Batchelors Farms: Flood Risk Assessment and Outline Drainage Strategy

P25024_R1
April 2025

Document Control

Title

Batchelors Farms: Flood Risk Assessment and Outline Drainage Strategy

Client

SDP,
Buncton Barn,
Buncton Lane,
Bolney,
West Sussex,
RH17 5RE

Reference

P25024_R1

Status

Final

Document reference	Issue date	Comments	Written by	Approved by
P20253_R2	Nov 2022	Draft report for Client review	HJK	JEM
P20253_R2_Rev1	Sep 2023	Updated site layout	HJK	JEM
P25024_R1	April 2025	Updated site layout	HJK	JEM

Table of Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

1.1. Instruction

Aqua Terra Consultants Ltd (Aqua Terra) was instructed by Fairfax Acquisitions Ltd (Fairfax; the Client) on behalf of SDP (the Applicant) to provide a Flood Risk Assessment (FRA) and Outline Drainage Strategy (ODS) for a parcel of land on the outskirts of Burgess Hill, West Sussex (the Site). Instruction to proceed was provided by email on the 8th November 2022.

1.2. Background

The Client is seeking to obtain planning permission to develop a parcel of land at Burgess Hill in West Sussex. The Site address is: Land Adjacent to Batchelors Farm, Keymer Road, Burgess Hill, West Sussex RH15 0BQ.

The proposed development is residential in nature and the plot is currently a greenfield site. It is proposed to build 26no. new properties with shared green spaces, SuDS features, access roads and car parking areas. Further details of the proposed development are provided in Section 3.

1.3. Scope of the report

The scope of this assessment is as follows:

- Preparation of an FRA, written in line with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG) to satisfy the Mid Sussex District Council (MSDC) and the Lead Local Flood Authority (LLFA, West Sussex County Council) that all potential flood risks to and from the proposed development have been considered and that the proposed development is appropriate, as defined in the NPPF;
- Consideration of appropriate Site-specific flood risk mitigation measures; and,
- Development of an outline SuDS strategy to mitigate the potential increase in runoff and deterioration in water quality as well as providing amenity and biodiversity benefits.

1.4. Data sources

The main sources of data utilised in this assessment are summarised below:

- Proposed Site development plans as provided by the Client;
- Site infiltration test data collected in December 2021 (Ground and Environmental Services Limited, 2021);
- Sewer and water supply asset location plans;
- Environment Agency (EA) flood risk data;
- The Mid Sussex Level 1 Strategic Flood Risk Assessment (Aegaea, 2024);
- The West Sussex LLFA Policy for the Management of Surface Water (West Sussex County Council, 2018);
- The West Sussex Adoptable Highway Drainage and Sustainable Drainage Systems: Guidance for Developers (Council, West Sussex County, 2019);
- LiDAR digital terrain model (DTM) data;
- Hydrological descriptor data from the Flood Estimation Handbook (FEH) website (CEH, 2024);
- The CIRIA SuDS Manual (CIRIA, 2015);

- Ordnance Survey mapping; and,
- British Geological Survey (BGS) mapping.

1.5. Limitations

This report is written strictly for the benefit of the Client and bound by the conditions presented in Appendix A.

2. Site Description

2.1. Site setting and surrounding area

The Site is located on the outskirts of Burgess Hill, in a setting of residential, agricultural and greenfield land uses (see Figure 2-1). The National Grid Reference for the approximate centre of the Site is TQ 31765 17667 and the nearest postcode is RH15 0BQ.

Figure 2-2 presents an aerial image of the Site area showing the current layout and condition. The Site comprises an irregularly shaped plot, currently occupied by scrubland and derelict farm buildings (in the south). It is bounded to the south, west and north by agricultural land, with Keymer Road and residential dwellings present to the east.

The Site is approximately 1.34 Ha in size and is currently surfaced mostly with short grass/ scrub, with some mature vegetation around the perimeter (see Figure 2-2) and some fractured hardstanding present in the south, around the old farm buildings. Historically, the Site has been used for agricultural purposes.

