

Woodcroft Farm Flood Risk Assessment and Drainage Strategy

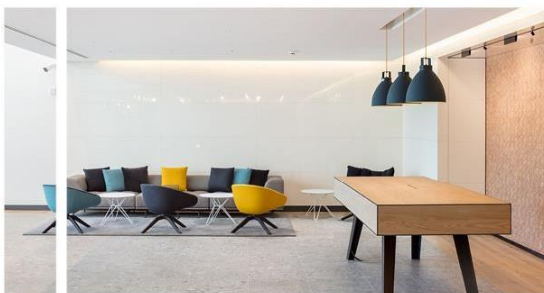
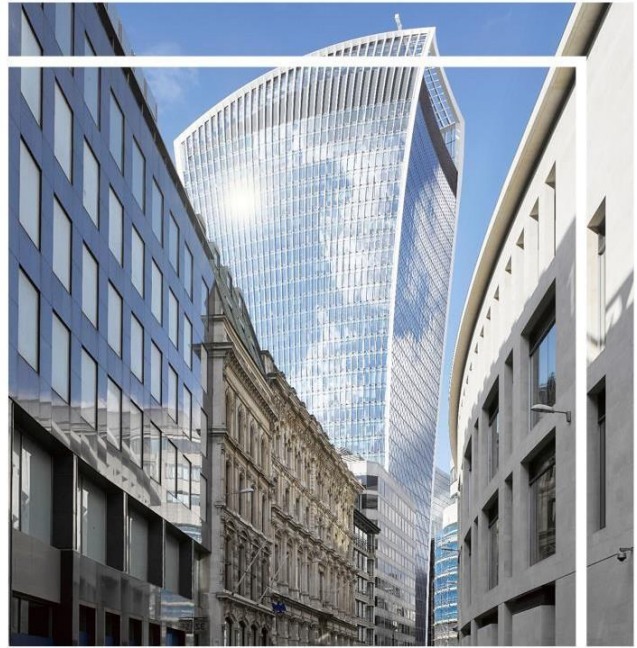
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Executive Summary

Hilson Moran has been commissioned by Grainger Plc to prepare a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA), along with supporting the sewerage and Sustainable Drainage Systems (SuDS) Strategy, appropriate to the nature and scale of the residential development at Woodcroft Farm in East Hampshire.

The national grid reference of the site is: SU 68151 12243.

The proposed development will consist of the planned development of 190 dwellings split between 2 previously undeveloped (Greenfield) sites that are connected by a hedged public footpath in the middle. The total area is approximately 8.61 hectares (ha).

The FRA has identified that the site is within a Flood Zone 1 and demonstrates that the site is at low risk of flooding from all tidal and river sources, artificial water bodies, and also groundwater. Some potential surface water flooding has been highlighted from the Environment Agency (EA) flood maps; this is mainly routed within the middle section of the site (*i.e.*, the potential Karstic area). As a precautionary measure, the evolving masterplan has not placed any buildings within this region. Due to the site being greenfield, there is no recorded historical flooding within the vicinity, and being in Flood Zone 1, therefore a Sequential Test will not be required for the site.

NPPF (2019) states that plans should take a proactive approach to mitigate and adapt to climate change, considering the long-term implications for flood risk. East Hampshire District Council SFRA also has set requirements which include: *“All major developments (10 or more dwellings and 100m² floorspace) and other development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff.”*

The development site is classified as a greenfield development. Where reasonably practical, the runoff volume discharged from the development should not exceed the greenfield runoff volume up to 1 in 100-year, 6-hour rainfall event.

The proposed masterplan for Woodcroft Farm shows that the site has two distinct development areas (*i.e.* Field A and B), split by the Karstic under drainage zone, as illustrated in the figure below.

There will be minimal development within the zone of Karstic underdrainage with no properties to be built within the zone. Instead, this area will include a cycling path connecting the two development areas, and an access road, and will be complemented with enhanced landscaping such as planted trees and orchards. Therefore, the calculations for greenfield runoff rates of the two fields will be treated separately. The area of Karstic underdrainage (17,590 m²) will be presumed to be 100% greenfield post-development and therefore will be excluded from the runoff calculations.

The calculations have identified that for **Field A** the peak greenfield runoff rate for the 1 in 1 and the 1 in 100 year critical storm is **0.62 l/s** and **2.77 l/s**, respectively, requiring a stormwater attenuation capacity of **1205.7 m³** during the 1 in 100 year 6-hour storm including a 45 % climate change allowance.

Field B calculations shows that the peak greenfield runoff rate for the 1 in 1 and the 1 in 100 year critical storm is **0.31 l/s** and **1.46 l/s**, respectively, requiring a stormwater attenuation capacity of **596.7 m³** during the 1 in 100 year 6-hour storm including a 45 % climate change allowance.

It is proposed that the site will aim to meet the DEFRA 2015 Non-statutory Technical Standards for Sustainable Drainage Systems and the requirements from the local SFRA, which mandate the reduction of runoff rates from the proposed development during the 1 in-1 year and the 1 in-100-year events to respective green field rates, accounting for the effects of climate change on rainfall-runoff over the lifetime of the proposed development. This will be achieved by using a series of Sustainable Drainage System (SuDS) measures within the site including:

- Permeable Paving,
- Subsurface storage geocellular systems – *e.g.* Polystorm systems, nominally 1 m x 0.5 m x 0.4m (l/w/d), with 95% void ratio.
- Detention basins (Field A).

Based on the developmental areas available within the masterplan, approximately **2719 m²** of driveway was measured, and around **1545 m²** of the total parking area is shared parking space, within **Field A**. Within **Field B**, approximately **2811 m²** of driveway was measured, and around **2213 m²** of the total parking area is shared parking space. These parking areas can be used to accommodate subsurface geocellular units providing a storage capacity of **1033 m³** within Field A. The remaining flows from Field A (**223m³**) will be attenuated by detention ponds located within the site; collectively, the combined area of the ponds is approx. 500 m². An area of **500 m²**, along with an average depth of **0.45 m** will be able to provide **225 m³** of storage, exceeding the requirement to attenuate the remaining flows within **Field A**.

Following a review of the master plan, spatial constraints have been identified for **Field B**. The entire attenuation of **672.3 m³** (1 in 100-year 6-hour storm including a 45 % climate change allowance) is proposed to be achieved via subsurface storage. The shared parking area has been identified to accommodate this requirement. The area is 2811 m² in size and will provide an attenuation storage of approx. **1068 m³**, based on a 1-unit deep system (400mm), along with a 95% void ratio.

Other SuDS that may be incorporated within the site (but have not been included in the calculations) are swales, which can help channel surface water flows, together with the installation of water butts. These are a cost-effective way to store rainfall. It has been assumed that the main new highways will be adopted by the Highways Authority and therefore, these areas have not been used for the construction of SuDS.

Since infiltration will not be suitable for the site, the subsurface modular cells and detention basin will be lined with an impermeable layer (tanking the system). The outgoing flows attenuated from the storage will then be conveyed by a 150 mm pipe to a newly constructed manhole, which will include a “complex flow control” device such as a Hydrobrake (vortex flow control). The flow control is required to discharge flows from the site to the targeted 1 in 1 year and 1 in 100-year greenfield runoff rates, for the respective rainfall return periods. To ensure self-cleansing, the outfall pipe will require a minimum gradient of 1:150 from the

subsurface storage to the construction of the manhole that houses the “complex flow control” device, which will help to ensure flow discharge from the site to be regulated to **0.62 l/s** during the 1 in 1-year and to **2.77 l/s** for the 1 in 100-year (inclusive of 45% climate change) for **Field A** and **0.31 l/s** during a 1 in 1-year to **1.46 l/s** for the 1 in 100-year (inclusive of 45% climate change) for **Field B**. The surface water discharge from both fields is proposed to be to the local adopted sewers. Approval of the above discharge rates and volumes to adopted sewers will be gained from Southern Water at the detailed drainage design stage. Consequently, it is wholly evident that as the site lies in entirely in Flood Zone 1 (Low risk) for fluvial and coastal risk, whilst the provision of a SuDS train throughout the scheme will sustainably manage surface water runoff. Therefore, the scheme is appropriate on flood risk grounds.

1. Introduction

1.1. Background

Grainger plc. has commissioned Hilson Moran to provide support with the planning application for the development of Woodcroft Farm in East Hampshire for residential purposes. The total size of the application site is approximately 8.61 ha with a hedged footpath that splits the two fields. The land is undeveloped and classified as a greenfield site. The proposal is to develop 190 dwellings split between the 2 fields. This report constitutes the FRA and Drainage Statement.

The national grid reference of the site is: SU 68151 12243

1.2. Purpose of the Report

The purpose of the FRA and drainage statement constitutes formal support for the planning application. NPPF requires that stipulates that developments that have a size greater than 1 hectare (ha) will require a flood assessment. The drainage recommendations and a Sustainable urban drainage (SuDS) that is appropriate to the scale and nature of the development and risks involved and should address the requirements for surface water drainage requirement of the Lead Local Flood Authority (LLFA), Hampshire County Council.

1.3. Scope of the Assessment

This document comprises a full FRA and drainage statement, using relevant information and up-to-date methodologies available to support the planning application for the development at Woodcroft Farm, East Hampshire

1.4. Structure

The remainder of this document describes the legislative context of East Hampshire District Council the Lead Local Flood Authority (LLFA) guidance for SuDS strategies and sewer adoptions, including a sewerage network connection plan, appraises the pre-existing baseline conditions at the development site, describes the proposed development, presents the surface water runoff calculations, proposes a Surface Water Drainage Strategy for the scheme, and finally presents a summary and conclusions relating to this report.

Relevant appendices are included at the end of the report.

1.5. Limitation and Copyright

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2. Policy Framework and Regulation

2.1. Planning Policy

2.1.1. National

The NPPFⁱ sets out policies that apply to the preparation of local plans, and development management decisions. This framework sets out the Government’s economic, environmental, and social planning policies for England. Taken together, these policies articulate the Government’s vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.

The NPPF states that flood risk and surface water disposal are material considerations for Local Planning Authorities (LPAs) when determining individual land-use planning proposals.

The NPPF reinforces the importance that the Government attaches to the management and reduction of flood risk in the land-use planning process, whilst also adopting a precautionary approach and fully accounting for the effects of climate change. The NPPF states how flood risk should be considered at all stages of planning and development, in an attempt to reduce future loss of life and damage to property.

The NPPF also states that surface water disposal is a material consideration for LPAs when determining individual land-use planning proposals and that SuDS should be incorporated into a development wherever practical development “unless there is clear evidence that this would be inappropriate. The systems used should:

- a) take account of advice from the lead local flood authority;
- b) have appropriate proposed minimum operational standards;
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- d) where possible, provide multifunctional benefits.”

The NPPF is supported by Planning Practice Guidance, which provides further information on key issues in the implementation of policies identified in the NPPF.

2.1.2. Local

Local Planning policy is provided by the LLFA Hampshire County Council’s “*Information for developers on SuDS principals and application*”ⁱⁱ for guidance and policy regarding SuDS adoption. For flood risk guidance, reference is made to the East Hampshire District Council Strategic Flood Risk Assessment (SFRA)ⁱⁱⁱ and sewer guidance is provided by Southern Water’s “*Adoption of Existing Sewers Guidance Notes*”^{iv} and “*Adoptable Pumping Station Local Practice Guidance*”.

2.2. Legislation

2.2.1. Building Regulations Part H: Drainage and Waste Disposal (2010)

Building Regulations Approved Document Part H^{vi} provides guidance on the hierarchy of options for surface water removal from a development site. The document states that, where feasible, the first choice for surface water removal should be to discharge such waters to an adequate soakaway or infiltration system. If this is not reasonably practicable then discharge should be to a watercourse, with discharge to an existing sewer being the least favoured option. Infiltration techniques should therefore be applied wherever they are feasible.

Building Regulation H3 stipulates that “...[Infiltration devices should not be built] *where the presence of any contamination in the run-off could result in the pollution of a groundwater source or resource*”. This is reaffirmed in the SuDS Manual, which states that “*in areas containing contaminated soils or contaminated groundwater, soakaways are not acceptable*”.

2.2.2. Water Industry Act (1991)

Legislation covering connection to a public sewer is contained in Section 106 to Section 109 of the Water Industry Act 1991 (the Act).^{vii} Section 106 of the Act stipulates that the owner or occupier of any premises may have their drains or private sewer connected to the public sewers of the sewerage undertaker.

In accordance with the Act, the following types of connection may (subject to approval) be made to the public sewerage system. The type of connection you make will depend on the sewerage system in the area of the required connection.

- a. Foul water into a foul sewer (e.g. from toilets, sinks, showers, and baths);
- b. Surface water into a surface water sewer (e.g. roof and paved area drainage);
- c. Foul and surface water into a combined water sewer (both a. and b. above); and
- d. Other types of connections may be permitted in exceptional circumstances, but they would be considered at the time of application.

2.2.3. Environmental Protection Act (1990)

Part II of the Environmental Protection Act 1990^{viii} states that “*contaminated land is any land which appears to be in such a condition, because of substances in, on or under the land, that:*

- *significant harm is being caused or there is a significant possibility of such harm being caused; or,*
- *pollution of controlled waters is being or is likely to be caused”.*

2.2.4. Flood and Water Management Act (2010)

The Act states that construction work that has drainage implications may not be commenced unless a drainage system for the work has been approved by an approving body (unitary authority/ County Council).^{ix}

In determining an application for approval, the approving body must *“grant it, if satisfied that the drainage system if constructed as proposed will comply with national standards for sustainable drainage; or refuse it if not satisfied”*.

The Act therefore removes the automatic right to connect to the public sewer if the proposed drainage strategy does not fully consider the feasibility of sustainable drainage techniques.

As part of the provisions of the Act, Defra released ‘Non-statutory Technical Standards for Sustainable Drainage Systems’ in March 2015. The Standards include the following general provisions applicable to this development:

- *“For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event;*
- *Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer, or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event;*
- *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer, or surface water body..., the runoff volume must be discharged at a rate that does not adversely affect flood risk;*
- *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30-year rainfall event;*
- *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*

The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people and property.”

3. Proposed Development

3.1. Location

The proposed development at Woodcroft Farm is approx. 8.61 ha in size and located in East Hampshire. The site borders the Borough of Havant on the west and Winchester district to the east. The site is bounded to the west by Clarendon Farm (located in Winchester District), an existing residential development to the east (Merritt Way), and James Copse Woods immediately north of the development.

The national grid reference of the site is: SU 68151 12243

3.2. Proposal

The proposal is to construct up to 190 residential dwellings within the site at Woodcroft Farm. These are split between the two existing fields and will include amenity areas, such as play areas, orchards, and ecological ponds (Figure 3.1).



