough Council Local Plan (2017 to 2031):

- **Policy CP 7 - Conserving and enhancing the natural environment – providing for green infrastructure:** Development Proposals will promote expansion of Swale's natural assets by taking account of and integrating with natural processes such as flood risk and utilising sustainable urban drainage.
- **Policy ST 1 - Delivering sustainable development in Swale:** All development proposals will meet the challenge of flooding by applying planning policies to manage flood risk.
- **Policy ST 5 - The Sittingbourne area strategy:** Development proposals within the Sittingbourne area are appropriate to the level of risk from flooding.
- **Policy DM 21 - Water, flooding and drainage:** When considering the flooding and drainage implications of development; avoid development in flood risk areas and where development would increase flood risk elsewhere, include a Sustainable Drainage System (SuDS), safeguard groundwater Source Protection Zones from pollution.

1.5 Report Structure

1.5.1 This report is structured as follows:

- Section 2 identifies the sources of information that were consulted;
- Section 3 describes the Site and the existing and proposed development;
- Section 4 outlines the flood risk to the existing site and proposed development;
- Section 5 details the proposed mitigation measures against identified flooding sources;
- Section 6 assesses the potential impacts of the proposed development on surface water drainage and proposes mitigation for those effects; and
- Section 7 presents a summary and conclusions.

2.0 Sources of Information

2.1 Sources of Information

2.1.1 The following information was consulted:

- Ordnance Survey 1:25,000 mapping (Explorer 149: Sittingbourne & Faversham).
- Detailed topographic survey (Appendix 1).
- Environment Agency online mapping (Flood Map for Planning[5], Long Term Flood Risk Assessment for Locations in England[6], Catchment Data Explorer[7] and Main River Map[8]).
- River Basin District (RBD) Maps[9] (Thames RBD) together with guidance on climate change allowances[10].
- National River Flow Archive[11].
- Swale Borough Council Strategic Flood Risk Assessment (SFRA) and associated mapping[12] (Appendix 2).
- British Hydrological Society Chronology of British Hydrological Events[13].
- National Soils Resources Institute (NSRI): Soilscapes online mapping[14].
- British Geological Survey [BGS] online mapping: Geology of Britain Viewer[15].
- Landmark's Promap: Flood Data package: Additional flood mapping.
- Geosmart 1 in 100-year groundwater flood risk map.
- Southern Water sewer asset plans (Appendix 3).
- DEFRA's Magic Map[16] for identifying Designated Sites.

[5] https://flood-map-for-planning.service.gov.uk/
[6] https://flood-warning-information.service.gov.uk/long-term-flood-risk/
[7] http://environment.data.gov.uk/catchment-planning/
[8] https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386
[9] https://www.gov.uk/government/publications/flood-risk-assessments-river-basin-district-maps
[10] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[11] http://nrfa.ceh.ac.uk
[12] https://services.swale.gov.uk/assets/Planning-General/Planning-Policy/SFRA%202020/2020%20Swale%20Borough%20Council%20Level%201%20SFRA%20(1).pdf
[13] http://www.cbhe.hydrology.org.uk/search.php
[14] http://www.landis.org.uk/soilscapes/
[15] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[16] http://www.natureonthemap.naturalengland.org.uk/

2.2 Consultation and Discussion with Regulators

2.2.1 Consultation and discussions were undertaken with the Environment Agency, the Local Planning Authority (LPA)/Lead Local Flood Authority (LLFA), and Water Utility.

Environment Agency

2.2.2 The Environment Agency is a statutory consultee on flood risk and planning and is directly responsible for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas; and it has a strategic overview for all forms of flooding.

2.2.3 Environment Agency Standing Advice[17] and the NPPF/PPG ID: 7 was consulted and reviewed.

2.2.4 Correspondence with the Environment Agency is included in Appendix 4.

Lead Local Food Authority (LLFA)

2.2.5 LLFAs (unitary authorities or county councils) are Kent County Council as the Lead Local Flood Authority (LLFA) is responsible for local flood risk management in their areas and for maintaining a register of flood risk assets. They also have lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary watercourses.

2.2.6 Kent County Council as the LLFA was consulted on flood risk issues at this Site.

2.2.7 Correspondence with the LLFA is included in Appendix 5.

Water Utility

2.2.8 Drainage and sewerage services in the UK are provided by a number of water and sewerage companies. Southern Water is responsible for sewerage within the area of the Site.

2.2.9 All sewerage undertakers maintain the 'DG5 register' of properties and external areas (such as gardens, highways, open spaces) which have suffered flooding from public foul/combined sewers. It does not include flooding caused by blockages.

2.3 Site Walkover

2.3.1 Enzygo staff carried out a walkover of the Site during March 2021. Observations made were used to inform the Site description.

[17] https://www.gov.uk/guidance/flood-risk-assessment-standing-advice

3.0 Site Location and Description

3.1 Location

3.1.1 The Site is located on land south of Swanstree Avenue, Sittingbourne, Kent, ME9 0AA.

3.1.2 The Site is centred on National Grid Reference (NGR) 591192, 162573.

3.1.3 The 5.9ha Site location is shown in Drawing 001 and in more detail in Drawing 002.

3.2 Land Use

3.2.1 The land use is comprised of agricultural (arable and orchard) land (Figures 3.1 and 3.2).

3.2.2 The Site is bounded by Swanstree Avenue to the north and Highsted Road and Chilton Manor Farm to the West. To the south and east of the Site is agricultural land.

3.2.3 The Site is currently accessed from Chilton Manor Farm via Highsted Road. There are two vehicle gates and two pedestrian footpath gates off Swanstree Avenue with access to the Site.

Figure 3.1: Photograph of the Site

View from the north east of the Site looking south west

Figure 3.2: Aerial Photograph of the Site

Image © 2021 Digital Globe.

3.3 Topographic Information

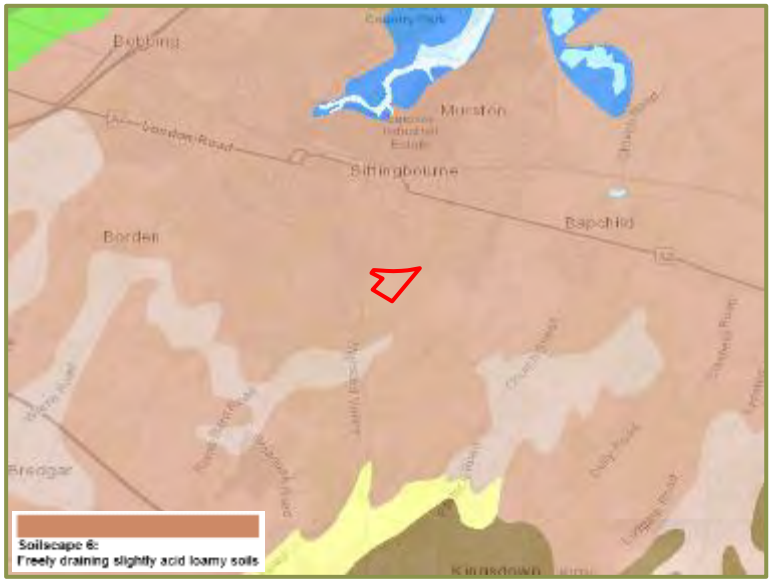
3.3.1 A detailed topographic survey was carried out during June 2014 and a copy is included in (Appendix 1). The Site falls north from 36.22 metres Above Ordnance Datum (m AOD) (located in the southern corner) to 28.1m AOD (located central along the northern boundary). The fall of approximately 8.12m over 275m which gives a gradient of 1:33.

3.4 Soils and Geology

Soils Mapping

3.4.1 The Soilscapes online soils map viewer shows that the Site is underlain by freely draining, slightly acidic loamy soils. (Figure 3.3).

Figure 3.3: Soils Mapping



Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2021].

Geology Mapping

3.4.2 The Geology of Britain online map viewer (Figure 3.4) shows the bedrock on the Site is Seaford Chalk Formation - chalk beneath western extent and Thanet Formation – sand, silt, and clay beneath the eastern extent. The chalk bedrock is likely to have high permeability due to its porosity whilst the Thanet Formation may have variable permeability dependent on its composition.

3.4.3 Across the western extent of the Site there is an area of Head – clay and silt superficial deposit. There is also a small area in the north-eastern corner of the Site with the same band of Head. The Head is likely to have low permeability based on the clayey nature of the deposit.

Figure 3.4: Geology Mapping (continues over page)

Top: Bedrock Geology Bottom: Superficial Deposits. Contains British Geological Survey materials © NERC [2021].

BGS Borehole Logs

3.4.4 The Geology of Britain online map viewer (Figure 3.5) shows there are no historical boreholes located within the Site boundary. There are three borehole locations (TQ96SW6/A, TQ96SW6/B, and TQ96SW6/C) within the Seaford Chalk to the south, south-west, and one (TQ96SW5) to the west of the Site. There is one borehole (TQ96SW12) located within the Thanet Formation to the north of the Site.

3.4.5 The borehole records (Appendix 6) cannot be used to confirm the bedrock geology as depicted by the Geology of Britain mapping as the strata details were not recorded for the 4 boreholes within the Seaford Chalk Formation. The borehole which did have the strata recorded does not support that the Thanet Formation is the bedrock and is likely to be on Seaford Chalk formation (Table 3.1). However, the records can be used to determine the groundwater level within the superficial deposits on the Site.

Figure 3.5: Borehole Mapping

Contains British Geological Survey materials © NERC [2021].

Table 3.1: BGS Borehole Data

Reference	Summary of Strata	Depth (m bgl)	Groundwater Depth (m bgl)
TQ96SW5	No Strata Details	30.48	9.45
TQ96SW6A	No Strata Details	38.33	18.29
TQ96SW6B	No Strata Details	39.62	17.37
TQ96SW6C	No Strata Details	39.62	16.76
TQ96SW12	0.00 - 0.30m = Top Soil 0.30 – 3.96m = Loamy clay 3.96 – 76.2m = Chalk and Flints	76.2	14.94

Contains British Geological Survey materials © NERC [2021].

Soakaway Testing

3.4.6 Soakaway testing was undertaken in July 2021 (Appendix 7). A total of 3 soakaway test pits and 3 boreholes for falling head tests were established (Figure 3.6) and testing was undertaken in accordance with DG 365 'Soakaway Design' methodology guidance.

3.4.7 The test pits were excavated to a depth of 2.80 to 3.10 metre below ground level (m bgl) and the boreholes drilled to a depth of approximately 5.0 to 10.0 metres. A summary of the trial pit logs is summarised in Table 3.2. The borehole logs confirm the soils and geology as depicted by the soils and geology mapping.

Figure 3.6: Soakaway Test Pit Location

Table 3.2: Trial Pit & Borehole Data

Trial Pit/Borehole	Summary of Strata
SA1	0.00 - 0.40m = brown silty sandy topsoil. 0.40 - 2.10m = firm brown silty slightly sandy clay. 2.10 - 2.70m = brown silty sand and gravel. 2.70 - 3.10m = grey silty fine to medium sand.
SA2	0.00 - 2.10m = brown silty sand and gravel [Head]. 2.10 - 2.80m = firm brown silty slightly sandy clay [Head].
SA3	0.00 - 0.40m = brown silty sandy topsoil. 0.40 - 2.20m = firm brown silty slightly sandy clay [Head]. 2.20 - 3.0m = brown silty slightly sandy slightly gravelly clay [Head].
BH1	0.00 - 0.30m = brown sandy topsoil. 0.30 - 3.50m = very soft brown slightly silty sandy clay [Head]. 3.50 - 4.50m = medium dense grey and brown silty fine to medium sand [Head]. 4.50 - 10.0m = white structureless chalk composed of sandy silty gravel [Seaford Chalk Formation].
BH2	0.00 - 0.80m = brown sandy topsoil. 0.30 - 1.50m = soft brown slightly silty sandy clay [Head]. 1.50 - 2.50m = medium dense brown silty sand and gravel [Head]. 2.50 - 9.20m = medium dense grey and brown silty fine to medium sand [Head].
BH3	0.00 - 0.40m = brown sandy topsoil. 0.40 - 2.10m = firm brown slightly silty sandy clay [Head]. 2.10 - 3.80m = brown slightly sandy gravelly clay [Head]. 3.80 - 5.30m = Dense grey and brown silty fine to medium sand [Head]. 5.30 - 10.0m = white structureless chalk composed of slightly sandy silty gravel [Seaford Chalk Formation].

3.5 Hydrogeology

Infiltration potential

3.5.1 Soils mapping indicates that the freely draining loamy soils are likely to represent a high infiltration potential.

3.5.2 The infiltration potential of the superficial deposits is likely to be low based on the clayey nature of the Head deposits (Table 3.1).

3.5.3 Infiltration potential of the Chalk bedrock is likely to be high based on the porous nature of chalk. The infiltration potential of the Thanet Formation bedrock is likely to be variable dependent on the ratios of clay silt and sand.

3.5.4 BGS online borehole mapping (Figure 3.5 and Table 3.1) shows groundwater ingress was encountered in all of the borehole logs between depths of 9.45 and 18.29 metres. This is likely to be linked to the chalk bedrock.

3.5.5 Soakaway testing (Appendix 7) demonstrated a low infiltration potential in the shallow deposits however, deeper borehole testing demonstrated a higher infiltration potential in the bedrock. Groundwater ingress was not encountered in any of the soakaway trial pits or boreholes.

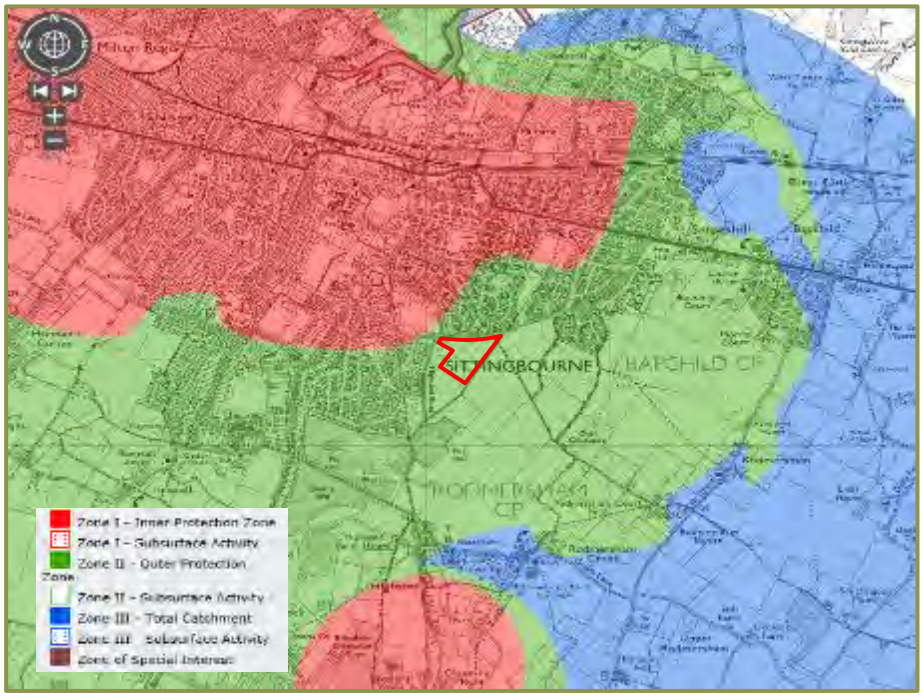
Defra Magic Map

3.5.6 Defra Magic Map online mapping (Figure 3.7) shows the Site is in a groundwater Source Protection Zone (SPZ). The Site is located within the 400-day travel time 'Outer Protection'

(Zone 2) and is close to the 50-day travel time 'Inner Protection' (Zone 1) of a groundwater abstraction.

3.5.7 These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk. Where infiltration-based SuDS are proposed to manage surface water from a development, then direct discharge into groundwater would not be permissible. Therefore, the elevation of the groundwater table with respect to the base of the soakaway is critical, and there must be an unsaturated zone in the aquifer unit.

Figure 3.7: Source Protection Zone Map

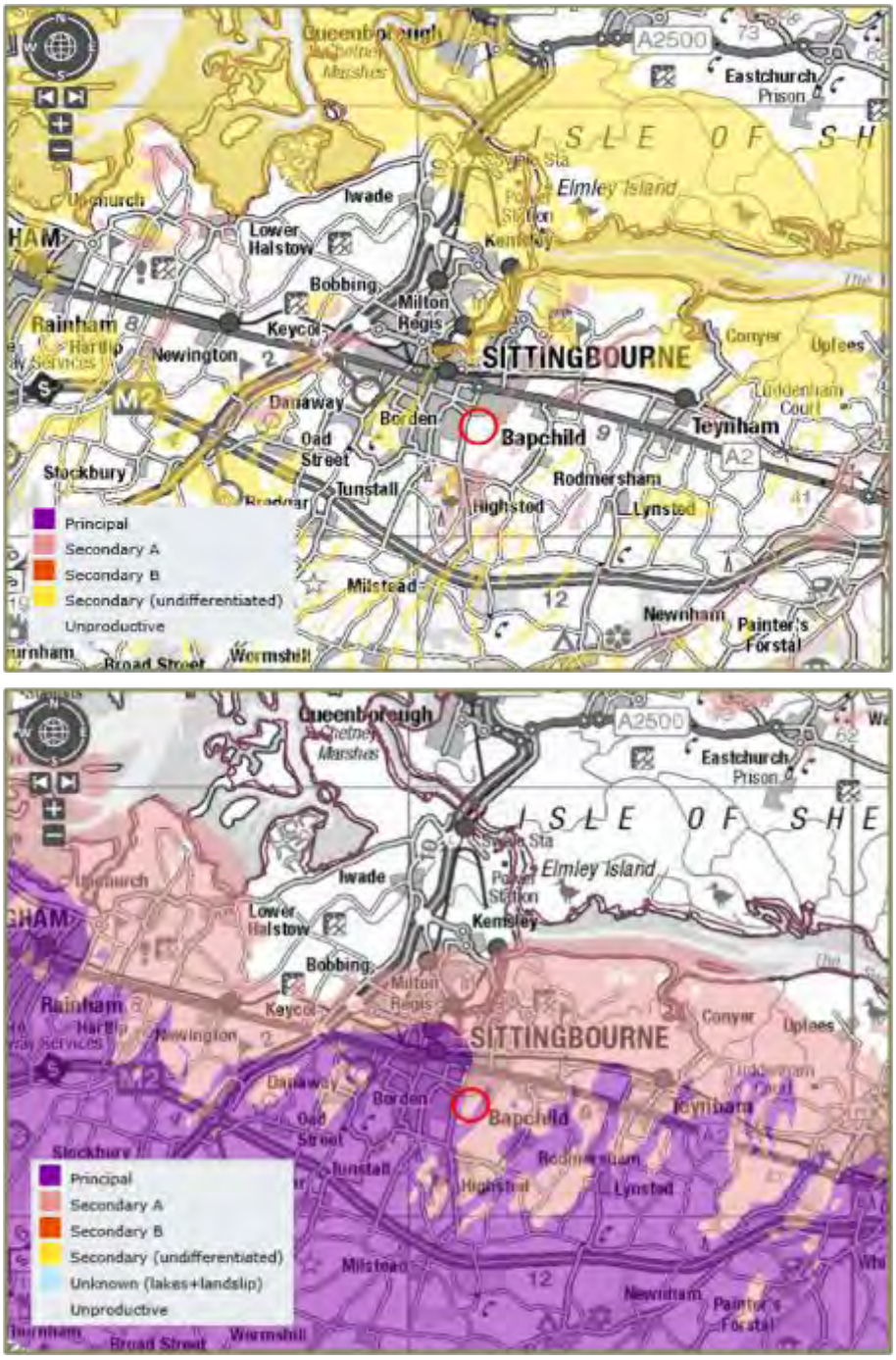


From Magic Map. Contains Environment Agency information © Environment Agency and database right.

3.5.8 The Site is not located above an aquifer for superficial designations (Figure 3.8).

3.5.9 The Site is located above the boundary between a Principal Aquifer and Secondary A Aquifer - bedrock designation (Figure 3.8). Indirect inputs of clean surface water to groundwater are permissible, for example where the base of the soakaway is above the water table and there is an unsaturated zone in the aquifer unit.

Figure 3.8: Aquifer Designation Map



Top: Aquifer Designation (superficial deposits). Bottom: Aquifer Designation (bedrock). From Magic Map. Contains Environment Agency information © Environment Agency and database right [2021].

3.6 Catchment Hydrology

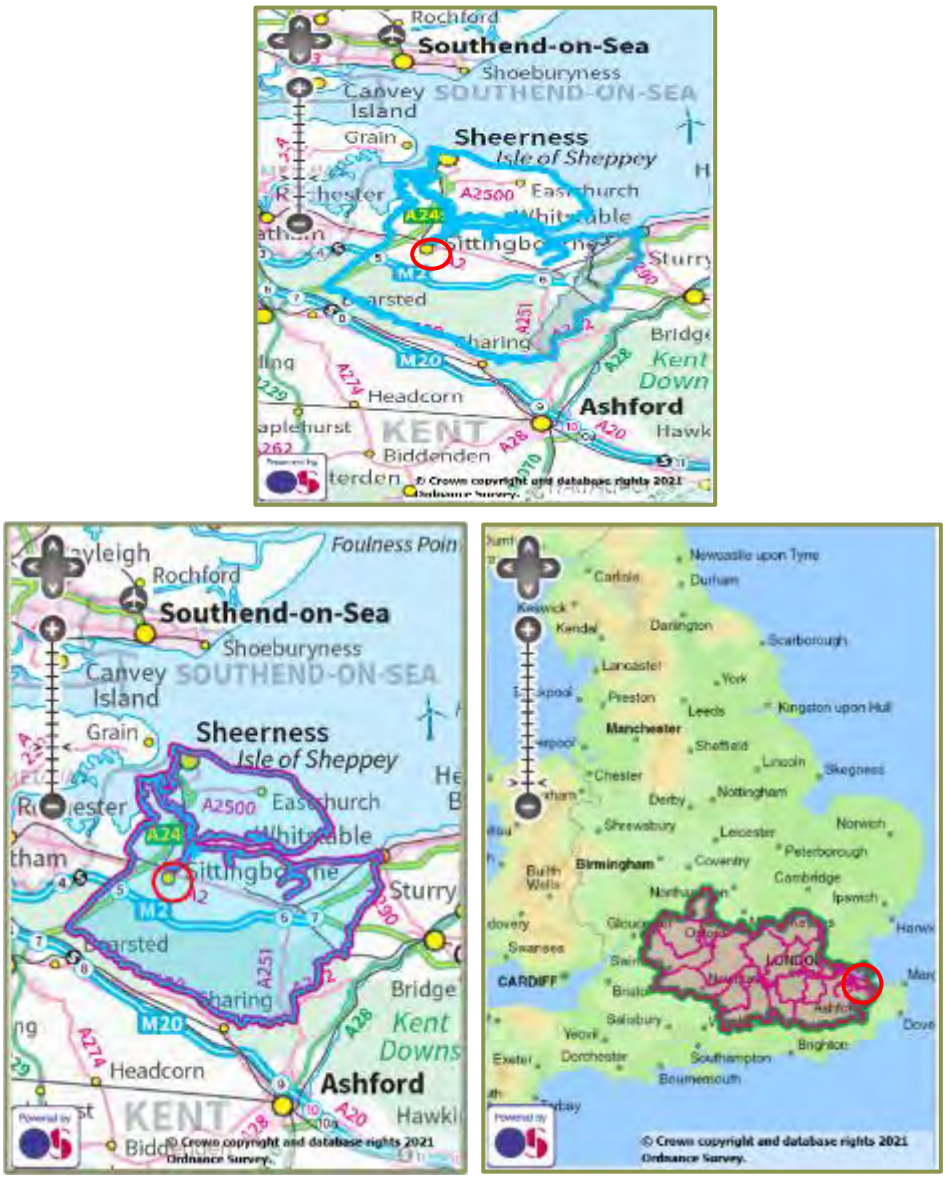
OS Mapping and Topographic Survey

3.6.1 OS mapping shows that there are no watercourses located in or bounding the Site, nor in the immediate vicinity.

Environment Agency Catchment Data Explorer Mapping

3.6.2 The Site resides within the White Drain and Lakes Operational Catchments, Kent North Management Catchment and Thames River Basin District (Figure 3.9).

Figure 3.9: Catchment Data Explorer



Top: White Drain and Lakes Operational Catchments. Bottom Left: Kent North Management Catchment. Bottom Right: Thames River Basin District. Contains Environment Agency information © Environment Agency and database right [2021].

3.7 Sewerage Assets

3.7.1 Southern Water asset plans (Appendix 3) show that there is a Ø150mm foul sewer within Marjoram Drive associated with the residential development approximately 50 metres to the west of the Site. This foul conveys flows north then west joining a Ø225mm foul sewer within Crocus Drive, which is orientated north to south. There is a Ø150mm foul sewer within Farm Crescent approximately 60m to the north of the Site, associated with residential developments, conveying flows north. The closest surface water sewer is approximately 320m north-east of the Site at its closest point, size Ø225mm, associated with residential developments.

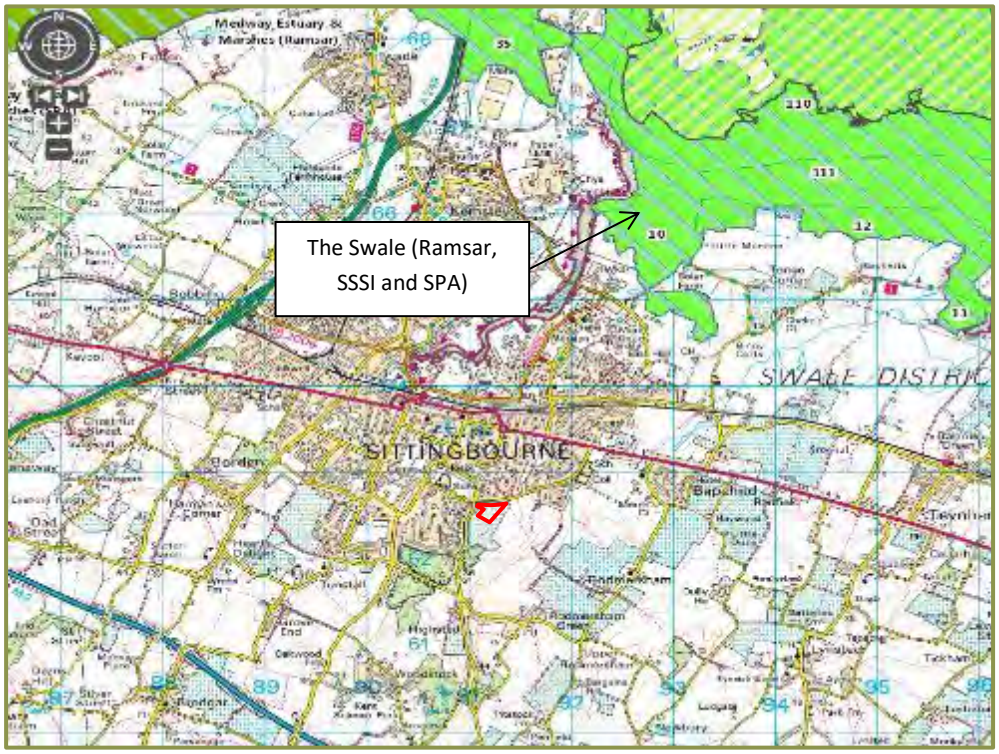
3.8 Designated Sites

3.8.1 The DEFRA Magic Map (England and Wales) (Figure 3.10) shows there are no designated sites in or close to the Site including downstream (from a flood risk and drainage perspective).

3.8.2 The nearest designated site is 'The Swale' (Ramsar, Site of Special Scientific Interest [SSSI] and Special Protection Area [SPA]). However, this designated site does not have a hydrological connectivity to the Site. The proposed development would not impact any designated sites.

3.8.3 The Site and wider area is not located within a Nitrate Vulnerable Zone (NVZ).

Figure 3.10: Designated Sites



From Magic Map. Contains Environment Agency Information © Environment Agency and database right.

4.0 Flood Risk Assessment

4.1 Potential Sources of Flooding

4.1.1 A summary of the potential sources of flooding and the potential risk posed by each source at the Site is presented in Table 4.1. Each source of flooding and level of risk is then assessed in further detail.

Table 4.1: Potential Risk Posed by Flooding Sources

Flooding Source	Potential Flood Risk at Application Site (Yes/No)	Potential Source	Data Sources
Fluvial	No	None Identified	Environment Agency flood mapping (Drawing 005) and SFRA mapping. OS Mapping
Tidal	No	None identified	Environment Agency flood mapping (Drawing 005) and SFRA mapping.
Groundwater	Yes	Principal / Secondary A Aquifer (bedrock)	BGS mapping (Drawing 003) and Geosmart Groundwater (Drawing 005) and SFRA mapping.
Surface Water	Yes	Poor permeability and Site topography	Environment Agency online flood mapping, SFRA mapping, JBA Surface Water Flooding (Drawing 004) and Environment Agency Complex mapping (Drawing 008.1-4).
Sewer	No	None Identified	Southern Water Asset plans, SFRA mapping.
Infrastructure Failure	No	None Identified	Environment Agency online flood mapping, SFRA mapping

4.2 Fluvial Flooding

Environment Agency Flood Zone Mapping

4.2.1 The Environment Agency Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, since these can be breached, overtopped and may not be in existence for the lifetime of a development.

4.2.2 The Environment Agency online flood map shows the Site is located within Flood Zone 1; outside the 1 in 1000-year probability of fluvial (river) flooding (0.1% Annual Exceedance Probability [AEP]), at 'low' risk.