Figure 2-1 Site location

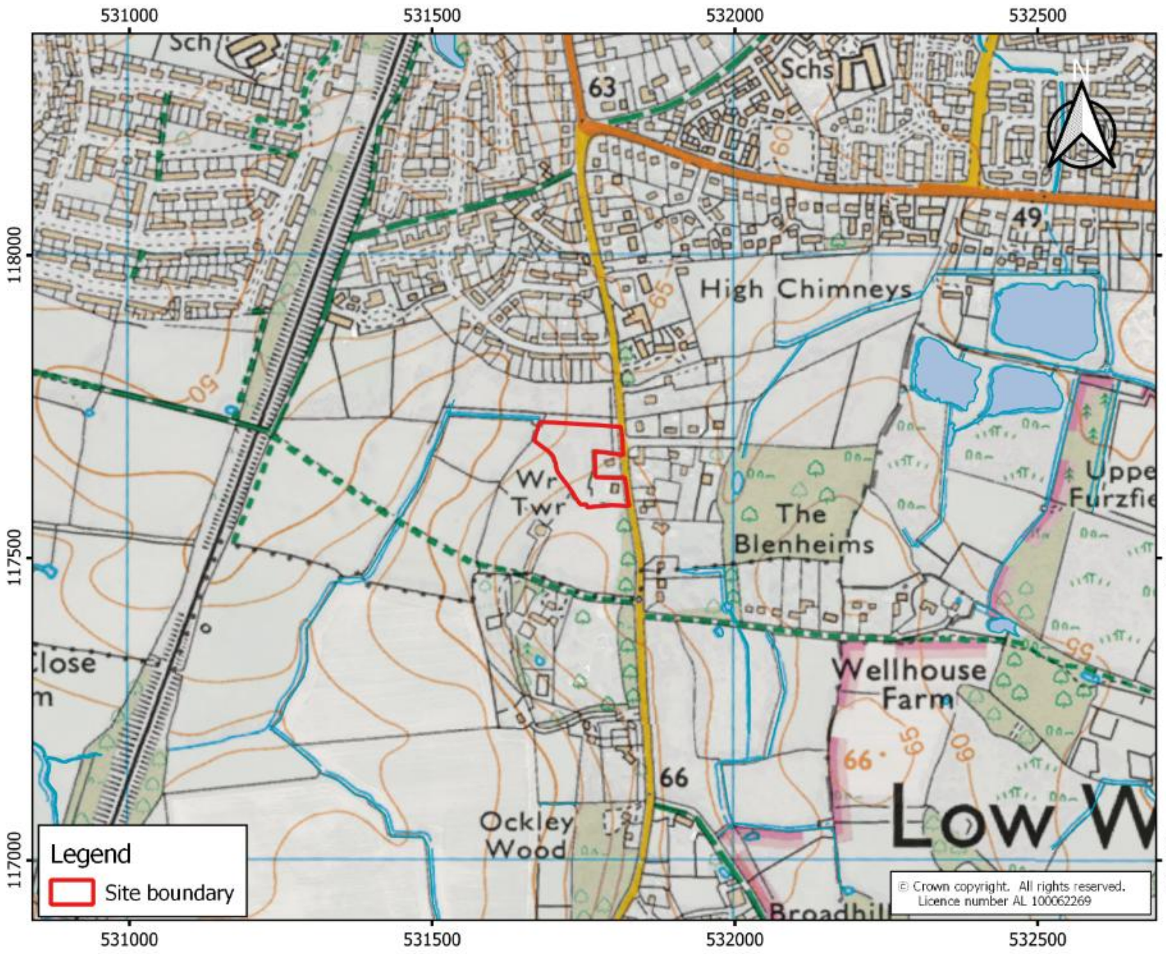


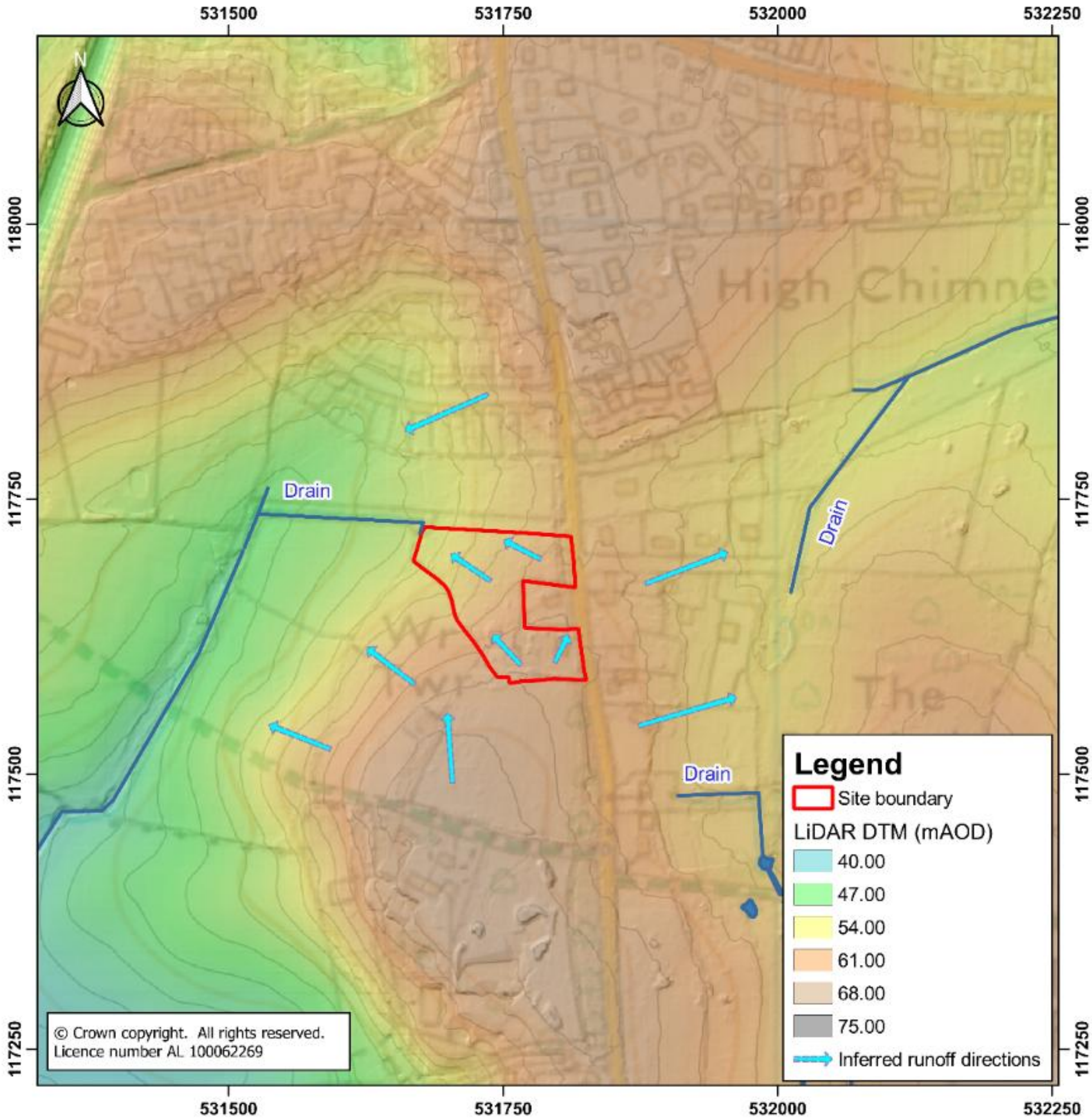
Figure 2-2 Existing Site layout

2.2. Topography

Topographical data (LiDAR 1m resolution Digital Terrain Model – DTM) is presented in Figure 2-3 for the Site area along with inferred runoff directions and surface water features. The land along Keymer Road is in an elevated position, with the ground sloping away to the east and west from this location.