Figure 3.1 Proposed Master Plan for Woodcroft Farm

4. Baseline Conditions

4.1. Existing Site

Currently, the site is arable greenfield land, previously used for grazing (but currently vacant). Forming the site are 2 parcels that have been divided by a bridgeway and hedge on either side splitting the 2 fields in the middle. For ease of this report, the field to the west will be named Field A which measures approximately 43,050 m², and the field east of the footpath (Field B), measuring approximately 23,000 m². Both fields have a clear site boundary defined by hedges (refer to Figure 4.1).



Figure 4.1 Current site conditions

4.2. Site Walkover

A site walkover was conducted on 10/10/2023 to take photo evidence of the site and to verify the initial desk-based study.

The weather conditions during the site visit were overcast (but dry), and ground conditions were wet (refer to Appendix A for the site photos).



Figure 4.2 Representative current conditions of the site

4.3. Topography

Data from the EA's 1m Digital Terrain Model (LiDAR), indicates that the site follows a general trend and slopes from north to south with the highest elevation recorded at the northeast corner, measuring roughly 72.5 m above Ordnance Datum (AOD) (Figure 4.3).

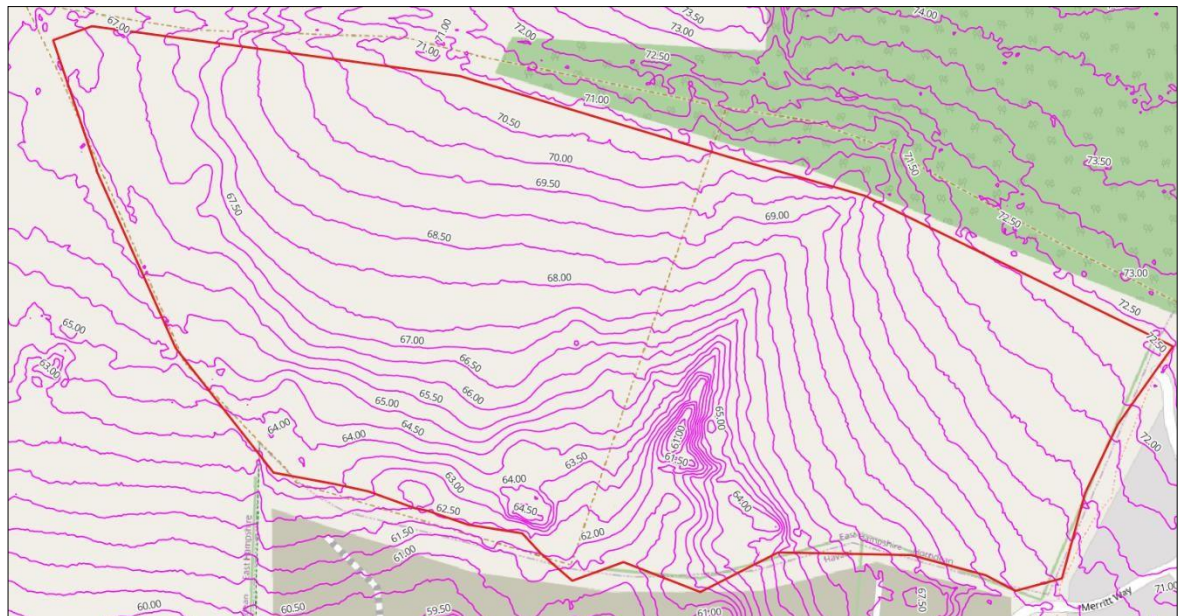


Figure 4.3 The topography of the site and surrounding area

The site has distinctive depression features near the southern boundary with the largest measuring roughly 2000 m² immediately east of the bridleway. The rapid drop in elevation within an almost “concentric-shaped” depression is indicative of sinkholes. These features within the vicinity of the site have been featured on the 1932 OS maps (see Appendix B). The lowest topography was measured within the sinkhole at 61 m AOD.

(Figure 4.4). The site visit confirmed the large depression, which is heavily vegetated with bramble and an oak tree within the location.

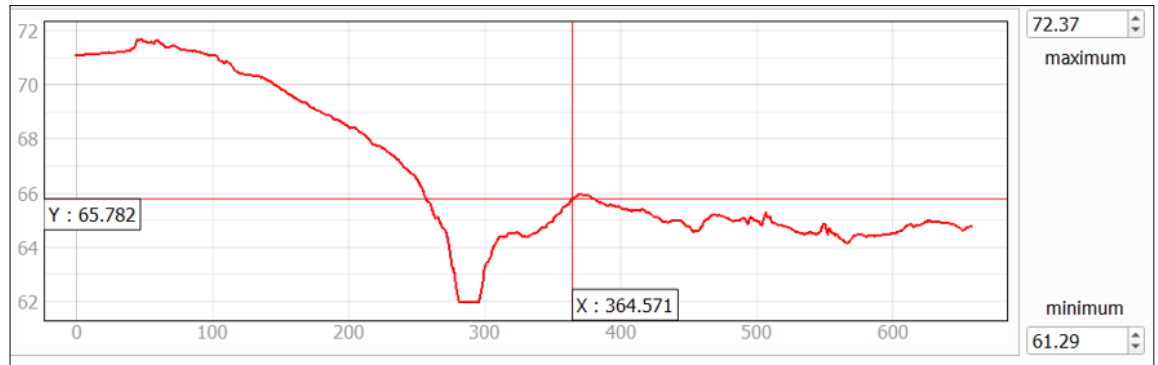


Figure 4.4 A cross-section from the east to the west of the site through the “Sinkhole”

4.4. Geology and Soils

The British Geological Survey’s (BGS) Geology of Britain viewer^{*} provides an understanding of the geological formations throughout Great Britain. A review of the information at the 1:50,000 scale mapping identifies that the bedrock of the area is Lambeth Group which is a Palaeogene sedimentary formation consisting of clay, slits, and sands. A small part on the top left corner of the site is identified as being a part of the Tarrant chalk member, which is a chalk formation from the Cretaceous period (Figure 4.5).

The superficial deposits are mainly unknown, however, a small section on the south has been identified as a Quaternary period “Head” deposit that consists of gravels and silts.



Figure 4.5 Bedrock geology of the site and area surrounding Woodcroft Farm

With reference to the National Soil Resources Institute (NSRI) Soilscape^{xi} the soil in the area is split between slowly permeable seasonally wet loamy/clayey soils that cover the

northern and eastern parts of the site, with the south and the west of the site having freely draining loamy soils (Figure 4.6).

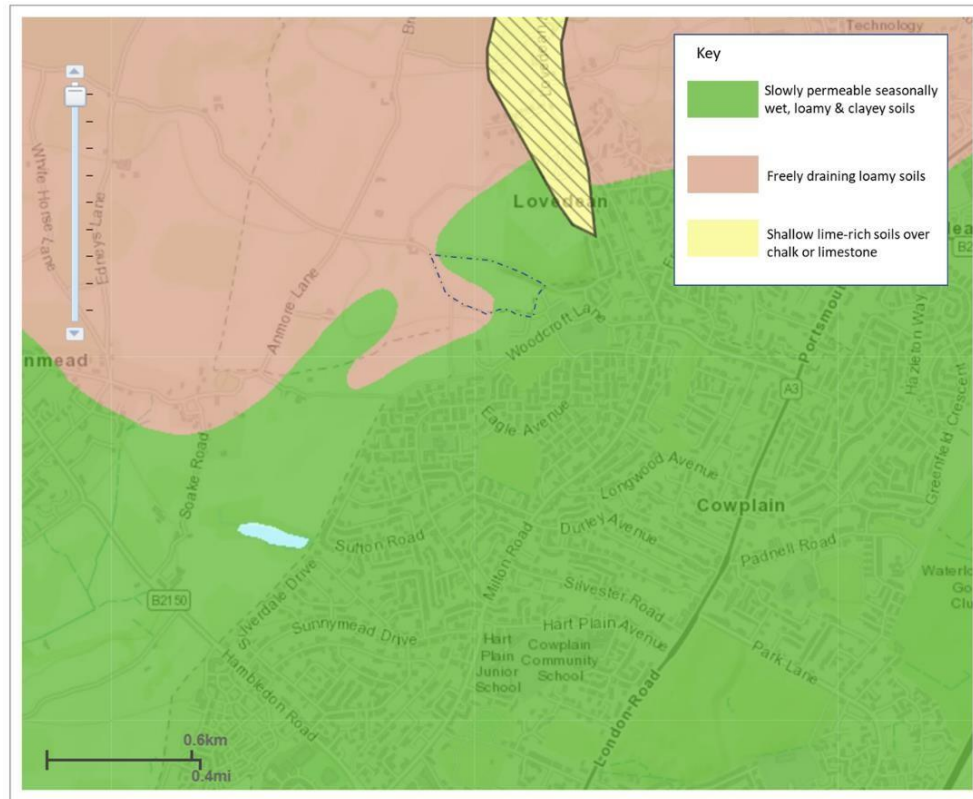


Figure 4.6 Soilscape soil map of the site and surrounding area

As mentioned in Section 4.2, the presence of sinkholes located in parts of the site was confirmed during the site visit on 10/10/2023 (See Appendix A for photos).

Sinkholes are formed by the subsidence of the ground due to the natural process of the dissolution of chalk. The potential sinkhole areas have been identified within the master map of the site, with a precautionary 10 m buffer zone being provided around the edge of the sinkhole which will act as a development exclusion zone, which includes avoiding development for building services, but some vehicles access has been proposed within the buffer zone (Refer to Appendix B).

A ground investigation conducted by Geo-Environmental provided information regarding the ground conditions, sinkholes, their presence within the site and the possible zone of Karstic underdrainage (likely from a paleo channel) that runs across the centre of the site (Appendix B). The report has identified that six oval to circular depressions are located within the site. The findings from the report has help revise the road layouts within the masterplan to avoid needing to form locally extensive earthworks, however some access roads may need to require the construction of a basal load transfer platform (LTP), to reduce or mitigate potential deformation at road surfaces due to potential settlement of soils within the sinkholes upon loading. For more information regarding the geology and the ground investigation within the site please refer to Geo-Environmental's Ground investigation report for Wood Croft Farm Phase 3, published on the 05/12/2023.

4.5. Hydrology

4.5.1. Information Sources

In determining the hydrological conditions across the site and environs, reference has been made to several sources. In particular, information has been brought together from:

- The EA's Flood Map internet resource^{xiii};
- The EA's Long-Term Flood Risk Map^{xiv}
- East Hampshire District Council's SFRA (2022)

4.5.2. Historic Flood Information

Hilson Moran has consulted with Hampshire County Council (on 10/10/2023) regarding any historical flooding within the area. From their records, they could not identify any historical flooding within a 250 m radius of the site. However, they have notified that the flood incidents before 2012 may not have been reported, and if further investigation is required then the EA may have pre-2012 flood records of the area. Refer to **Appendix D** for further details from the consultation.

4.5.3. Surface Water

Surface water (pluvial) flooding occurs when rainfall water cannot sufficiently drain away through local sewerage systems. This might be caused by a combination of factors including site topography, rainfall exceeding the capacity of local surface water/combined systems, or blockages to the sewers systems. The site is greenfield, therefore there is the assumption that surface water runoff is currently routed to field drains. Referring to the EA Risk of Flooding from Surface Water Map, there is a potential risk of areas of pluvial flooding, which are mainly concentrated within the large sinkhole. Other areas in the site have a very low chance of being affected by surface water (Figure 4.7).

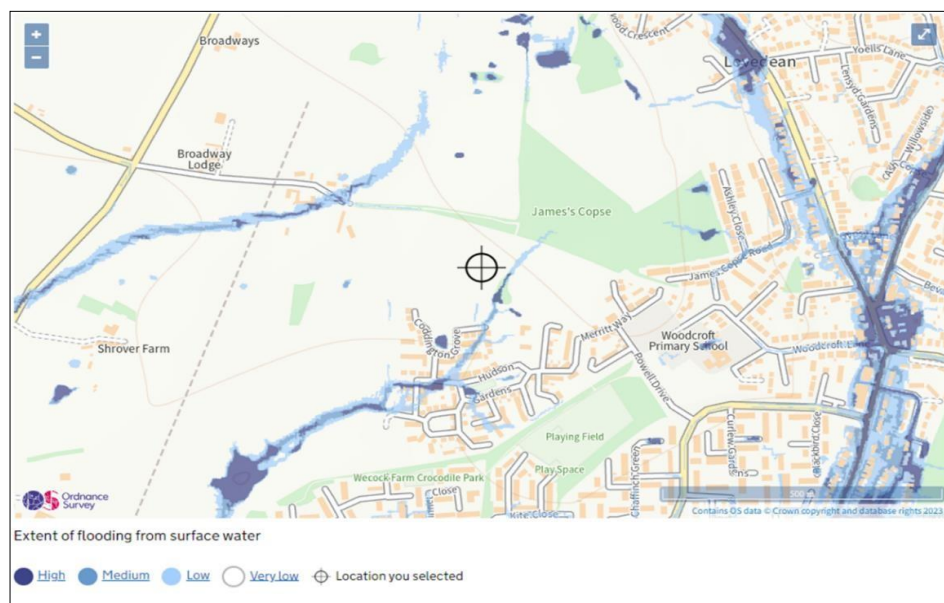


Figure 4.7 EA Surface Water Flood Map

4.5.4. Fluvial Sources

Fluvial flooding occurs when water levels exceed the banks of the watercourse (rivers, lakes, sea) causing it to overflow into the surrounding areas. This can be caused by excessive rainfall snowmelts or coastal surges.

Referring to the EA Flood Map, the site at Woodcroft Farm has a very low risk of flooding from fluvial sources (tidal/ rivers) as the entire site is within Flood Zone 1. The nearest watercourse is roughly 700 m southwest of the site (a tributary to Billy's Lake).