SFRA Mapping

4.2.3 SFRA mapping confirms the Site is located within Flood Zone 1.

Flood History

4.2.4 The SFRA mapping shows that there have been no historical fluvial flooding events within the Site boundary.

Flood Defences

4.2.5 Environment Agency online flood mapping and SFRA mapping show that the Site does not benefit from flood defences.

Flood Warning Service

4.2.6 Environment Agency online flood mapping shows the Site is not located within an area which receives flood warnings.

Summary Flood Risk

4.2.7 The risk of fluvial flooding is assessed as negligible.

4.3 Tidal Flooding

4.3.1 The Site is not located close to tidally affected flooding sources and so the flood risk from this source is assessed as negligible.

4.4 Groundwater Flooding

Introduction

4.4.1 Groundwater flooding occurs when subsurface water emerges either at surface or in made ground or in subsurface structures such as basements and services ducts. It occurs as diffuse seepage, emergence from new point source springs or an increase in flow from existing springs. It results from aquifer recharge from infiltrating rainfall, from sinking streams entering aquifers from adjacent non-aquifers, or from high river levels or tides driving water through near surface deposits. It tends to occur with a delay following rainfall and can last for several weeks or months. Groundwater flooding or shallow water tables also prevent or reduce infiltration and so can worsen surface water flooding.

Flood History

4.4.2 Consultation with the LLFA reported no historical groundwater flooding incidents within the Site boundary.

SFRA Mapping

4.4.3 SFRA mapping shows the north-western and north-eastern extents of the Site are located within an area where groundwater levels are between 0.5 and 5m below the ground surface. This is likely to be associated with perched groundwater within the superficial Head deposits.

4.4.4 The SFRA mapping is coarse and should be superseded by the Geosmart groundwater flood risk map.

BGS Groundwater Flooding Susceptibility Map

4.4.1 The BGS Groundwater Flooding Susceptibility Map (Drawing 003) shows most of the Site is located outside the mapped extent of groundwater flooding.

4.4.2 There is an area within the eastern and southern extent of the Site at with '*limited potential for groundwater flooding to occur'*. The risk of groundwater flooding is likely to be associated with perched groundwater within the Thanet Bed formation which underlies the east of the Site.

4.4.3 The BGS mapping is coarse and should be superseded by the Geosmart groundwater flood risk map.

Geosmart Groundwater Flood Risk Map

4.4.4 The Geosmart 1 in 100-year groundwater flood risk map (Drawing 006) shows that the Site is at negligible risk of groundwater flooding and falls within Risk Class 4 (Table 4.2).

4.4.5 Mapped classes combine understanding of likelihood, model and data uncertainty, and possible severity. Likelihood is ranked according to whether we expect groundwater flooding at a site due to extreme elevated groundwater levels with an annual probability of occurrence greater than 1%, considering model and data uncertainty. Severity relates to expectations of the amount of property damage or other harm that groundwater flooding at that location might cause (Table 4.2).

Table 4.2: Groundwater Flood Risk Classification

Risk Class	Probability of Groundwater Flooding	Effect
4: Negligible	Annual probability less than 1%.	Negligible unless unusually sensitive use.
3: Low	Annual probability greater than 1%.	Remote possibility of damage to property or harm to sensitive receptors Flooding likely to be limited to seepages and waterlogged ground, damage to basements and subsurface infrastructure, and should pose no significant risk to life. Surface water flooding may be worsened.
2: Moderate	Annual probability greater than 1%.	Significant possibility of damage to property or harm to other sensitive receptors at or near this location. flooding is likely to be in the form of shallow pools or streams. Surface water flooding and failure of drainage systems may be worsened when groundwater levels are high.
1: High	Annual probability greater than 1%.	Groundwater flooding will occur which could lead to damage to property or harm to other sensitive receptors at or near this location. Flooding may result in damage to property, road or rail closures

Risk Class	Probability of Groundwater Flooding	Effect
		and, in exceptional cases, may pose a risk to life. Surface water flooding and failure of drainage systems may be worsened when groundwater levels are high.

Borehole Logs

4.4.6 The nearest borehole logs showed groundwater levels between 9.45mgl and 18.29mbgl.

Soakaway Testing

4.4.7 Soakaway testing was carried out on the Site during July 2021 and did not encounter groundwater to depths of 10.0 mbgl.

Flood Risk

4.4.8 The risk of groundwater flooding is assessed as negligible.

4.5 Surface Water Flooding

Introduction

4.5.1 Surface water flooding occurs following rainfall on ground where infiltration rates are less than the rainfall precipitation rate. This can occur when either:

- Soils or ground materials are naturally of low permeability or have been compacted (infiltration excess runoff);
- Soils or ground materials are saturated from previous rainfall either directly or from upslope (saturation excess runoff and return flow) or from high groundwater levels.

Flood History

4.5.2 Consultation with the LLFA reported no historical surface water flooding incidents within the Site boundary.

SFRA Mapping

4.5.3 SFRA mapping shows that there is a narrow area of surface water flooding associated with a 1 in 1000-year event (0.1% Annual Exceedance Probability [AEP]) from the northern boundary into the central extent of the Site.

JBA Surface Water Flood Map

4.5.4 The JBA Surface Water Flood Map (Drawing 004) shows the Site is located outside the mapped extent of surface water flooding. There is however an area of surface water ponding adjacent to the southern boundary, and a flow pathway parallel to the northern boundary.

4.5.5 The JBA Surface Water Flood mapping is superseded by the more detailed Environment Agency Complex Surface Water Flood mapping.

Environment Agency Complex Surface Water Flood Mapping

4.5.6 The Environment Agency Complex Surface Water Flood Mapping (Drawings 008.1 to 008.4) shows that the Site is outside the extent of surface water flooding. There are flow pathways parallel to the northern boundary, and western boundary associated with Swanstree Avenue and Highsted Road. There is also an area of ponding adjacent to southern boundary.

Flood Risk

The risk of surface water flooding is assessed as negligible.

4.5.7 Mitigation measures against surface water flooding are discussed in Section 5.

4.6 Sewer Flooding

Introduction

4.6.1 Sewer flooding occurs when urban drainage networks become overwhelmed after heavy or prolonged rainfall due to restrictions or blockage in the sewer network or if the volume of water draining into the system exceeds the sewer design capacity.

4.6.2 New sewers are built to the guidelines within Sewers for Adoption[18] and have a design standard to the 1 in 30-year flood event. Older sewers were not designed to any standard. Modern sewer systems will only surcharge during rainstorm events with a return period greater than 1 in 30-years (e.g. 1 in 100-years).

4.6.3 There are no public sewers located within the Site boundary. From a review of SFRA there are no recorded sewer flooding incidents located within the Site.

Flood Risk

4.6.4 The risk of flooding from sewers is assessed as negligible.

4.7 Flooding from Infrastructure Failure

Reservoir

4.7.1 The Environment Agency online flood mapping shows the Site is located outside the extent of flooding sourced from reservoirs. The risk of flooding from reservoirs is assessed as negligible.

[18] WRC (2012) Sewers for Adoption 7th Edition.

5.0 Flood Risk Mitigation Measures

5.1 Introduction

5.1.1 No sources of flooding were identified.

5.2 Mitigation Methods

5.2.1 No mitigation methods are required. However, a surface water management strategy will be adopted.

5.3 Summary of Flood Risk

5.3.1 Table 5.1 summarises the probability and level of risk, both with and without mitigation measures.

Table 5.1: Probability and Consequences of All Sources of Flooding

Flooding Source	Potential Source	Probability	Consequence & Impact Without Mitigation	Consequence & Impact with Mitigation
Fluvial	None Identified	Negligible	Negligible	Negligible
Tidal	None identified	Negligible	Negligible	Negligible
Groundwater	None Identified	Negligible	Negligible	Negligible
Surface Water	Poor permeability and Site topography	Negligible	Negligible	Negligible
Sewer	None Identified	Negligible	Negligible	Negligible
Infrastructure Failure	None Identified	Negligible	Negligible	Negligible

Key: Green - Negligible, Yellow - Low, Orange - Medium and Red - High; based on consequence and impact with mitigation from each flooding source.

5.4 Flood Guidance and Sequential Test

5.4.1 The proposal is for residential development. Table 2 of PPG ID: 7 (not included in this report) classifies the proposed use as 'more vulnerable'.

5.4.2 The Environment Agency Flood Zones and acceptable development types are listed in Table 5.2. All development types (including 'more vulnerable' uses) are acceptable in Flood Zone 1 (low risk). Subject to the above mitigation measures, the Sequential Test would be passed, and the Exception Test would not be required as indicated in Table 5.3.

Table 5.2: Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).	All development types generally acceptable.
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year.	Most development type are generally acceptable.
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.	Some development types not acceptable.
Zone 3b	'Functional Floodplain'	Land where water must flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).	Some development types not acceptable.

Note: *The Flood Zones are the current best information on the extent of the extreme flood from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The identified risk of fluvial flooding is highlighted green.*

Table 5.3: Vulnerability and Flood Zone 'Compatibility' as Identified in Table 3 of PPG ID: 7

Flood Risk Vulnerability classification (see Table 1 of PPG ID: 7)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	Yes	Yes	Yes	Yes	Yes
Zone 2	Yes	Yes	Exception test required	Yes	Yes
Zone 3a	Exception test required	Yes	No	Exception test required	Yes
Zone 3b 'Functional Floodplain'	Exception test required	Yes	No	No	No

Key: *Yes: Development is appropriate, No: Development should not be permitted.*
The identified risk of fluvial flooding is highlighted green.

6.0 Site Drainage

6.1 Surface Water Drainage

6.1.1 Consideration of flood issues is not confined to the floodplain. This is recognised in the NPPF and associated guidance where all proposed development of 1ha or more in flood zone 1 and so outside the floodplain nevertheless requires an FRA. The alteration of natural surface water flow patterns through development can lead to problems elsewhere in a catchment, particularly flooding downstream, and the replacement of permeable vegetated areas by low-permeability roofs, roads and other paved surfaces will increase the speed, volume and peak flow of surface water runoff. So, the NPPF and associated guidance require an FRA for all proposed development of 1ha or more outside the floodplain in flood zone 1.

6.1.2 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the Site. The developer will be required to ensure that any scheme for surface water management should build in enough capacity for the entire Site.

6.1.3 The surface water drainage arrangements for any development Site should be such that the volume and peak flow rates of surface water leaving a developed Site are no greater than the rates prior to the proposed development unless specific off-Site arrangements are made and result in the same net effect.

6.1.4 An assessment of the surface water runoff rates was undertaken to determine the surface water options and attenuation requirements for the Site.

6.2 Existing Drainage System

6.2.1 The 5.9ha Site land use comprises agricultural land.

6.2.2 The Site is underlain by permeable soils and bedrock. It is likely that drainage is predominantly via of infiltration to bedrock, with a small amount of overland flow following the topography of the Site to the topographic low points.

6.2.3 There is currently no foul water discharging from the undeveloped Site. Please note that foul drainage is not considered within this FRA but is dealt with in a separate standalone report.

6.3 Developable and Impermeable Areas

6.3.1 The proposal is for residential development.

6.3.2 An allowance of 55% impermeable area (inclusive of 10% for urban creep) was applied to the 3.9ha developable area. The existing and proposed impermeable areas are shown in Table 6.1.

Table 6.1: Impermeable Area

Area	Existing Buildings and Hardstanding	Proposed Buildings and Hardstanding	Difference
Area (ha)	0	2.15	+2.15
Percentage of Total Site Area (%)	0	36.4	+36.4

6.3.3 The proposed development will increase the impermeable surfaces and so increase the amount of runoff.

6.4 Greenfield Runoff Rates

6.4.1 An assessment of greenfield runoff rates was undertaken to determine the attenuation requirements for the proposed development.

6.4.2 The runoff rates were calculated using the HRWallingford UKSuDS online tool, with FEH method inputs (descriptors obtained from the FEH webservice[19]). This is a recommended methodology for Sites up to 50ha in area.

6.4.3 The following parameters were used in the runoff calculations:

- Developable Area: 3.9ha
- Average Annual Rainfall (SAAR): 634 mm/year;
- BFIHOST19: 0.734
- Region No.: 7

6.4.4 BFIHOST was updated to BFIHOST19 (November 2019) since a number of issues were identified with BFIHOST, which including a tendency to underestimate BFI in clay-dominated catchments.

6.4.5 BFIHOST19 is the baseflow index developed using the Hydrology of Soil Types (HOST) classification and is the baseflow proportion of the flow on average. It is estimated based on the daily mean flow data. Baseflow comprises water entering the watercourse through shallow subsurface flow and groundwater flow (mechanisms other than direct surface runoff); hence permeable soils and geology tend to yield a higher baseflow.

6.4.6 The Soilscapes online soils map viewer and Geology of Britain online map viewer and soakaway testing identified the following:

- Soils: sandy loamy clayey
- Superficial Deposits: sand and gravel
- Bedrock: Seaford Chalk Formation – chalk.
- Groundwater: N/A

6.4.7 BFIHOST19 value assigned by the FEH webservice is considered to replicate on-site conditions of freely draining slightly acid loamy soils.

6.4.8 Table 6.2 shows the calculated greenfield runoff rates. Runoff calculations are included in Appendix 8.

[19] Centre for Ecology and Hydrology, Flood Estimation Handbook Web Service [https://fehweb.ceh.ac.uk/].

Table 6.2: Greenfield Runoff Rates

Annual Probability (Return Period, years)	Greenfield Runoff (l/s)
QBAR	4.1
100% (1)	3.4
3.33% (30)	9.3
1% (100)	12.9
1% Plus Climate Change	18.1

Note: *40% added to the data to account for long-term climate change as stated in 'Flood Risk Assessment: Climate Change Allowance'. The 1 in 1-year, 30-year and 100-year annual probability events are of importance to the Water Companies and the Environment Agency when looking at sewage discharge and flood risk.*

6.5 Sustainable Drainage Options (SuDS)

Feasibility of SuDS

6.5.1 Soakaway testing was undertaken during July 2021. A copy of the Infiltration Test Report is included in Appendix 7. Findings show that shallow infiltration-based SuDS would not be feasible due to low infiltration potential.

6.5.2 Deep bore soakaways will be feasible with good infiltration rates encountered from 5.0mbgl.

Choice of SuDS Options

6.5.3 Sustainable water management measures should be used to control the surface water runoff from the proposed development Site, thereby managing the flood risk to the Site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the Site.

6.5.4 Current guidance promotes sustainable water management using SuDS. Options applicable to this Site are identified in Table 6.3.

Table 6.3: SuDS Options

Green roofs	Infiltration
Water butts	Detention basins
Permeable paving	Oversized pipes
Rainwater harvesting	Brown roofs
Filter strips	Swales
Wetland Areas	Cellular Storage

Note: *SuDS appropriate to the development are highlighted green.*

6.5.5 A hierarchy of SuDS techniques is identified[20]:

1. **Prevention** – the use of good Site design and housekeeping measures on individual Sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
2. **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
3. **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
4. **Regional Control** – management of runoff from several Sites, typically in a detention pond or wetland.

6.5.6 Using SuDS as opposed to conventional drainage systems provides several benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream.
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed Sites.
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources.
- Reducing potable water demand through rainwater harvesting.
- Improving amenity through the provision of public open spaces and wildlife habitat.
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

SuDS Maintenance

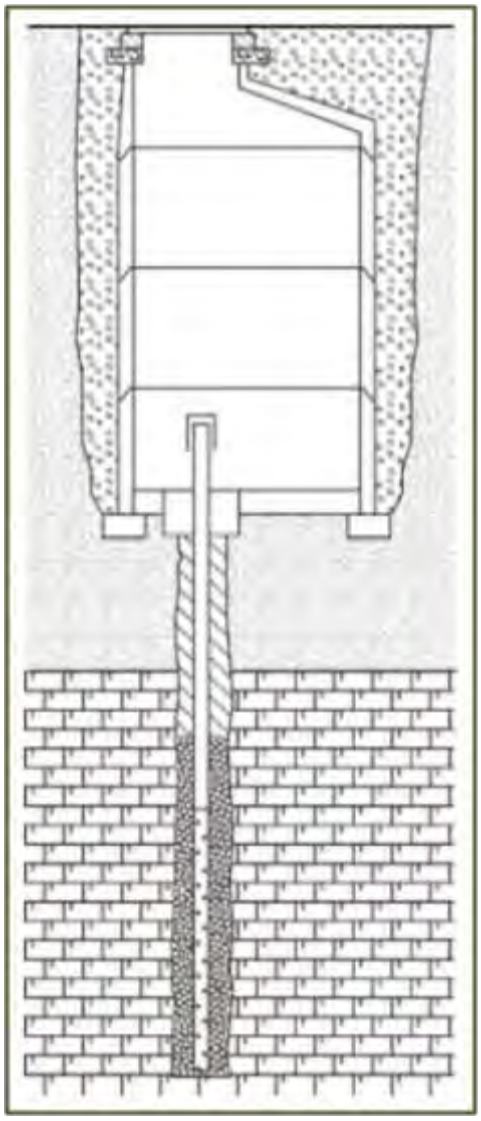
6.5.7 It is standard for SuDS features within a new development to be maintained by a private maintenance company unless the Council or Utility Company adopts it. If the maintenance company goes into administration, the Site will be contracted to a new maintenance company. Residents will pay a surcharge to the maintenance company and a number of them would be appointed to its board. This will ensure maintenance throughout the lifetime of the development.

6.5.8 Details of other SuDS features, and maintenance would be considered further at detailed design, when a detailed layout has been produced. The level of detailed provided within this FRA should be sufficient at outline stage to demonstrate that SuDS would be deliverable.

6.5.9 Due to the low infiltration potential of the clayey soils and superficial deposits, shallow soakaways would not be feasible. As such, borehole soakaways would be utilised. The borehole would be designed in line with Kent County Council Soakaway Design Guide (July 2000). A schematic extract is included in Figure 6.1.

[20] CIRIA (2004) Report C609, Sustainable Drainage Systems – Hydraulic, Structural and Water Quality advice.

Figure 6.1: Borehole Soakaway Schematic



SuDS Features and Maintenance

6.5.10 Detention basins will form the main attenuation features in the development Site, before discharging to borehole soakaways.

6.5.11 Maintenance of the SuDS features would be in line with the SuDS Manual (CIRIA C753, 2015), as detailed in Figure 6.2. The maintenance would be undertaken by a private maintenance company.

6.5.12 Example maintenance for boreholes soakaways is included below, extracted from Kent County Council (Kent Design Guidance: Making It Happen – Sustainability [Drainage Systems][21]):

6.5.13 It is standard for SuDS features within a new development to be maintained by a private maintenance company unless the Council or Utility Company adopts it. If the maintenance company goes into administration, the Site will be contracted to a new maintenance company. Residents will pay a surcharge to the maintenance company and a number of them would be

[21] https://www.kent.gov.uk/__data/assets/pdf_file/0010/13006/Making-it-Happen-C2-Drainage-systems.pdf

appointed to its board. This will ensure maintenance throughout the lifetime of the development.

6.5.14 Details of other SuDS features and maintenance would be considered further at detailed design, when a detailed layout has been produced. The level of detailed provided in this FRA should be sufficient at outline stage to demonstrate that SuDS would be deliverable.

Figure 6.2: Detention Basin Operation and Maintenance Requirements (Table 22.1 of the SuDS Manual)

TABLE 22.1 Operation and maintenance requirements for detention basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Borehole Soakaways

- Check inlets and pre-treatment measures for sediment build-up and structural damage. Note if any sediment needs to be removed.
- Undertake jetting and cleaning prior to adoption. Adequate access should be provided to an infiltration trench facility for inspection and maintenance.

- In the case of soakaway failure:
  - Rebore existing liner – a larger diameter borehole will normally be required, and problems may occur if the original or new borehole is not drilled vertically. Visual inspection of soil samples and further soakage tests will be required to assess soakage capacity of the strata. The stability of the area local to the chamber and the risk of leakage from the chamber must also be assessed.
  - Install replacement borehole soakaway elsewhere in the chamber – This will either require the cover of the chamber to be rotated or a core hole through the soakaway cover to provide access to the new borehole location. Coring through the cover will require approvals from the soakaway manufacturer and the adopting authority. Decommissioning of the failed deep bored liner may also be required.
  - Reconstruction of the chamber and deep bore at a new location – this may be required if the damage is severe. Decommissioning of the failed deep bored liner may also be required.

6.6 Surface Water Management Strategy

Hierarchy of Discharge

6.6.1 In accordance with requirement H3 of the Building Regulations 2000[22] rainwater runoff must discharge to one of the following, listed in order of priority:

1. **An adequate soakaway or some other adequate infiltration system:** The use of infiltration-based SuDS into the Chalk bedrock is considered feasible, based on borehole soakaway testing (Appendix 7).
2. **A watercourse:** There are no watercourses in the immediate vicinity of the Site.
3. **A sewer:** There are no public surface water sewers located within the immediate vicinity of the Site.

6.6.2 The potential route to discharge from the existing Site will be by infiltration to the Chalk bedrock.

Drainage Design

6.6.3 Surface water runoff would be directed to the drainage system through drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas.

6.6.4 Landscaped areas should be incorporated into the layout where possible, and the associated gardens of each unit will allow a proportion of the rainfall to infiltrate into the soil substrate.

6.6.5 Surface water will be directed to an onsite detention basin, which will then discharge to borehole soakaways. The borehole soakaways would be designed with a 15m easement (from buildings).

6.6.6 Water quality discharging to the borehole soakaways could be improved through the use of sediment traps, oil interceptors and SuDS features (i.e. detention basin).

[22] Office of the Deputy Prime Minister, The Building Regulations 2000.

6.6.7 An indicative drainage layout is in Drawing 101.

Attenuation Requirements

Developed Area (Roof Space and Highways)

6.6.8 Attenuation storage is required to reduce the post-application surface water runoff from the Site up to and including the 1 in 100-year (+40%CC) rainfall event.

6.6.9 The following input parameters were assumed in the calculations:

- Impermeable Area: 2.15ha (36.4%)
- Cv (proportion of rainfall forming surface water runoff): 75% summer, 84% winter
- Infiltration losses: 1.548m/hr (BH1 infiltration results)

6.6.10 The attenuation volume for the 1 in 100-year event (plus climate change) is 2,190m^3 (1,950m^3 –basin, 240m^3 – soakaways).

6.6.11 Attenuation calculations are included in Appendix 9. The calculated runoff rates and attenuation volumes will be reviewed at detailed design stage. Due to the limitations of the Source Control function in MicroDrainage the solution is modelled as one soakaway 5.1m diameter (equivalent to 17 no. borehole soakaways at 0.3m dia.) with associated storage at ground level.

6.6.12 It is proposed that the basin will retain a level of water for ecological purposes. Levels will be determined at detailed design stage.

Exceedance Routes

6.6.1 The onsite attenuation will be designed with a capacity up to a 1 in 100-year (plus 40% climate change) event, with a +300mm freeboard allowance. This provides a betterment (reduction) in runoff when compared to existing undeveloped conditions, where runoff is uncontrolled across all return periods.

6.6.2 A storm event in excess of this design standard would be extreme and would cause the detention basin to overtop (with no sudden deluge) and would then shed overland following the topography (north), as per existing conditions (Drawing 009).

6.6.3 Finished floor levels of new dwellings will be set above external levels, which will mitigate the residual risk of overtopping.

7.0 Summary and Conclusions

7.1 Introduction

7.1.1 A site-specific Flood Risk Assessment (FRA) has been undertaken for a proposed residential development, located on a 5.8ha Site on land of Swanstree Avenue, Sittingbourne, Kent.

7.2 Flood Risk

7.2.1 The risk of fluvial flooding is assessed as negligible.

7.2.2 The risk of surface water flooding is assessed as negligible.

7.2.3 The risk of flooding from all other sources is assessed as negligible.

7.3 Mitigation Measures

7.3.1 Flood risk mitigation measures are not required as the flood risk from all sources is assessed negligible however, the following approach will be implemented:

- Adoption of a surface water management strategy.

7.4 Flood Guidance

7.4.1 The proposed residential development use is classified as more vulnerable. More vulnerable uses are considered acceptable in terms of flood risk in Flood Zone 1. Subject to the implementation of the above mitigation measures, the Sequential Test would be passed, and the Exception Test would not be required.

7.5 Site Drainage

7.5.1 The proposed development will increase the area of impermeable surfaces and therefore increase the amount of runoff without mitigation.

7.5.2 Surface water runoff from the proposed development would be attenuated on-site up to and including the 1 in 100-year event, plus 40% climate change.

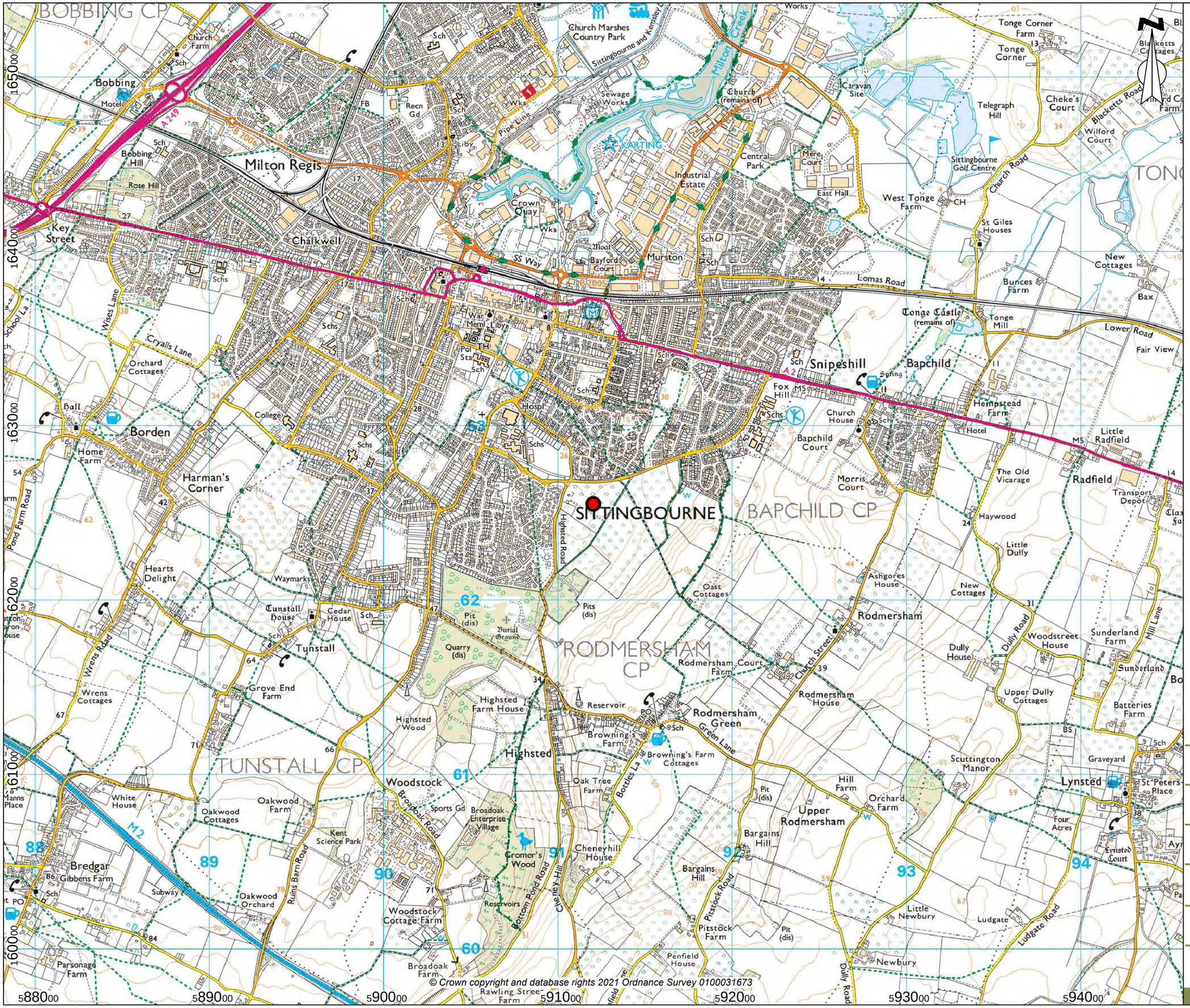
7.5.3 A SuDS drainage scheme is proposed to manage excess runoff from the development, comprising a range of SuDS features to improve water quality, before discharging to ground via borehole soakaways. Attenuation volumes have been designed to maintain runoff at pre-development rates.