Within the Site boundary the ground elevation falls from c. 64.6m above Ordnance Datum (m aOD) near the entrance to Keymer Road in the southeast to c. 52.5m aOD in the northwest. The Site slopes in a north-westerly direction generally, towards the minor watercourse/ drain on the Site boundary.

Figure 2-3 Site topography and current runoff regime



2.3. Geology and hydrogeology

The following information has been compiled from intrusive site investigation works (trial pitting and soakaway testing) undertaken in December 2021 and January 2022 (Ground and Environmental Services Limited, 2021) and British Geological Survey (BGS) 1:50,000 scale mapping.

The geological sequence underlying the Site is as follows:

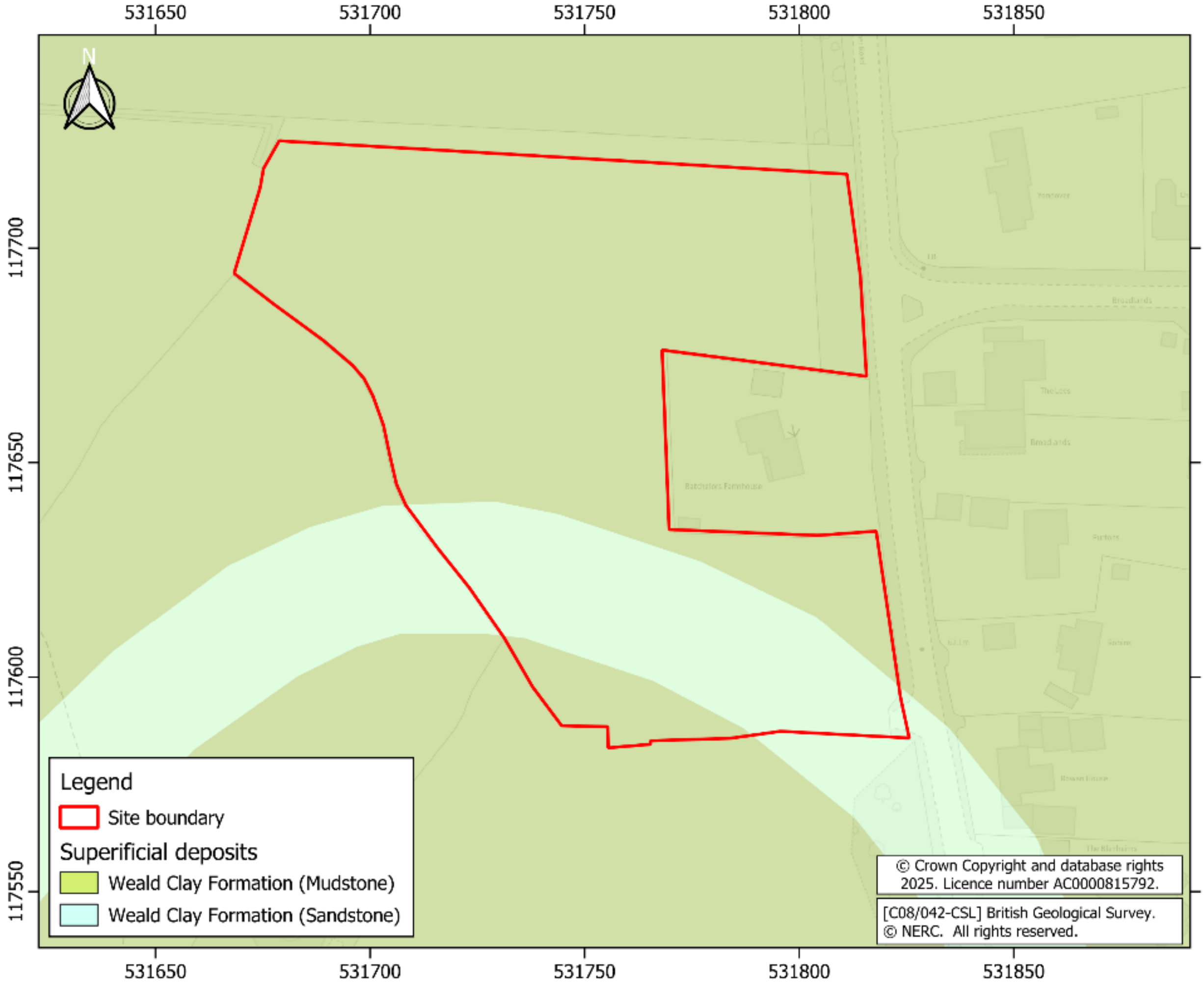
- Soil: The soil on-site is noted as being dark brown, silty, clayey topsoil with frequent fine roots.
- Superficial deposits: None present over the Site area.
- Solid geology: Weald Clay Formation (Mudstone) over the majority of the Site, with a band of Wald Clay Formation (Sandstone) at the south of the site (see Figure 2-4). Weald Clay

Formation is described as dark grey, thinly-bedded mudstone shales and mudstones with subordinate siltstones, and fine to medium fine-grained sandstones, including calcareous sandstone. The upper horizons encountered during the site investigation (SI) works were noted as being “orange brown, mottled light grey slightly silty Clay”.

The underlying Weald Clay Formation (Mudstone) is classified as “Unproductive Strata”. These are described by the Environment Agency (EA) as rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Where present, the Weald Clay Formation (Sandstone) is classified as "Secondary A" aquifer. These are described by the EA as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Figure 2-4 Bedrock geology map (BGS)



The Site is not located within or close to a Source Protection Zone (SPZ).

Some made ground (comprising red brick, asphalt and concrete with mottled grey clay fill) was noted in the window sample locations in the south of the Site (around the disused farm buildings).