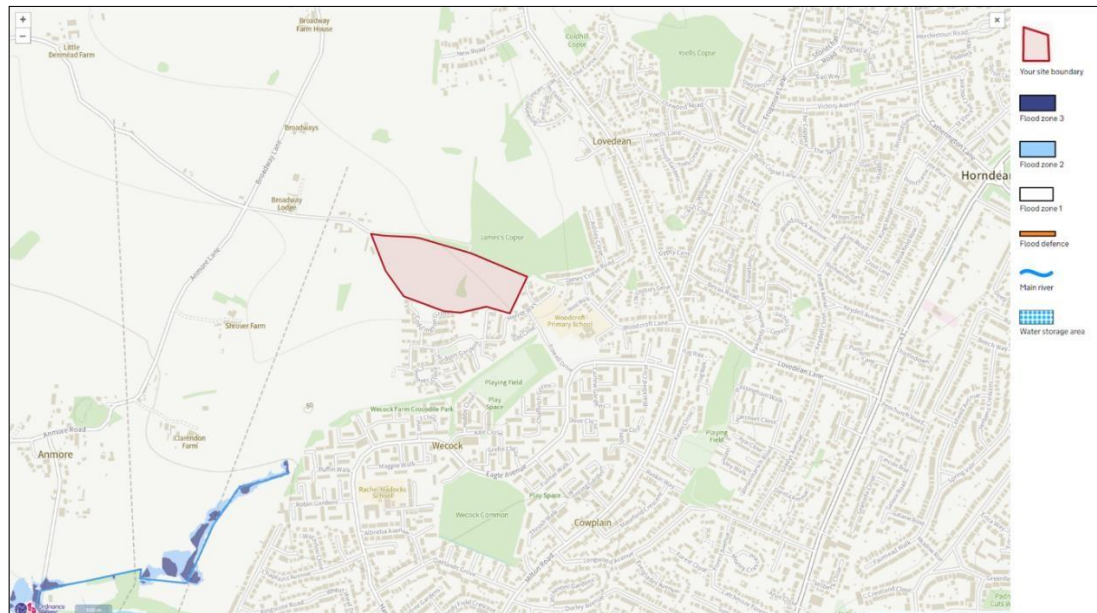


Figure 4.8 EA Flood Map showing Woodcroft Farm relative to Fluvial Flood Zones.

4.5.5. Groundwater

Groundwater flooding occurs when water from underground emerges above the surface. Depending on the underlying geology and superficial geology of the area, flooding from this source usually occurs after a particularly heavy storm when the infiltrated rainfall raises the local water table, causing the flows to flood the surface. Flooding from groundwater is generally more common in winter months.

The local SFRA has identified that the Chalk is the predominant bedrock that underlies many parts of East Hampshire. The SFRA shows that historical groundwater flooding does not include the areas surrounding the site (refer to Appendix C) and the BGS susceptibility to groundwater flooding also indicates that there is a low risk of flooding from groundwater sources at Woodcroft farm (Figure 4.9).

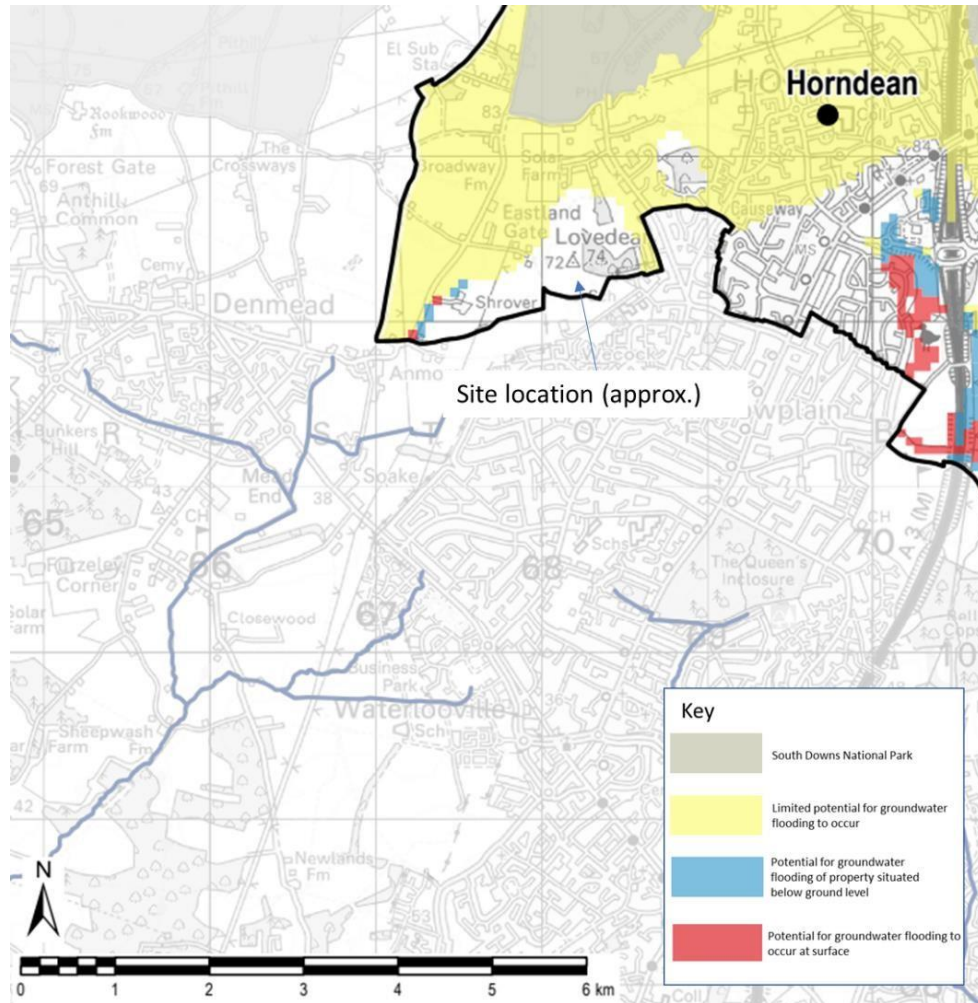


Figure 4.9 Susceptibility to groundwater flooding (BGS)

With reference to the EA's Groundwater Source Protection Zones Map (SPZs)^{xv}, the site lies within an SPZI (Inner zone) *i.e.* an area where the groundwater is used to supply drinking water. The EA designates these zones to protect the groundwater from pollution and contamination. Being in an SPZI means that contamination will have a *50 day travel time of the pollutant to source with a 50 meters default minimum radius*, indicating that SuDS from infiltration will be unsuitable in the area (Figure 4.10). This information will be considered during the SuDS design concepts chapters.

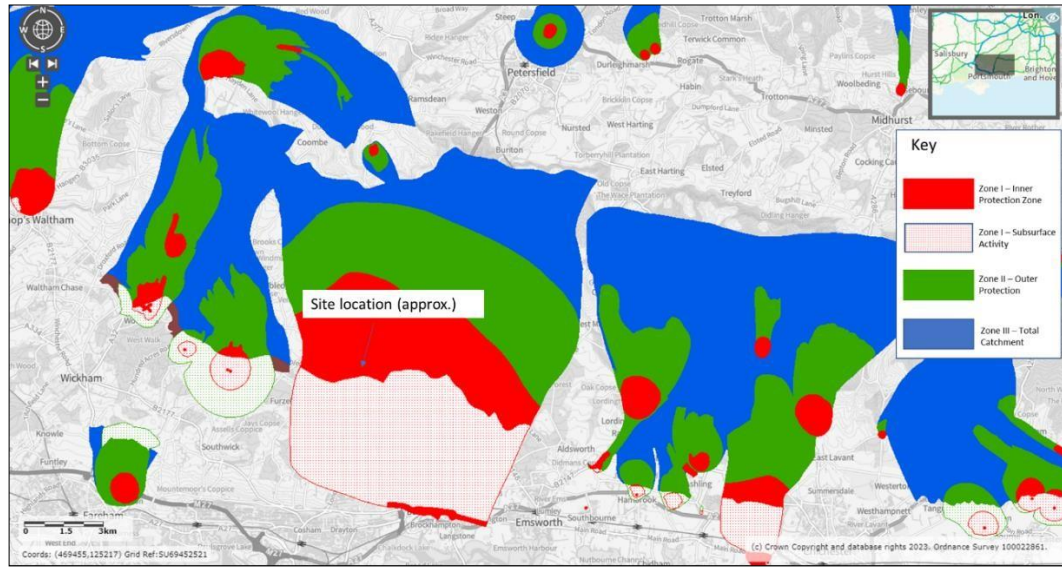


Figure 4.10 DEFRA MAGIC Map showing that the site is within a SPZ I

4.5.6. Sewer Records

Due to the site being a greenfield site, it is assumed that no surface water and foul drainage infrastructure has been established across the site.

A utility search was commissioned by Hilson Moran on 08/08/2023. The sewer records from Southern Water indicated that the only existing network within the vicinity is at the northeast corner, which is a head manhole (MH) for both a stormwater (SW) and foul water (FW) network. 5205 is a FW manhole that drains to the east that has a cover level (CL) of 71.87m AOD and a Invert Level (IL) of 70.17m AOD, whilst the SW MH 5257 has a CL that measures at 71.78m AOD and IL of 70.28m AOD, respectively (refer to Appendix D for further details). However, no details of the sewer networks were identified from Southern Water's sewer record of the existing development immediately south of the newly constructed Woodcroft Farms development (named Woodcroft Lane). This is likely due to the development being relatively new and Southern Water's database yet to be updated. Woodcroft Lane's S104 Adoptable Drainage Plan was obtained using the local planning portal (<https://www.havant.gov.uk/planning-services/search-and-comment-planning-applications>) which shows the adoptable drainage network on the site and potential points of connections for the drainage at Woodcroft Farm to the wider Southern Water network (refer to Appendix E).

5. Surface Water Management Philosophy

The NPPF states that the Government's policy is to reduce flood risk. Therefore, the development of the site should be seen as an opportunity for environmental enhancement and a net reduction in flood risk. As such, the development should aim to reduce run-off below the existing condition. If this is deemed impractical due to various constraints, the proposed development should at least maintain run-off rates and volumes at existing conditions.

SuDS can be a combination of both physical structures and techniques used to control surface water run-off as close to its origin as possible, before surface water discharges to a watercourse or ground. There is a wide variety of sustainable drainage options available that can be applied in different ways to help manage both surface and ground waters sustainably. Specific solutions need to be developed for each site, the choice of which will depend on factors such as the nature of the site, the type of pollutants potentially present, the hydrology of the area, and the presence of Groundwater SPZs.

The implementation of SuDS as an alternative to conventional drainage systems can provide significant direct and indirect long-term environmental benefits. Depending on the choice of the system these can include:

- Reduction in overall flood risk on-site and downstream from the proposed development by reducing surface water run-off to watercourses, either permanently or after peak flow periods in the system;
- Providing an opportunity for infiltration of surface water into the soil, where feasible.

5.1. Assessment of Impact

5.1.1. General Design Concept

For new developments, there is a general expectation that a drainage system should be adequate, particularly with regard to drains created by developments subject to Building Regulations. Adequate performance will usually be achieved if the drainage system:

- Conveys the flow via a suitable network or treatment systems to a suitable outfall (a soakaway, a watercourse, surface water, or combined sewer);
- Minimises the risk of blockage or leakage with good access for clearing blockages and any necessary maintenance;
- Has sufficient capacity to carry or retain the expected flow at any point in the system and so does not increase the vulnerability of the development to flooding;
- Provides drainage from roofs or paved areas to an adequately and suitably designed drainage system;
- Where necessary is adequately ventilated such that foul air does not enter buildings;

It should be noted that:

- I. The priority for discharge of rainwater is first to an adequate soakaway or infiltration system, if that is not reasonably practicable then to a watercourse, the last option is to a sewer; and
- II. Discharges into the ground (where permitted) should be distributed sufficiently so that the foundations of buildings or structures are not damaged.

In considering the most appropriate SuDS for the proposed development, reference has been made to the CIRIA *“Sustainable Drainage System Manual”* ^{xvi} (the *“SuDS Manual”*), local SFRA^{xvii}, along with the regional SuDS guidance for the South East of England (*“Water.People.Places”*).^{xviii}

The strategy aims to reduce the runoff from the site, compared to the pre-existing situation, as per requirements for non-major applications.

5.1.2. SuDS Hierarchy

When designing the SuDS Strategy, reference has been made to the priorities for discharge (*i.e.* the *“SuDS Hierarchy”*) presented in the SuDS Manual and Building Regulations.

The final bespoke SuDS solution has been arrived at through a process of elimination in the following way:

1. *“Discharge to the ground”* – with reference to Section 4.5.4 above, the local SFRA indicates that the site has no historic evidence of groundwater flooding, along with BGS susceptibility to groundwater flooding is low. However, the presence of sinkholes (confirmed in the site visit), along with the site being within an Inner Source Protection Zone (SPZ I), indicate that ground infiltration SuDS will not be suitable for this area.
2. *“Discharge to surface waters”* – there are no nearby watercourses that could act as a discharge point for the scheme (refer to Section 4.5.3);
3. *“Discharge to a surface water sewer, highway drain or another drainage system”* – most feasible option - adopted Southern Water sewer plans presented.
4. *“Discharge to a combined sewer”* – the area does not have a combined sewer network.

5.1.3. Preliminary Runoff Calculations

The following section provides an empirical demonstration of the reduction in surface water runoff volumes and rates, anticipated from the installation of appropriate SuDS devices.

5.1.3.1. Methodology

Firstly, the greenfield peak runoff rates for a range of return periods have been estimated using the IH124 methodology, included within HR Wallingford's Greenfield Runoff Rate Estimation Tool^{xix}. For sites <50 ha, the method uses a *pro-rata* methodology based on IH Report 124 with growth curves from the Flood Studies Report and CIRIA Book 14. The method requires the input of the standard average annual rainfall (SAAR) for the site in question (*i.e.* 820 mm). The SuDS Manual and Wallingford Procedure Technical Report

were used to determine values for soil index (SOIL) and 'urban catchment wetness index' (UCWI) for the Application Site, which are 0.1 and 136, respectively. Run-off rates and volumes for the proposed development have then been calculated. Any impact on run-off has been addressed through the installation of compensatory surface water storage.

In addition, Flood Estimation Handbook (FEH)/ Flood Studies Report (FSR) methods have been employed to facilitate the determination of the surface water run-off from the developed site for a range of return periods. The FEH Webservice generates the design rainfall depth for a range of specified return periods and storm durations, the latest FEH22 was used to produce the rainfall for this site.

Results were obtained using:

- The FEH method to establish rainfall depths for a range of return periods;
- The Modified Rational Method to calculate peak discharges for each return period;
- Derivation of run-off volume from RUNVOL (volume of run-off expressed as mm over total area) using the Wallingford Procedure.

A range of storm return periods has been modelled, using the modified Wallingford Procedure, to simulate a range of worst-case scenario surface water run-off rates and volumes from the site.

There are inherent difficulties in estimating greenfield run-off volumes for specific storm durations using the Wallingford Procedure. Consequently, the existing greenfield run-off volumes were approximated using the simple method presented on HR Wallingford's "UK Sustainable Drainage Guidance & Tools website, whereby it is assumed that the greenfield runoff volume is equal to the Standard Percentage Runoff (SPR) value of the soil. With reference to the same website, a value of 0.1 has been determined for the Application Site.