7.6 Conclusion

7.6.1 This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of national policy and guidance.

7.6.2 The development should not therefore be precluded on the grounds of flood risk and surface water drainage.

DRAWINGS



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Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:20,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Site Location Plan

DRAWING NO: SHF.1132.260.HY.D.001

Key

Site Boundary

Surface Water Features
(none present)

Recreation Ground
Cemetery
PW
THE MEWS
Sittingbourne Memorial Hospital
Fulston Manor School
Highsted Grammar School
CAPEL ROAD
OAST COURT
BELL ROAD
BRENCHLEY ROAD
ROMAN BURIAL GROUND
STANHOPE AVENUE
GRAYSHOTT CLOSE
THE FINCHES
KESTREL CLOSE
MERLIN CLOSE
FULSTON PL
OSPREY COURT
GAZE HILL AVENUE
PEREGRINE DRIVE
HARRIER DRIVE
POND DRIVE
FARM CRESCENT
HAYSEL
HARVEY DR
FALLOWFIELD
HIGHSTED ROAD
BRENCHLEY RD
SWANSTREE AVENUE
WADHAM PLACE
NUTFIELDS
RECTORY ROAD
MIDDLE WAY
CAMBRIDGE ROAD
GLEBE LANE
PRINCE CHARLES AVENUE
STEP STYLE
BLENHEIM RD
LONGRIDGE
FAIRLEAS
ST JOHN'S AV
MANWOOD CL
COLE COURT
THE MEADOWS
BERGAMOT CL
BLUEBELL DRIVE
GERRARDS DRIVE
THE FAIRWAY
NORTHWOOD DRIVE
VINERS CL
SHURLAND AVENUE
ARUNDEL AVENUE
CROCUS DRIVE
JONQUIL CL
MARJORAM DRIVE
PRIMROSE AVE
IRIS DRIVE
CARNATION CRES
PEONY CRES
CROSSWAYS
MARIGOLD DR
Recreation Ground
Path
Workings (dis)
Track
Oast Cottages
MUDDY LANE
20m
23m
24m
26m
31m
34m
17m
18m
1630 00
1625 00
1620 00
5905 00
5910 00
5915 00
5920 00

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PROJECT REF: SHF.1132.260

DRAWN: MG

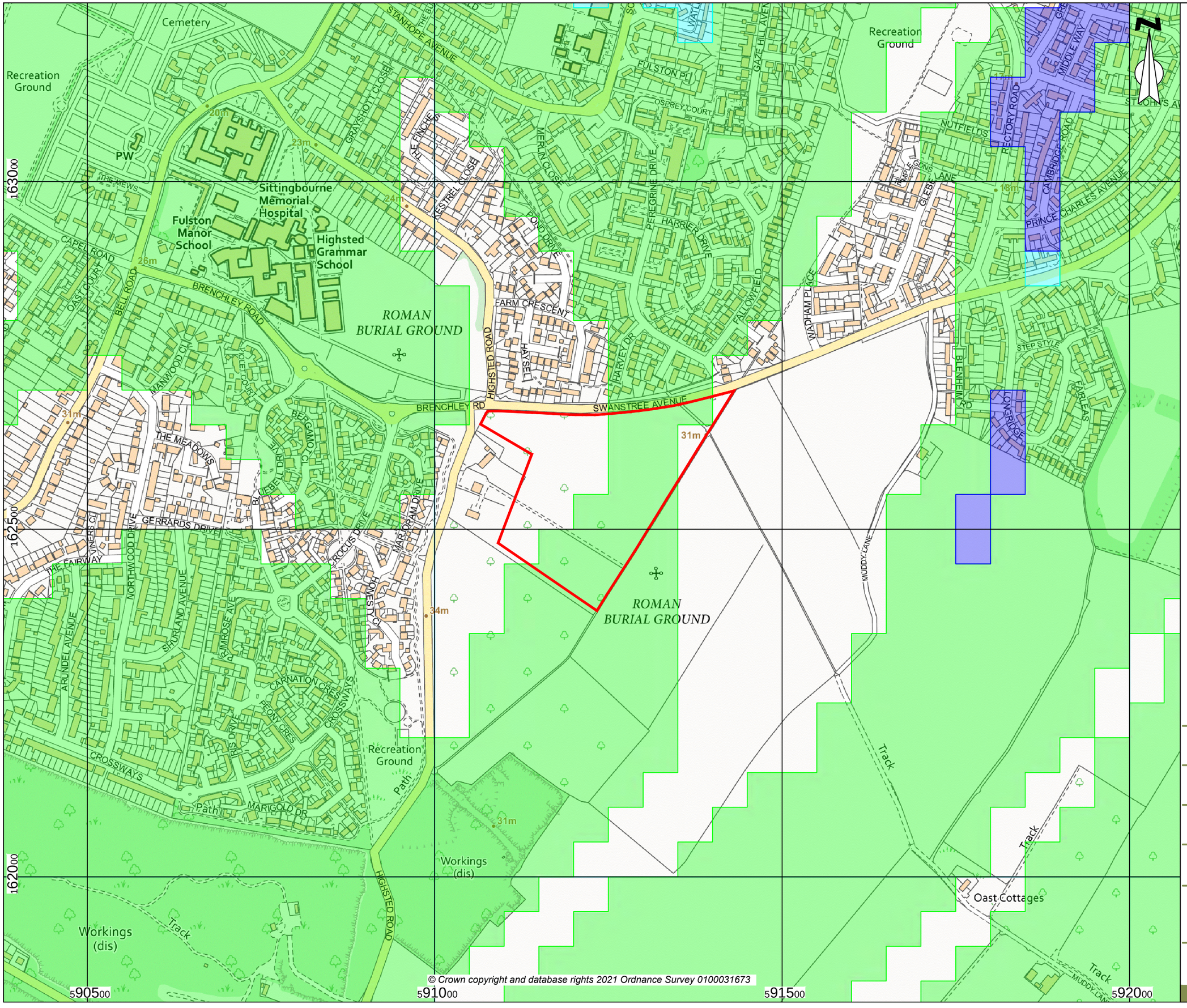
CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Surface Water Features

DRAWING NO: SHF.1132.260.HY.D.002



Key

- Site Boundary
- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

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CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

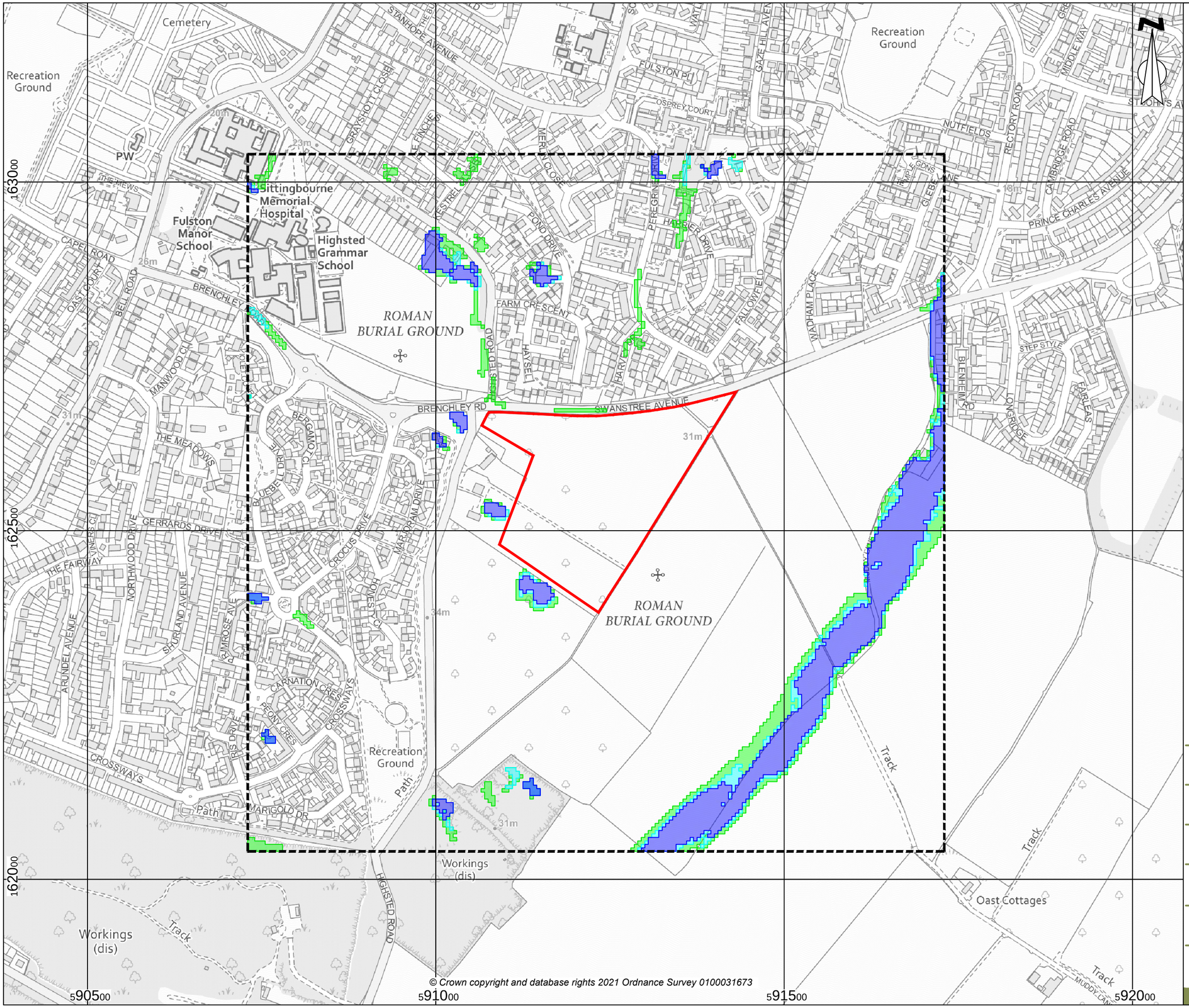
CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: BGS Groundwater Flooding Susceptibility

DRAWING NO: SHF.1132.260.HY.D.003



Key

- Site Boundary
- Search Extent
- 1 in 75 Year Surface Water Flooding
- 1 in 200 Year Surface Water Flooding
- 1 in 1000 Year Surface Water Flooding

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CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: JBA Surface Water Flooding

DRAWING NO: SHF.1132.260.HY.D.004

Key

- Site Boundary
- Flood Zone 3
- Flood Zone 2
- Flood Zone 1

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Environment Agency Flood Zones

DRAWING NO: SHF.1132.260.HY.D.005

Key

- Site Boundary
- Search Extent
- Class 1 - High Risk
- Class 2 - Moderate Risk
- Class 3 - Low Risk
- Class 4 - Negligible Risk

Notes:

GEOSMART GROUNDWATER FLOOD RISK MAP GW5
Version 2.3© - www.geosmartinfo.co.uk

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Groundwater Flood Risk Map

DRAWING NO: SHF.1132.260.HY.D.006

Key

- Site Boundary
- Search Extent
- High Potential
- Moderate Potential
- Low Potential

Notes:

GEOSMART SUDS INFILTRATION POTENTIAL MAP SD50
Version 1.0© - www.geosmartinfo.co.uk

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: SuDS Infiltration Potential Map

DRAWING NO: SHF.1132.260.HY.D.007

Key

- Site Boundary
- Search Extent
- 30 Year Extent
- 100 Year Extent
- 1000 Year Extent
- Flow Direction

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

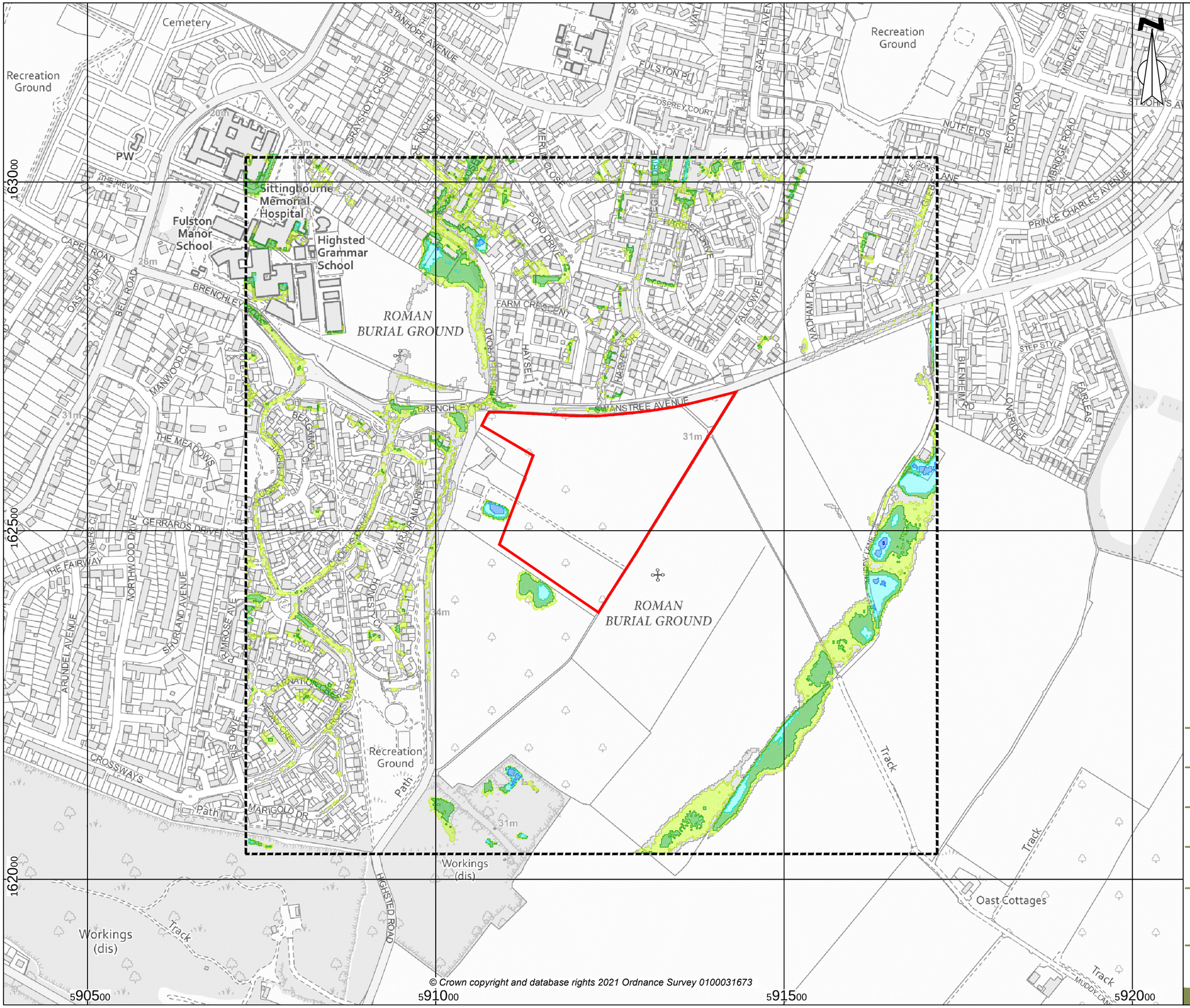
CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Environment Agency Surface Water Flow Paths

DRAWING NO: SHF.1132.260.HY.D.008.1



enzygo
environmental consultants

Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

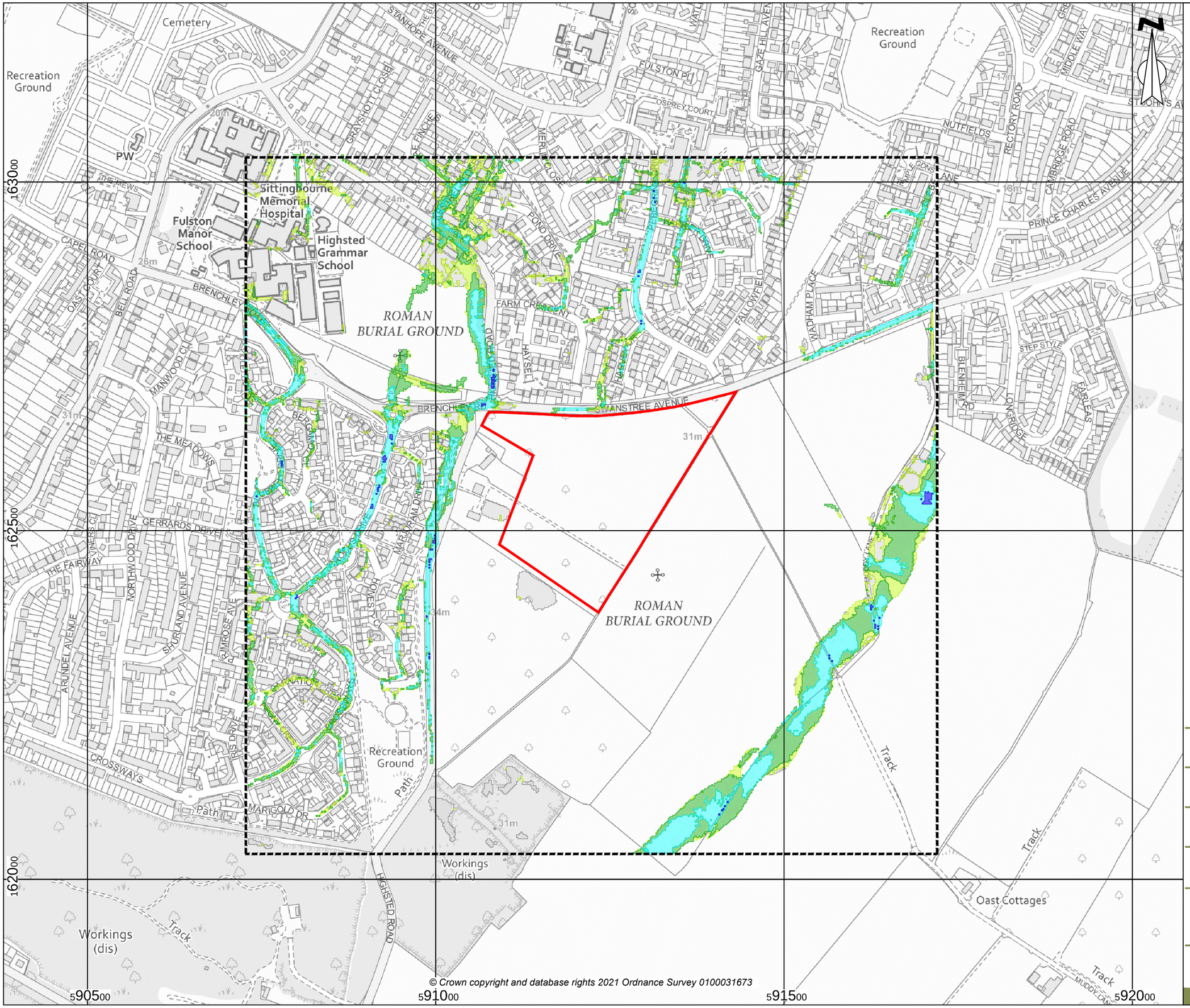
CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Environment Agency 1 in 1000 Year Surface Water Depth

DRAWING NO: SHF.1132.260.HY.D.008.2



enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Environment Agency 1 in 1000 Year Surface Water Velocity

DRAWING NO: SHF.1132.260.HY.D.008.3

Key

- Site Boundary
- Search Extent
- Extreme Hazard (> 2.0)
- Significant Hazard (1.25 - 2.00)
- Moderate Hazard (0.75 - 1.25)
- Low Hazard (0.50 - 0.75)

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:5,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

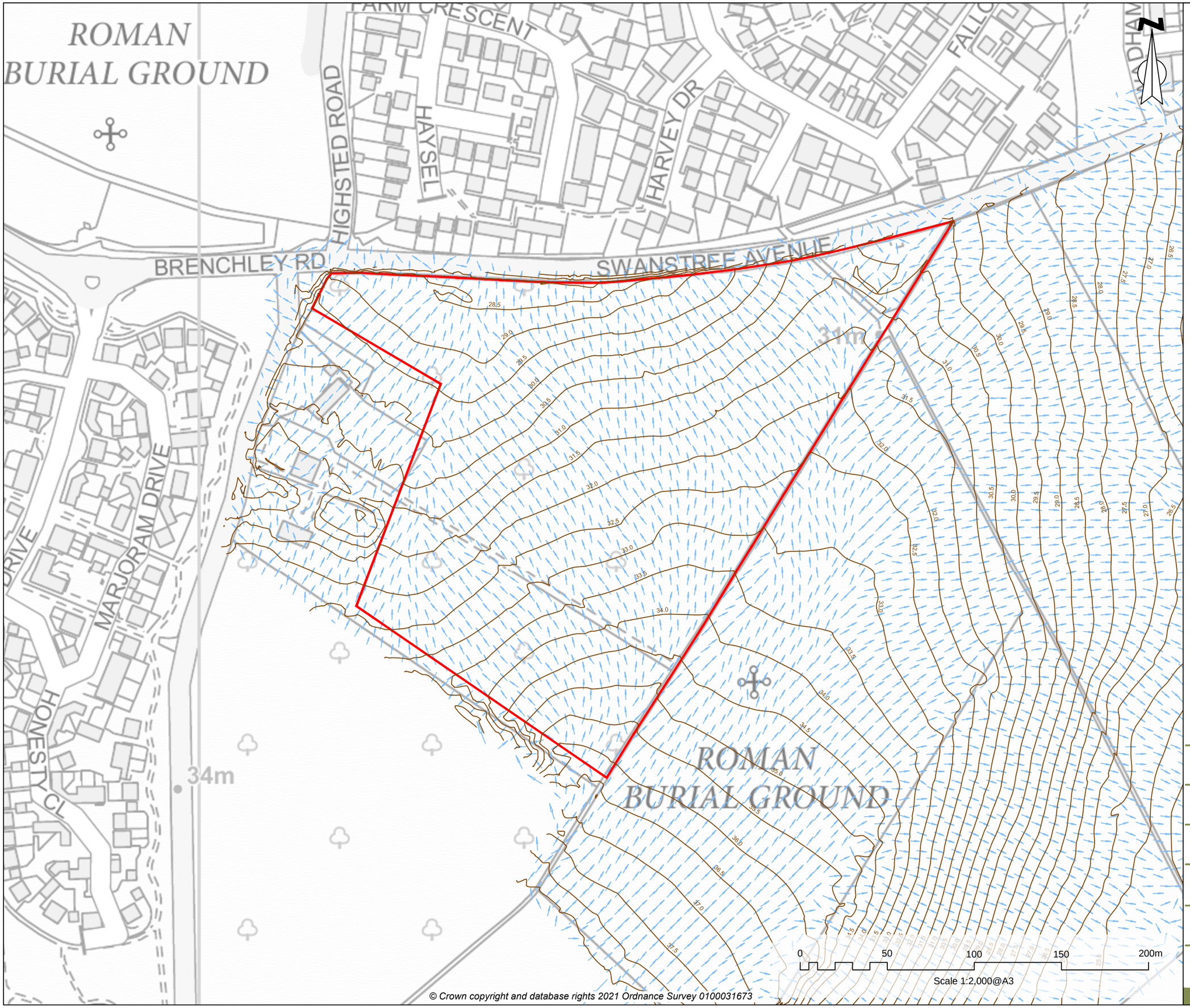
CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Environment Agency Surface Water 1000 Year Hazard Rating

DRAWING NO: SHF.1132.260.HY.D.008.4



Key

- Site Boundary
- Contours
  0.5m Intervals (mAOD)
- Surface Water Flow Path

Notes:

Ground Model Specification: Topographical Survey

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:2,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Flow Pathway Analysis

DRAWING NO: SHF.1132.260.HY.D.009

Key

- Site Boundary
- Borehole Location (BH) (BH1 - BH3)
- Soakaway Location (SA) (SA1 - SA3)

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:2,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

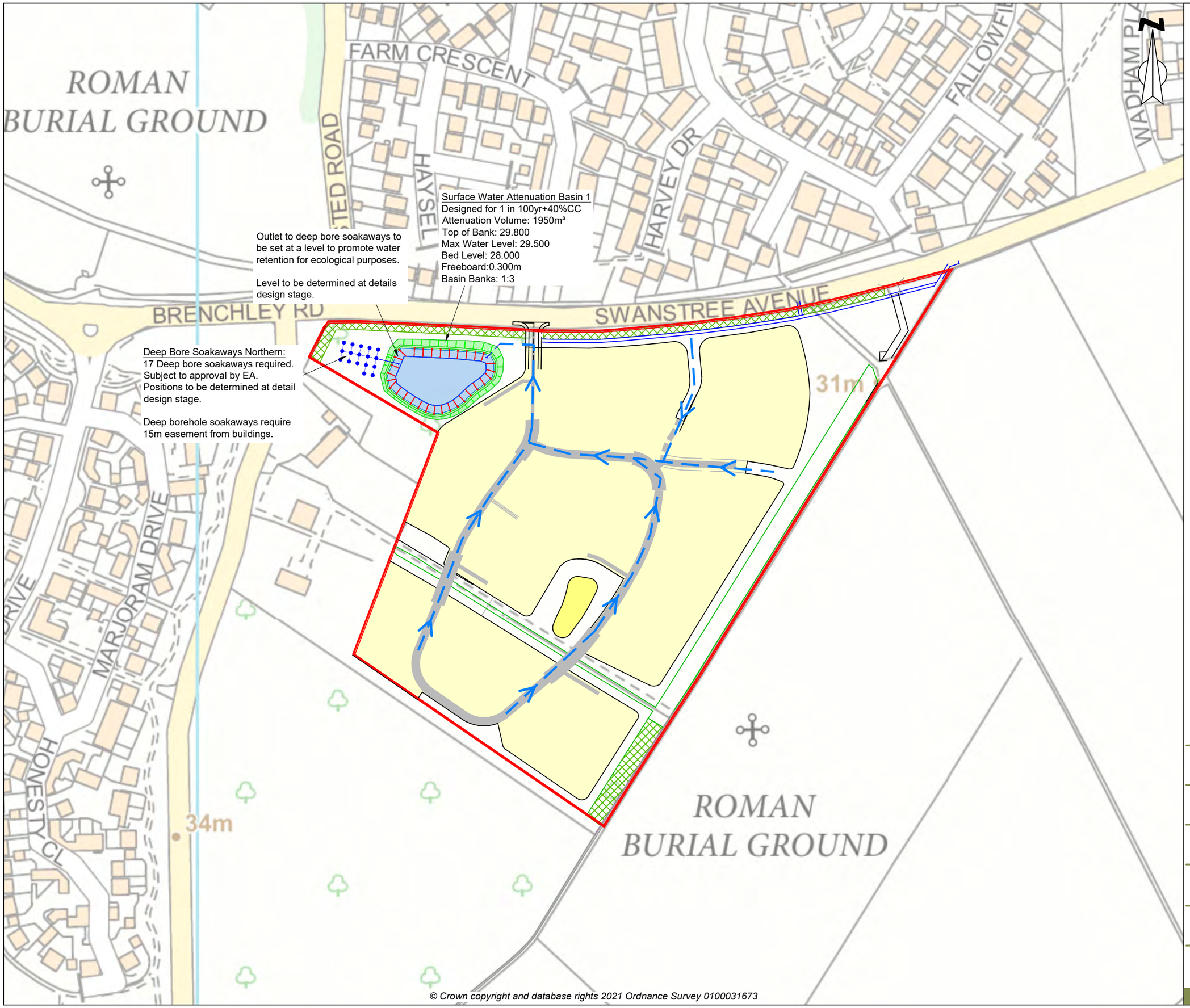
CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Location Plan

DRAWING NO: SHF.1132.260.HY.D.010



Key

- Site Boundary
- Indicative Surface Water Route
- Borehole Soakaway
- Headwall with Associated Pipework
- Developable Area

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:2,000@A3

PROJECT REF: SHF.1132.260

DRAWN: EA

CHECKED: EO'C

DATE: Sept 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Indicative Drainage Strategy

DRAWING NO: SHF.1132.260.HY.D.101.P03

APPENDICES

Appendix 1 – Topographic Survey

SURVEY ORIENTATED TO REAL TIME GPS

NOTES AND AMENDMENTS

ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED WITH LOCAL AUTHORITY RECORDS PRIOR TO WORK COMMENCING
Levels defining edge of carriageway are observed at channel (bottom of kerb). Unless otherwise stated.

TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE THE AVERAGE SPREAD. THE DRIP LINE LAYER DENOTES THE TREES EXTREMITY

REVISIONS

REV.	DESCRIPTION	DRAWN	CHKD.	DATE

0m 25m 50m
SCALE BAR 1:500

Topographical Survey Legend

Bol	Bollard	Hyd	Hydrant
Bin	Litter bin	IC	Inspection cover
BS	Bus stop	JB	Junction box
BT	British telecom ic	KO	Kerb outlet
CPS	Concrete paving slabs	LB	Letter box
CS	Cover slab	LP	Lamp post
Elec	Electrical ic	Mar	Utility marker
EP	Elec. pole	MP	Mile post
ER	Earth rod	NP	Name plate
FP	Flagpole	P	Post
FL	Floodlight	PM	Parking meter
G	Grille	RE	Rodding eye
GP	Gate post	RS	Road sign
GV	Gas valve	TV	Cable television cover

Fence annotation

B/W	Barbed wire
C/B	Closed boarded
C/I	Corrugated iron
C/L	Chain link
H/P	Hoarding panel
H/R	Hand rail
I/R	Iron railings
O/B	Open boarded
P/C	Post & chain
P/R	Post & rail
P/W	Post & wire
W/M	Wire mesh
rwp	Rain water pipe
SP	Sign post
SL	Street light
SB	Service Box
SV	Stop valve
TCB	Telephone call box
TL	Tie line
TP	Telephone pole
TPS	Tactile paving slabs
TS	Traffic signal light
TV	Television cover
VP	Vent pipe
WM	Water meter
U/L	Unable to lift

Level prefix descriptions

BC	Bed level
BL	Bed level
CL	Cover level
EH	Eaves level
FL	Floor level
OL	Overflow
PL	Parapet level
RH	Roof/ridge level
SL	Soffit level
Spr	Arch springing level
TH	Top of pipe/culvert
WL	Wall height
WL	Water level

BENCH MARK INFORMATION

All levels relate to OSBM Newyln
Datum Generated by VRS GPS

SURVEY STATIONS			
STN1	591799.070	162849.676	20.472
STN2	591690.596	162816.863	21.156
STN3	591545.952	162748.323	27.417
STN4	591395.296	162692.491	30.528
STN5	591258.634	162671.679	26.887
STN6	591053.282	162681.748	27.793
STN6A	591036.541	162585.887	30.047
STN7	590954.520	162669.925	28.308
STN8	590884.514	162686.406	29.191
STN9	590827.909	162725.552	28.471
STN10	590802.886	162742.983	28.054

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EMAIL:- peterlbounsell@jlpsurveys.com

PROJECT
Swanstree Lane
Sittingbourne

DRAWING TITLE
Topographical Land Survey

SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1:500	A0	4	18.06.14	

DRAWING NUMBER
S14/262-2

SURVEY ORIENTATED TO REAL TIME GPS

NOTES AND AMENDMENTS

ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

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REVISIONS

REV.	DESCRIPTION	DRAWN	CHKD.	DATE

0m 25m 50m

SCALE BAR 1:500

Topographical Survey Legend

Bol	Bollard	Hyd	Hydrant
Bin	Litter bin	IC	Inspection cover
BS	Bus stop	JB	Junction box
BT	British telecom ic	KO	Kerb outlet
CPS	Concrete paving slabs	LB	Letter box
DR	Drain	LP	Lamp post
Elec	Electrical ic	Mkr	Utility marker
EP	Elec. pole	MP	Mile post
ER	Earth rod	NP	Name plate
FP	Flagpole	P	Post
FT	Floodlight	PM	Parking meter
G	Gully	RE	Rodding eye
GP	Gate post	RS	Road sign
GV	Gas valve	TV	Cable television cover

Fence annotation

B/W	Barbed wire
C/B	Closed boarded
C/I	Corrugated iron
C/L	Chain link
C/P	Concrete panel
H/R	Hand rail
I/R	Iron railings
O/B	Open boarded
P/C	Post & chain
P/R	Post & rail
P/W	Post & wire
W/M	Wire mesh
rwp	Rain water pipe
SP	Sign post
ST	Stop tap
SB	Service Box
SV	Stop valve
TCB	Telephone call box
TL	Tie line
TP	Telegraph pole
TPS	Tactile paving slabs
TS	Traffic signal light
TV	Television cover
VP	Vent pipe
WM	Water meter
UTL	Unable to lift

Level prefix descriptions

AL	Arch level
BL	Bed level
CL	Cover level
EH	Eaves level
FL	Floor level
IL	Invert level
PL	Parapet level
RH	Roof/ridge level
SL	Soffit level
Spr	Arch springing level
Top	Top of pipe/culvert
WH	Wall height
WL	Water level

BENCH MARK INFORMATION

All levels relate to OSBM Newyln

Datum Generated by VRS GPS

SURVEY STATIONS			
STN1	591799.070	162849.676	20.472
STN2	591690.596	162816.863	21.156
STN3	591545.952	162748.323	27.417
STN4	591395.296	162692.491	30.528
STN5	591258.634	162671.679	26.887
STN6	591053.282	162681.748	27.793
STN6A	591036.541	162585.887	30.047
STN7	590954.520	162669.925	28.308
STN8	590884.514	162686.406	29.191
STN9	590827.909	162725.552	28.471
STN10	590802.886	162742.983	28.054

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Mobile - 07710 428498
EMAIL:- peterhouston@jlpsurveys.com

PROJECT
Swanstree Lane
Sittingbourne

DRAWING TITLE
Topographical Land Survey

SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1:500	A0	4	18.06.14	

DRAWING NUMBER
S14/262-3

N

SURVEY ORIENTATED TO REAL TIME GPS

NOTES AND AMENDMENTS

ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED WITH LOCAL AUTHORITY RECORDS PRIOR TO WORK COMMENCING

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THE DRIP LINE LAYER DENOTES THE TREES EXTREMITY

REVISIONS

REV.	DESCRIPTION	DRAWN	CHKD.	DATE

0m 25m 50m

SCALE BAR 1:500

Topographical Survey Legend

Bol	Bollard	Hyd	Hydrant
Bin	Litter bin	IC	Inspection cover
BT	BT cover	KO	Kerb outlet
BT	British telecom jc	KO	Kerb outlet
CPS	Concrete paving slabs	LB	Letter box
DR	Drain	LP	Lamp post
Elec	Electrical tc	Mkr	Utility marker
EP	Earth pit	MP	Marker post
ER	Earth rod	NP	Name plate
FP	Flagpole	P	Post
FT	Floodlight	PM	Parking meter
G	Gully	RE	Rodding eye
GP	Guide post	RS	Road sign
GV	Gas valve	TV	Cable television cover

Fence annotation

B/W	Barbed wire
C/B	Closed boarded
C/I	Chain link on iron
C/L	Chain link
C/P	Concrete panel
H/R	Hand rail
O/B	Open boarded
O/I	Open bloarded
P/C	Post & chain
P/R	Post & rail
P/W	Post & wire
W/I	Wire on iron
WP	Rain water pipe
SP	Sign post
ST	Stop tap
SB	Service Box
TC	Traffic cone
TCB	Telephone call box
TL	Tie line
TP	Telegraph pole
TPS	Tactile paving slabs
TS	Traffic control light
TV	Television cover
VP	Vent pipe
WM	Water meter
U/TL	Unable to tilt

Level prefix descriptions

AL	Arch level
BL	Bed level
CL	Centre level
CO	Cover level
FL	Floor level
IL	Invert level
PL	Parapet level
SL	Sill/Step level
SL	Soffit level
Spr	Arch springing level
Top	Top of pipe/culvert
WH	Wall height
WL	Water level

BENCH MARK INFORMATION

All levels relate to OSBM Newlyn

Datum Generated by VRS GPS

SURVEY STATIONS			
STN1	591799.070	162849.676	20.472
STN2	591690.596	162816.863	21.156
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STN4	591395.296	162692.491	30.528
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STN6	591053.282	162681.748	27.793
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STN9	590827.909	162725.552	28.471
STN10	590802.886	162742.983	28.054

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EMAIL:- peterbeaston@jlpsurveys.com

PROJECT
Swanstree Lane
Sittingbourne

DRAWING TITLE
Topographical Land Survey

SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1:500	A0	4	18.06.14	

DRAWING NUMBER
S14/262-4

ROMAN BURIAL GROUND

BRENCHLEY ROAD

HIGHSTED ROAD

HAYSSEL

HARVEY DRIVE

SWANSTREE AVENUE

Meadowsweet Walk

Snowdrop Walk

CROCUS DRIVE

BERGAMOT CLOSE

JEBELL DRIVE

Rose Walk

Fulston Manor Vistas

MARJORAM DRIVE

Daisy Walk

Track

Chilton Manor Farm

El Sub Sta

LB

CF

ESS

Ps

27.1m

29.3m

32.6m

SURVEY ORIENTATED TO REAL TIME GPS

NOTES AND AMENDMENTS

ONLY MANHOLES AND SERVICES VISIBLE AT TIME OF SURVEY SHOWN

DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED WITH LOCAL AUTHORITY RECORDS PRIOR TO WORK COMMENCING

Levels defining edge of carriageway are observed at channel (bottom of kerb). Unless otherwise stated.

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REVISIONS

REV.	DESCRIPTION	DRAWN	CHKD.	DATE

0m 25m 50m

SCALE BAR 1:500

Topographical Survey Legend

Bol	Bollard	Hyd	Hydrant
BT	BT cover	IC	Inspection cover
BS	Bus stop	JB	Junction box
BT	British telecom ic	KO	Kerb outlet
CPS	Concrete paving slabs	LB	Letter box
DK	Drain	LP	Lamp post
EM	Electrical ic	MH	Manhole cover
EP	Elec. pole	MP	Mile post
ER	Earth rod	NP	Name plate
FF	Flexgrille	P	Post
FT	Flexdight	PM	Parking meter
GP	Gate post	RG	Road gully
GP	Gate post	RS	Road sign
GV	Gas valve	TV	Cable television cover

Fence annotation

B/W	Barbed wire
C/B	Closed boarded
C/I	Corrugated iron
C/L	Chain link
C/P	Concrete panel
H/G	Hedge row
I/R	Iron railings
O/B	Open boarded
P/C	Post & chain
P/W	Post & rail
W/F	Wire fence
W/M	Wire mesh
rwp	Rain water pipe
SP	Slipn post
ST	Stop tap
SV	Soil vent pipe
SV	Stop valve
TCB	Telephone call box
TL	Tie line
TP	Telegraph pole
TS	Traffic signal cabs
TS	Traffic signal light
TV	Television cover
VP	Vent pipe
WM	Water meter
WL	Unable to lift

Level prefix descriptions

AL	Arch level
BL	Base level
CL	Cover level
EH	Eaves level
FL	Floor level
IL	Invert level
RL	Ridge level
RH	Roof/ridge level
SL	Soffit level
Spr	Arch springing level
Top	Top of pipe/culvert
WL	Water level
WL	Water level

BENCH MARK INFORMATION

All levels relate to OSBM Newlyn

Datum Generated by VRS GPS

SURVEY STATIONS

STN1	591799.070	162849.676	20.472
STN2	591690.596	162816.863	21.156
STN3	591545.952	162748.323	27.417
STN4	591395.296	162692.491	30.528
STN5	591258.634	162671.679	26.887
STN6	591053.282	162681.748	27.793
STN6A	591036.541	162585.887	30.047
STN7	590954.520	162669.925	28.308
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STN10	590802.886	162742.983	28.054

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PROJECT

Swanstree Lane
Sittingbourne

DRAWING TITLE

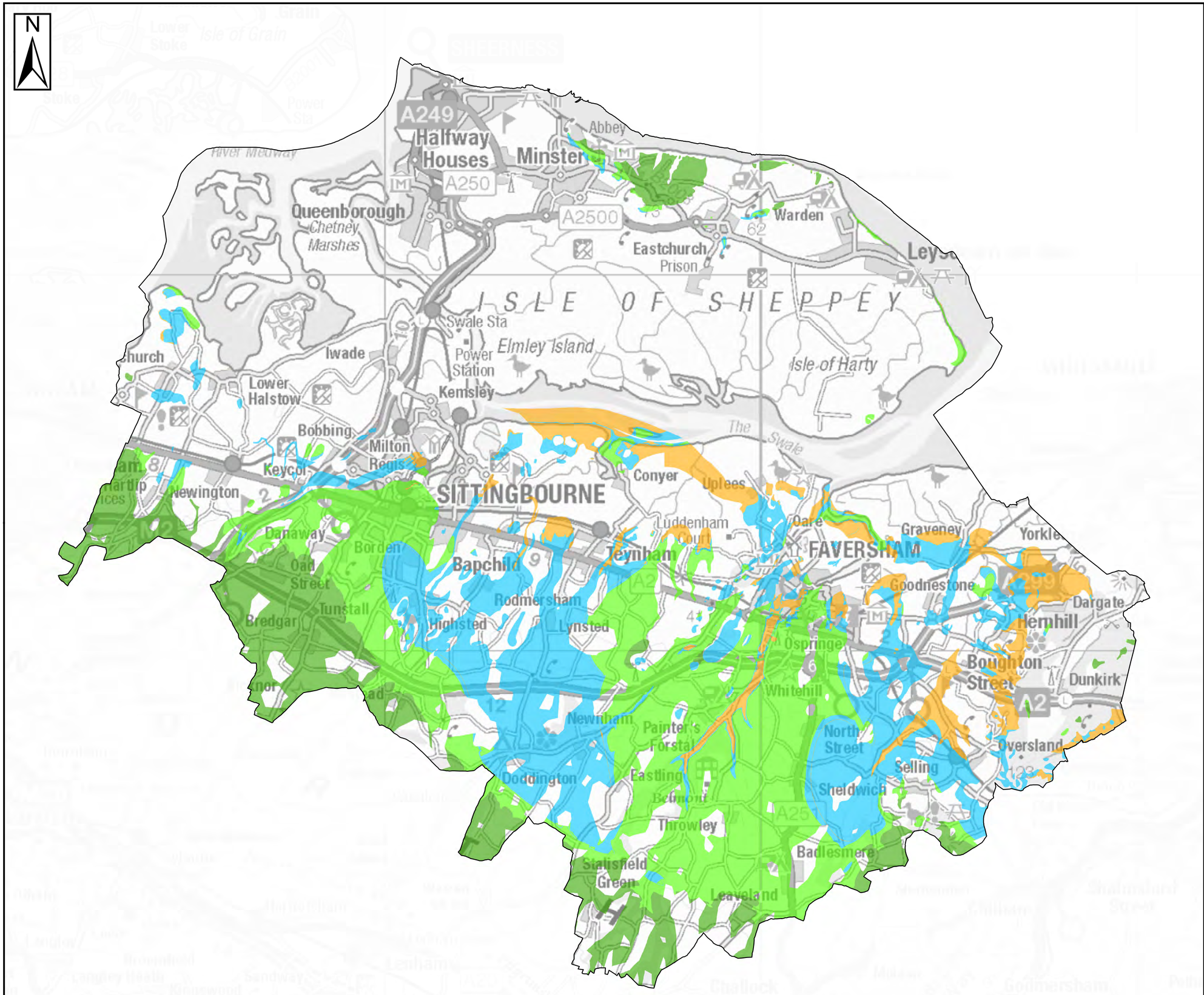
Topographical Land Survey

SCALE	SHEET SIZE	No. of SHEETS	DATE	REVISION
1:500	A0	4	18.06.14	

DRAWING NUMBER

S14/262-1

Appendix 2 – SFRA Mapping Extracts



Key Plan

Legend

Swale Borough

JBA Groundwater Flood Map Depths

- No risk.
- Groundwater levels are either at or very near (within 0.025m of) the ground surface.
- Groundwater levels are between 0.025m and 0.5m below the ground surface.
- Groundwater levels are between 0.5m and 5m below the ground surface.
- Groundwater levels are at least 5m below the ground surface.

Notes

The modelled groundwater levels are not predictions of typical groundwater levels, rather they are flood levels. The 5m resolution JBA Groundwater Flood Map categorises the head difference (m) between the predicted groundwater levels and the surface level into five feature classes based on the 100-year flood model outputs.

It should be noted that the JBA Groundwater Flood Map is suitable for general broad-scale assessment of the groundwater flood hazard in an area, but is not explicity designed for the assessment of flood hazard at the scale of a single property.

0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX F

JBA GROUNDWATER FLOOD MAP

JBA consulting

Swale Borough Council
Making Swale a better place

Key Plan

Legend

- Swale Borough
- Environment Agency Reservoir Flood Extents

Notes

The risk of inundation due to reservoir breach or failure of reservoirs within the area has been mapped using the outlines available from the Risk of Flooding from Reservoir dataset, made available by the Environment Agency. An Environment Agency programme for updating and improving this mapping is in progress and is due to be completed by 2020.

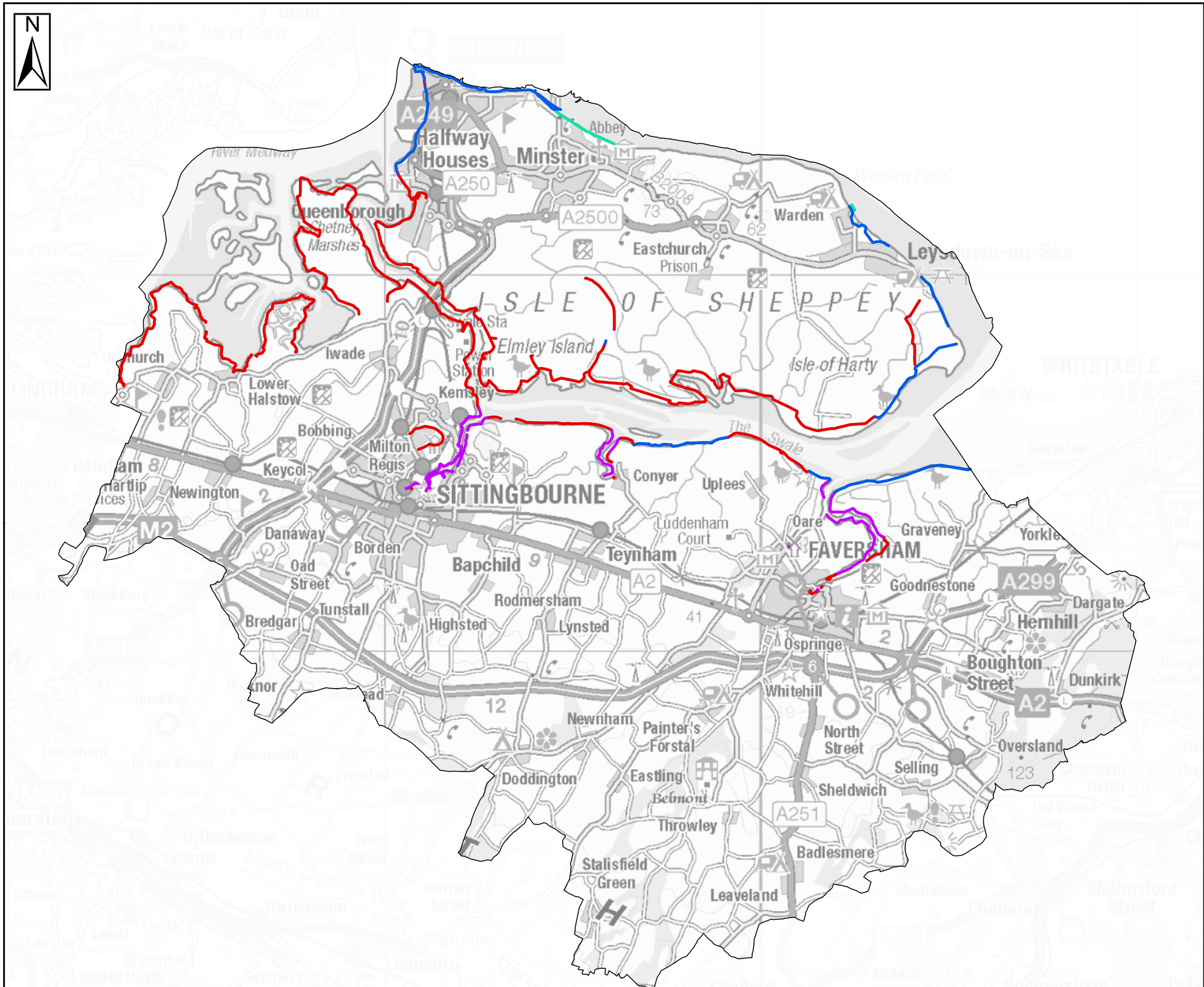
0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX G
RESERVOIR INUNDATION

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place



Key Plan

Legend

Swale Borough

Swale Borough Council defence protection type

Coastal

Environment Agency defence protection type

Coastal

Fluvial and Tidal

Tidal

Notes

Environment Agency defences are shown with a standard of protection which is against a 5% AEP event or more. Man-made and natural defences which may arise, for instance due to the presence of naturally high ground adjacent to a settlement, have been considered.

Many of the defences around the coastline are coastal defences. With climate change, it is likely that many of the coastal defences will need to become tidal defences in the future.

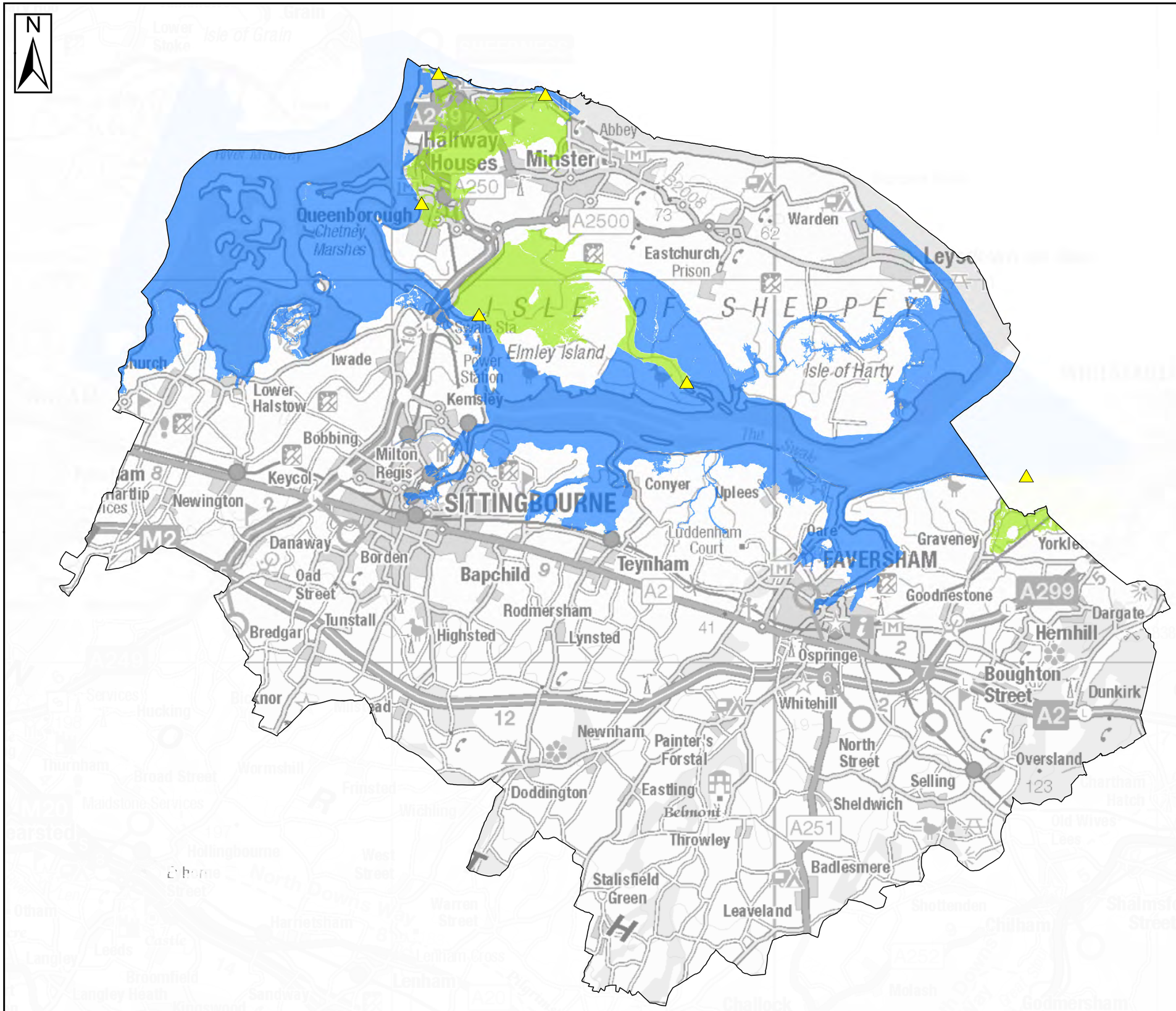
0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX H
FLOOD DEFENCES

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place



Key Plan

Legend

- Swale Borough
- Locations of modelled breaches
- Modelled breach flood extents
- Baseline flood extents (0.5% AEP)

Notes

Breaches modelled as part of the North Kent Coast modelling study (2019) that are predicted to impact flooding within the Local Plan area are shown. The total area predicted to be impacted by the breaches is represented as the areas shaded green, For further information on the predicted extents for individual breaches the modelling study should be referred to.

The locations selected for testing of breach failure were based on where the Environment Agency had identified area where a defence failure could have a high impact. The possibility of breach failure at other locations is plausible and further analysis should be undertaken as part of site-specific flood risk assessments where defences are present and sites may therefore be at risk of a breach event.

0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX I
MODELLED BREACH EXTENTS

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place

N

Key Plan

Legend

- Swale Borough
- EA Flood Warning Areas
- EA Flood Alert Areas

Notes

Flood Alerts are used by the Environment Agency to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. Flood Alerts are issued earlier than a flood warning to give notice of the possibility of flooding but before the Environment Agency are fully confident that flooding in Flood Warning Areas is expected.

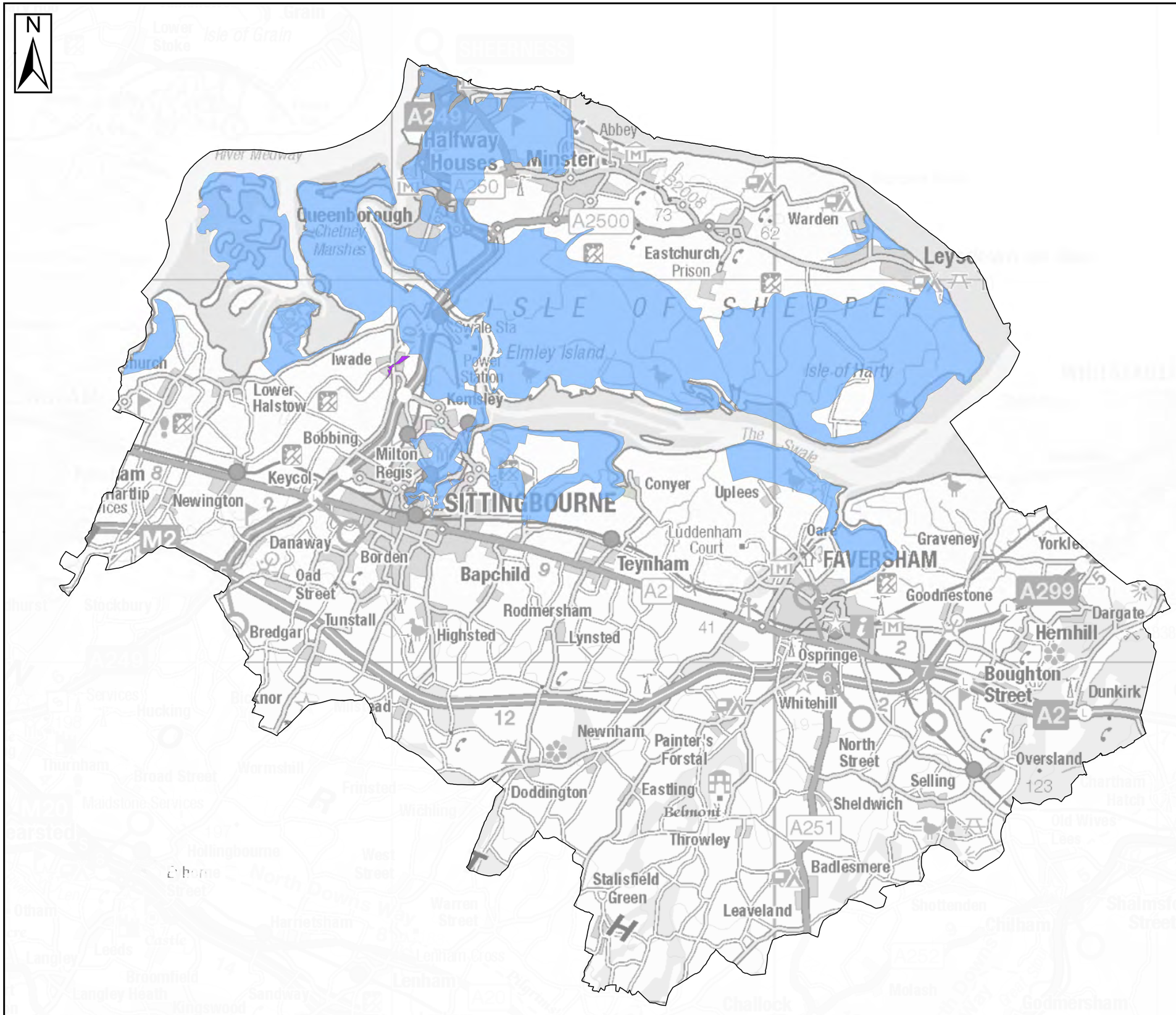
Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.

0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL
SFRA: APPENDIX J
ENVIRONMENT AGENCY FLOOD WARNINGS AND ALERTS

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place



Key Plan

Legend

Swale Borough

Enviornment Agency's Recorded Flood Outlines

Flooding from the sea

Flooding from Main Rivers

Notes

The Historic Flood Map shows the recorded flood outlines availabile from the Environment Agency. The dataset records historical flooding from rivers, the sea, groundwater and surface water.

It is possible that the pattern of flooding has changed and areas would now flood or not flood under different circumstances.

Please note that not all historical records may be shown on this map, and that it is therefore advised you contact the Environment Agency for updated information.

The map does not included recorded incidents of flooding held by Kent County Council or Southern Water.