The log for BGS borehole TQ31NW7 located at Broad Hill Farm (1 km southeast of the Site) proves the Weald Clay Formation to be over 60m thick in this location.

The presence of groundwater could not be definitively proven during the SI works, partly owing to the presence of rainwater in some of the pits. Given the local topography and nature of the bedrock, groundwater is not expected close to the surface in the vicinity of the Site (with the possible exception of localised perched groundwater).

2.3.1. Soakaway test results

Soakaway testing was undertaken in two locations at the Site – one in the south and one in the north – in accordance with the BRE Digest 365 methodology. Full details of the site work and results are presented in the Geo Environmental Investigation report (Ground and Environmental Services Limited, 2021). The following results were noted following completion of the testing:

> *"The results of the soakage testing undertaken in SP1 and SP2 indicated negligible soakage potential, with water levels not dropping in the trial pits over a period of 3 hours. Based on the results obtained the use of shallow chamber type soakaways for the disposal of surface water is not considered feasible"*

2.4. Climate

The Standard Average Annual Rainfall (SAAR) for the Site area is 866 mm per annum (mm/a) (CEH, 2024)

2.5. Hydrology

Water features in the vicinity of the Site are presented in Figure 2-3. The land along Keymer Road is on an elevated position, with the ground sloping to the east and west from this location. A drainage channel is present at the north-western part of the Site boundary; this receives most of the total Site runoff and drains westwards, under the railway line, to Mill Stream.

Two similar drainage channels are present on the eastern side of Keymer Road.

2.6. Current drainage arrangements

The Site is currently predominantly greenfield, with the exception of the southernmost extent. Runoff naturally runs off in a north-westward direction from the topographical high point at the entrance to Keymer Road (see Figure 2-3). The Site is not currently served by a formal drainage system.

Public sewer asset plans for the Site and surrounding local area have been obtained and are presented in Appendix D. There are not thought to be any surface water sewers in the immediate vicinity of the Site.

3. Proposed Development

The illustrative masterplan for the Site is provided in Appendix C. The proposal is for a residential development with green spaces, access roads and parking facilities.

The development will contain 26 separate dwellings of varying sizes up to three-bedroom detached houses with gardens and garages. Green spaces will be retained in the east and north-western corner, for amenity and ecological benefits as well as for the inclusion of SuDS features. An ecological buffer strip is included along the southern, western and northern boundaries.

A grassed detention basin will be positioned in the downgradient, north-westerly, part of the Site to manage site runoff and a large, shallow swale feature will intercept and convey runoff from the south-western part of the Site to the detention basin. A more complete description of the SuDS proposals is included in Section 8.

The proposed development will change the use of the Site from greenfield to residential, therefore the Site's flood risk vulnerability classifications would change from "Water compatible / Less vulnerable" to "More vulnerable".

A development life of 100 years has been considered within this assessment.