Thus, the greenfield runoff volume for the rainfall event can be calculated as:

$$\text{Greenfield Vol} = RD \times \text{AREA} \times 10 \times \text{SPR}, m^3$$

Where RD = Rainfall Depth for the return period storm of interest. Similarly, for those areas of impermeable surfaces, the following equation has been used:

$$\text{Runoff volume} = RD \times \text{AREA} \times \text{Runoff Coefficient}, m^3$$

Appropriate runoff coefficients have been sourced from the 2015 CIRIA SuDS Manual^{xx} and comprise 0.90 for pitched roofs with tiles and 0.75 for all other hardstandings.

With reference to the size and topography of the site, the time to concentration (*t_c*) of peak overland run-off from the site was determined using the Kinematic Wave Equation. The average time to concentration for a 50.4 mm/hr storm (Building Regs recommended

design rainfall intensity for surface water drainage design for normal situations – equating roughly to a 1 hour 1 in 100-year return storm) was estimated to be approximately 10.76 minutes (Field A) and 10.04 (Field B), on the basis that the existing developable area has an average gradient of around 0.04 m/m (Field A) and 0.05 m/m (Field B), with the highest point located on the northeast.

Furthermore, the 100-year 6-hour event was also modelled for each scenario, permitting the difference in run-off volume and pre- and post-development for this event to be calculated, as per EA guidance.

The proposed Master Plan for Woodcroft Farm shows that the site has two distinct development areas, split between the zone of Karstic under drainage (Figure 5.1).

There will be minimal development within the zone of Karstic underdrainage with no properties to be built within the zone. Instead, this area will be used to enhance the landscape by tree planting and proposed orchards. The infrastructure planned within this zone is a cycle route to connect the 2 developments, along with the site access for Field A on the southern boundary of the site. Therefore, the calculations for greenfield runoff rates for the 2 fields will be treated separately (for simplicity these will be labelled as Field A and B). The runoff areas of each field will be treated separately, and the area of Karstic underdrainage will be presumed to be 100 % greenfield post development. Consequently, this area (approx. 17500 m²) will be excluded from the calculations.

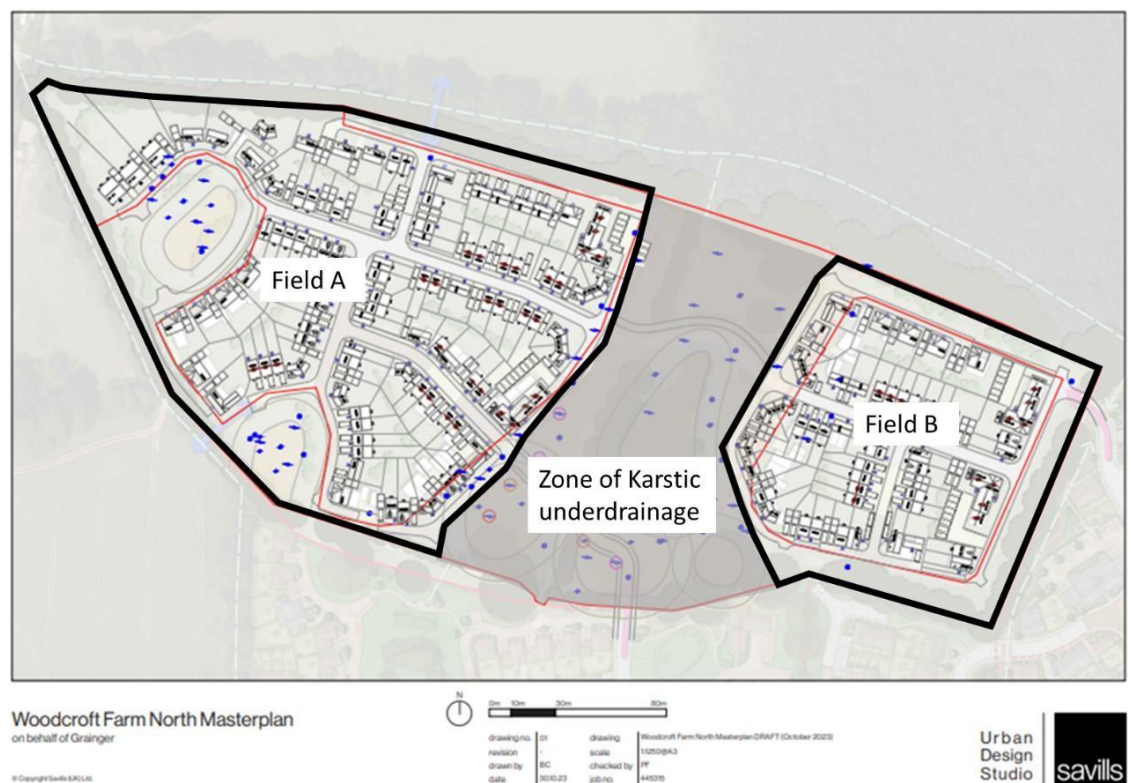


Figure 5.1 Master Plan highlighting the zone of Karstic under drainage

5.1.3.2. Greenfield runoff rates

Greenfield runoff rates were calculated using the methodology described above. The results of this procedure are presented in Table 5.1, which demonstrates an estimated greenfield runoff rate for the 100-year storm of 2.77 l/s and 0.64 l/s/ha for Field A and in Table 5.2 for Field B the rates are 1.46 l/s and 0.64 l/s/ha for the same return period.

Table 5.1 Greenfield runoff rates of Field A

Return period (years)	Peak Greenfield runoff rate (l/s)	Peak Greenfield runoff rate (l/s/ha)
Qbar _{rural}	0.87	0.2
1	0.62	0.14
30	1.97	0.46
100	2.77	0.64

Table 5.2 Greenfield runoff rates of Field B

Return period (years)	Peak Greenfield runoff rate (l/s)	Peak Greenfield runoff rate (l/s/ha)
Qbar _{rural}	0.46	0.2
1	0.31	0.17
30	1.03	0.46
100	1.46	0.64

5.1.3.3. Proposed development runoff rates and volumes

Runoff rates and volumes for the proposed development have been calculated in the absence of any mitigation, such as the provision of SuDS. The permeable surface area within **Field A** will decrease from **43,050 m²** to **25,510 m²**. This is a percentage decrease from **100%** to **59.3%**. **Field B** will decrease its permeable area from **22,632 m²** to **12,700 m²**. This is a decrease of percentage from **100%** to **57.4%** (based on the latest iteration of the proposed Master Map).

The decrease in permeable area is from the additional hard surfaces created by the pitched roofs from the buildings (houses, flats, and garages), parking spaces, and the pedestrian footpaths to the houses proposed within the masterplan. The results are presented in Tables 5.3 and 5.4 and demonstrate an estimated runoff rate for the 100-year critical storm and an estimated runoff rate for the 100-year critical storm for the post-development of field A and B respectively.

Table 5.3 Field A Proposed development peak runoff rates and volumes (without mitigation)

Return Period (Years)	Critical FEH storm depth (mm)	Run-off Volume (m ³)	Peak Flow Q	
			(l s ⁻¹)	(l s ⁻¹ ha ⁻¹)
1	5.8	65.1	140.6	32.7
30	16.4	184.3	397.9	92.4
100	20.4	229.6	496.0	115.2

Table 5.4 Field B Proposed development peak runoff rates and volumes (without mitigation)

Return Period (Years)	Critical FEH storm depth (mm)	Run-off Volume (m ³)	Peak Flow Q	
			(l s ⁻¹)	(l s ⁻¹ ha ⁻¹)
1	6.0	38.9	78.4	34.6
30	16.9	110.3	222.3	98.2
100	21.1	137.8	277.6	122.7

Consequently, with reference to the above sections, in the absence of any mitigation, the proposed development will result in an increase in the 1 in 100-year critical storm runoff rate and volume for **Site A** by 496.0 l/s (115.2 l/s/ha) and 229.6 m³ and in the 1 in 100-year 6- hour storm runoff rate and volume by 42.2 l/s (9.8 l/s/ha) and 433.2 m³. For Site B. This the rates without mitigation, the critical storm in a 1in 100 return period are 277.6 l/s (122.7 l/s/ha) and 137.8 m³, respectively, together with an increase in the 1 in 100-year 6-hour storm runoff rate and volume by 24.4 l/s (10.8 l/s/ha) and 264.8 m³ when compared against the existing situation, for **Field B**.

Within the design of drainage networks for new developments, the incorporation of an appropriate allowance for future climate change impacts on peak rainfall intensities is recommended to ensure that all future developments give rise to a net reduction in runoff rates and volumes throughout their operational lifetime.

Updated UK Government climate change allowances are available for DEFRA, Climate Change Allowances^{xxi}. Both central and upper-end predictions for peak rainfall intensity are provided. Associated guidance advises that “for flood risk assessments and strategic flood risk assessments, assess both the central and upper-end allowances to understand the range of impact”. Assuming a 100-year lifetime for the proposed development, the guidance suggests that the central total potential change anticipated for 2061 to 2125 and the upper end total potential change anticipated for the same period is 45 % for both 1 in 100-year events.

Consequently, making a precautionary +45 % allowance for increased rainfall intensity over the anticipated lifetime of the proposed development, the post-development 100-year critical storm duration (28.5 mm rain) was also modelled and returned a run-off rate of 694.4 l/s (161.3 l/s/ha) and an increase in the volume of 321.5 m³ for Field A. Field B also sees an increase using the same allowances to 29.6 mm rain and returned a run-off rate of 192.9 l/s (71.7 l/s/ha) and an increased volume of 192.9 m³.

Therefore, the post-development for **Site A**, the 100-year critical storm event modelled above, inclusive of a +45 % allowance for increased rainfall intensity due to climate change (45 % CC), indicates that the application site, with the impacts of climate change over the lifetime of the development, would lead to an increase in the volume of 321.5 m³ rainfall run-off during the 100-year critical storm and for the 100-year 6-hour event (87.2 mm rain) there would be an increase of approximately **1205.7 m³** when compared against the existing greenfield rates. For **Site B**, the 100-year critical storm event plus 45 % CC (29.6 mm rain) there would be an increase of approximately 192.9 m³ when compared against the existing greenfield rates and in a 100-year 6-hour event (87.2 mm rain) there would be an increase of approximately **672.3 m³**.

Without mitigation, the proposed development would not facilitate the sustainable management of surface water run-off taking account of the potential increase in rainfall run-off, due to climate change, expected over the operational lifetime of the +45 % CC allowance development.

5.1.4. SuDS Design Concept (Guidance)

In Section 12.10 of the East Hampshire District Council SFRA, “*All major developments (10 or more dwellings and 100m² floorspace) and other development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff.*”

For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event must be as close as reasonably practicable to greenfield runoff rates from the development and should never exceed the rate of discharge from the development before redevelopment for that event. For greenfield developments (where reasonably practical), the runoff volume discharged from the scheme should not exceed the greenfield runoff volume in the 1 in 100-year, 6-hour rainfall event.

The inclusion of infiltrating SuDS is dependent on the following factors;

- The local geology (both superficial and bedrock);
- Proximity to an SPZ; and
- Any areal constraints (*i.e.* nearby other built areas).

Due to the local geology and the presence of sinkholes within the site, it is **not** deemed suitable for the use of infiltrating SuDS as infiltration may have adverse effects on the ground stability. As a precautionary approach, the SuDS design concepts for this report (refer to Section 6.15) will use non-infiltrating SuDS.

It is, therefore, intended that the proposals will include the attenuation of surface water run-off rates and volumes from the site by incorporating SuDS, capable of mitigating against predicted increases in peak rainfall intensity resulting from climate change, over the lifetime of the new proposed builds.

5.1.4.1. Mitigation Consideration

The existing site comprises an open field (Field B) on the east and arable fields (used for horses) on the west (Field A). There is no nearby watercourse to discharge surface water flows and infiltration is not possible. Therefore with reference to the SuDS Hierarchy, the intention is to discharge the surface water into the nearby surface water sewer network, highway drain, or other drainage system, as both infiltration and discharge to a watercourse is deemed not suitable (refer to Section 5.1.2). Consequently, it is intended to attenuate runoff on-site and then discharge to the nearby surface water sewer system.

It has been calculated that:

1. The peak greenfield runoff rate for **Field A** in the 1 in-1-year critical storm is **0.62 l/s**, requiring **66.3 m³** storage during the critical storm, and in **Field B** is **0.31 l/s**, requiring **41.0 m³** storage during the critical storm when a 45 % allowance for climate change is taken into account;
2. The peak greenfield runoff rate for **Field A** in the 1 in 100-year storm is **2.77 l/s**, requiring **233.7 m³** storage during the critical storm, and in **Field B** is **1.46 l/s**, requiring **145.0 m³** storage during the critical storm when a 45 % allowance for climate change is taken into account;
3. The additional development runoff volume for **Field A**, for the 1 in 100-year, 6-hour rainfall event requires **1205.7 m³** storage when climate change is taken into account;
4. The additional development runoff volume for **Field B**, for the 1 in 100-year, 6-hour rainfall event requires **672.3 m³** storage when climate change is taken into account;
5. In order to achieve greenfield run-off rates in **Field A**, the 1 in 1-year discharge rate will be regulated at **0.62 l/s** and the 1 in 100-year discharge rate will be regulated at **2.77 l/s**, requiring a stormwater attenuation capacity of **1205.7 m³** during the 1 in 100-year 6-hour storm including a 45 % climate change allowance.
6. In order to achieve greenfield run-off rates in **Field B**, the 1 in 1-year discharge rate will be regulated at **0.31 l/s** and the 1 in 100-year discharge rate will be regulated at **1.46 l/s**, requiring a stormwater attenuation capacity of **672.3 m³** during the 1 in 100-year 6-hour storm including a 45 % climate change allowance.

5.1.5. SuDS Design Concept

It is intended that the proposed development will aim to meet the DEFRA 2015 Non-Statutory Technical Standards for Sustainable Drainage Systems ^{xxii} and the requirements from the local SFRA. The requirement mandates to reduce runoff rates from the proposed development during the 1 in-1 year and the 1 in-100-year events to respective green field rates, accounting for the effects of climate change on rainfall-runoff over the lifetime of the proposed redevelopment. With reference to the Non-statutory Technical Standards, ideally:

“For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.”

and

“Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 years, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.”

A concept used in the development of SuDS is a “treatment train” which uses a variety of different SuDS measurements to reduce the peak runoff discharged from the site as well as having measurements for pollution controls.