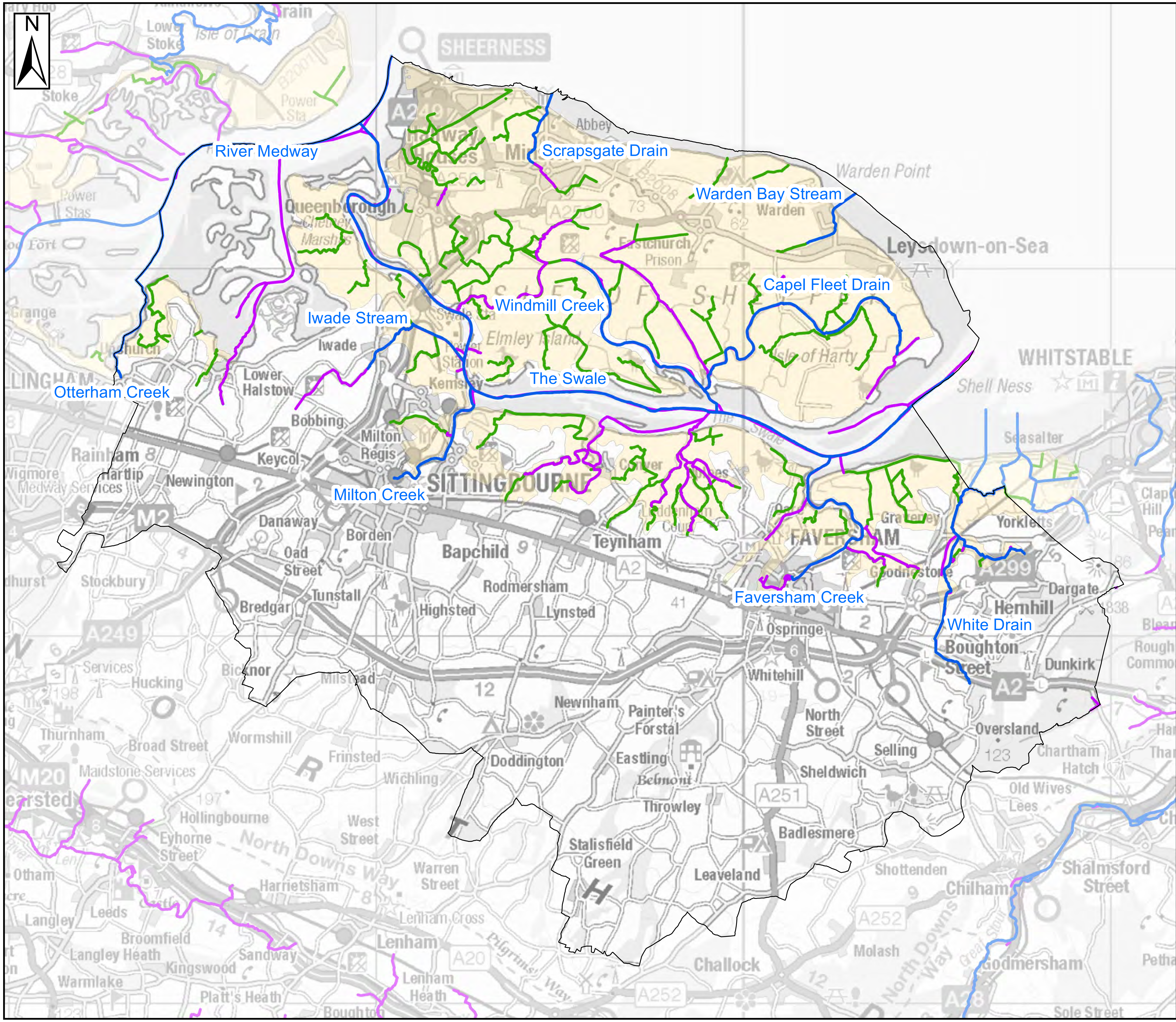
0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX A
HISTORIC FLOODING

JBA consulting

Swale Borough Council
Making Swale a better place



Key Plan

Legend

- Swale Borough
- Main Rivers
- Ordinary Watercourses
- Lower Medway Internal Drainage Board Watercourses
- Lower Medway Internal Drainage Board Administrative Area

0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX B
WATERCOURSES

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place

Key Plan

Legend

- Swale Borough
- Wave overtopping included in delineation of Flood Zone 3b
- Surface Water Functional Flood Zones
- Flood Zone 3a used to define Flood Zone 3b
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2
- Flood Zone 1

Notes

Flood Zone 1: Land assessed as having a less than 0.1% AEP of river or sea flooding.
Flood Zone 2: Land assessed as having a 0.1% - 1% AEP of river flooding or a 0.1% - 0.5% AEP of flooding from the sea.
Flood Zone 3a: Land assessed as having a greater than a 1% AEP of river flooding or a greater than a 0.5% AEP of flooding from the sea.
Flood Zone 3b: Land where water has to flow or be stored in times of flood (functional floodplain). The SFRA identified this Flood Zone as land which floods with an annual probability of 5% AEP where detailed modelling exists. Where the 5% AEP outputs are not available, Flood Zone 3a is used as a surrogate as a precautionary approach. If a proposed development is in Flood Zone 3, further analysis should be undertaken in a detailed site specific FRA to define and confirm the extent of Flood Zone 3b.

Areas of Flood Zone 3a occur in dry valleys as it is derived from generalised JFlow modelling, meaning flood risk in these areas is more likely to be associated with surface water flooding, rather than fluvial or tidal. Therefore, areas of Flood Zone 3b in dry valleys derived using the precautionary approach have instead been termed **Surface Water Functional Flood Zones**.

Areas where wave overtopping along the coastline has been included in the delineation of Flood Zone 3b are shown.
The Environment Agency regularly reviews its hydrology, hydraulic modelling and flood risk mapping. They should be contacted to determine whether updated (more accurate) information is available before starting a site-specific FRA.

0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX C
FLOOD ZONES

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place

N

Key Plan

Legend

Swale Borough

Tidal event

- 0.5% AEP 2070 tidal event
- 0.5% AEP 2115 tidal event

Fluvial event

- 1 % AEP plus 25%
- 1% AEP plus 35%
- 1% AEP plus 50% CC (Scrapsgate Drain only)
- 1% AEP plus 65% CC (Warden Bay only)
- 1% AEP plus 70% CC (Iwade Stream only)
- 1% AEP plus 105% CC (Scrapsgate Drain only)
- Flood Zone 2 - proxy for CC

Notes

Climate change extents for the 1% AEP event with the Central (25%) and Higher Central (35%) estimates (2070-2115) are shown. Differing Upper End estimates are shown for Iwade Stream (70%), Warden Bay (65%) and Scrapsgate Drain (50% and 105%).
Where no fluvial model was available, Flood Zone 2 has been used to provide indicative climate change information. Detailed site-specific hydraulic modelling using topographic survey is needed to confirm flood risk to these sites.
The North Kent Coast modelling study (2019) shows the tidal and coastal flood risk for the 0.5% AEP event for 2070 and 2115.
The Environment Agency climate change allowances may update in the future. Please refer to the latest allowances provided by the Environment Agency.

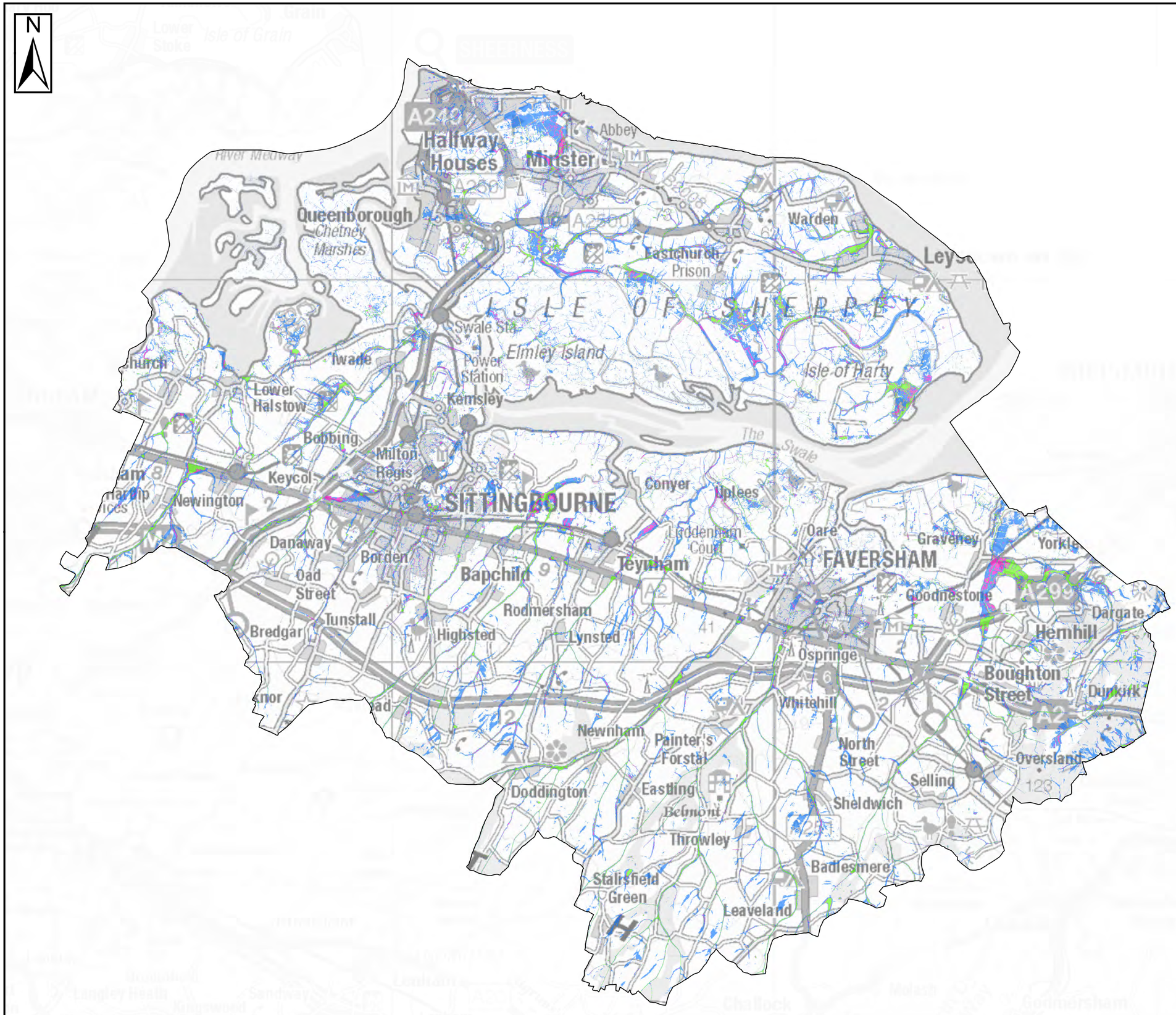
0 1.25 2.5 5 Kilometres

SWALE BOROUGH COUNCIL

SFRA: APPENDIX D
CLIMATE CHANGE

JBA consulting

Swale BOROUGH COUNCIL
Making Swale a better place



Key Plan

Legend

Swale Borough

Risk of Flooding from Surface Water return period

- 3.33% AEP (1 in 30-year)
- 1% AEP (1 in 100-year)
- 0.1% AEP (1 in 1000-year)

Notes

The Environment Agency's Risk of Flooding from Surface Water (RoFSW) model is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water.

The results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale.

0 1.25 2.5 5 Kilometres

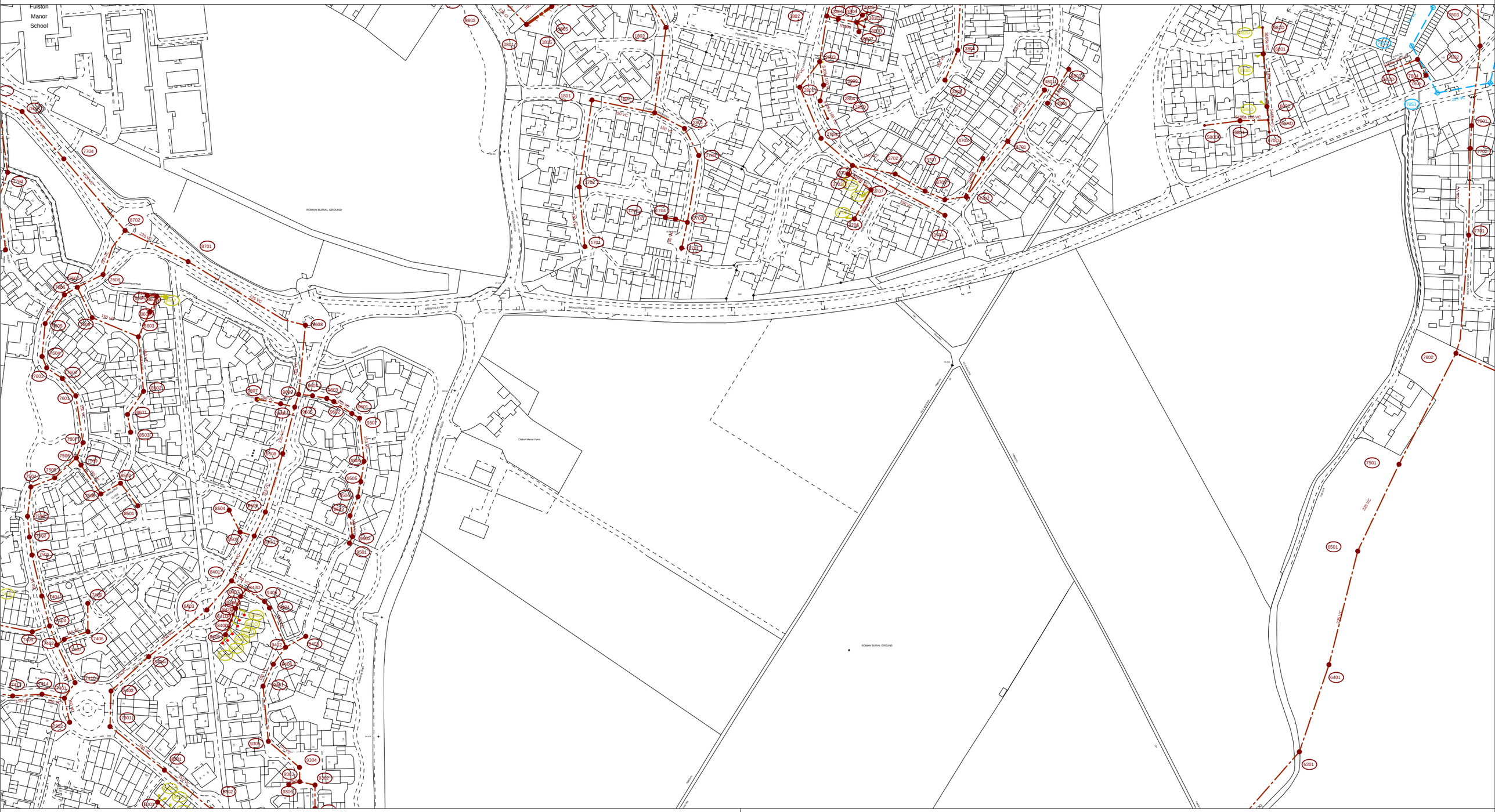
SWALE BOROUGH COUNCIL
SFRA: APPENDIX E
RISK OF FLOODING FROM SURFACE WATER

JBA consulting

Swale Borough Council
Making Swale a better place

Appendix 3 – Southern Water Sewer Asset Plans

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530

Southern Water

O.S. REF: TQ9162NW

Scale: 1:2500

N

Printed By: Mercy

Date: 8-3-2021

Sewer Plot

Site Plan

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Requested By:

Appendix 4 – Environment Agency Correspondence

Fraser McCarter

From: KSL Enquiries <KSLE@environment-agency.gov.uk>
Sent: 01 April 2021 10:27
To: Daniel Alstead
Subject: KSL 209273 AC - Swanstree Avenue, Sittingbourne

Dear Daniel,

KSL 209273 AC - Swanstree Avenue, Sittingbourne

Thank you for your request for information that was received on 17 February 2021. We apologise for the delay in our response and any inconvenience this may have caused. This is due to the national situation in respect of the coronavirus (COVID-19) pandemic, which is challenging for everyone at the moment.

We are taking safety measures for our staff, partners and customers against the spread of coronavirus (Covid-19), in line with current government and medical advice. For the latest information from the government, please go to https://www.gov.uk/government/topical-events/coronavirus-covid-19-uk-government-response.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

This site is located in an area of Flood Zone 1 where we do not have modelled flood levels.

We can confirm that we have no record of flooding (from rivers and/or the sea) for this location. You may wish to check with the Lead Local Flood Authority for this area, Kent County Council, who hold detailed records for surface water flooding.

Environment Agency pre application service

We are able to supply a preliminary opinion outlining the key environmental issues and opportunities which is free. For more detailed advice, guidance, review of draft report, meetings etc we can organise a cost recovery agreement which is chargeable.

We encourage early discussions to ensure environmental issues and opportunities are considered early in the planning process. If you would like a free preliminary opinion or our cost recovery service please complete the form in the link below and email back to kslplanning@environment-agency.gov.uk

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297018/LIT_9015_c2822b.pdf
Please be aware that you can access our flood map(s) for free http://apps.environment-agency.gov.uk/wiyby/cy/37837.aspx and here.

If you have requested this information to help inform a development proposal, then you should refer to the flood risk standing advice pages on our website

http://www.environment-agency.gov.uk/research/planning/82584.aspx

You can find further information about flooding and our flood maps on our website:

http://www.environment-agency.gov.uk/homeandleisure/floods/default.aspx

Please refer to the Open Government Licence which explains the permitted use of this information.

I trust this information is of use. If you have any further questions, please contact us and we will be happy to help.

If you have any further queries or if you'd like us to review the information we have provided under the Freedom of Information Act 2000 and Environmental Information Regulations 2004 please contact us within two months and we will happily do this for you.

Kind regards,

Alan Clarke

Environment Agency | 02084 746848 – If you are unable to reach us, please contact our National Customer Contact Centre on 03708 506 506

Customers and Engagement Team | Kent South London & East Sussex

Orchard House | Endeavour Park | London Road | West Malling | Kent | ME19 5SH

From: Enquiries, Unit
Sent: 18 February 2021 14:59
To: 'Daniel Alstead' <daniel.alstead@enzygo.com>
Subject: 210218/GS17 RE: FRA Enquiry - Swanstree Avenue, Sittingbourne

Dear Daniel,

I have passed your e-mail to the local customer team who will deal with your request.

The Freedom of Information Act and Environmental Information Regulations state that a public authority must respond to requests for information within 20 working days. However, due to the ongoing COVID-19 pandemic affecting staff and resources we may take longer than the 20 working days to reply. We will aim to provide an answer as soon as we can.

You can find more information about our service commitment by clicking on the link below:

https://www.gov.uk/government/publications/environment-agency-customer-service-commitment

You can contact our customer team directly on the contact details below, or call the National Customer Contact Centre on 03708 506506 who will transfer you to the area team.

Please quote your enquiry reference 210218/GS17 in any correspondence with us regarding this matter.

Customers & engagement team
Environment Agency - Kent, South London & East Sussex Area - KSLE@environment-agency.gov.uk

Kind regards,

Graham Shoebridge
Customer Service Adviser
National Customer Contact Centre
Environment Agency
☎ Tel: 03708 506 506
💻 Web Site: www.gov.uk/environment-agency

Click an icon to keep in touch with us:-

From: Daniel Alstead [mailto:daniel.alstead@enzygo.com]
Sent: 17 February 2021 19:12
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>; SUDS@kent.gov.uk
Cc: Eric O'Connor <eric.oconnor@enzygo.com>; Matt Travis <matt.travis@enzygo.com>
Subject: FRA Enquiry - Swanstree Avenue, Sittingbourne

Our Reference: SHF.1132.260 - Swanstree Avenue, Sittingbourne

Site Location: Swanstree Avenue, Sittingbourne, Kent, ME10 4UU (NGR. 591186, 162572)

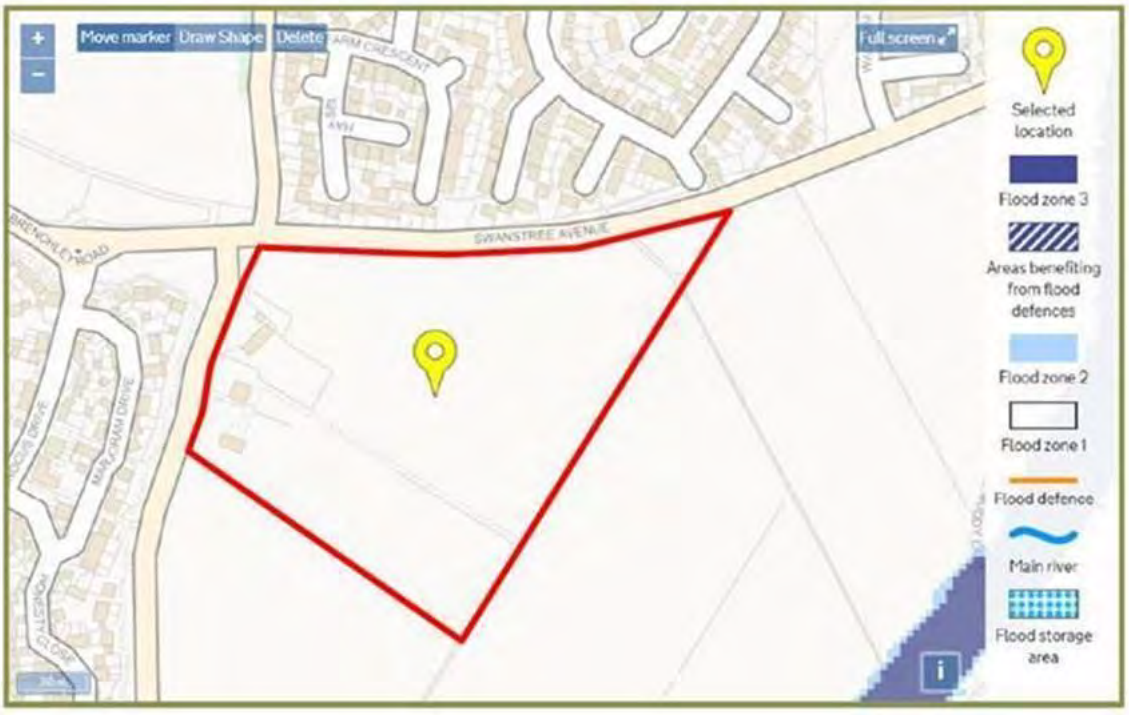
Introduction

Enzygo have been commissioned to undertake a Flood Risk Assessment [FRA] for a proposed outline planning application for a residential development, located on land [7.24-hectare] to the south of Swanstree Avenue, Sittingbourne. A location plan is included in Figure 1 and 2.

Ordnance Survey [OS] mapping shows there are no onsite our bounding watercourses.

Environment Agency online Flood Map for Planning [Figure 1] shows the Site is located in Flood Zone 1; which is land outside the 1 in 1000-year [0.1% Annual Exceedance Probability [AEP]] extent of fluvial [river] flooding, at 'low' risk.

Figure 1: Flood Map for Planning



Environment Agency online surface water mapping [Figure 2] shows most of the Site is located outside the mapped extent of surface water flooding. There is a small area of surface water ponding ['medium' to 'high' risk] in the western extent and just outside the and southern boundary.

Figure 2: Surface Water Mapping

Data Request

Could you provide us with flooding data? In relation to the Site, we would require clarification on the following points. Please note we are consulting with both the Environment Agency and Lead Local Flood Authority [LLFA].

Flood Risk

- Can you confirm the Flood Zone[s] within the Site boundary as described above?
- Please can you provide modelled flood levels, where available? Can you comment on the age of the model from which the levels have been extracted? Where the 1 in 100-year modelled flood levels do not include revised [February 2016] climate change allowances, would you allow an interpolated level, or would you require a model re-run?
- Do you have any records of historic flooding events on this Site, either from fluvial, surface water, groundwater, sewers or infrastructure failure sources? If you are aware of historical flooding at the Site, can you please provide us with details of these historical flood events where it is available, including flood levels, estimated return periods, photographs, and other such data as may be relevant to our study?
- Do you agree with our above interpretation of surface water flooding?

We understand the above questions are of a technical nature. Please can you quote us for any pre-planning enquiry fees required to address the above points and for further works [i.e. meetings] where you feel we would benefit from early discussions to address flood risk and drainage issues, in order to avoid issues at a later date.

Drainage

- Do you have any information on drainage within the Site and in the local area, including any known drainage problems?
- The proposal is for a development of a greenfield Site. Please could you indicate the maximum allowable discharge rate?
- What level of allowance for climate change would be required when considering surface water attenuation?

- Please can you also indicate to us whether you are aware of any relevant environmentally sensitive receptors [such as aquatic wildlife in receiving watercourses, etc.] in the area around the Site that we should be aware of when preparing the surface water drainage strategy?

Closure

We trust that the details presented herein are self-explanatory and clear. If, for any reason you should have any queries or comments, please do not hesitate to contact me.

Best Regards

Daniel Alstead BSc (Hons) MSc MCIWEM C.WEM
Associate Director

COVID-19 STATEMENT
Please be advised that Enzygo is continuing to operate and provide services to our clients whilst following Government and WHO guidelines. All staff can homework with access to our IT and phone systems which will provide minimal disruption to our service, but we appreciate your understanding if some communications are delayed.

Enzygo Ltd,
Offices in Bristol, Sheffield and Manchester

Landscape, Hydrology, Permitting, Ecology, Geo-environmental, Noise, Transport, Planning and Arboriculture

Tel: +44 (0) 114 321 5151
Mob: +44 (0) 7595 654 238
Email: @enzygo.com
Web: www.enzygo.com

Registered Office: Stag House, The Chipping, Wotton under Edge, GL12 7AD
Registered in England & Wales registered number: 06525159 VAT number: 238 259677

At Enzygo Ltd we merit any and all comments received from our clients, take pride in providing an excellent service and place value on our ability to correct error. Should you wish to comment on any aspect of the service that I personally, or Enzygo Ltd as a whole, have given you, please reply through my e-mail address above, or email hello@enzygo.com (in confidence - if appropriate).

Please consider the environment before printing this email

or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

Appendix 5 – Kent County Council Correspondence

Daniel Alstead

Flood and Water Management
Invicta House
Maidstone
Kent
ME14 1XX
Website: www.kent.gov.uk/flooding
Email: suds@kent.gov.uk
Tel: 03000 41 41 41
Our Ref: NON/2021/083181
Date: 12 March 2021

Application No: pre app

Location: Swanstree Avenue, Sittingbourne, Kent ME10 4UU

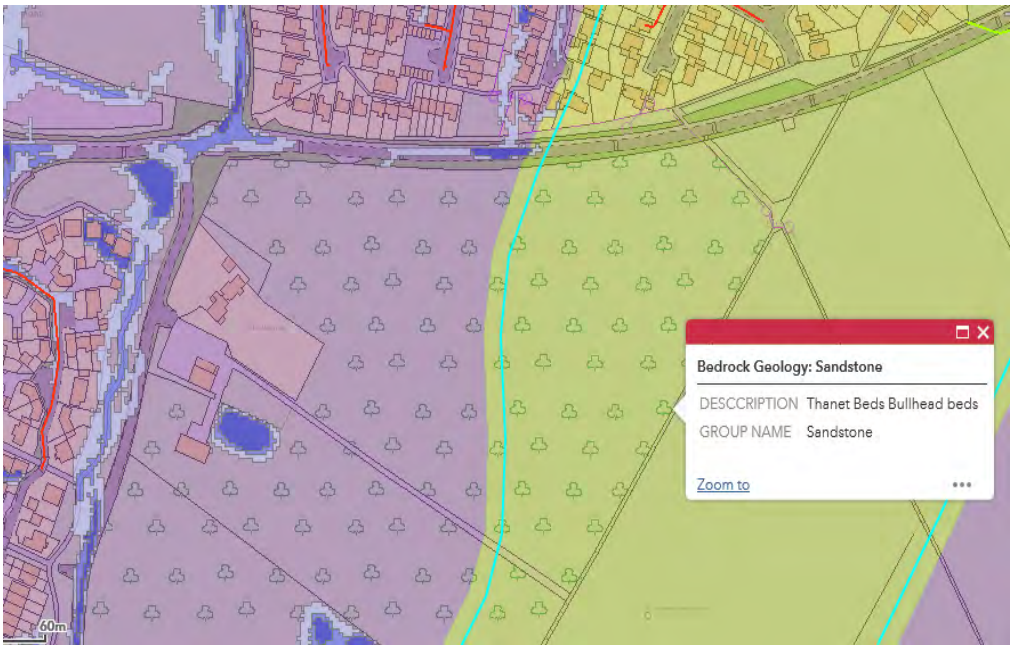
Proposal: Residential - outline

Thank you for your enquiry in relation to the above site.

We have reviewed our records that we hold for your site and we can provide you with the following information:

Site Conditions

The site conditions identified from mapping identifies the site is at a geoligcal boundary between Upper Chalk on the western part of the site and Thanet Beds (Sandstone) on the east section of site area, as shown below:



Both formations typically allows for infiltration but the Thanet Beds can have varying rates of infiltration and potential ground instability hazards to consider. There is also the presence of superficial deposits on site that may hinder shallow infiltration. British

Geological Survey mapping highlights that the superficial deposits may be poorly draining and may consist up to a depth of 3 metres. It is therefore advised that a full ground investigation is undertaken to ascertain the areas on site that provide the optimal areas for infiltration.

British Geological Survey mapping available to the LLFA notes that this area of interest is not likely to have shallow groundwater and water is likely below 5 metres ground level all of the year.

As noted from your enquiry email, Surface Water Flood Mapping from the Environment Agency does highlight any one area of "high" risk and a two additional "high" risks at the southern redline boundary. It is to our understanding that these area likely constitute to low spots in comparison to the surrounding area. Future site development will likely remove this highlighted risk.

Historic flood events

The LLFA are unaware of any on site flooding or serious off site flooding in the nearby area. A search of our KCC Highways Database has been carried out on the surrounding roads closest to the site. The database holds reports of flooding from members of the public. Most reports logged are in relation to road/ drainage issues only unless specified.

Highsted Road - Numerous reports of blocked drains and carriageway flooding have been reported along this road between 2012 and 2021. The latest report was logged on 03/03/2021. The report locations are not within the influence of the site area as they are situated either at the north section of Highsted Road (north of Swanstree Avenue) and at the south side coinciding with the junction with Cromers Road and Stockers Hill.

Swanstree Avenue - Nine reports of blocked gullies between 2008 and 30/10/2020. All instances logged appear to be related to the section of Swanstree Avenue by the Sittingbourne School and are not linked to the site of interest.

Brenchley Road - One report of blocked drain on the 21/03/2019. Drain located close to the Fulston Manor School (to the east of the site).

Runoff/ Discharge Rates and Pollution Control

Should for any reason infiltration not be possible, KCC would accept either a staged discharge from development areas or for the Qbar value to be used. For the staged discharge from site, it should be demonstrated that the rates for all storm up to and including the 100 year do not exceed the equivalent peak greenfield runoff rate. This is to ensure no increase in discharge rates off-site for lower storm return periods. Alternatively, as mentioned above, we would accept the Qbar value to be used should a complex control not be used.

As mentioned above, we would seek all developments to achieve as close to greenfield runoff rates as possible. Areas of previously developed land should as a minimum have a 50% reduction compared to the existing site. There are no known watercourse or ditches in the nearby vicinity of the site and as such it would be our understanding that a connection to a sewer would be the last option to discharge surface water form the site.

Please note that the entirety of the site is situated within a source protection zone (SPZ) 2 and considerably close to an abstraction zone (SPZ 1). All developments irrespective of source protection zones should safeguard water quality however, being close to groundwater abstraction is even more significant. Pollution controls will be required on site that provide treatment prior to discharge whether to the ground or watercourse.

We would expect to see demonstrated that surface water is managed appropriately, and that any new drainage system complies with the required total treatment levels as detailed within Ciria Suds Manual (2015) Part E section 26. This should be demonstrated within the future drainage strategy report.