4. Flood Risk to the Development

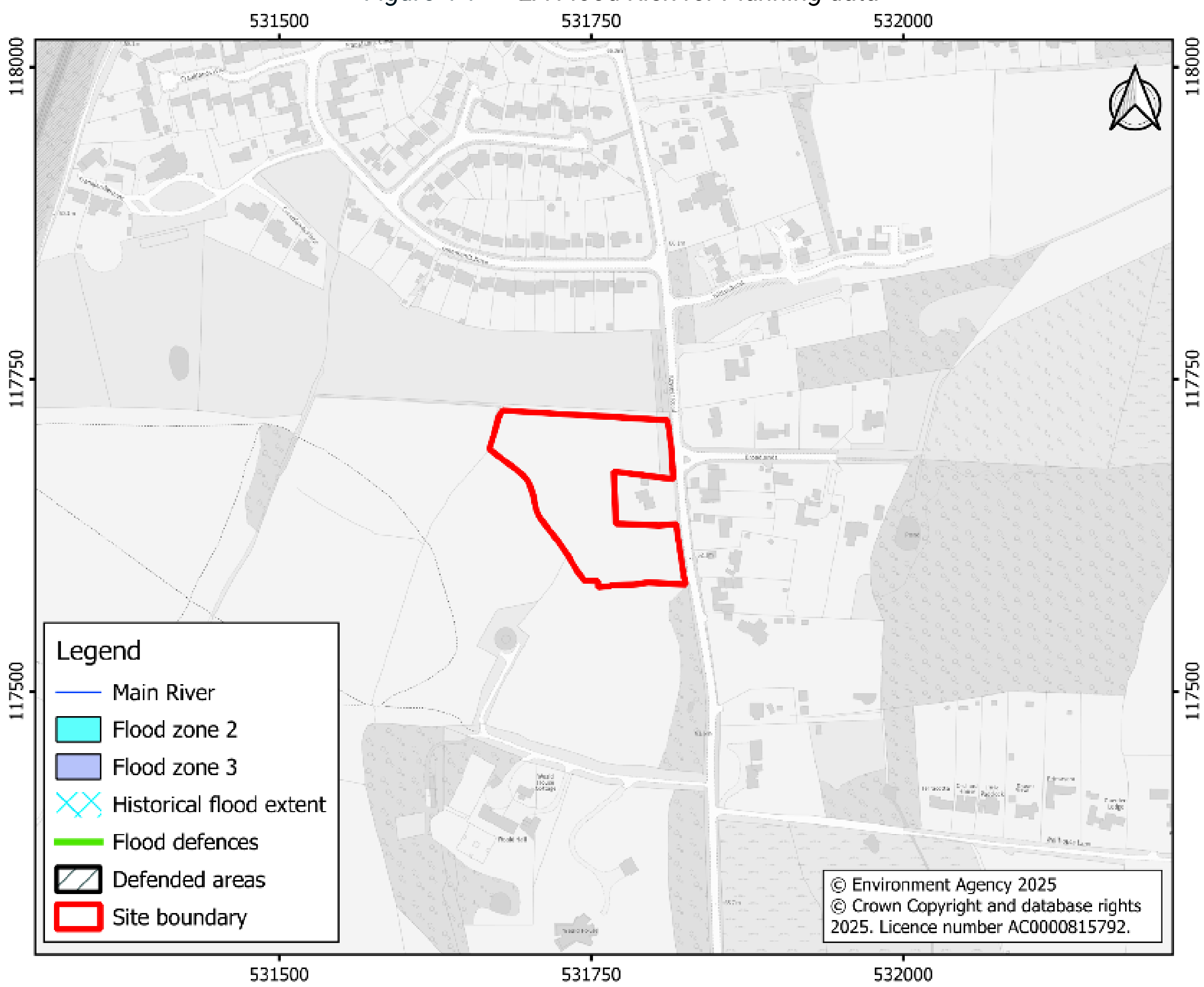
4.1. Rivers and Seas

The EA's Flood Map for Planning (see Figure 4-1) indicates that the Site is located in Flood Zone 1, and as such has a Low Probability of flooding from rivers and the sea (i.e. less than a 0.1% annual probability of flooding from these sources). As such, the risk to the proposed development of flooding from rivers or the sea is not considered further.

The Site lies approximately 0.78 km south-west of the nearest land located within Flood Zones 2 and 3 associated with an unnamed river that flows through Burgess Hill.

The Site is not protected by any flood defences according to EA data.

Figure 4-1 EA Flood Risk for Planning data



4.2. Surface Water

Surface water (pluvial) flooding is usually associated with extreme rainfall events but may also occur when rain falls on land that is already saturated or has a low permeability. Rainfall that is unable to infiltrate into the ground generates overland flow which can lead to flooding or 'ponding' in localised topographical depressions before the runoff is able to enter local drainage systems and watercourses.

A map of EA's Risk of Flooding from Surface Water (RoFSW) data is shown in Figure 4-2, and the risk of surface water flooding reaching or exceeding a depth of 0.2 m is shown in Figure 4-3 and a depth of 0.3 m in Figure 4-4. This data includes the 'Central' climate change allowance for the 2050s epoch (2040-2060).

The Site is generally at a negligible risk of surface water flooding, with the exception of a small isolated area close to the existing buildings in the southeast of the Site at Low to High surface water flood risk; this is associated with a minor topographical depression in this area. The expected depth of flooding in this area is shallow, with less than 1% chance (1 in 100 annual probability) of exceeding 0.3 m in any given year. This would be mitigated via the implementation of the proposed site drainage (see Section 8).

A linear area of low risk is also adjacent to the north-western corner, outside of the Site, associated with the drainage channel flowing from this area. This does not present a flood risk to the Site as it is at a lower elevation and would contain runoff flowing away from the Site within the channel.

Figure 4-2 Flood Risk from Surface Water (with climate change allowance)

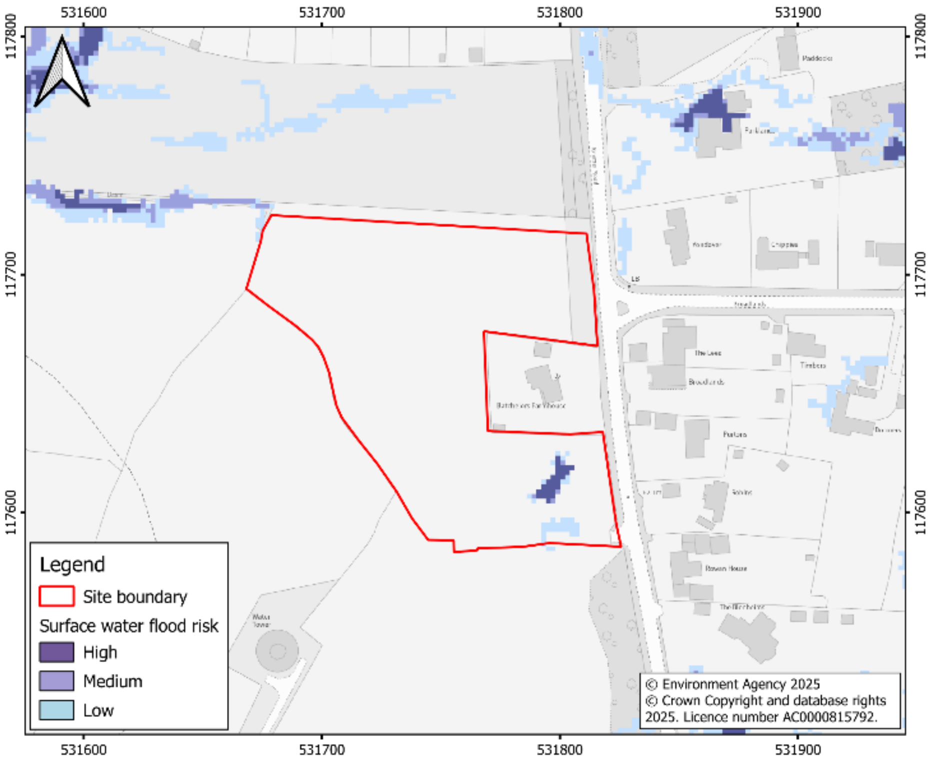


Figure 4-3 EA surface water flood depth risk (0.2m; with climate change allowance)