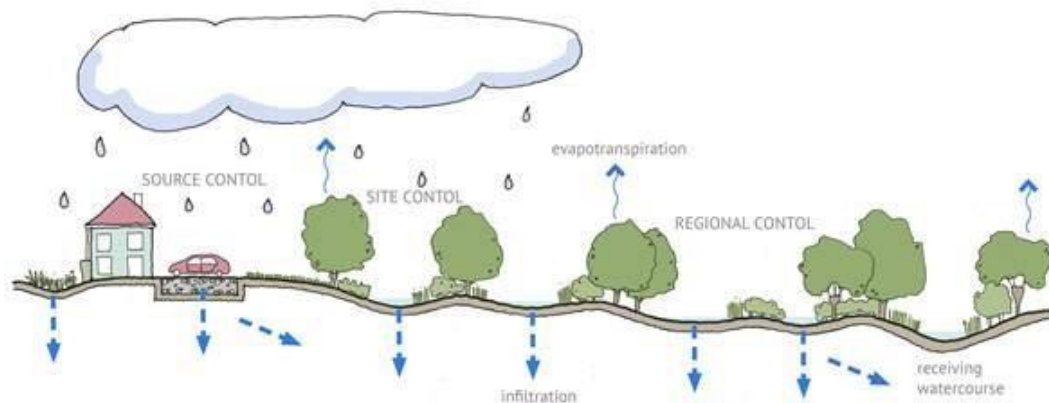


Figure 5.2 SuDS management train concept – Susdrain

The provision of a SuDS train within the Woodcroft Farm development will be the key to mitigating and future-proofing the site from surface water flood risk (this includes return periods for the 1 in 1-year and 1 in100-year rainfall, plus additional +45 % climate change factors. It is therefore anticipated that the development will attenuate at a total of **1878 m³** (split between **1205.7 m³** for **Field A** and **672.3 m³** for **Field B**). This will be achieved through the provision of permeable paving, detention basins, and subsurface storage.

5.1.5.1. Water Butts

Water Butts are small off-line storages that are designed to capture and store rainfall runoff directly from the roof. These are simple and fairly cost-effective means of rainwater harvesting and reuse for gardens. A water butt collects rainwater run-off from roofs via an inlet that is connected to the roof down-pipe. The device is normally constructed from polyethylene, which is often sourced from recycled material. Water butts are manufactured in a wide variety of sizes and some models consist of inter-connectable units. During wet periods, water butts are often full, resulting in little or no attenuation or reduction in outflow rates or volumes.

However, water butts can be designed to attenuate run-off by using a throttled overflow system, as identified in (Figure 6.2). It is, therefore, proposed to provide water butts for all dwellings on the site, where practical, as per the design in Figure 5.3, resulting in both water conservation and stormwater attenuation benefits.

As a precautionary measure, the attenuation provided by water butts has not been included in the mitigation calculations.

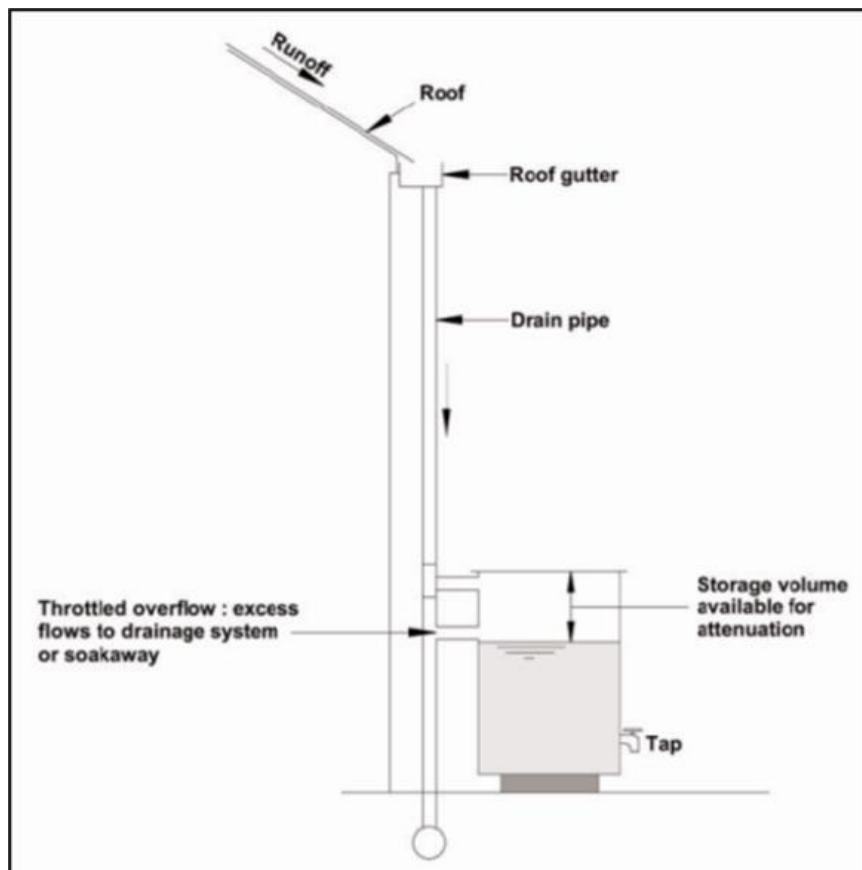


Figure 5.3 Two-stage water butt schematic (designed for stormwater attenuation)

5.1.5.2. Swales

Swales are vegetated channels (normally with slopes no steeper than a 3:1) used to both store and convey runoff of flows. An ideal swale design can both help with filtering pollutants taken up from the runoff and effectively conveying flow. Swales can have a variety of profiles and a range of planting strategies to meet the site characteristics and the system objectives. A swale can also temporarily pond runoff to increase pollutant retention. The benefits of using swales are they can be placed in areas where space is a premium and be incorporated with other SuDS measures.

Within the proposed site, there is a potential to incorporate swales including the eastern boundary of Field A, between the footpath and the Karstic area. This area can accommodate a swale and within Field B the section along the eastern boundary along the south can be furnished with swales as well. Both “fields” can use the swales as a form of conveyance for surface water runoff from impermeable areas (roofs, impermeable surfaces, etc) into attenuation ponds (refer to Section 5.1.5.4).

Where space is limited, a maximum slope of 1 in 3 (33%) is recommended, however, a 1 in 4 (25%) slope is preferred to allow for easier maintenance.

It is ideal if an underdrain is provided through the swale to convey flow away from the developed area to prevent the site from becoming waterlogged. Underdrains and outlets should be designed using conventional hydraulic design methods and should be connected to a positive outflow. Underdrains are most often constructed using slotted pipes or geocellular units. The underdrain should lie beneath the depth indicated for the swale and will provide additional storage within the pipes themselves for added benefit to the site.

Though swales have some capacity for storage and infiltration, as a precautionary measure, their potential capacity has not been included in the storage calculations. If swales are intended to be implemented for storage, then this can be addressed at the detailed design stage.

5.1.5.3. Permeable Paving

Permeable pavements offer an effective SuDS method of providing a structural hardstanding suitable for pedestrians and vehicular traffic, whilst also allowing water to pass through the surface into the pavement construction for temporary storage and re-use if required. Products on the market include the Gridforce LDPE modular permeable paver system (Figure 5.4), amongst other systems available. This system is fabricated from 100 % recycled plastic and can be infilled either with soil/grass or gravel and can withstand loading from HGVs such as bin lorries and emergency vehicles such as fire engines. The systems are typically laid on well-prepared, free-draining, firm, and relatively-level stone subbase (a reduced fines Type 3 for example, nominal depth 150 to 200 mm), which is then overlaid with a geotextile membrane separator followed by 20-30 mm of coarse sand as a bedding layer, providing a permeable surface.



Figure 5.4 Gridforce LDPE modular permeable paver system with either soil/grass or gravel infill

Permeable pavements can help reduce the effects of pollution by allowing water to infiltrate through the porous surfaces. Additionally, these can be used in conjunction with subsurface storage.

Within the development, it is proposed that the selected shared parking areas and private parking areas will be constructed from permeable surfaces. The maximum area for **Field A** available measures roughly **2720 m²** with around **1545 m²** of the total parking area being shared parking space. For **Field B**, the available parking space measures **2811 m²** with around **2213 m²** of the total parking area being shared parking space.

It has been assumed that the main new highways will be adopted by the Highways Authority and therefore, these areas have not been used for the construction of SuDS.

5.1.5.4. Sub-Surface Storage and Detention Basin

It is anticipated that the site will attenuate the runoff from the roof, roads, and other impermeable surface within the site, up to the 1 in 100 rainfall event plus an additional 45% for climate change. This equates to attenuating **1033 m³** of runoff within *Field A* and **1068 m³** within **Field B**. The proposed plan is to use a combination of geocellular sub-surface storage underneath the permeable paving, along with the creation of a detention basin to attenuate flows, before ultimately discharging to the local surface water network.

Geocellular subsurface units will be of the modular “orange-crate” type that can be used to manage and control surface water. They can be used as a soakaway when infiltration is feasible or as temporary storage to attenuate the flows during a storm event. There are a range of different types and manufacturers on the market, including Polypipe, which manufactures the Polystorm geocellular systems (Figure 5.5).

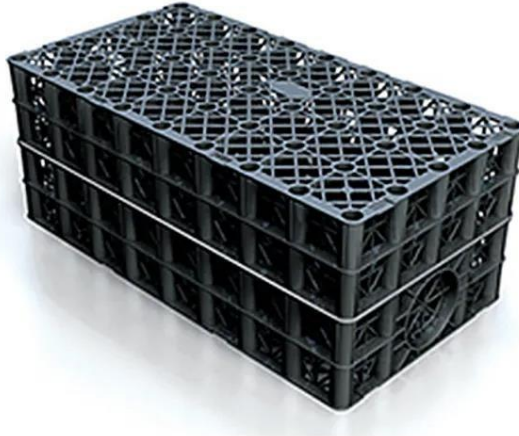


Figure 5.5 Single unit of the Polystorm Geocellular system (1000 mm/500 mm/400 mm (l/w/h) with a void ratio of 95% refer to <https://www.polypipe.com/civils/water-management-solutions/polystorm-geocellular-system>)

The geocellular units will be used to store flows up to and including the 1 in 30-years storm, plus 45% climate change, constituting **982.6 m³** for **Field A**. The above attenuation target can be achieved by installing approximately **2719 m²** of geocellular modules, which will attenuate **1033 m³** at 1 unit deep (*i.e.* 400 mm).

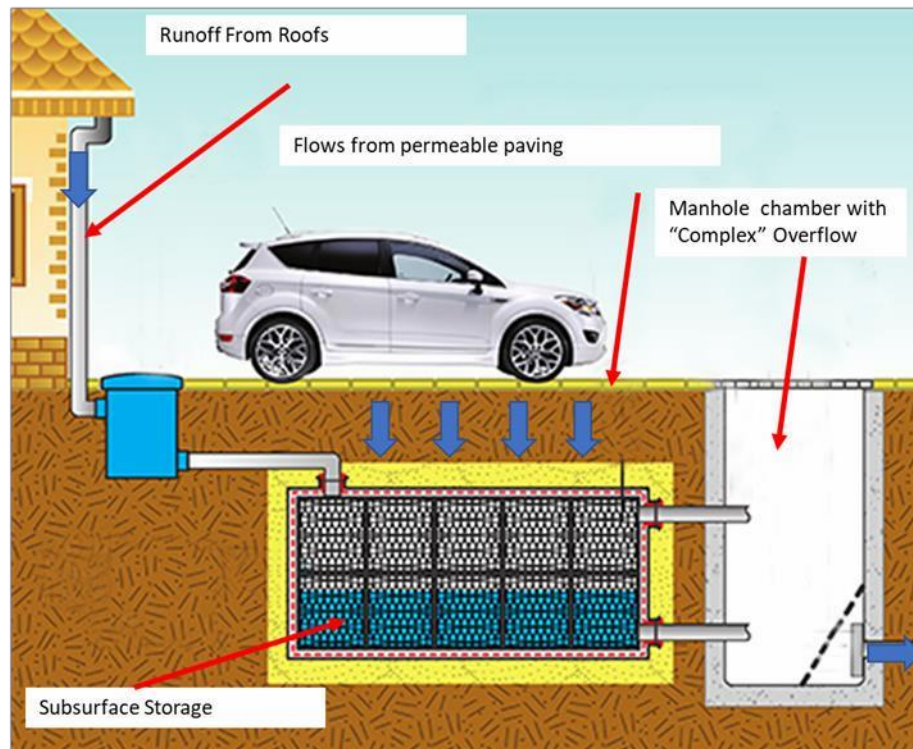


Figure 5.6 Example layout of permeable pavement/sub-surface storage system - surface water runoff conveyed from the roof and the pavement (via permeable paving) into subsurface storage and then discharged via an overflow system.

The remaining flows that require to be attenuated within **Field A** are calculated as the difference between the 1 in 100-year + climate change and 1 in 30-year + climate change volume of **223.1 m³**, which will be stored in the detention basins. Detention basins are surface storage features that are typically dry during normal conditions and can be used for other amenities such as football pitches but will act as additional storage to attenuate runoff during storm events (Figure 5.7). The side slopes of the basins should be kept to a maximum slope of 1:3. A low flow channel will be required to prevent erosion on the inlet and to route the flows to the outlets. Finally, the maximum water depth should be kept to 1.2m for safety reasons.

The latest master plan shows a number of areas within **Field A** that can be used for detention basins (Figure 5.8).



Figure 5.7 An example of a detention basin installed within a housing development, which will provide amenity space when not in used for flood storage – Susdrain

The preliminary proposal comprises the diversion of surface water runoff from **Field A** into 2 detention basins as shown in Figure 5.8. A combined area of **497 m²** is available, with an average nominal depth of 0.45 m, which will be able to provide **224 m³** of storage, meeting the requirement to attenuate the remaining flows within **Field A**.