Recommendation on surface water management within the development

As mentioned within the Vision Document produced by Scott Properties, infiltration testing has been undertaken and produced favourable results. Whilst the results of this testing have not been provided, it would appear that infiltration is likely feasible on site and as such it is expected that this will be utilised upon brining forward the strategy.

Failing infiltration, the only other option for surface water management would be a controlled discharge to the foul sewer, adhering to the runoff rate requirements stated above. This would be the least preferred option and would have to be explained/ demonstrated within the future drainage strategy report why.

Soakaways

As noted above, we would expect that the future drainage design would utilise infiltration where possible. It is likely that soakaways will feature predominately in the future design alongside above ground basins and swales.

For housing, KCC strongly advise against soakaway's or storage structures serving multiple properties being situated within the boundaries of a single property. This arrangement may be problematic in the future as ownership may be uncertain, maintenance obligations not defined and access to the feature not manageable. Any changes to this drainage measure would have the potential to impact a number of properties. Ideally these features would be located in open space/communal areas to avoid any conflicts between residents.

Furthermore, all infiltrating features should be sited at appropriate distances from building foundations which is at the advice obtained from the ground investigations and geo-technical engineers. This is particularly important given the underlying geology (see 'Site conditions' section above).

Swales and basins

Basin and swale features should be designed with side slopes of 1 in 4, or where space is limited the slopes, the slopes should be no greater than 1 in 3. The design of these features should also consider access and maintenance arrangements of these features. The CIRIA SuDs Manual recommends a minimum freeboard of 300mm is provided above the max water level. This is to prevent overtopping or minimize the amount of overland flow leaving the pond following intense storm events.

With recent experience on drainage design implementation, we recommend that these features are not considerably deep (greater than 1.5m deep). Whilst this limits the amount of storage within the basin, we would recommend that geo-cellular tanks are also installed beneath the basin to provide any additional storage needed.

Climate Change Allowance, Urban Creep and Exceedance

The design must accommodate and appropriately manage the 1 in 100-year storm with a 20% allowance for climate change. Additional analysis should also be undertaken to understand the flooding implications for a greater climate change allowance of 40%.

For residential developments, KCC require consideration is applied to future development of extensions and impermeable areas (urban creep). The allowance for increased impermeable area is dependent upon the density of housing proposed. The table below outlines our requirements and the percentage allowance that should be applied:

Table 3: impermeable area allowances for urban creep

Residential development density(Dwellings per hectare) (% of impermeable area)	Change allowance
≤ 25	10
30	8
35	6
45	4
≥ 50	2
Flats & Apartments	0

KCC would accept exceedance of the drainage network for 100-year storms however, it must be demonstrated as to the volume of exceedance, where it is to be held and the residence time above surface. The exceedance plan and routes must ensure that people and property are not at increased risk.

Useful Documentation

- Kent Design Guide Making it Happen (Drainage Systems) provides supporting guidance on drainage design alongside our requirements and recommendations. This is available to view and download at:

  https://www.kent.gov.uk/__data/assets/pdf_file/0010/13006/Making-it-Happen-C2-Drainage-systems.pdf

- Kent County Council Drainage and Planning Policy Statement (December 2019):

  https://www.kent.gov.uk/about-the-council/strategies-and-policies/environment-waste-and-planning-policies/flooding-and-drainage-policies/drainage-and-planning-policy-statement

I trust this information assists with your enquiries.

Yours faithfully,

Daniel Hoare
Flood Risk Project Officer
Flood and Water Management

Appendix 6 – BGS Borehole Logs

B
2

ADDITIONAL INFORMATION SHEET

Licence No. .....

272/TQ 96/19
20

Date of completion of well catalogue: Sept. 1962

Date of publication: 1964

Additional Sheet No. 1

DATE	*	ADDITIONAL INFORMATION	INIT.
17.10.66		Well disused. Owned by Cerebos Ltd., Willesden, N.W.10. former occupiers G.H. Dean and Co. Ltd. have now vacated site. WQ/272	VAM
		DATA Bank	

FILMED

* Insert Well Reference Letter, If More Than One Well At Site

P.T.O.

Section 6	Pumping test	Observ. well	Recorder	E.R. log

Geological Survey, Water Department South Kensington, London, S.W.7.

(4130) Wt.34984/P.S.127 5m 9/63 G.W.B.Ltd. Gp.863

DATE		ADDITIONAL INFORMATION	INIT.

FILMED

INSERT WELL REFERENCE LETTER, IF MORE THAN ONE WELL AT SITE

Additional Information Sheet No. .... Commenced ....

TQ 96 SW/5

TQ 9049 6280

272/20 **Messrs. G. H. Dean & Co., Ltd., Whitehall Preserve Works, Bell Road, Sittingbourne**

[illegible] +94. Shaft 56 × 4. R.W.L. +64. *By the Co., 1908.*
[illegible] by 8 in. bore. *Date unknown.* R.W.L. +63. P.W.L. +57. Yield 1,500 g.p.h.
194[illegible] [illegible]. +56. Electric pump. *Spring 1944.* R.W.L. +37½. *Aug. 1949;* +52.
P.W.[illegible]. Yield 2,500 g.p.h. *Oct. 1954.* R.W.L. +50½. *May 1958;* +48. P.W.L. +47.
Yield [illegible] g.p.h. *Oct. 1959.*

[illegible] 100 100

(94493)

.O.

ORVEY,
TMENT
NGTON,
.W.7.

TQ 9049 6280

272/20 Messrs. G. H. Dean & Co., Ltd., Whitehall Preserve Works, Bell Road, Sittingbourne

TQ 96/19

Surface +94. Shaft 56 × 4. R.W.L. +64. *By the Co., 1908.*
Deepened by 8 in bore. *Date unknown.* R.W.L. +63. P.W.L. +57. Yield 1,500 g.p.h. *1940.* R.W.L. +56. Electric pump. *Spring 1944.* R.W.L. +37½. *Aug. 1949;* +52. P.W.L. +52. Yield 2,500 g.p.h. *Oct. 1954.* R.W.L. +50½. *May 1958;* +48. P.W.L. +47. Yield 2,500 g.p.h. *Oct. 1959.*

UCk	...	...	100	100

272/20

272 TQ 96/19
20

17.10.66 VAR.

Whitehall Preserve Works, 60, Bell Road, Sittingbourne Kent.

Height above O.D. +94 Depth of well 50 ft., diameter 4 ft.

Made by G. H. Dean & Co in 1908. Water level 31 ft down, pumping water-level 37 ft. down. The yield is 1500 gallons per hour.

Analysis of water made in 1936

Uck 100 ft

DJG

Kent 33 NW/W
SW/E

Ref. 9509/30. Inf. from the Co. by letter

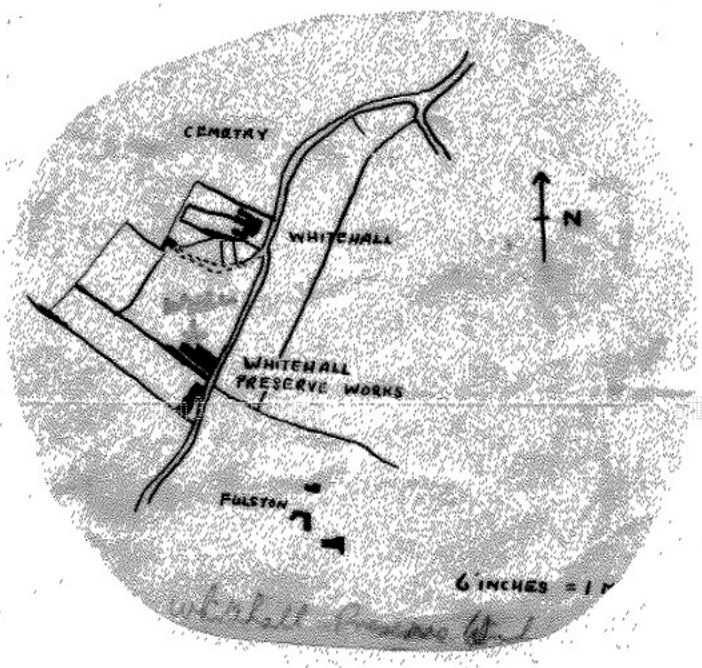
JMR 29. V. 40.

Extract from a report by Prof. H. L. Hawkins in ministry of Housing & Local Government File No 1635/7091. — p. 2 —

" Messrs Deans well — The well consists of a brick lined shaft (4 ft. in diameter) dug to a depth of 56 ft from the surface and a 8" bore from the shaft bottom that is said to reach to the depth of 100 ft. at the time of my visit (25th August 1949) the

1B

shaft was completely dry — when a light was lowered to the bottom no traces of seepage through the brickwork could be detected. The boring was full of water to within about 6" below the floor of the shaft; that is, 56.5 ft from the ground level."



"... pump is electrically driven ... bottom end of rising main is only 10ft down the boring .... near failure due to lowering of the water level .... pumping is reported to cause depression of 16ft."

Summary.—

Well top	+ 94' O.D.	
R.W.L.	+ 37' O.D.	August 25th 1949.
	+ 56' O.D.	Autumn & Spring 1949-50.
	+ 64' O.D.	1908. (Date of construction.)

"This indicates a very severe decline in the level of saturation, amounting to no less than 18'6" in five years."

Dafforn 3/3/53.

Visited. R.W.L. 44' 7½" down from top of brickwork which is 1' above ground level. In use. 5-5-58 ASR.

ie. RWL + 49½.

02

G. H. DEAN & CO. LTD.

Farmers and Fruit Growers

HEMPSTEAD
[redacted]

SITTINGBOURNE
KENT

272/20

TQ96/19

20

DIRECTORS:
SIR LESLIE DOUBLEDAY
G. L. DOUBLEDAY
D. J. DEAN

TELEPHONE
SITTINGBOURNE
[redacted]
3981

OUR REF. BHS/JAG

YOUR REF. 272/20

DATE 17th October 1966.

Institute of Geological Sciences,
Water Department,
Exhibition Road,
South Kensington,
LONDON S.W.7.

Dear Sirs,

We have received the enclosed letter from you which we think was addressed to our factory address at Whitehall Works, Bell Road, Sittingbourne. The Factory at that address has now closed down and perhaps you would amend your records accordingly.

Yours faithfully,
G.H. DEAN & CO. LTD.

(The well is at the factory in Bell Road & is not, of course, any longer in use. The factory is still owned by Beebox Ltd. Willesden, N.W.10.)

A.Lyp.C.
3.11.66
VAF

TQ 9108 6202 (c)

272/21 The Associated Portland Cement Manufacturers Ltd., Highsted Forstal, Sittingbourne (formerly Messrs. Smeed, Dean & Co., Ltd.)

(a) (Disused). Surface +76. Shaft 40 × 9; rest bore 12 in. Depth 125¼. *By the Co., 1926.*

P.W.L. +60. Yield 8,000 g.p.h. *1940.* R.W.L. +65.2/3. *May 1958.*

(b) Surface +75. Shaft 30 × 6; rest bore 9 in. Depth 130. *By the Co., before 1900.*

P.W.L. +57. Yield 8,800 g.p.h. *1940.* R.W.L. +44¼. Yield 4,200 g.p.h. *July 1950.* R.W.L. +51¼. P.W.L. +51¼. Yield 6,600 g.p.h. *Oct. 1955.* R.W.L. +53. Yield 7,160 g.p.h. *Oct. 1957.* R.W.L. +50. P.W.L. +46¼. Yield 4,200 g.p.h. *Oct. 1959.*

(c) Surface +75. Shaft 30 × 6; rest bore 9 in. *By the Co., 1900.*

P.W.L. +55. Yield 6,600 g.p.h. *1940.* R.W.L. +42¾. Yield 7,160 g.p.h., 16 h.p.d. *July 1950.* R.W.L. +53¼. P.W.L. +53¼. Yield 3,300 g.p.h. *Oct. 1955.* R.W.L. +48. P.W.L. +46¼. Yield 4,200 g.p.h. *Oct. 1957.* R.W.L. +50¼. P.W.L. +48¼. Yield 4,200 g.p.h. *Oct. 1959.*

(c) UCk	...	...	130	130

ADDITIONAL INFORMATION SHEET

Licence No.

TQ 9076 6195 A
TQ 9105 6201 B

272/21

Date of completion of well catalogue: Sept. 1962

Date of publication: 1964

* TQ 96 SW/6 A-B

Additional Sheet No. 1

DATE	•	ADDITIONAL INFORMATION	INIT.
26.10.66		R.W.L. Stalker Esq. A.P.C.M. attached	VAM
17.7.72	A	Estimated class:	
		UCk No strata details 125¾'	
	B	Estimated class:	
		UCk No strata details 130'	BH.

FILMED

• Insert Well Reference Letter, If More Than One Well At Site

P.T.O.

Section 6	Pumping test	Observ. well	Recorder	E.R. log

Geological Survey, Water Department South Kensington, London, S.W.7.

(4130) Wt.34963/P.S.127 5m 9/65 C.W.B.Ltd. Up.865

A. TQ 9076 6195
B. TQ 9105 6201
C. TQ 9108 6202

TQ96/18A-C

272/21 The Associated Portland Cement Manufacturers Ltd., Highsted Forstal, Sittingbourne (formerly Messrs. Smeed, Dean & Co., Ltd.)

(a) (Disused). Surface +76. Shaft 40 × 9; rest bore 12 in. Depth 125¾. *By the Co., 1926.*

P.W.L. +60. Yield 8,000 g.p.h. *1940.* R.W.L. +65.2/3. *May 1958.*

(b) Surface +75. Shaft 30 × 6; rest bore 9 in. Depth 130. *By the Co., before 1900.*

P.W.L. +57. Yield 8,800 g.p.h. *1940.* R.W.L. +44¼. Yield 4,200 g.p.h. *July 1950.* R.W.L. +51½. P.W.L. +51¼. Yield 6,600 g.p.h. *Oct. 1955.* R.W.L. +53. Yield 7,160 g.p.h. *Oct. 1957.* R.W.L. +50. P.W.L. +46¾. Yield 4,200 g.p.h. *Oct. 1959.*

(c) Surface +75. Shaft 30 × 6; rest bore 9 in. *By the Co., 1900.*

P.W.L. +55. Yield 6,600 g.p.h. *1940.* R.W.L. +42¾. Yield 7,160 g.p.h., 16 h.p.d. *July 1950.* R.W.L. +53½. P.W.L. +53¼. Yield 3,300 g.p.h. *Oct. 1955.* R.W.L. +48. P.W.L. +46½. Yield 4,200 g.p.h. *Oct. 1957.* R.W.L. +50¼. P.W.L. +48¼. Yield 4,200 g.p.h. *Oct. 1959.*

(c) UCk	...	...	130	130

272/21.

Kent. 33 NE/E.

272/21

The Associated Portland Cement Manufacturers Ltd., wells at the Chalk Pits near Highsted Forstal.

TQ96/18 A-C

The sites are given overleaf :—

	(a)	(b)	(c)
Shaft or well	40' deep × 9' dia.	30' deep × 6' dia.	30' deep × 6' dia.
Depth & dia. of borehole	85' 9" × 12 in.	100 ft × 9 in.	100 ft × 9 in.
Yield in gals per hour	8,000	8,800	6,600
Pumping water level	16' down	18' down	20' down
	Brick lined to depth of 20 ft. No lining tube.	Brick lined to depth of 20 ft. No lining tube	Brick lined to depth of 20 ft. No lining tubes.

UCK 130

Wells made by the engineering staff of Messrs Smeed, Dean & Co. Ltd., former owners of the pits.

M.O.N. file 9/222/16/1070
MTCP letter 18. VIII. 50 to HOM

No 1 borehole 4,200 g.p.h.
RWL 30ft 10 ins
No 2 borehole 7,160 g.p.h.
RWL 30ft 4 ins.
Total 16 hours pumping per day

J.V. 18.VIII.50

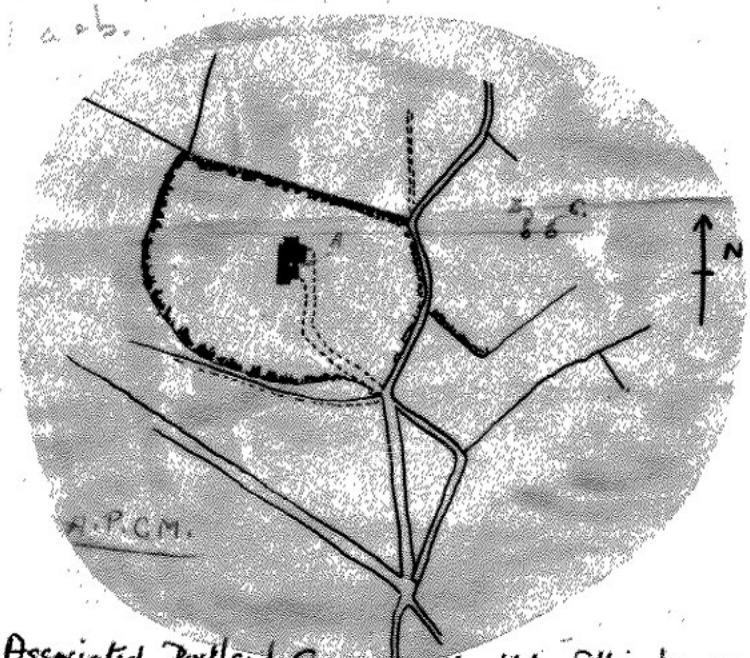
(See 272/25a well also at Hempstead Brick Co Ltd. 7,460 g.p.h. RWL 17ft Also pumping — wood lane Brickworks. KENT 33 NW At rock east of Bapchild.)

Inf. from letter from A.P.C.M. file 9508/30. 272/21

JAR, 30.V.40.

P.T.O.

2



Information from Associated Portland Cement Mfrs. Ltd. Sittingbourne - See WB/272/159 - Apr. 14th. 1953

a) Highstead New Quarry ? 80ft deep { Shaft 34'x9' dia. / Bore 46'(?)x12" } Pump Capacity. 12,000(?) g.p.h. Sunk 1926 by ~~A.P.C.M. Ltd~~ Drunstraple Cement Co.

b) Highstead Old Quarry No:1. ? 80ft. deep { Shaft 21'6" x6' / Bore 58'6"(?)x12" } Pump Capacity 8,800 g.p.h. Sunk pre 1900 Well sinker not known.

c) Highstead Old Quarry No: 2 ? 80ft. deep { Shaft 19'.6" x6' / Bore 60'.6"(?)x12" } Pump Capacity 4,400 g.p.h. Sunk 1900 Well sinker not known.

272/21(a)

Information from WB letter 13 July 1956. - boreholes cut off flush and pumps removed

Visited. (a) O.D.+76 R.W.L. 10' 4" down. Occasionally water is allowed to overflow into this well from the other two. Disused.

(b)+(c) In use. O.D. +c 75

5-5-58 ALR

ADDITIONAL INFORMATION SHEET

Licence No. 272/TQ96/18

21 A+B

Date of completion of well catalogue: Sept. 1962

Date of publication: 1964

Additional Sheet No. 1

DATE	*	ADDITIONAL INFORMATION	INIT.
26.10.66		R.W.L. Slade Esq. A.P.C.M. attached	VAM
17.7.72	A	Estimated class:	
		UCk No strata details 125¾'	
	B	Estimated class:	
		UCk No strata details 130'	BH.

FILMED

* Insert Well Reference Letter, If More Than One Well At Site

P.T.O.

Section 6	Pumping test	Observ. well	Recorder	E.R. log	Geological Survey, Water Department South Kensington, London, S.W.7.

(4130) Wt.34984/P.S.127 5m 9/63 G.W.B.Ltd. Gp.863

DATE	•	ADDITIONAL INFORMATION	INIT.
FILMED		INSERT WELL REFERENCE LETTER, IF MORE THAN ONE WELL AT SITE	

Additional Information Sheet No. .... Commenced ....

THE ASSOCIATED PORTLAND CEMENT MANUFACTURERS LIMITED

SITTINGBOURNE WORKS, MURSTON,

SITTINGBOURNE, KENT

Telephone SITTINGBOURNE 3241/2/3

Head Office:
PORTLAND HOUSE,
STING PLACE,
LONDON, S.W.1

OUR REF. TRD/MAB

YOUR REF. 272/21

26th October 66.

TQ 96/18B

Institute of Geological Sciences,
Water Department,
Exhibition Road,
South Kensington,
LONDON S.W.7.

Dear Sirs,

Ground Water levels - Highsted Quarry.

With reference to the detailed ground water level survey you are conducting, we enclose slip IGS Ref. No. 272/21 b & c on which we have added the information requested.

We think you should know that the rest levels given are not natural levels as the old Highsted Quarry was used by the Medway Water Board between 3rd October and 12th October 1966 as a receiving area for water when they tested their Highsted Pumping Station. During that period 7½ million gallons of water was discharged into the Quarry, most of which has now percolated into the ground and this has had considerable effect on our boreholes.

The rest levels taken just before the Medway Water Boards test are as follows:-

b No. 1 Borehole.

Date.	Rest level.
21. 9.1966.	17' 8"
1.10.1966.	19' 0"

Not used since 5th March 1966.

Cont/....

TQ 9140 6303

TQ 96/20

272/168 Messrs. C. Burley Ltd., Brick Works, Sittingbourne

Surface +70. Lining tubes: 54 × 8½ in from 3½ down. Water struck at +21, +13, -15 and -70. R.W.L. +42. P.W.L. +37. Yield 4,290 g.p.h. *LeGrand, Dec. 1936.*

Made	...	...	1	1
T	...	...	12	13
UCk	...	...	237	250

272/168

RECORD OF WELL (SHAFT OR BORE)

272

1" N.S. 272
1" O.S.
Grid Ref. TQ96/20
168

C. Burley Ltd.,

At Works

Town or Village Sittingbourne County Kent Six-inch quarter sheet

Exact site (A rough sketch-map or a tracing from a map is very desirable)

in parish of

Level of ground surface above sea-level (O.D.) 45 ft. If well starts below ground surface, state how far ft.

Shaft ft., diameter ft. Bore ft. Diameter of bore: at top ins.; at bottom ins.

Details of permanent lining tubes (internal diameters preferred) 54' x 8⅝" . Top 3'6" b.s.

Water struck at depths of (feet) 49', 57', 85', 140'.

Rest-level of water ~~above~~ below top of well 28 feet. Suction at feet. Yield on hours' / days' test

4,290 gallons per hour (with pump of capacity g.p.h.); depressing water level to 33 feet

below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.

Quality (attach copy of analysis if available)

Sunk by Le Grand S. & Co. or Mr. Date of well 2. 12. 36.

Information from Le Grand

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
Made	Top soil	1	-	1	-
Thanet Sand	Loamy Clay	12	-	13	-
Upper Chalk	Chalk and Flints	237	-	250	-
	JCAH 2.1.47. JMR.				
	Sited 15.2.40 another well at Rainham sited — by Mullins of Deal about 1928. JMR.				
	This well has not been used for many years & we have no records (Borden Wash Mill).				
	from Sec. 6 Corresp. 29.11.34. Rok.				
	FOR C. BURLEY LTD. J. M. Burley DIRECTOR.				
	Visited Well house bolted shut. Workmen required to open it. Quarry disused at present O.D. + c.70. (Used only in the winter) 5.58 ADK.				
	DATA Bank				

Kent 33 NW/W

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)
DEC 1939		

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

(*11815) Wt.29051/O.369 10,000 9/39 A.& E.W.Ltd. Gp.686

TQ 96 SW/12
9140 6303

2/[illegible] Messrs. [illegible] Burley Ltd., Brick Works, Sittingbourne

Surface [illegible] Dimensions: Cubes: 54 × 8½ in from 3¼ down. Water struck at +21, +13, -15 [illegible]-70. [illegible] Yield 4,290 g.p.h. *LeGrand, Dec. 1936.*

[illegible]	...	...	1
[illegible]	...	...	13
[illegible]	...	230	250

Appendix 7 – Soakaway Test Results

enzygo environmental consultants

Ducie House, Ducie Street
Manchester, M1 2JW

Tel: 0114 321 51 51
www.enzygo.com

FAO: Mike Heming,
Gladman Developments
Gladman House
Alexandria Way
Congleton
Cheshire
CW12 1LB

Date: 6th August 2021
Your Ref:
Our Ref: MAN.1132.260.GE.L.001
Email: m.heming@gladman.co.uk

Dear Mike,

SWANSTREE AVENUE, SITTINGBOURNE – INFILTRATION TESTING REPORT

Introduction

We are pleased to report the results of the infiltration testing undertaken at the above site.

Anticipated Geology

The British Geological Survey (BGS) Geology of Britain viewer indicates the site is underlain by the Head deposits [Clay and Silt] followed by the solid geology recorded as the Seaford Chalk Formation [Chalk].

Fieldwork

A Ground Investigation was undertaken at the above-named site between Monday 26th July and Wednesday 28th July 2021, comprising three soakaway pits [SA1 – SA3] and three boreholes [BH1 – BH3], with associated soakaway testing.

Trial Pit Soakaway Testing

Three soakaway test pits (SA1 – SA3) were established, and infiltration testing was undertaken in accordance with BRE 365 "Soakaway Design" guidance, 2016. The test pits were excavated to a depth deemed sufficient to 'represent' a section of the design soakaway. The soakaway pits were established to a maximum depth of 3.10m below existing ground level (begl) to represent infiltration for conventional soakaway assets inclusive of chambers and infiltration trenches. The soakaways were excavated using a JCB 3CX backhoe excavator with locations available in the drawings section. Weather was sunny with occasional heavy downpours, damp, with a light breeze. Once the soakaway test pits had been excavated, a tractor towed water bowser was used to rapidly fill the pits and the fall in water levels recorded.

Table 1: Pit Specifications

Pit Reference	Dimensions (m)		
	Width	Length	Depth
SA1	0.60	2.20	3.10
SA2	0.60	2.60	2.80
SA3	0.60	3.00	3.00

All soakaways were filled with water to the depths indicated in the appended results, and the subsequent fall in water level was recorded against time.

Borehole Permeability Testing

Three cable percussive boreholes (BH1 to BH3) were advanced to a depth of 10m begl. Falling head tests were undertaken during the drilling works, between depths of approximately 5.00m and 10.00m begl. One cycle of testing was attempted at each test location depth. Groundwater was not encountered within any of the boreholes prior to commencement of the falling head tests. The results are summarised in Table 3 overleaf, with results, exploratory hole logs and a soakaway location plan are included within the appendices.

Ground Conditions

Ground conditions typically comprised [up to 400mm] Topsoil; typically overlying sandy gravelly Clay, fine to medium Sand or silty Sand and Gravel of flint [Head]; this in turn overlies the solid geology of the Seaford Chalk Formation encountered at depths between 4.50m [BH1] and 9.20m [BH2] begl. Groundwater was not encountered, however, all three boreholes were installed with a 50mm pipe to carry out future groundwater monitoring, should this be required.

Results and Conclusions

Infiltration rates were not shown to be favorable at the shallow soakaway locations [SA1 – SA3] as they did not achieve the required '25% effective depth' within an appropriate timescale and consequently results were required to be extrapolated.

Infiltration rates were shown to be more favourable within the deeper boreholes [BH1 – BH3] as they did achieve a 25% effective depth within an appropriate time scale. Infiltration rates are given in Table 2 & 3 below and included within the appendices.

Table 2: Soakaway Infiltration Rates

Test Pit	Soakaway Infiltration Rate (m/s)			Worst case Infiltration rate (m/s)
	Test 1	Test 2	Test 3	
SA1	1.44E-06	1.30E-06	1.59E-06	1.30E-06
SA2	Insufficient Uptake	Insufficient Uptake	Insufficient Uptake	N/A
SA3	1.63E-06	1.36E-06	2.20E-06	1.36E-06

Ducie House, Ducie Street
Manchester, M1 2JW

Tel: 0114 321 51 51
www.enzygo.com

Table 3: Borehole Soakaway Infiltration Rates

Exploratory Hole	Depths (m begl)	Soakaway Infiltration Rate (m/s)	Worst case Infiltration rate (m/s)
		Test 1	
BH1	4.00 – 5.00	2.92E-05	2.92E-05
	7.00 – 8.00	1.70E-04	1.70E-04
	9.00 – 10.00	4.30E-04	4.30E-04
BH2	5.00 – 7.00	3.07E-05	3.07E-05
	7.50 – 9.50	2.97E-04	2.97E-04
BH3	5.50 – 7.50	2.30E-03	2.30E-03
	8.50 – 10.00	3.76E-03	3.76E-03

Please note that borehole permeability testing is likely to give more conservative full scale soakage tests.

Recommendation

Based upon the available data, shallow soakaways did not yield good infiltration rates, however, deeper borehole permeability testing did. This indicates that a deep soakage solution should be feasible for the proposed development, with appropriate consents and permits from EA and / or other require regulatory bodies as required.