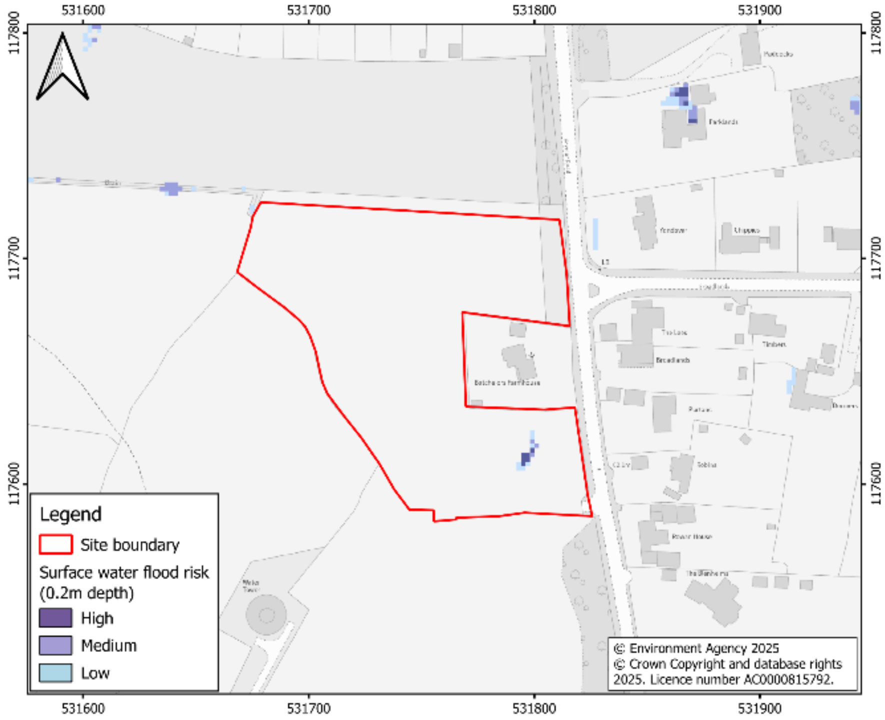
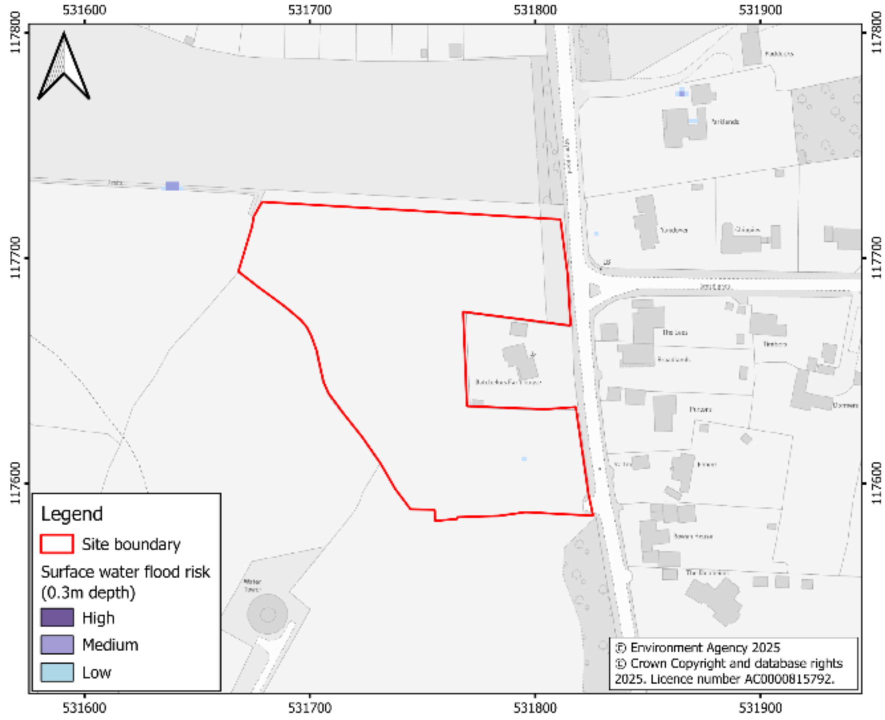


Figure 4-4 EA surface water flood depth risk (0.3m; with climate change allowance)



MSDC SFRA (Aegaea, 2024) does not define Critical Drainage Areas (CDA) within its boundaries, however, the Site is not thought to be within a CDA based on its setting. The Site would drain to SuDS features and discharge to the adjacent watercourse post-development in any case, as detailed in Section 8.