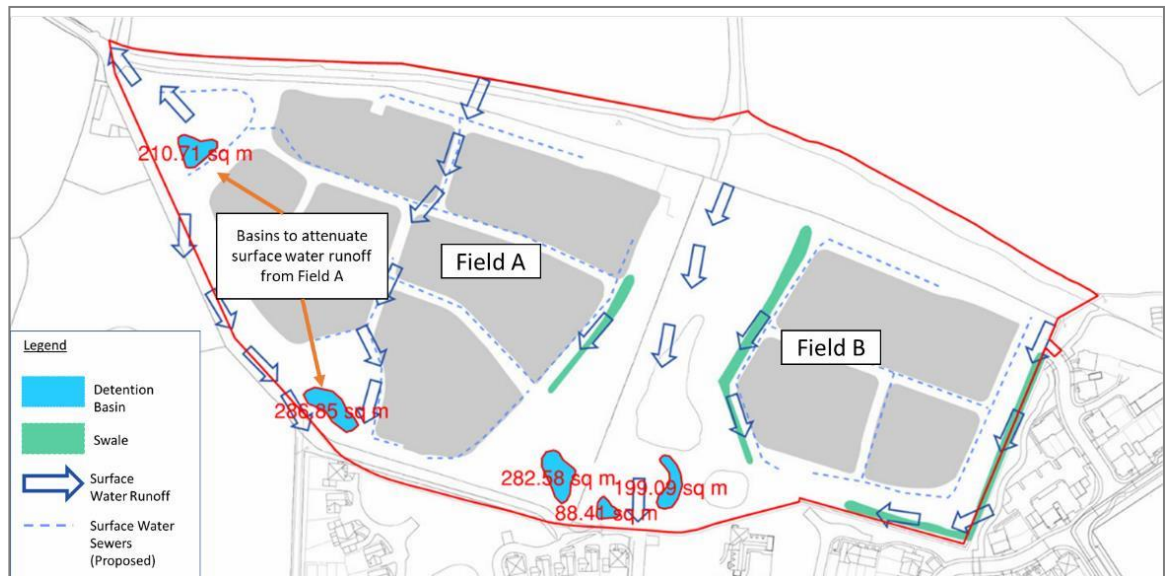


Figure 5.8 Proposed drainage strategy

Following the review of the master plan, spatial constraints have been identified for **Field B**. The entire attenuation of **672.3 m³** (1 in 100-year 6-hour storm including a 45 % climate change allowance) is proposed to be achieved via subsurface storage. The shared parking area has been identified to accommodate this storage. The area of **2213 m²** will provide an attenuation storage of approx. **804 m³**, based on a 1-unit deep system (400 mm), along with a 95 % void ratio.

Since infiltration will not be suitable for the site, the subsurface modular cells and detention basin will be lined with an impermeable layer (tanking the system). The outgoing flows attenuated from the storage will then be conveyed by a 150 mm pipe to a newly constructed manhole, which will house a “*complex flow control*” device such as a Hydrobrake (vortex flow control). The flow control is required to discharge flows from the site to the targeted 1 in 1 year and 1 in 100-year greenfield runoff rates, for the respective rainfall return periods. To ensure self-cleansing the outfall pipe will be laid at a minimum gradient of 1:150 from the subsurface storage to the construction of a manhole, with the “*complex flow control*” device, which will ensure that discharge from the site is regulated to **0.62 l/s** during the 1 in 1-year and to **2.33 l/s** for the 1 in 100-year (inclusive of 45% climate change) for **Field A** and **0.31 l/s** during a 1 in 1-year to **1.16 l/s** for the 1 in 100-year event plus climate change for **Field B**.

5.1.6. Maintenance of SuDS

Anticipated maintenance will be coordinated and paid for by the owner of the site and comprise:

1. Periodic checking of inspection chambers and pipework for blockages or physical damage, and remediation as required;
2. Periodic jetting or rodding of pipework as required to clear blockages;
3. Periodic desilting of the flow control (*e.g.* Hydrobrake) sump. The sump should be emptied/checked at least as follows (but with an annual inspection and additional cleansing if required): On completion of drainage works, Year 1, Year 3, then every 5 years;
4. Permeable pavements: Annual sweep/clearance of permeable external surfaces if permeable surfacing is installed. Annual inspections of the inlet(s) for litter/blockages and annual (or as required) removal of sediment from pre-treatment structures.

5.1.7. Pollution Minimisation during Construction

Minimisation of pollution events during the construction phase will be ensured by the adequate maintenance of vehicles, the responsible handling and storage of potentially polluting materials and liquids, and suitable training of staff.

In order to reduce the impact of accidental spillages (e.g. from plant fuel) during construction, appropriate planning will identify such risks and the precautionary measures to be taken such as:

- Spillage response kits;
- Seals to drains;
- Bunding of high-risk areas; and
- Training of staff in emergency procedures.

Furthermore, the Control of Pollution (Oil Storage) (England) Regulations 2001 (together with the EA's former Pollution Prevention Guidelines 2 [PPG2]) will be complied with. The Regulations cover the storage of oil of any kind, including petrol, mineral oil, heating oil, lubricating oil, vegetable oil, heavy oils such as bitumen, and oils used as solvents, such as paraffin or kerosene. The Regulations stipulate the strength, integrity, and delivery systems of oil containers and prescribe secondary containment systems such as drip trays or bunds, which will ensure that the likelihood of oil spillages is minimised.

6. Summary & Conclusion

Hilson Moran has been commissioned by Grainger plc to prepare a NPPF compliant FRA, along with supporting the sewerage and Sustainable Drainage Systems (SuDS) Strategy, appropriate to the nature and scale of the residential development at Woodcroft Farm in East Hampshire.

The national grid reference of the site is: SU 68151 12243.

The proposed development will consist of 190 residential dwellings split between 2 previously undeveloped greenfield sites that are connected by a hedged public footpath in the middle. The total area is approximately 8.61 ha.

The FRA has identified that the site is within Flood Zone 1 and demonstrates that it is at low risk of flooding from all tidal and river sources, artificial water bodies, and also groundwater. The EA Flood Maps have identified that some potential surface water flooding is present, mainly routed within the middle section of the site (*i.e.*, the potential Karstic area). As a precautionary measure, the evolving masterplan has not placed any buildings within this region. There is no recorded historical flooding within the vicinity, and being within Flood Zone 1, therefore the scheme will not require a Sequential Test from the NPPF and East Hampshire.

National Planning Policy Framework (2023) states that plans should take a proactive approach to mitigate and adapt to climate change, considering the long-term implications for flood risk. East Hampshire District Council SFRA also has set requirements which include: "All major developments (10 or more dwellings and 100m² floorspace) and other development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff."

The development site is classified as a greenfield development. Where reasonably practical, the runoff volume discharged from the development should not exceed the greenfield runoff volume up to the 1 in 100-year, 6-hour rainfall event.

The proposed masterplan for Woodcroft Farm shows that the site has two distinct development areas (*i.e.* Field A and B), split by the Karstic under drainage zone.

There will be minimal development within the zone of Karstic underdrainage with no properties to be built within the zone. Instead, this area will include a cycle path connecting the two development areas, and an access road which will be complemented by enhanced landscaping, such as planted trees and orchards. Therefore, the calculations for greenfield runoff rates for the two fields will be treated separately. The area of Karstic underdrainage (17,590 m²) will be 100 % greenfield post-development, and therefore will be excluded from the runoff calculations.

The calculations have identified that for Field A the peak greenfield runoff rate for the 1 in 1 and the 1 in 100 year critical storm is **0.62 l/s** and **2.77 l/s**, respectively, requiring a stormwater attenuation capacity of **1205.7 m³** during the 1 in 100 year 6-hour storm, including a 45 % climate change allowance.

Field B calculations shows that the peak greenfield runoff rate for the 1 in 1 and the 1 in 100 year critical storm is **0.31 l/s** and **1.46 l/s** respectively, requiring a stormwater attenuation capacity of **672.3 m³** during the 1 in 100 year 6-hour storm including a 45 % climate change allowance.

It is proposed that the site will aim to meet the DEFRA 2015 Non-statutory Technical Standards for Sustainable Drainage Systems and the requirements from the local SFRA. The requirement mandates to reduction of runoff rates from the proposed development during the 1 in-1 year and the 1 in-100-year events to respective green field rates, accounting for the effects of climate change on rainfall-runoff over the lifetime of the proposed redevelopment. This will be achieved by using a series of SuDS features within the site including:

- Permeable paving,
- Subsurface storage geocellular systems, such as the Polystorm system, nominally 1 m x 0.5 m x 0.4 m (l/w/d), with 95 % void ratio.
- Detention basins (Field A).

Based on the developmental areas available within the masterplan, approximately **2719 m²** of driveway was measured, and around **1545 m²** of the total parking area is shared parking space, within **Field A**. Within **Field B**, approximately **2811 m²** of driveway was measured, and around **2213 m²** of the total parking area is shared parking space. These parking areas can be used to accommodate subsurface geocellular units providing a storage capacity of **1033 m³** within Field A. The remaining flows from Field A will be attenuated by detention ponds located within the site; collectively, the combined area of the ponds is approx. 500 m². An area of **500 m²**, along with an average depth of **0.45 m** will be able to provide **225 m³** of storage, meeting the requirement to attenuate the remaining flows within **Field A**.

Following review of the master plan, spatial constraints have been identified for **Field B**. The entire attenuation of **672.3 m³** (1 in 100-year 6-hour storm including a 45 % climate change allowance) is proposed to be achieved via subsurface storage. The shared parking area has been identified to accommodate this requirement. The area is 2811 m² in size and will provide an attenuation storage of approx. **1068 m³**, based on a 1-unit deep system (400mm), along with a 95% void ratio.

Other SuDS that may be incorporated within the site (but have not been included in the calculations) are swales, which can help channel surface water flows, together with the installation of water butts. These are a cost-effective way to store rainfall. It has been assumed that the main new highways will be adopted by the Highways Authority and therefore, these areas have not been used for the construction of SuDS.

Since infiltration will not be suitable for the site, the subsurface modular cells and detention basin will be lined with an impermeable layer (tanking the system). The outgoing flows attenuated from the storage will then be conveyed by a 150 mm pipe to a newly constructed manhole, which will include a “complex flow control” device such as a Hydrobrake (vortex flow control). The flow control is required to discharge flows from the site to the targeted 1 in 1 year and 1 in 100-year greenfield runoff rates, for the respective rainfall return periods.

To ensure self-cleansing, the outfall pipe will require a minimum gradient of 1:150 from the subsurface storage to the construction of the manhole that houses the “complex flow control” device, which will help to ensure flow discharge from the site to be regulated to **0.62 l/s** during the 1 in 1-year and to **2.77 l/s** for the 1 in 100-year (inclusive of 45% climate change) for **Field A** and **0.31 l/s** during a 1 in 1-year to **1.46 l/s** for the 1 in 100-year (inclusive of 45% climate change) for **Field B**. The surface water discharge from both fields is proposed to be to the local adopted sewers. Approval of the above discharge rates and volumes to adopted sewers will be gained from Southern Water at the detailed drainage design stage. Consequently, it is wholly evident that as the site lies in entirely in Flood Zone 1 (Low risk) for fluvial/ coastal risk and has no historical flooding within the area, therefore a Sequential Test will not be required for this site. The provision of a SuDS train throughout the scheme will sustainably manage surface water runoff. Therefore, the scheme is appropriate on flood risk grounds.

Appendices

Appendix A – Site Visit photos

Description	Photo
	View of the Karstic area
	General conditions of the eastern field at Woodcroft Farm.



Surface water gulley is located at the (almost completed) Catherington Park development site, bordering the south of Woodcroft Farm.



Looking south to Catherington Park



General landscape of Woodcroft farm on the west field.

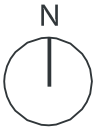


Minor surface water ponding at the top left corner of the west field.

Appendix B – Landscape Context



- Key
- Site Boundary
 - Public Right of Way
 - Woodland
 - Deciduous Woodland
 - Ancient Woodland
 - Ancient Woodland 15m Buffer
 - Ancient Woodland 50m Buffer
 - Existing Trees/Hedgerow
 - Existing Category A/B Trees/Hedgerow Root Protection Area
 - Category C Trees Root Protection Area
 - Sink Holes & Offsets
 - Possible Zone of Karstic Underdrainage
 - Potential Vehicular Access



Land North of Woodcroft Farm
on behalf of Grainger plc

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C:\Users\athina\OneDrive\Box\UK\UrbanDesign\Projects\Grainger\SNUD445315-GRAINGER\WoodcroftFarmNorth\Hampshire\Drawings\IND04a_LandNorthofWoodcroftFarm_DrawingPack31\07\23
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drawing no.	LA004	drawing	Landscape Context
revision	-	scale	NTS
drawn by	AM	checked by	PF/RB
dat	01.06.2023	job no	445315

Appendix C – HCC, historical groundwater flooding events

Date	Location	Description
1995	Rowlands Castle	Higher rainfall in the winter of 1994 and 1995 caused groundwater levels to increase, resulting in flooding causing damage to gardens and road closure. The source of flooding from the 1995 event began in Finchdean within the SDNP Authority Area which also experienced flooding. Residents within the neighbouring villages of Finchdean and Deanlane End (located within the SDNP authority area) also experienced flooding during the 1994 event.
April 2000- March 2001	Rowlands Castle	A prolonged period of rainfall exceptional caused the aquifers within Hampshire to become saturated, causing groundwater flooding around Hampshire. Significant flooding was experienced in the south of the district in the village of Rowlands Castle where several properties experienced internal and external flooding. Groundwater flooding caused the sewer system and cesspits to surcharge. Access was prevented to properties.
January 2001	Bordon	Water in the garden of the property.
March 2001	Whitehill	Water in the cellar
July 2001	Bordon	Standing water in the garden.
2013 -2014	Rowlands Castle	Prolonged rainfall and high groundwater levels including associated river flows caused flooding within Rowlands Castle and Finchdean (SDNPA).
2013-2014	Chawton	Flooding is caused by high groundwater levels and prolonged and heavy rainfall.
2013-2014	Lower Faringdon	Experienced serious groundwater flooding, resulting in the A32 being closed for a considerable period. A social housing scheme was abandoned and demolished. HCC subsequently carried out flood alleviation works downstream.
2014	Alton	The EA has also supplied their PAD which shows 5 records of flooding in Alton with a mixture of internal, basement, and garden flooding reported.

2019-2020	Northbrook Park near Alton /Holybourne	Significant flooding following Storm Ciara and the December 2019 floods resulted in A31 between Bentley and Farnham being closed for 3 days; the River Wey close to record levels; the entire North Wey valley flooded from Holybourne through to Farnham.
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Appendix D - Pre-application Advice from Hampshire County Council



Universal Services
The Castle
Winchester, Hampshire SO238UD

Tel: 03005551375
Fax 01962 847055
www.hants.gov.uk

<i>Enquired to</i>	Thomas Callaway	<i>My reference</i>	SWM-PRE/2023/0615
<i>Direct Line</i>	03707 798982	<i>Your reference</i>	
<i>Date</i>	15 November 2023	<i>Email</i>	swm.consultee@hants.gov.uk

Dear Sir/Madam,

**Proposed development/FRA at 26 HUDSON GARDENS,
WATERLOOVILLE, HAMPSHIRE PO8 9FA (Application No.**

Hampshire County Council as Lead Local Flood Authority has provided comments in relation to the above pre-application in our role as statutory consultee on surface water drainage for major developments.

In order to assist applicants in providing the correct information to their Local Planning Authority for planning permission, Hampshire County Council has set out the information it requires to provide a substantive response at <https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/planning>

Assessment of Flooding

The site is within Flood Zone 1 and is generally at very low risk of flooding from surface water but a flow path exists through the centre. Development (including surface water drainage features) should be located within the lowest risk areas of the site and not obstruct any existing surface water flow paths.