Yours sincerely,

Nigel Ramsumair
Senior Engineer

Enc. *Exploratory Hole Plan*
Soakaway Test Results

Key

- Site Boundary
- Borehole Location (BH) (BH1 - BH3)
- Soakaway Location (SA) (SA1 - SA3)

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Gladman Developments Ltd

SCALE: 1:2,000@A3

PROJECT REF: SHF.1132.260

DRAWN: MG

CHECKED: EO'C

DATE: July 2021

PROJECT: Swanstree Avenue, Sittingbourne

TITLE: Location Plan

DRAWING NO: SHF.1132.260.HY.D.010

Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site				BH1
Sittingbourne				
Job No: SHF.1132.260	Dates: Start 26-07-21, Finish 26-07-21	Ground Level (m)	Co-Ordinates	
Client: Gladman Developments				Sheet: 1 of 1

Well	Water Levels	Samples & In Situ Testing: Depth (m)	No/Type	Results	Depth (m)	Level (mAD)	Legend	Stratum Description
					0.30			Brown sandy TOPSOIL. Sand is fine to coarse
		1.20	SPT	N=6				Very soft brown slightly silty sandy CLAY. Sand is fine to medium. [Head]
		2.00	SPT	N=6				
		3.00	SPT	N=4				
					3.50			Medium dense grey and brown silty fine to medium SAND. [Head]
		4.00	SPT	N=13				
					4.50			White Structureless CHALK composed of slightly sandy silty, angular to subrounded GRAVEL . Clasts are very weak and weak, low to medium density, with occasional black specks. Cream matrix. Occasional subangular to subrounded, fine to coarse gravels of flint. (Dc) [Seaford Chalk Formation]
		5.00	SPT	N=10				
		6.50	SPT	N=17				
		8.00	SPT	N=11				
		9.50	SPT	N=25				
					10.00			Borehole completed at 10.00m.
					{10.50}			

0 1 2 3 4 5 6 7 8 9 10

General Remarks

1. Hand excavated inspection pit from ground level to 1.20m begl.
2. Densities and soil consistencies are based on insitu tests.
3. No visual or olfactory evidence of contamination observed.
4. Groundwater was not encoutered.
5. SPT - Standard Penetration Test; N - Number of blows.
6. Install details: 50mm plain pipe concrete flush cover from 0.00m begl to 0.10m begl; Bentonite seal between 0.10m begl to 1.00m begl; 50mm slotted pipe with gravel between 1.00m begl to 10.00m begl.

Groundwater

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

All dimensions in metres Scale 1:65.625		Logged By NR

Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site				BH2
Sittingbourne				
Job No: SHF.1132.260	Dates: Start 27-07-21, Finish 27-07-21	Ground Level (m)	Co-Ordinates	
Client: Gladman Developments				Sheet: 1 of 1

Well	Water Levels	Samples & In Situ Testing: Depth (m)	No/Type	Results	Depth (m)	Level (mAD)	Legend	Stratum Description
					0.80			Brown sandy TOPSOIL. Sand is fine to coarse
		1.50	SPT	N=20	1.50			Soft brown slightly silty sandy CLAY. Sand is fine to medium. [Head]
					2.50			Medium dense brown silty SAND and GRAVEL. Gravel is angular to subrounded, fine to coarse flint. Sand is fine to coarse. [Head]
		3.00	SPT	N=10				Medium dense grey and brown silty fine to medium SAND. [Head]
		4.50	SPT	N=14				
		6.50	SPT	N=15				
		8.00	SPT	N=12				
		9.50	SPT	N=8	9.20			White Structureless CHALK composed of slightly sandy silty, angular to subrounded GRAVEL . Clasts are very weak and weak, low to medium density, with occasional black specks. Cream matrix. Occasional subangular to subrounded, fine to coarse gravels of flint. (Dc) [Seaford Chalk Formation]
					10.00			Borehole completed at 10.00m.
					{10.50}			

General Remarks

1. Hand excavated inspection pit from ground level to 1.20m begl.
2. Densities and soil consistencies are based on insitu tests.
3. No visual or olfactory evidence of contamination observed.
4. Groundwater was not encoutered.
5. SPT - Standard Penetration Test; N - Number of blows.
6. Install details: 50mm plain pipe concrete flush cover from 0.00m begl to 0.10m begl; Bentonite seal between 0.10m begl to 1.00m begl; 50mm slotted pipe with gravel between 1.00m begl to 10.00m begl.

Groundwater

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

All dimensions in metres
Scale 1:65.625

Logged By: NR

Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site: Sittingbourne

BH3

Job No	Dates	Ground Level (m)	Co-Ordinates
SHF.1132.260	Start 28-07-21 Finish 28-07-21		

Client: Gladman Developments

Sheet: 1 of 1

Well	Water Levels	Samples & In Situ Testing: Depth (m)	No/Type	Results	Depth (m)	Level (mAD)	Legend	Stratum Description
					0.40			Brown sandy TOPSOIL. Sand is fine to coarse.
		1.50	SPT	N=7				Firm brown slightly silty sandy CLAY. Sand is fine to medium. [Head]
					2.10			Brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of flint. Sand is fine to coarse. [Head]
		3.00	SPT	N=32				
					3.80			Dense grey and brown silty fine to medium SAND. [Head]
		4.50	SPT	N=17				
					5.30			White Structureless CHALK composed of slightly sandy silty, angular to subrounded GRAVEL . Clasts are very weak and weak, low to medium density, with occasional black specks. Cream matrix. Occasional subangular to subrounded, fine to coarse gravels of flint. (Dc) [Seaford Chalk Formation]
		6.50	SPT	N=9				
		8.00	SPT	N=19				
		9.50	SPT	N=21				
					10.00			Borehole completed at 10.00m.
					{10.50}			

0 1 2 3 4 5 6 7 8 9 10

General Remarks

1. Hand excavated inspection pit from ground level to 1.20m begl.
2. Densities and soil consistencies are based on insitu tests.
3. No visual or olfactory evidence of contamination observed.
4. Groundwater was not encoutered.
5. SPT - Standard Penetration Test; N - Number of blows.
6. Install details: 50mm plain pipe concrete flush cover from 0.00m begl to 0.10m begl; Bentonite seal between 0.10m begl to 1.00m begl; 50mm slotted pipe with gravel between 1.00m begl to 10.00m begl.

Groundwater

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

All dimensions in metres
Scale 1:65.625

Logged By: NR

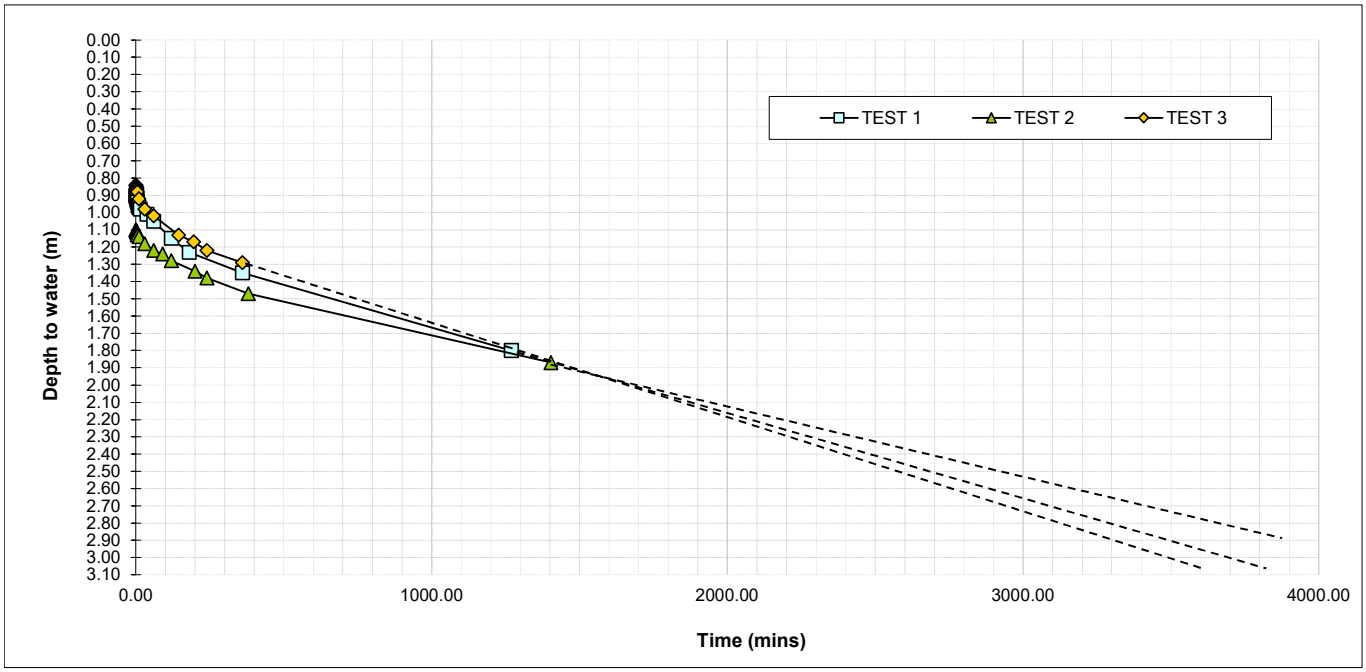
Site.....	Swanstree Avenue, Sittin	Trial Pit Number.....	SA1		
Job Number.....	SHF.1132.260	Length.....	2.20	m	
Date of Test.....	28/07/2021	Width.....	0.60	m	
		Depth.....	3.10	m	
SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m	
See B.R.E. Digest 365, 1991, Soakaway Design.					

Remarks -
0.00 - 0.40
Brown silty sandy TOPSOIL. Sand is fine to coarse.
0.40 - 2.10
Firm brown silty slightly sandy CLAY. Sand is fine. [Head]
2.10 - 2.70
Brown silty SAND & GRAVEL. Gravel is angular to subrounded, fine to coarse flint. Sand is fine to coarse. [Head]
2.70 - 3.10
Grey silty fine to medium SAND.
Stable side walls.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00	0.90	0.00	1.10	0.00	0.84
1.00	0.91	1.00	1.10	1.00	0.85
2.00	0.91	2.00	1.11	2.00	0.85
3.00	0.92	3.00	1.11	3.00	0.86
4.00	0.93	4.00	1.12	4.00	0.87
5.00	0.94	5.00	1.13	5.00	0.88
7.00	0.96	10.00	1.14	10.00	0.92
10.00	0.97	30.00	1.18	30.00	0.98
15.00	0.98	60.00	1.22	60.00	1.02
37.00	1.01	90.00	1.24	145.00	1.13
60.00	1.05	120.00	1.28	195.00	1.17
120.00	1.15	200.00	1.34	240.00	1.22
180.00	1.23	240.00	1.38	360.00	1.29
360.00	1.35	380.00	1.47		
1270.00	1.80	1403.00	1.87		
		0.00	0.00		

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	2.20	2.00	2.26
75% Effective Storage Depth	m	1.65	1.50	1.70
(i.e. depth below GL)	m	**1.45**	**1.60**	**1.41**
25% Effective Storage Depth	m	0.55	0.50	0.57
(i.e. depth below GL)	m	**2.55**	**2.60**	**2.54**
Effective Storage Depth 75%-25%	m	1.10	1.00	1.13
Time to fall to 75% effective depth	mins	550.00	700.00	600.00
Time to fall to 25% effective depth	mins	2800.00	3150.00	2650.00
V (75%-25%)	m3	1.45	1.32	1.49
a (50%)	m2	7.48	6.92	7.65
t (75%-25%)	mins	2250.00	2450.00	2050.00
SOIL INFILTRATION RATE	m/s	**1.44E-06**	**1.30E-06**	**1.59E-06**

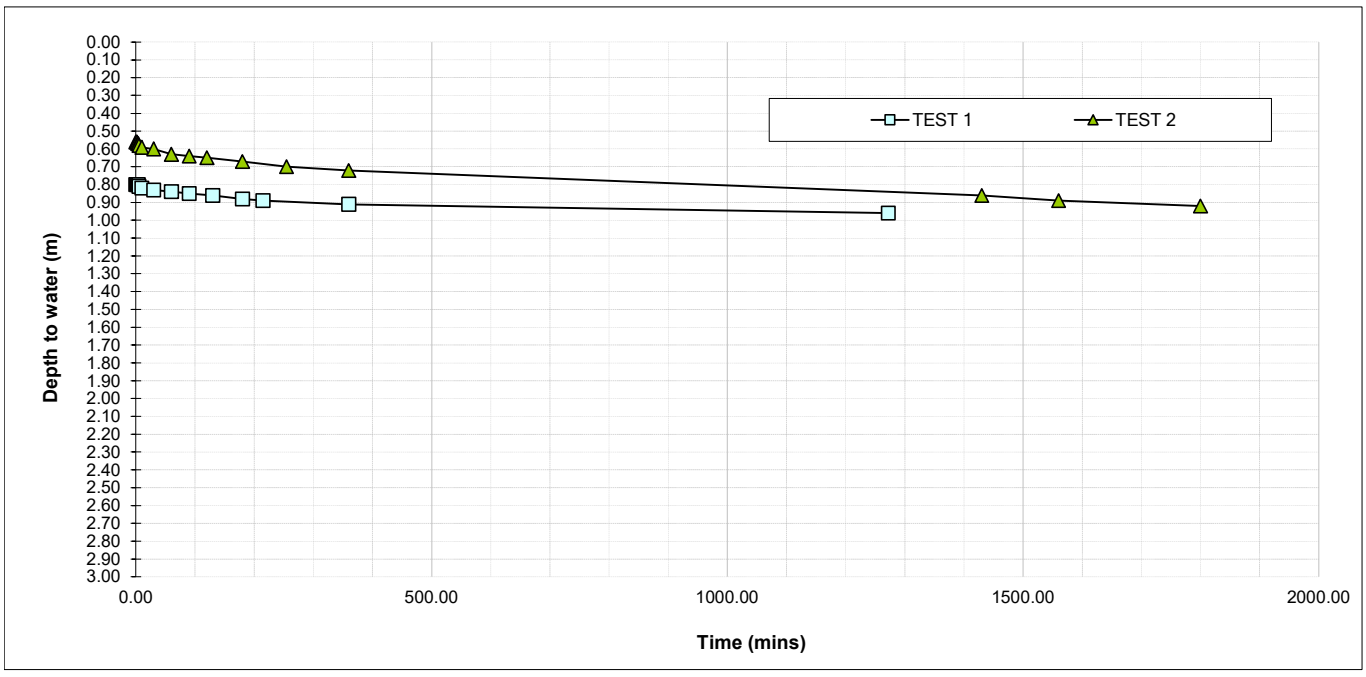
DESIGN SOIL INFILTRATION RATE, f	**1.30E-06**	**m/s**



Site.....	Swanstree Avenue, Sittin	Trial Pit Number.....	SA2		
Job Number.....	SHF.1132.260	Length.....	2.60	m	
Date of Test.....	28/07/2021	Width.....	0.60	m	
		Depth.....	2.80	m	
SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m	
See B.R.E. Digest 365, 1991, Soakaway Design.					

Remarks -		TEST 1		TEST 2		TEST 3	
0.00 - 2.10		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
Brown silty SAND & GRAVEL. Gravel is angular to subrounded, fine to coarse flint. Sand is fine to coarse. [Head]		0.00	0.80	0.00	0.56		
2.10 - 2.80		1.00	0.80	1.00	0.56		
Firm brown silty slightly sandy CLAY. Sand is fine. [Head]		2.00	0.80	2.00	0.56		
Stable side walls.		3.00	2.30	3.00	0.57		
		4.00	3.30	4.00	0.57		
		5.00	4.30	5.00	0.58		
		10.00	5.30	10.00	0.59		
		30.00	6.30	30.00	0.60		
		60.00	7.30	60.00	0.63		
		90.00	8.30	90.00	0.64		
		130.00	9.30	120.00	0.65		
		180.00	10.30	180.00	0.67		
		215.00	11.30	255.00	0.70		
		360.00	12.30	360.00	0.72		
		1272.00	13.30	1430.00	0.86		
				1560.00	0.89		
				1800.00	0.92		
Effective Storage Depth	m		2.00		2.24		
75% Effective Storage Depth	m		1.50		1.68		
(i.e. depth below GL)	m		**1.30**		**1.12**		
25% Effective Storage Depth	m		0.50		0.56		
(i.e. depth below GL)	m		**2.30**		**2.24**		
Effective Storage Depth 75%-25%	m		1.00		1.12		
Time to fall to 75% effective depth	mins		insufficient uptake		insufficient uptake		
Time to fall to 25% effective depth	mins		insufficient uptake		insufficient uptake		
V (75%-25%)	m3		1.56		1.75		
a (50%)	m2		7.96		8.73		
t (75%-25%)	mins		insufficient uptake		insufficient uptake		
SOIL INFILTRATION RATE	m/s		**N/A**		**N/A**		

DESIGN SOIL INFILTRATION RATE, f **N/A** **m/s**



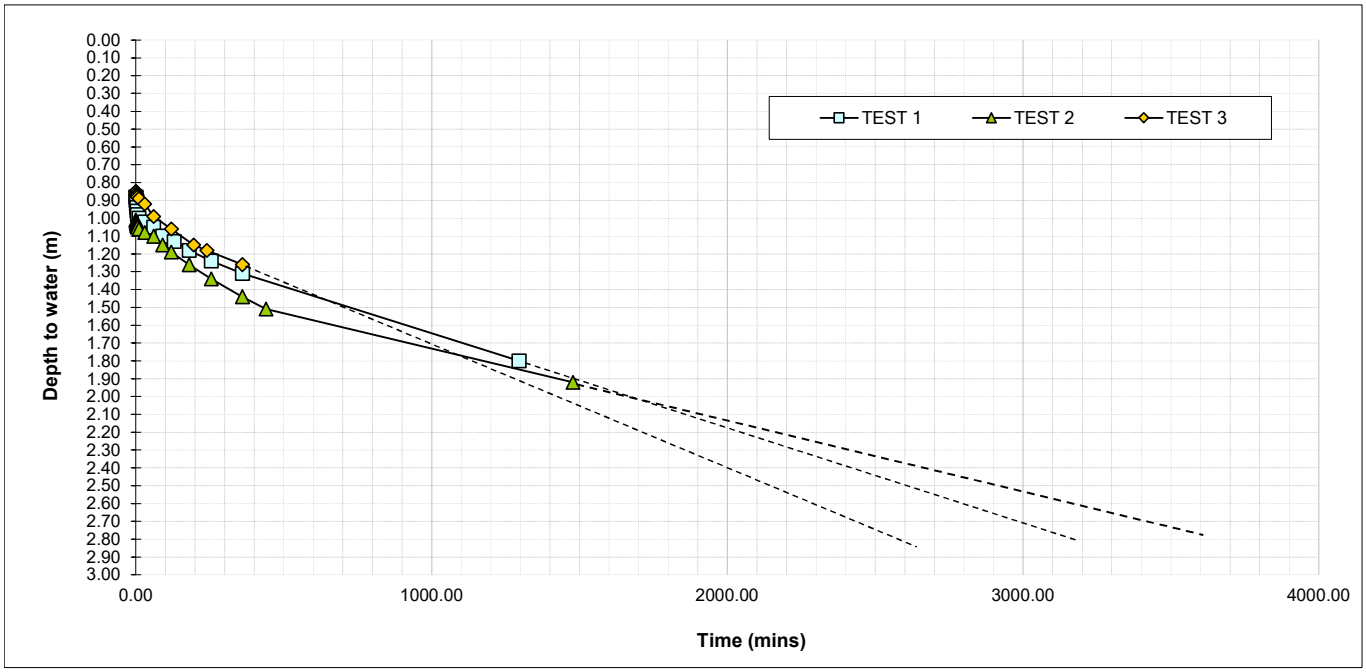
Site.....	Swanstree Avenue, Sittin	Trial Pit Number.....	SA3		
Job Number.....	SHF.1132.260	Length.....	3.00	m	
Date of Test.....	28/07/2021	Width.....	0.60	m	
		Depth.....	3.00	m	
SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m	
See B.R.E. Digest 365, 1991, Soakaway Design.					

Remarks -
0.00 - 0.40
Brown silty sandy TOPSOIL. Sand is fine to coarse.
0.40 - 2.20
Firm brown silty slightly sandy CLAY. Sand is fine. [Head]
2.20 - 3.00
Brown silty slightly sandy slightly gravelly CLAY. Gravel is is angular to subrounded, fine to coarse flint and chalk. Sand is fine to medium. [Head]
Stable side walls.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00	0.88	0.00	1.01	0.00	0.85
1.00	0.90	1.00	1.02	1.00	0.85
2.00	0.92	2.00	1.03	2.00	0.86
3.00	2.30	3.00	1.04	3.00	0.87
4.00	3.30	4.00	1.04	4.00	0.87
5.00	4.30	5.00	1.05	5.00	0.88
10.00	5.30	10.00	1.06	10.00	0.89
30.00	6.30	30.00	1.08	30.00	0.92
60.00	7.30	60.00	1.10	60.00	0.99
90.00	8.30	90.00	1.15	120.00	1.06
130.00	9.30	120.00	1.19	195.00	1.15
180.00	10.30	180.00	1.26	240.00	1.18
255.00	11.30	255.00	1.34	360.00	1.26
360.00	12.30	360.00	1.44		
1296.00	13.30	440.00	1.51		
		1478.00	1.92		

Effective Storage Depth	m	2.12	1.99	2.15
75% Effective Storage Depth	m	1.59	1.49	1.61
(i.e. depth below GL)	m	**1.41**	**1.51**	**1.39**
25% Effective Storage Depth	m	0.53	0.50	0.54
(i.e. depth below GL)	m	**2.47**	**2.50**	**2.46**
Effective Storage Depth 75%-25%	m	1.06	1.00	1.08
Time to fall to 75% effective depth	mins	500.00	450.00	540.00
Time to fall to 25% effective depth	mins	2570.00	2900.00	2080.00
V (75%-25%)	m3	1.91	1.79	1.94
a (50%)	m2	9.43	8.96	9.54
t (75%-25%)	mins	2070.00	2450.00	1540.00
SOIL INFILTRATION RATE	m/s	**1.63E-06**	**1.36E-06**	**2.20E-06**

DESIGN SOIL INFILTRATION RATE, f	**1.36E-06**	**m/s**



Site.....	Swanstree Avenue		Soakaway Number.....	BH1-1	
Job Number.....	SHF.1132.260		Diameter	0.15	m
Date of Test.....	26/07/2021		Casing Depth	4.00	m
			Borehole Depth.....	5.00	m
			Groundwater Level.....	Dry	m

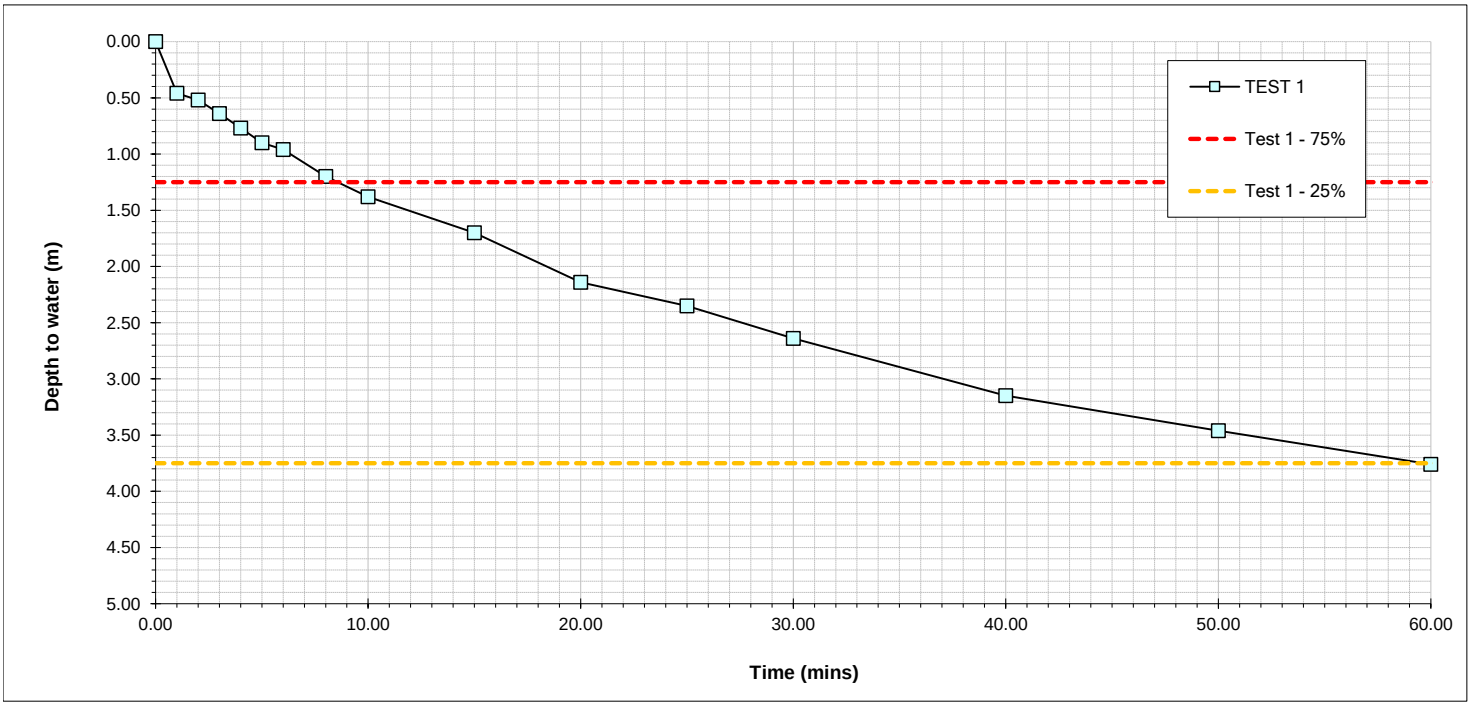
BOREHOLE SOIL INFILTRATION RATE TEST
See B.R.E. Digest 365, 1991, Soakaway Design.

Remarks -
Please refer to BH1 log for ground conditions.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.0	0.00				
1.0	0.46				
2.0	0.52				
3.0	0.64				
4.0	0.77				
5.0	0.90				
6.0	0.96				
8.0	1.20				
10.0	1.38				
15.0	1.70				
20.0	2.14				
25.0	2.35				
30.0	2.64				
40.0	3.15				
50.0	3.46				
60.0	3.76				

Effective Storage Depth	m	5.00		
75% Effective Storage Depth	m	3.75		
(i.e. depth below GL)	m	**1.25**		
25% Effective Storage Depth	m	1.25		
(i.e. depth below GL)	m	**3.75**		
Effective Storage Depth 75%-25%	m	2.50		
Time to fall to 75% effective depth	mins	8.50		
Time to fall to 25% effective depth	mins	60.00		
V (75%-25%)	m3	0.04		
a	m2	0.49		
t (75%-25%)	mins	51.50		
SOIL INFILTRATION RATE	m/s	**2.92E-05**		

DESIGN SOIL INFILTRATION RATE, f **n/a** **m/s**



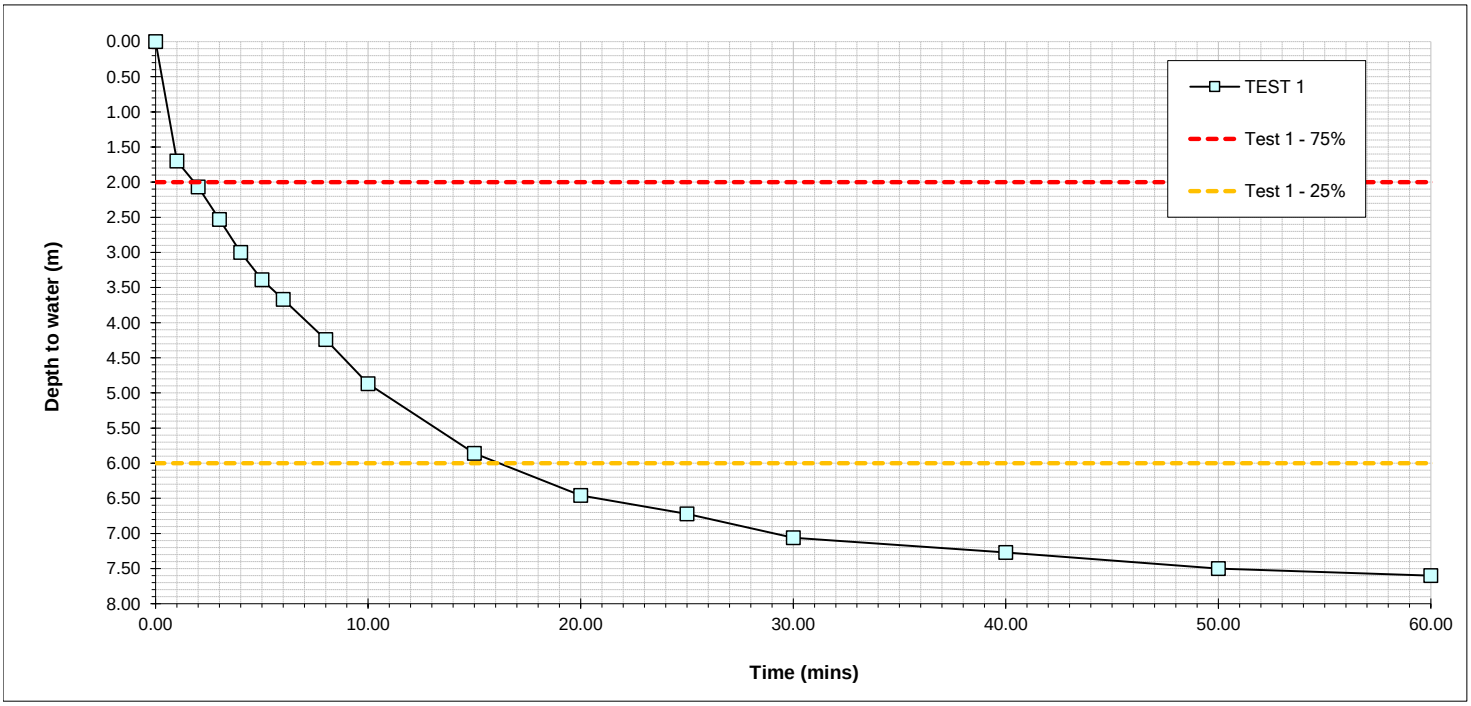
enzygo	Site.....	Swanstree Avenue	Soakaway Number.....	BH1-2	
	Job Number.....	SHF.1132.260	Diameter	0.15	m
	Date of Test.....	26/07/2021	Casing Depth	7.00	m
			Borehole Depth.....	8.00	m
	BOREHOLE SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m
	See B.R.E. Digest 365, 1991, Soakaway Design.				