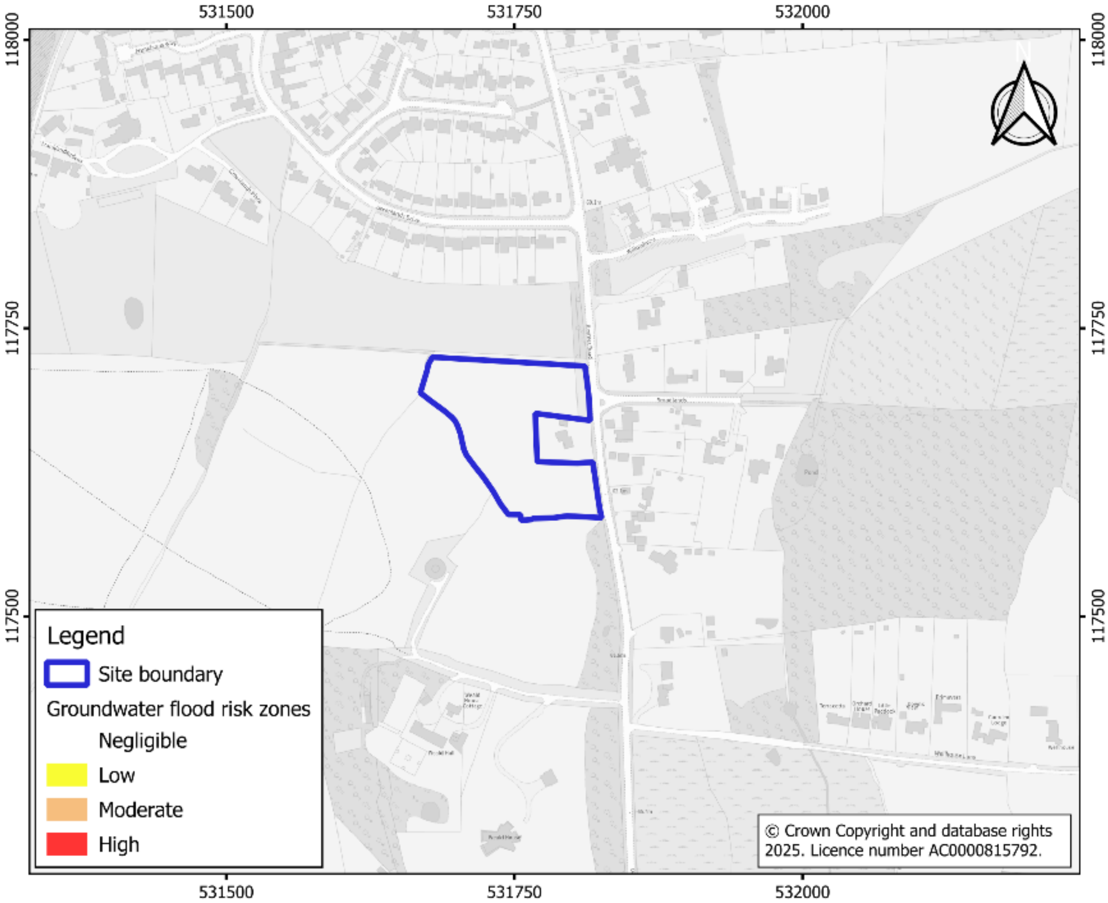
4.3. Groundwater

Groundwater flooding occurs when the water table rises above the surface elevation (or the floor of sub-surface structures).

According to historic flood mapping included within the SFRA, incidents of groundwater flooding are not reported as occurring at or within 100m of the Site (Aegaea, 2024).

Groundwater flood risk data obtained from Geosmart is presented in Figure 4-5. This data indicates that the Site area is at a negligible risk of groundwater flooding.

Figure 4-5 Groundwater flood risk data (GeoSmart)



4.4. Sewers

Sewer flooding can occur during periods of intense rainfall and/or if a sewer becomes blocked with debris. The Site is not currently served by a sewer system but is adjacent to some residential streets which would be.

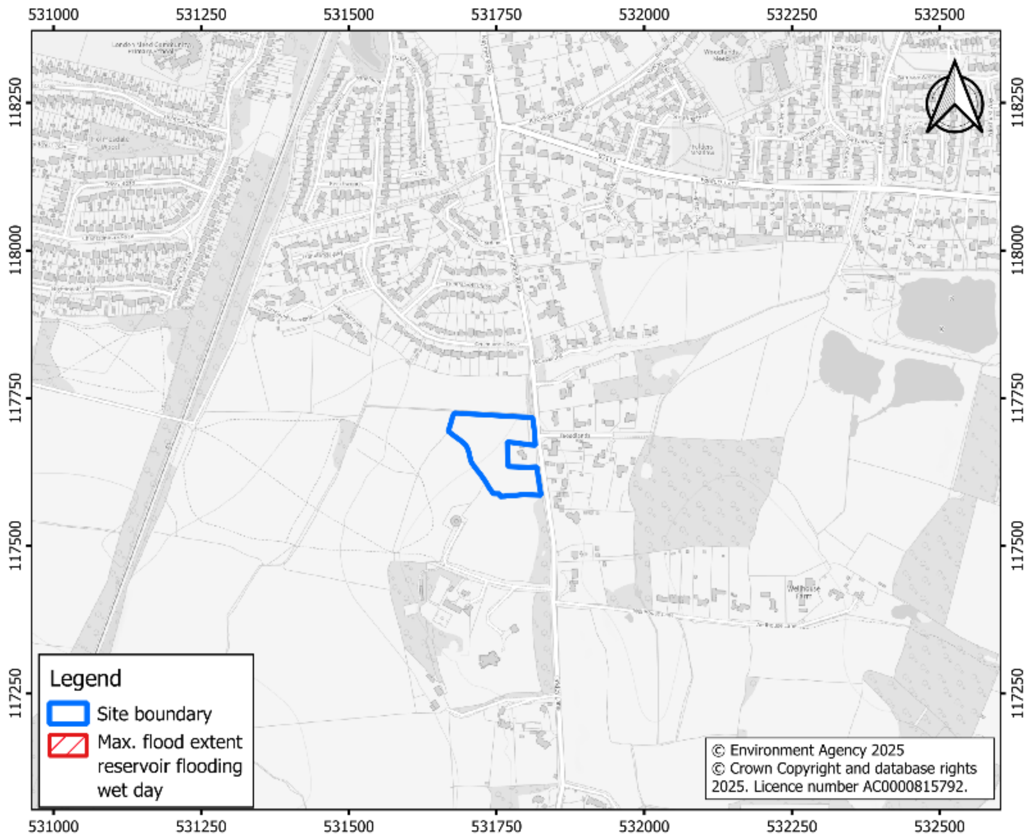
According to historic flood mapping contained within the SFRA (Aegaea, 2024), there has been 1No. external sewer flooding event in the "RH15 0" postcode (no data range provided). The risk of sewer flooding is therefore deemed Very Low.

4.5. Reservoirs

This section considers catastrophic failures of water bearing infrastructure in the area of interest.

The risk of reservoir flooding is related to the failure of a large water storage reservoir. The Site is not at risk of flooding in the event of reservoir failure according to EA data (see Figure 4-6). No canals or other significant water bodies exist in close proximity to the Site.

Figure 4-6 EA's risk of flooding from reservoir failure (wet day scenario)



4.6. Historical Flooding

The EA database of historical flooding also contains no evidence of flooding having occurred in this area (see Figure 4-1).

The Mid Sussex Level 1 Strategic Flood Risk Assessment (Aegaea, 2024) also contains no records of historical flooding occurring at the Site or in the local vicinity.

5. Suitability of the development

5.1. Sequential Test

The Sequential Test, outlined in the PPG for Flood risk and Coastal Change, identifies that developments should be directed to areas at the lowest probability of flooding.