Surface Water Management

Infiltration is the preferred drainage strategy of the LLFA, but is dependent on successful infiltration testing and sufficiently low winter groundwater levels. The potential for infiltration may be restricted by the geology type at the site. If likely to be feasible, infiltration testing should be undertaken in accordance with BRE 365, with three successive tests undertaken at the location and depth of proposed infiltration features. Winter groundwater monitoring is required to determine whether a one metre unsaturated zone beneath

Director of Universal Services
Patrick Blogg

proposed infiltration features is possible. Infiltration features should accommodate the 1 in 100 year storm event inclusive of a peak rainfall allowance, with suitable half-drain times (24 hours maximum for up to the 1 in 30 year storm event, with mitigation such as additional storage where half drain times are particularly slow for larger events).

Should infiltration not be viable as a strategy, an alternative drainage strategy may rely on attenuation with a restricted discharge to a watercourse or surface water sewer (subject to capacity and separate agreements) adjacent to the site if available. Attenuation storage should be an appropriate size to allow for the 1 in 100 year storm event (plus peak rainfall allowance) to be attenuated while discharging at rates no greater than greenfield runoff rates. The assumption is that the discharge would be restricted to Q_{bar} , however it must be ensured that the discharge rate does not exceed the equivalent greenfield runoff rate for all storms up to the 1 in 100 year event. Flow control devices should have an orifice of sufficient diameter that it is not prone to blockages. Vortex flow control devices generally allow for a greater orifice diameter for equivalent flow rates when compared with a simple orifice plate.

For a full application, hydraulic calculations for the whole surface water drainage network must be provided to show that flooding does not occur for the 1 in 30 year storm event, inclusive of a peak rainfall allowance appropriate for the location and design life of the development. Any flooding modelled for the 1 in 100 year storm event (including peak rainfall allowance) should have its extent marked up on a layout. Further information on peak rainfall allowances and how to apply them can be found here: <https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall> and here: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#using-peak-rainfall-intensity-allowances-to-assess-surface-water-flood-risk>. Urban creep must be considered by increasing the residential impermeable areas (excluding flats) by 10% to account for driveways and extensions that may be constructed in the future. Flood exceedance flow routes should also be shown on a layout, showing that overland flow routes avoid properties in the event of a failure of the drainage system.

Maintenance details will be required for the surface water drainage system components. This would need to include essential maintenance activities, the frequency of maintenance, and the responsible party for maintenance. Note that the maintenance of any ditches deemed to be the responsibility of the landowner is covered by the relevant section of the Land Drainage Act 1991, and the LLFA has enforcement powers to ensure the free flow of water. Easements for ditches are strongly recommended, and could be incorporated in open space corridors.

SuDS Design and Selection of Drainage Features

SuDS should be provided to include an element of biodiversity and amenity as well as managing water quality and quantity. Quantity should be assessed through hydraulic calculations for the relevant modelled storm events. Network calculations should be provided for a full application to determine whether flooding occurs at manholes in piped parts of the system. Water treatment must be assessed through the simple index approach, with consideration given to each treatment train. It may be necessary to incorporate additional SuDS features to ensure that runoff quality is improved through the drainage system.

Ordinary Watercourse Consenting

Any alterations to ordinary watercourses (if present), open or culverted, may require ordinary watercourse consent from the LLFA. Maintenance works do not require consent, but any temporary works required to enable maintenance may require consent. For pre-application advice and general consenting information, please see: <https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/c/hangewatercourse>.

Surface Water Checklist

In addition to this pre-application advice, please refer to the Surface Water Checklist for the information required by the LLFA for different types of planning application: <https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/planning>. This checklist is accompanied by guidance notes and details exactly what is required for the LLFA to review the surface water drainage proposals, depending on the type of planning application.

Yours faithfully,



Thomas Callaway
Senior FWM Project Officer



Hampshire County Council

L Ferguson
Hilson Moran
Third Floor South
Shackleton House
4 Battlebridge Lane
London
Southwark SE1 2HP

Economy, Transport and Environment Department
Elizabeth II Court West, The Castle
Winchester, Hampshire SO238UD

Tel: 0300 555 1375 (General Enquiries)
0300 555 1388 (Roads and Transport)
0300 555 1389 (Planning)
Textphone 0300 555 1390
Fax 01962 847055
www.hants.gov.uk

Enquiry to Flood & Water Management

My reference HFI-2023-0048

Direct line 01962 846730

Your reference

Date 13/11/2023

E-mail fwm@hants.gov.uk

Dear Ms Ferguson,

Re: Woodcroft Farm, Waterloo ville

We refer to your request for historic flood information on 19/10/2023.

Thank you for your application for historic flood information for this site. Please find below the information we have on our systems that we believe to be relevant for this request. Kindly note the declaration on the final page with regards to this information.

Historic flooding information

We have reviewed our records of flood incidents for this area and have no records of flooding within a 250m radius of the site. This does not necessarily mean that other flood events have not occurred, they either may not have been reported or events may have occurred prior to 2012 – Hampshire County Council as Lead Local Flood Authority have only been maintaining flood records since then following the establishment of the Flood and Water Management Act 2010. The Environment Agency (EA) may hold data on flood events prior to this date.

Please refer to attached map for the location of this flood event(s). Kindly note that outlines of areas highlighted as highway flooding on the map may include properties or other off-highway areas that were not impacted by flooding.

There are no flood reports undertaken for this area under Section 19 of the Flood and Water Management Act where significant flooding was reported.

Flood risk from surface water

The EA's Updated Flood Map for Surface Water illustrates the potential area of surface water flooding taking into account the topography and permeability of the area. It also includes factors to take into account drainage provision. This information is designed to be high level and should not be used to indicate specific properties and risk but identify low points and potential flow routing. The mapping indicates that this address is partially within an area at high risk of surface water flooding. High risk means that each year this area has a chance of flooding of greater than 3.3%, and some parts of the site may flood to a depth of 1.2m.

For more information on this flood risk, please see <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

HCC has prepared Surface Water Management Plans which are available on our website. For more detailed information on flooding in the Havant Borough Council administrative area, please see their Strategic Flood Risk Assessment, which can be found at [download \(havant.gov.uk\)](https://havant.gov.uk/download).

Flood risk from watercourses

Watercourses are any natural or artificial channel above or below ground through which water flows. Watercourses are classified as either 'Ordinary Watercourse' or 'Main River'. Ordinary watercourses are watercourses that are not part of a Main River and include streams, ditches, drains, culverts etc. through which water flows. The Lead Local Flood Authority (LLFA - in this instance Hampshire County Council) are responsible for managing the risk from ordinary watercourses and have powers to ensure maintenance is undertaken by the relevant body, usually the adjacent landowner. For more information, see <http://documents.hants.gov.uk/flood-water-management/HCCFloodRiskManagement-Landowners.pdf>.

Main Rivers are typically larger streams and rivers, but some are smaller watercourses of local significance. Main Rivers are nationally managed by the Environment Agency, but responsibility for maintenance remains with the landowner.

There are no Main Rivers within 250m of this site. Known Ordinary watercourses are marked on the attached map(s); however it should be noted that many ordinary watercourses are not recorded centrally (such as small ditches etc.). The site is located within the water body catchment of the River Meon and is in the Catchment Priority area of Horndean West.

For more information regarding fluvial (river) and tidal flooding and flood risk please contact the Environment Agency or refer to the following website: <https://flood-map-for-planning.service.gov.uk/>

Ordinary Watercourse Consenting

Hampshire County Council is responsible for issuing Ordinary Watercourse Consents. These consents assess the flood risk of proposed changes (both permanent and temporary) to ordinary watercourses and are a legal requirement of such work. We have no records of Ordinary Watercourse Consents (OWCs) within the search area.

Please refer to the Hampshire County Council OWC website for further information and the forms for consents:

<https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/change-watercourse>

The consenting process has a statutory timeframe of two months from when the application is validated. To request data relating to consents prior to 2012 please contact the EA on: psohiow@environment-agency.gov.uk

Any works proposed within eight metres of a main river are likely to require a flood risk permit from the Environment Agency. Please refer to the following for further information: <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>

Flood risk from sewers

For information regarding foul flooding, please contact Southern Water.

Vulnerability of site from groundwater

Groundwater is by definition hard to predict and difficult to manage. The geology of the site in question is primarily Lambeth group (clay, silt and sand) partially overlain with superficial deposits of Head 9clay, silt, sand and gravel).

Hampshire County Council hold no records of groundwater flooding in the area, however this does not necessarily mean that other flood events have not occurred. It can be difficult to define flooding as a result of groundwater particularly in those areas where silt, gravel and sand can lead to a perched watertable which can prevent infiltration drainage from working as opposed to being a groundwater emergence flood event which tends to be seen linked to chalk aquifers.

Please note this information should only be used to establish relative, but not absolute, risk of groundwater flooding. A more detailed assessment including groundwater monitoring may be required.

More detailed information is available in relation to potential groundwater flood risk from the British Geological Society however it should be noted that this is a chargeable service. For further information please refer to:

<https://www.bgs.ac.uk/research/groundwater/datainfo/GFSD.html>

Hampshire County Council has a draft Groundwater Management Plan that is available on our website which contains useful information. It can be found at:

<https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/strategies/groundwater-management-plan>

Environmentally designated sites

We note that the site is within 250m of 1 designated environmental sites:

- James' Copse and Outlier SINIC;

Drainage Assets

We do not hold information in relation to private or third party drainage assets but are aware that Hampshire County Council as Highways Authority are responsible for many assets within and draining the Highway.

It is the responsibility of Hampshire Highways to maintain their assets on the highway, and they are on a regular cleansing schedule. If there are any issues with any highway gullies, soakaways, culverts etc. from a maintenance perspective, this can be flagged on the online system:

<https://www.hants.gov.uk/transport/roadmaintenance/roadproblems>

If flooding issues are reported to Highways and are in relation to Highway infrastructure, we as LLFA may not have access to these records and you may need to place a request for this information using the above link.

If you have any further queries, please contact the Flood and Water Management (FWM) Team quoting the above reference

Kind regards

FWM Team
fwm@hants.gov.uk

Please Note: The data supplied has been compiled from a variety of sources of varying reliability. The data is constantly being revised and validated to ensure the highest accuracy possible. However, the data should not be relied upon or considered completely accurate and the data is provided on the understanding that neither the County Council nor the disclosing officer is to be held responsible should you rely on this data and consequently suffer damage.

This response has been provided using the best knowledge and information submitted as part of the planning application at the time of responding and is reliant on the accuracy of that information.

Hampshire County Council defines significant flooding as 'flooding that affects 20 or more properties internally in one flood event within the same location OR flooding that affects significant lengths of highways affecting 20 or more properties and lasts for a period of 3 hours from the onset of flooding'. For more information on how we define flooding, please see our guidance on our website <http://documents.hants.gov.uk/flood-water-management/FloodInvestigationsguidance.pdf>

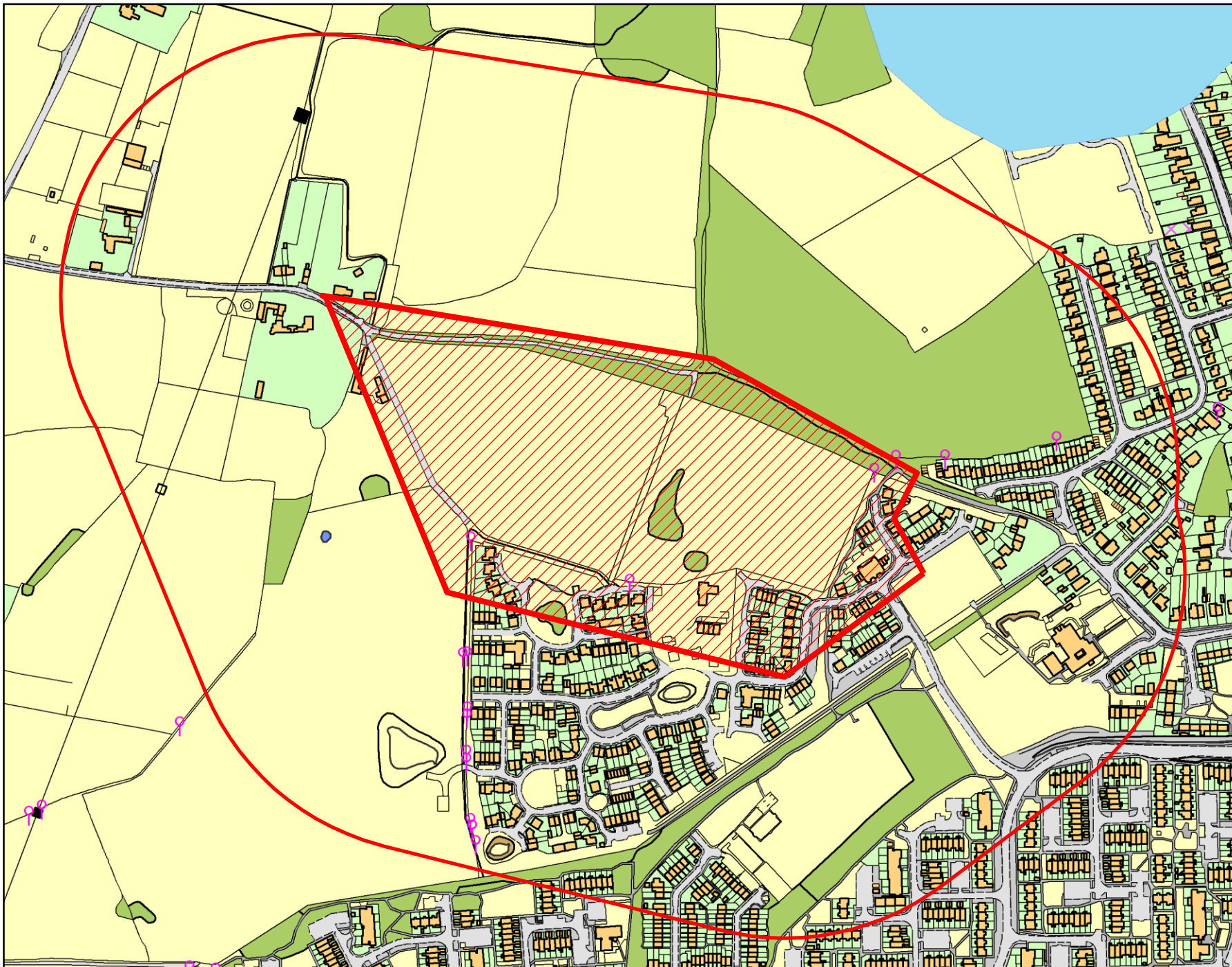
You may find the following websites useful –

- ❓ <http://bluepages.org.uk/>
- ❓ <https://nationalfloodforum.org.uk>
- ❓ <https://nationalfloodforum.org.uk/about-flooding/reducing-your-risk/protecting-your-property/>
- ❓ http://hummedia.manchester.ac.uk/institutes/mui/cure/research/documents/Property_owners_booklet_web_000.pdf (linked from the National Flood Forum)
- ❓ <https://www.floodre.co.uk/>

Users' Disclaimer

I understand that in using advice provided by the Hampshire Flood and Water Management Team I am aware of the following:

1. The Flood and Water Management (FWM) Team is part of Hampshire County Council ("We/Us/Our"). The Council holds copyright of this information and advice on behalf of the FWM team except where service level agreements state otherwise. No direct reproduction of this advice will be allowed as a direct copy, except for the purpose of Environment Information Requests.
2. Advice provided by the Hampshire FWM Team will only be used for the purpose stated and will not be stored beyond the life of the project for which it was acquired.
3. Any personal information supplied in association with these records will not be used, copied, or passed to any third party without the consent of the Hampshire FWM Team and in accordance with the GDPR.
4. Whilst every reasonable effort is made to validate information supplied to and by the Hampshire FWM Team owing to the dynamic and judgmental nature of information relating to flooding, the Hampshire disclaims any responsibility for the accuracy or comprehensiveness of the information supplied, and accepts no liability for any indirect, consequential, or incidental damages or losses arising from use of the information.
5. I am aware of the Hampshire FWM Team charging schedule and understand I may be charged for the advice.
6. All web links are accurate as on the day they were accessed.