Remarks -
Please refer to BH1 log for ground conditions.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.0	0.00				
1.0	1.70				
2.0	2.07				
3.0	2.53				
4.0	3.00				
5.0	3.39				
6.0	3.67				
8.0	4.24				
10.0	4.87				
15.0	5.86				
20.0	6.46				
25.0	6.72				
30.0	7.06				
40.0	7.27				
50.0	7.50				
60.0	7.60				

Effective Storage Depth	m	8.00		
75% Effective Storage Depth	m	6.00		
(i.e. depth below GL)	m	**2.00**		
25% Effective Storage Depth	m	2.00		
(i.e. depth below GL)	m	**6.00**		
Effective Storage Depth 75%-25%	m	4.00		
Time to fall to 75% effective depth	mins	1.80		
Time to fall to 25% effective depth	mins	16.00		
V (75%-25%)	m3	0.07		
a	m2	0.49		
t (75%-25%)	mins	14.20		
SOIL INFILTRATION RATE	m/s	**1.70E-04**		

DESIGN SOIL INFILTRATION RATE, f	**n/a**	**m/s**



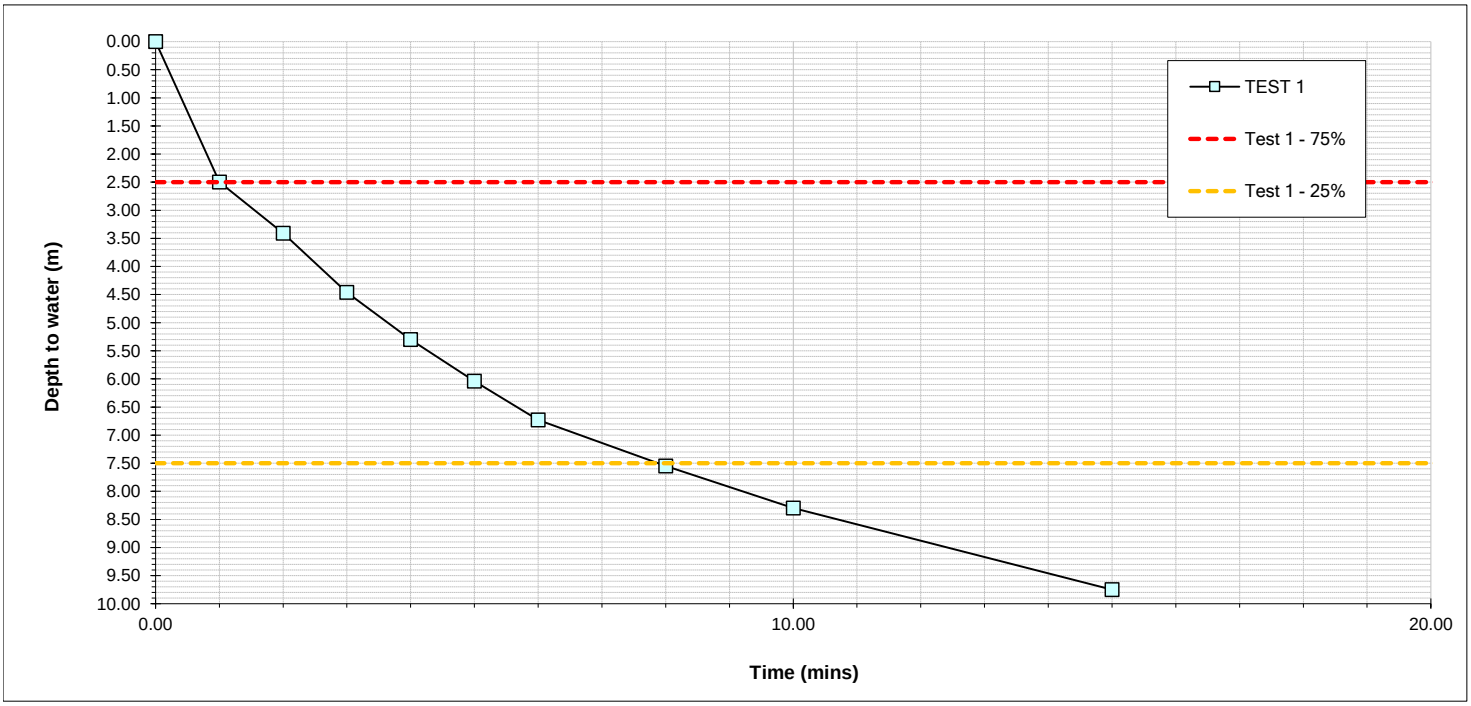
enzygo	Site.....	Swanstree Avenue	Soakaway Number.....	BH1-3	
	Job Number.....	SHF.1132.260	Diameter	0.15	m
	Date of Test.....	26/07/2021	Casing Depth	9.00	m
			Borehole Depth.....	10.00	m
	BOREHOLE SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m
	See B.R.E. Digest 365, 1991, Soakaway Design.				

Remarks -
Please refer to BH1 log for ground conditions.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.0	0.00				
1.0	2.50				
2.0	3.41				
3.0	4.46				
4.0	5.30				
5.0	6.04				
6.0	6.73				
8.0	7.55				
10.0	8.30				
15.0	9.75				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	10.00		
75% Effective Storage Depth	m	7.50		
(i.e. depth below GL)	m	**2.50**		
25% Effective Storage Depth	m	2.50		
(i.e. depth below GL)	m	**7.50**		
Effective Storage Depth 75%-25%	m	5.00		
Time to fall to 75% effective depth	mins	1.00		
Time to fall to 25% effective depth	mins	8.00		
V (75%-25%)	m3	0.09		
a	m2	0.49		
t (75%-25%)	mins	7.00		
SOIL INFILTRATION RATE	m/s	**4.30E-04**		

DESIGN SOIL INFILTRATION RATE, f **n/a** **m/s**



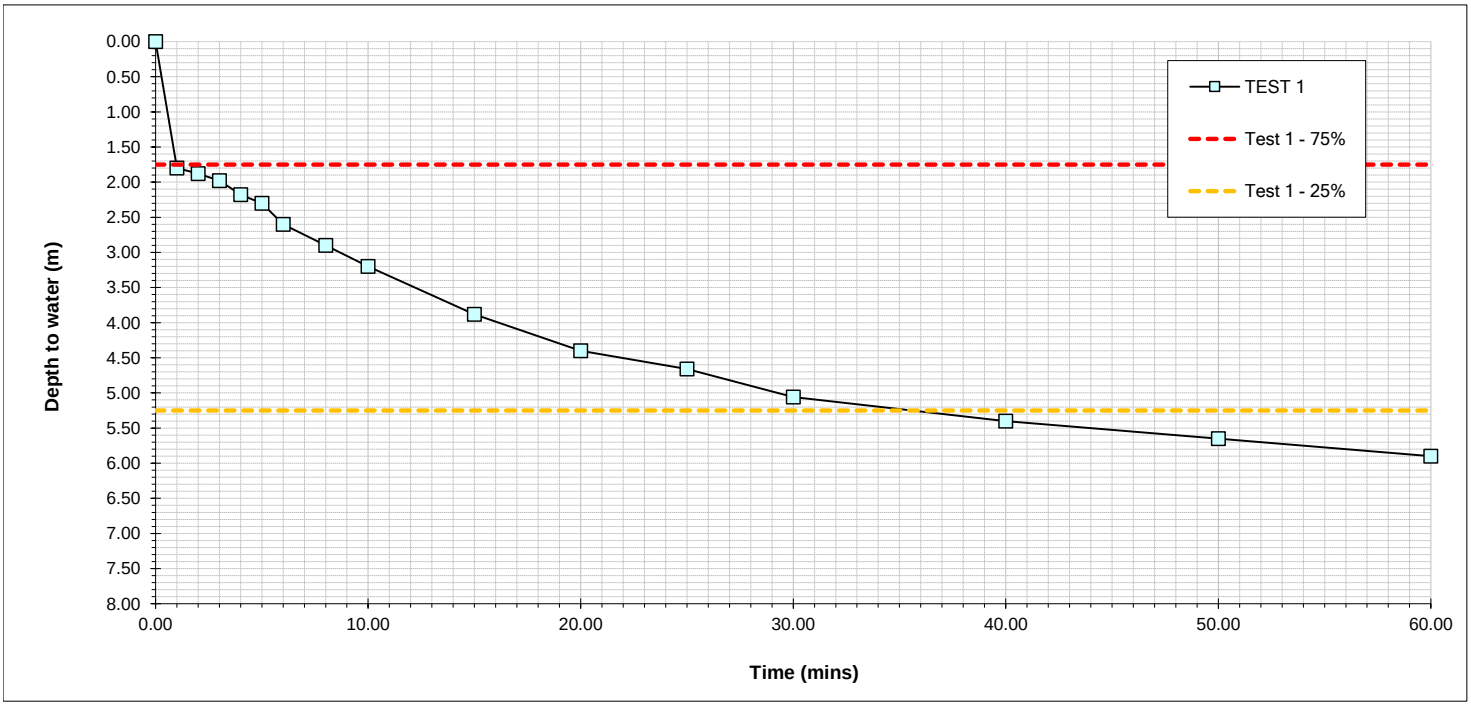
enzygo	Site.....	Swanstree Avenue	Soakaway Number.....	BH2-1	
	Job Number.....	SHF.1132.260	Diameter	0.15	m
	Date of Test.....	26/07/2021	Casing Depth	5.00	m
			Borehole Depth.....	7.00	m
	BOREHOLE SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m
	See B.R.E. Digest 365, 1991, Soakaway Design.				

Remarks -
Please refer to BH2 log for ground conditions.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.0	0.00				
1.0	1.80				
2.0	1.88				
3.0	1.98				
4.0	2.18				
5.0	2.30				
6.0	2.60				
8.0	2.90				
10.0	3.20				
15.0	3.88				
20.0	4.40				
25.0	4.66				
30.0	5.06				
40.0	5.40				
50.0	5.65				
60.0	5.90				

Effective Storage Depth	m	7.00		
75% Effective Storage Depth	m	5.25		
(i.e. depth below GL)	m	**1.75**		
25% Effective Storage Depth	m	1.75		
(i.e. depth below GL)	m	**5.25**		
Effective Storage Depth 75%-25%	m	3.50		
Time to fall to 75% effective depth	mins	1.00		
Time to fall to 25% effective depth	mins	36.00		
V (75%-25%)	m3	0.06		
a	m2	0.96		
t (75%-25%)	mins	35.00		
SOIL INFILTRATION RATE	m/s	**3.07E-05**		

DESIGN SOIL INFILTRATION RATE, f	**n/a**	**m/s**

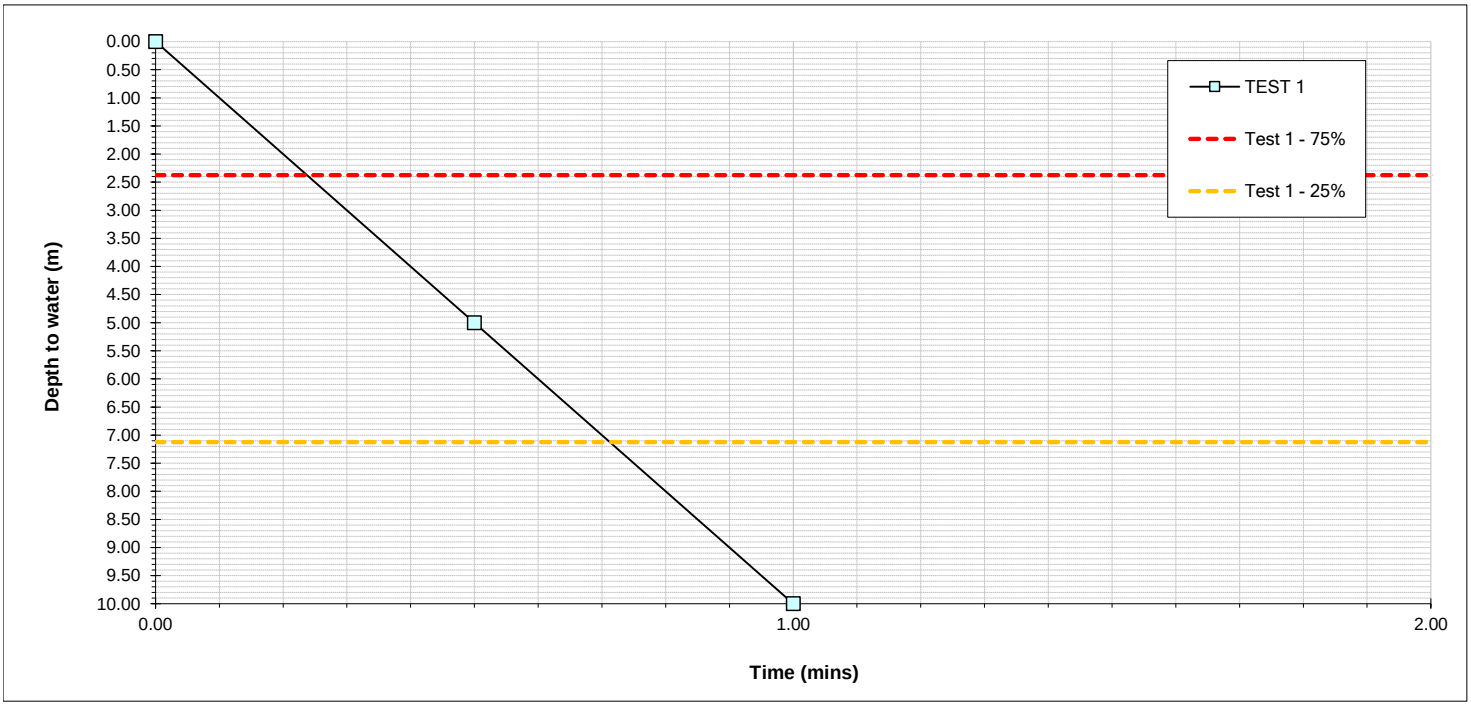


Site.....	Swanstree Avenue		Soakaway Number.....	BH2-2	
Job Number.....	SHF.1132.260		Diameter	0.15	m
Date of Test.....	26/07/2021		Casing Depth	7.50	m
			Borehole Depth.....	9.50	m
BOREHOLE SOIL INFILTRATION RATE TEST			Groundwater Level.....	Dry	m
See B.R.E. Digest 365, 1991, Soakaway Design.					

Remarks -	TEST 1		TEST 2		TEST 3	
Please refer to BH3 log for ground conditions.	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	0.5	5.00				
	1.0	10.00				

Effective Storage Depth	m	9.50		
75% Effective Storage Depth	m	7.13		
(i.e. depth below GL)	m	**2.38**		
25% Effective Storage Depth	m	2.38		
(i.e. depth below GL)	m	**7.13**		
Effective Storage Depth 75%-25%	m	4.75		
Time to fall to 75% effective depth	mins	2.30		
Time to fall to 25% effective depth	mins	7.20		
V (75%-25%)	m3	0.08		
a	m2	0.96		
t (75%-25%)	mins	4.90		
SOIL INFILTRATION RATE	m/s	**2.97E-04**		

DESIGN SOIL INFILTRATION RATE, f	**n/a**	**m/s**

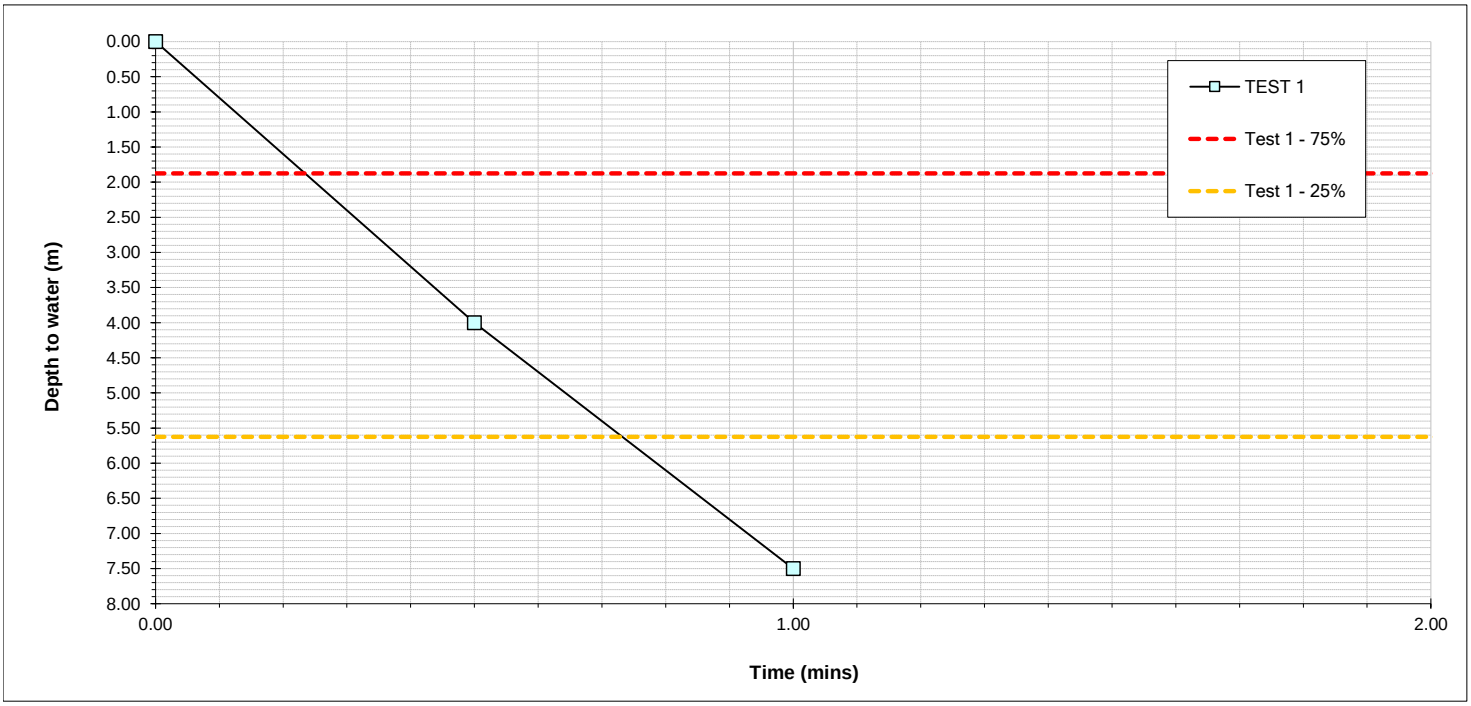


enzygo	Site.....	Swanstree Avenue	Soakaway Number.....	BH3-1	
	Job Number.....	SHF.1132.260	Diameter	0.15	m
	Date of Test.....	26/07/2021	Casing Depth	5.50	m
			Borehole Depth.....	7.50	m
	BOREHOLE SOIL INFILTRATION RATE TEST		Groundwater Level.....	Dry	m
	See B.R.E. Digest 365, 1991, Soakaway Design.				

Remarks -	TEST 1		TEST 2		TEST 3	
Please refer to BH3 log for ground conditions.	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	0.5	4.00				
	1.0	7.50				

Effective Storage Depth	m	7.50		
75% Effective Storage Depth	m	5.63		
(i.e. depth below GL)	m	**1.88**		
25% Effective Storage Depth	m	1.88		
(i.e. depth below GL)	m	**5.63**		
Effective Storage Depth 75%-25%	m	3.75		
Time to fall to 75% effective depth	mins	0.24		
Time to fall to 25% effective depth	mins	0.74		
V (75%-25%)	m3	0.07		
a	m2	0.96		
t (75%-25%)	mins	0.50		
SOIL INFILTRATION RATE	m/s	**2.30E-03**		

DESIGN SOIL INFILTRATION RATE, f	**n/a**	**m/s**



Site.....	Swanstree Avenue	
Job Number.....	SHF.1132.260	
Date of Test.....	26/07/2021	

BOREHOLE SOIL INFILTRATION RATE TEST
See B.R.E. Digest 365, 1991, Soakaway Design.

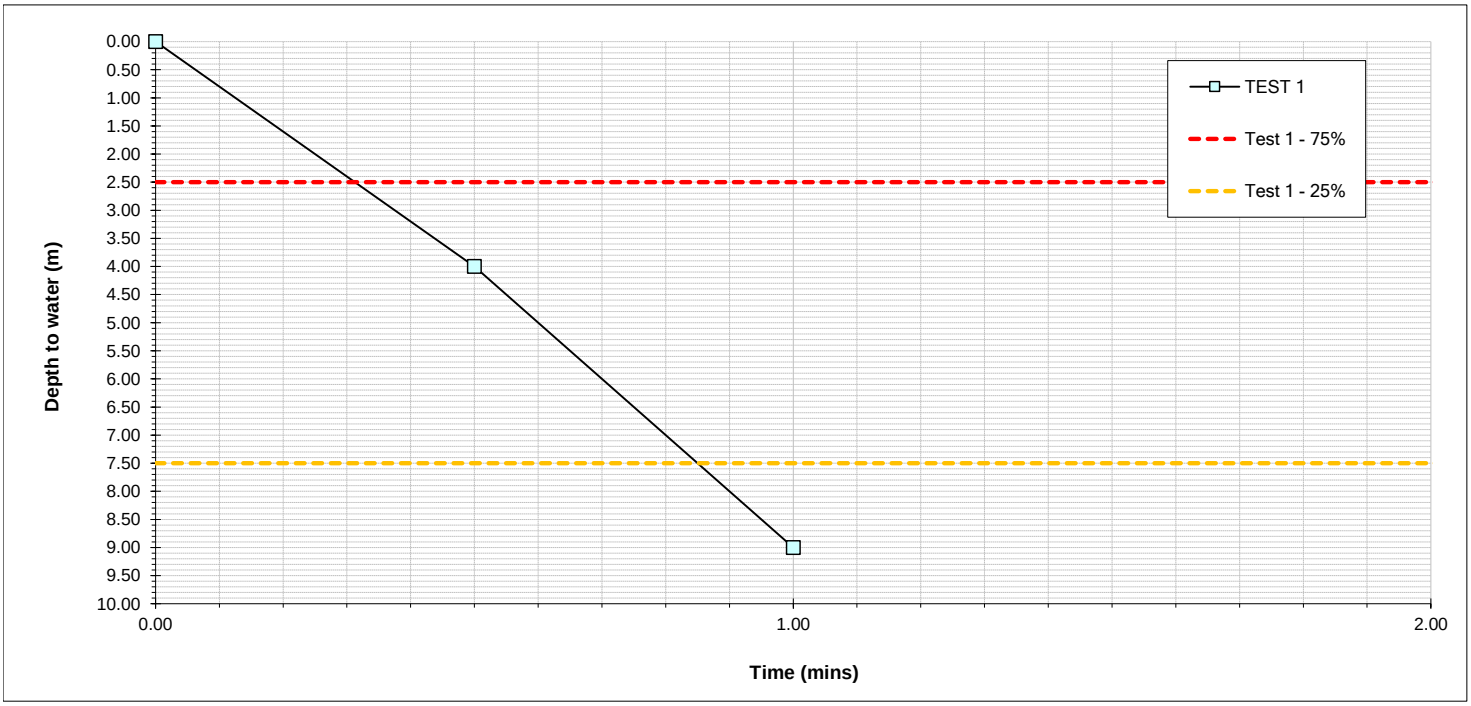
Soakaway Number.....	BH3-2	
Diameter	0.15	m
Casing Depth	8.50	m
Borehole Depth.....	10.00	m
Groundwater Level.....	Dry	m

Remarks -
Please refer to BH3 log for ground conditions.

	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	0.00				
	0.5	4.00				
	1.0	9.00				

Effective Storage Depth	m	10.00		
75% Effective Storage Depth	m	7.50		
(i.e. depth below GL)	m	**2.50**		
25% Effective Storage Depth	m	2.50		
(i.e. depth below GL)	m	**7.50**		
Effective Storage Depth 75%-25%	m	5.00		
Time to fall to 75% effective depth	mins	0.31		
Time to fall to 25% effective depth	mins	0.85		
V (75%-25%)	m3	0.09		
a	m2	0.72		
t (75%-25%)	mins	0.54		
SOIL INFILTRATION RATE	m/s	**3.76E-03**		

DESIGN SOIL INFILTRATION RATE, f **n/a** **m/s**



Appendix 8 – Runoff Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Elizabeth Austin
Site name:	Swanstree Avenue
Site location:	Sittingbourne

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.33012° N
Longitude:	0.74334° E
Reference:	1653604337
Date:	Sep 07 2021 08:21

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha): 3.9

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.734
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.14

Hydrological characteristics

	Default	Edited
SAAR (mm):	645	634
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):		4.05
1 in 1 year (l/s):		3.44
1 in 30 years (l/s):		9.3
1 in 100 year (l/s):		12.9
1 in 200 years (l/s):		15.13

Appendix 9 – Attenuation Volumes

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2396 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	28.179	15.179	7.8	539.2	O K
30 min Summer	28.310	15.310	7.8	709.5	O K
60 min Summer	28.442	15.442	7.8	880.5	O K
120 min Summer	28.588	15.588	7.8	1070.4	O K
180 min Summer	28.691	15.691	7.8	1205.3	O K
240 min Summer	28.774	15.774	7.8	1312.8	O K
360 min Summer	28.903	15.903	7.8	1480.5	O K
480 min Summer	29.001	16.001	7.8	1608.1	O K
600 min Summer	29.075	16.075	7.8	1704.4	O K
720 min Summer	29.132	16.132	7.8	1777.7	O K
960 min Summer	29.204	16.204	7.8	1871.2	O K
1440 min Summer	29.252	16.252	7.8	1933.6	O K
2160 min Summer	29.219	16.219	7.8	1890.6	O K
2880 min Summer	29.161	16.161	7.8	1815.5	O K
4320 min Summer	29.025	16.025	7.8	1639.3	O K
5760 min Summer	28.914	15.914	7.8	1494.8	O K
7200 min Summer	28.827	15.827	7.8	1380.9	O K
8640 min Summer	28.753	15.753	7.8	1285.1	O K
10080 min Summer	28.689	15.689	7.8	1201.7	O K
15 min Winter	28.230	15.230	7.8	605.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	138.005	0.0	44
30 min Summer	90.843	0.0	58
60 min Summer	56.736	0.0	88
120 min Summer	34.984	0.0	146
180 min Summer	26.611	0.0	204
240 min Summer	22.006	0.0	262
360 min Summer	16.919	0.0	380
480 min Summer	14.068	0.0	498
600 min Summer	12.163	0.0	616
720 min Summer	10.774	0.0	736
960 min Summer	8.831	0.0	972
1440 min Summer	6.558	0.0	1446
2160 min Summer	4.785	0.0	1980
2880 min Summer	3.794	0.0	2304
4320 min Summer	2.701	0.0	3048
5760 min Summer	2.125	0.0	3872
7200 min Summer	1.774	0.0	4680
8640 min Summer	1.537	0.0	5464
10080 min Summer	1.367	0.0	6272
15 min Winter	138.005	0.0	44

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	28.378	15.378	7.8	797.5	O K
60 min Winter	28.526	15.526	7.8	990.6	O K
120 min Winter	28.692	15.692	7.8	1206.3	O K
180 min Winter	28.811	15.811	7.8	1360.5	O K
240 min Winter	28.906	15.906	7.8	1484.2	O K
360 min Winter	29.056	16.056	7.8	1678.7	O K
480 min Winter	29.171	16.171	7.8	1828.3	O K
600 min Winter	29.259	16.259	7.8	1942.7	O K
720 min Winter	29.327	16.327	7.8	2031.2	O K
960 min Winter	29.417	16.417	7.8	2148.6	O K
1440 min Winter	29.490	16.490	7.8	2243.1	O K
2160 min Winter	29.477	16.477	7.8	2226.7	O K
2880 min Winter	29.407	16.407	7.8	2135.2	O K
4320 min Winter	29.240	16.240	7.8	1918.2	O K
5760 min Winter	29.082	16.082	7.8	1713.5	O K
7200 min Winter	28.950	15.950	7.8	1541.7	O K
8640 min Winter	28.837	15.837	7.8	1394.6	O K
10080 min Winter	28.736	15.736	7.8	1262.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	90.843	0.0	58
60 min Winter	56.736	0.0	86
120 min Winter	34.984	0.0	144
180 min Winter	26.611	0.0	200
240 min Winter	22.006	0.0	258
360 min Winter	16.919	0.0	374
480 min Winter	14.068	0.0	490
600 min Winter	12.163	0.0	606
720 min Winter	10.774	0.0	722
960 min Winter	8.831	0.0	954
1440 min Winter	6.558	0.0	1412
2160 min Winter	4.785	0.0	2076
2880 min Winter	3.794	0.0	2684
4320 min Winter	2.701	0.0	3304
5760 min Winter	2.125	0.0	4216
7200 min Winter	1.774	0.0	5112
8640 min Winter	1.537	0.0	5968
10080 min Winter	1.367	0.0	6776

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 591132 162629 TQ 91132 62629
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.150

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	5	0.360	10	15	0.358	20	25	0.358
5	10	0.358	15	20	0.358	25	30	0.358

Model Details

Storage is Online Cover Level (m) 29.800

Deep Bore Soakaway Structure

Chamber Invert Level (m)	28.000	Borehole Depth (m)	15.000
Chamber Diameter/Length (m)	10.000	Infiltration Coefficient Base (m/hr)	1.54800
Chamber Width (m)	130.000	Safety Factor	2.0
Borehole Diameter (m)	5.100		

Depth (m)	Side Infil. Coef. (m/hr)	Depth (m)	Side Infil. Coef. (m/hr)	Depth (m)	Side Infil. Coef. (m/hr)	Depth (m)	Side Infil. Coef. (m/hr)
0.000	0.00000	6.001	0.61200	8.001	0.10500	15.000	0.00000
6.000	1.54800	8.000	0.61200	11.000	0.00000		

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