- Legend**
- 250m buffer
 - Site
 - Recorded Highway Flooding
 - Recorded Highway Flooding in Hampshire
 - External Flooding Incident

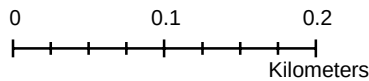
Historic Flood Information Request

Historical Flooding Information

L Ferguson c/o Hilson Moran

Woodcroft Farm,
Waterlooville

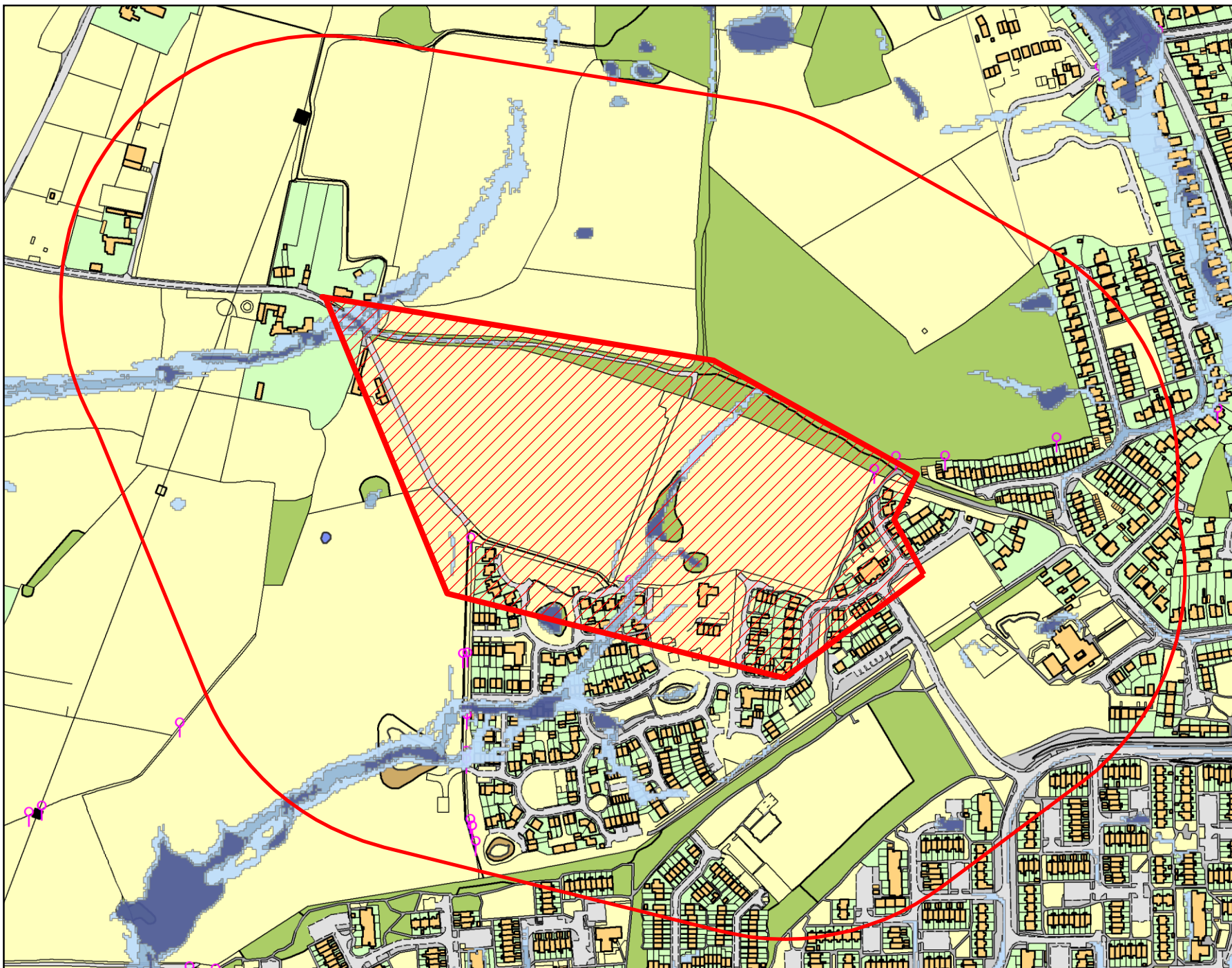
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Revision:	1	Initials:	CT



Legend

- 250m buffer
- Site
- Flood Maps for Surface Water (High)
- Flood Maps for Surface Water (Medium)
- Flood Maps for Surface Water (Low)

Historic Flood Information Request

Flood Map for Surface Water

L Ferguson c/o Hilson Moran

Woodcroft Farm,
Waterlooville

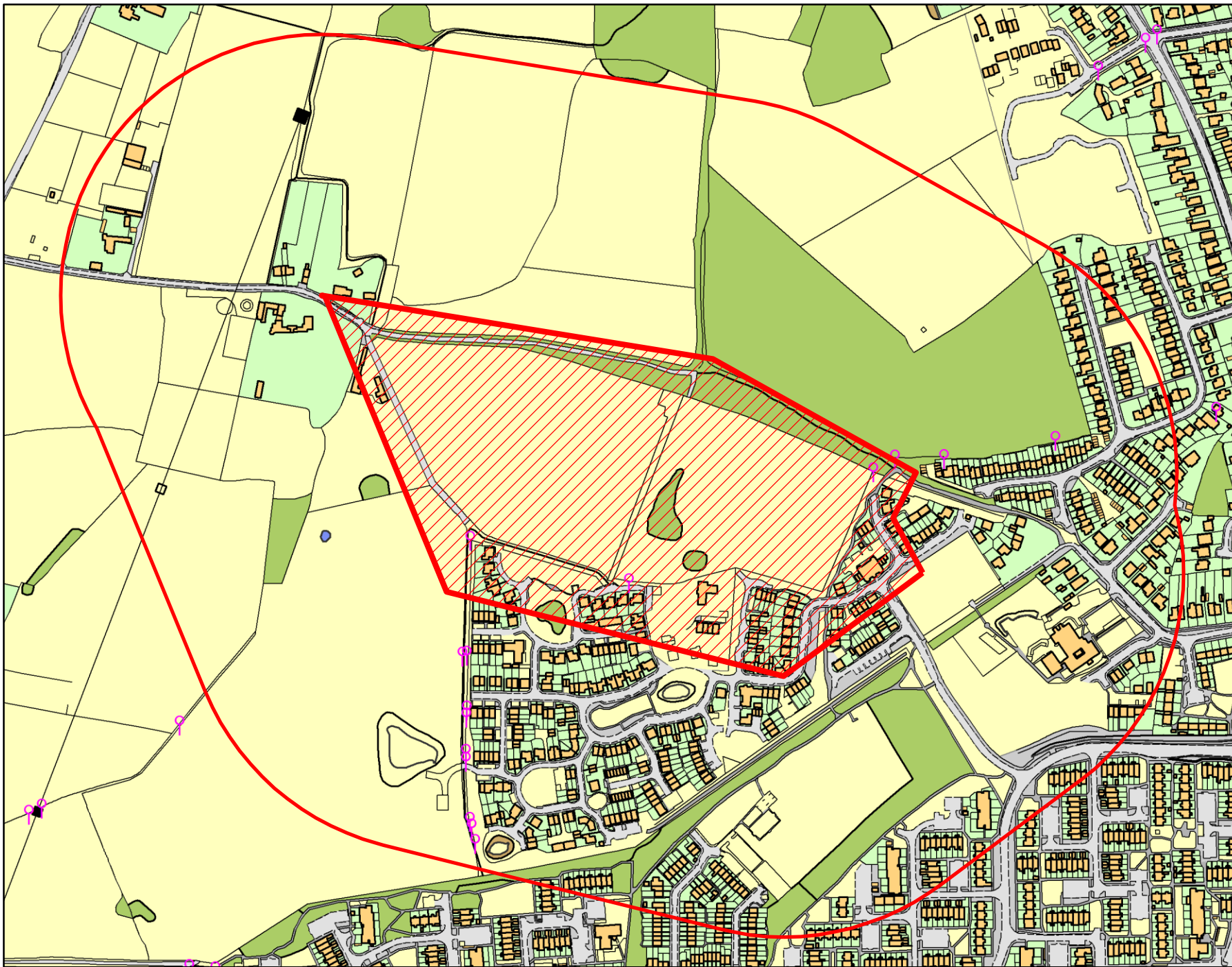
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Kilometers

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Legend

- 250m buffer
- Site

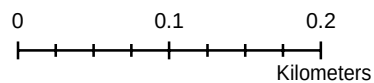
Historic Flood Information Request

E A Flood Zones and Detailed River Network

L Ferguson c/o Hilson Moran

Woodcroft Farm,
Waterlooville

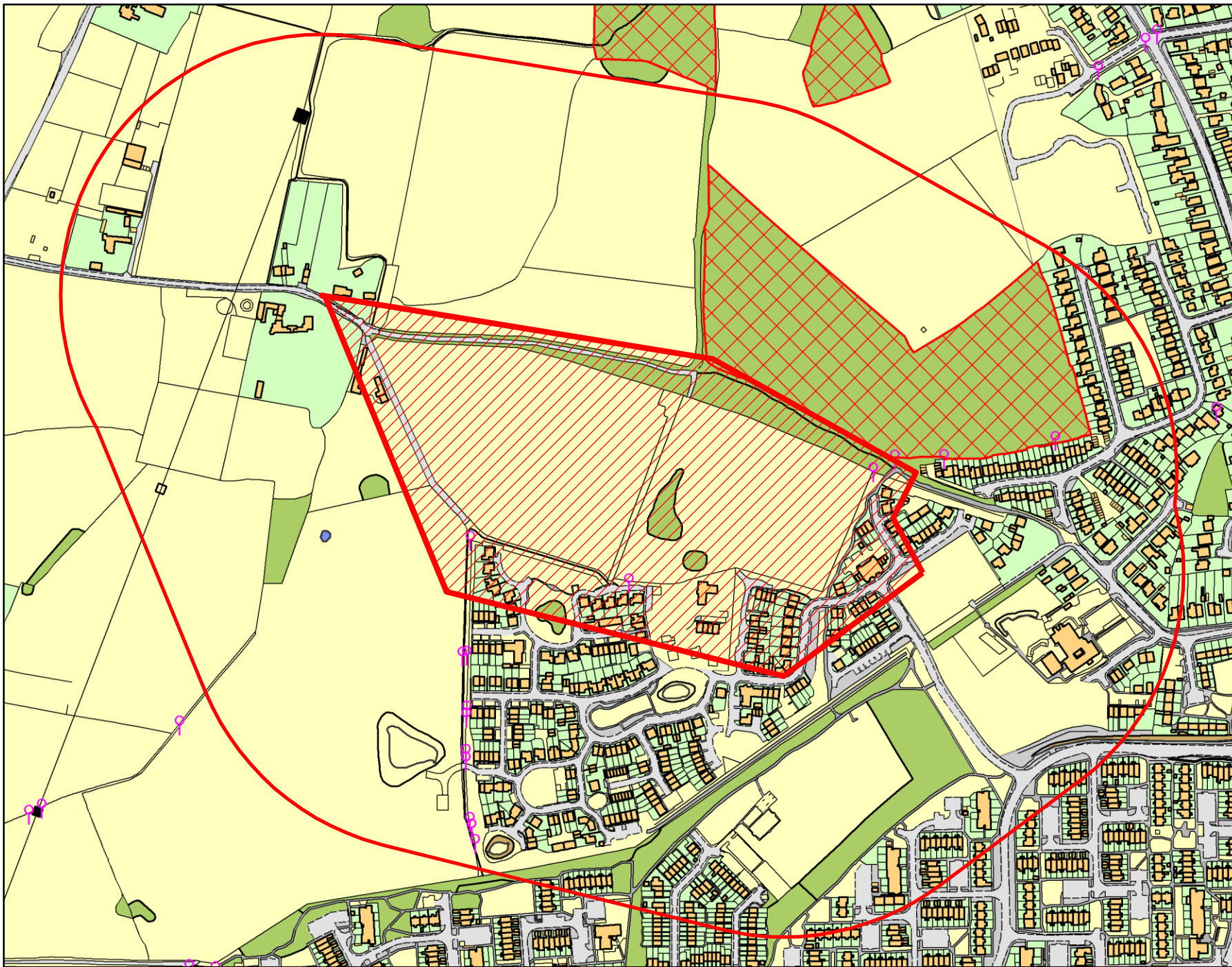
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- Legend**
- 250m buffer
 - Site
 - SINC

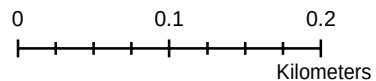
Historic Flood Information Request

Environmental Designations

L Ferguson c/o Hilson Moran

Woodcroft Farm,
Waterlooville

Notes:



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Revision:	1	Initials:	CT



References

- ⁱ Ministry of Housing, Communities and Local Government (2019) - National Planning Policy Framework.
- ⁱⁱ Hampshire County Council (2018) - Information for developers on SuDS principals and application
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