The entire Site is within Flood Zone 1, and the development is classified as “More Vulnerable” with regards to flood risk. According to the NPPF (see Table 5.1), "More Vulnerable" site use is considered appropriate within Flood Zones 1 and an Exception Test is not required.

The only elevated flood risk at the Site is due to small areas of surface water flood risk that will be mitigated post-development by the implementation of the drainage infrastructure (see Section 8).

Therefore, the Sequential Test is considered passed.

Table 5.1 Flood risk vulnerability and flood zone compatibility.

Flood risk vulnerability classification	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Zone 1 (low probability)	✓	✓	✓	✓	✓
Zone 2 (medium probability)	✓	✓	Exception Test required	✓	✓
Zone 3a (high probability)	Exception Test required	✓	×	Exception Test required	✓
Zone 3b (functional floodplain)	Exception Test required	✓	×	×	×

✓ *Development is appropriate.*
x *Development should not be permitted.*

5.2. Sequential development

Where flood risk is present to varying degrees across a Site, layouts should be tailored to ensure the most sensitive parts of a development are located in parts of the Site least at risk of flooding.

Given that the proposed development is entirely within Flood Zone 1, there are no restrictions on the layout of the Site from a flood risk perspective.

6. Flood Risk from the Proposed Development

The National Planning Policy Framework (NPPF) stipulates that all new developments must be "safe, without increasing flood risk elsewhere". As such the following stipulations are provided in the EA guidance for managing rainfall runoff (Environment Agency, 2013):

- Stormwater runoff rates and volumes discharged from urban developments should approximate to the Site greenfield response over a range of storm frequencies of occurrence (return periods).
- Runoff for extreme events should be managed on-site. This requires:
  - the peak rate of stormwater runoff to be limited;
  - the volume of runoff to be limited;
  - the pollution load to receiving waters from stormwater runoff to be minimised; and,
  - the assessment of overland flows and temporary flood storage across the Site.

The Sustainable Drainage Strategy for the Site (see Section 8) has been designed in such a way as to prevent an increase in runoff from the Site under a range of design storm scenarios. This includes suitable allowances for future increases in rainfall intensity caused by climate change.

7. Flood risk mitigation measures

7.1. Key considerations

To meet the PPG requirements, all land uses will be considered appropriate for location within Flood Zone 1 provided the following additional requirements are met:

- Remains safe in times of flooding whilst taking climate change into account;
- Does not result in a net loss of floodplain storage;
- Does not impede existing water flow pathways; and,
- Does not increase the volume and rate of surface water runoff leaving a site over its intended design lifetime.

Each of these requirements is discussed in relation to the proposed development in Sections 7.2 to 7.5 below.

7.2. Remain safe in times of flooding

The development area is considered to be at negligible risk of flooding from rivers, groundwater and the sea.

There is a small mapped area of elevated surface water flood risk within the Site boundary as stated in Section 4.3. This does not indicate a significant surface water flow path or large area of deep water. Surface water flood risk post-development will be mitigated with the implementation of the proposed development and surface water management scheme.

7.3. No net loss of floodplain storage

The proposed development would not result in a net loss of river floodplain storage as the development area is not shown to be within the floodplain.

7.4. No impediments to flood water flows

The proposed development would not result in any impedance of flood flows. The Site is not within a floodplain nor is it intersected by a surface water flowpath.

7.5. No increase in the volume and rate of surface water runoff

The Sustainable Drainage Strategy discussed in Section 8 would ensure that runoff rates and volumes are not increased as a result of the proposed development.

8. Outline Sustainable Drainage (SuDS) Strategy

8.1. Introduction

The following sections describe the outline SuDS Strategy for the proposed development with due regard to DEFRA's Non-Statutory Technical Standards for SuDS (DEFRA, 2015) and the local standards and guidance for surface water drainage on major developments in West Sussex (West Sussex County Council, 2018), which recommends the following hierarchy for the disposal of surface water from new developments:

1) Infiltration to ground (most preferred)[1];
2) Discharge to a surface water body;
3) Discharge to a surface water sewer or highway drain; and,
4) Discharge to a combined sewer (least preferred).

The proposed residential development will be located on largely previously undeveloped, 'greenfield' land. A proportion of the Site would comprise impermeable areas following its development (for example, rooftops and roads). Without appropriate management, this would result in an increase in both the volume and rate of surface runoff generated by the Site, which could lead to an increase in surface water flood risk elsewhere (i.e. downstream). Surface runoff from the developed Site will, however, be sustainably managed using SuDS, as described in the following sections.

SuDS aim to mimic the natural drainage characteristics of a site prior to its development by controlling surface water runoff as close to where the rain falls as possible e.g. through interception and re-use, evaporation and infiltration into the ground. Furthermore, SuDS provide opportunities to remove pollutants from runoff and also provide amenity and biodiversity benefits.

8.2. Greenfield runoff and permissible discharge rates

The Revitalised Flood Hydrograph (ReFH2) method in the 'Rural Runoff' calculator within the Causeway "Flow" v10.4 software was utilised to estimate the greenfield runoff rates for the existing Site. This was calculated for a range of return period storm events using the point FEH hydrological descriptors, with the results displayed in Table 8.1.

Table 8.1 Greenfield runoff

Return period (yrs)	Runoff rate (l/s)
1	13.8
2	16.2
Qbar*	16.7
30	39.4
100	50.8

**Interpolated value*

[1] Note that the Building Regulations Approved Document Part H (HM Government, 2015) also recommends water capture and reuse as a preferred method of water disposal.

The West Sussex County Council guidance for surface water management (West Sussex County Council, 2018) recommends using the greenfield Q1 runoff rate as the 'permissible discharge rate' for new developments. As such, a 13.8/s 'permissible discharge' rate may be assumed in this instance.

8.3. Runoff destination and proposed SuDS layout

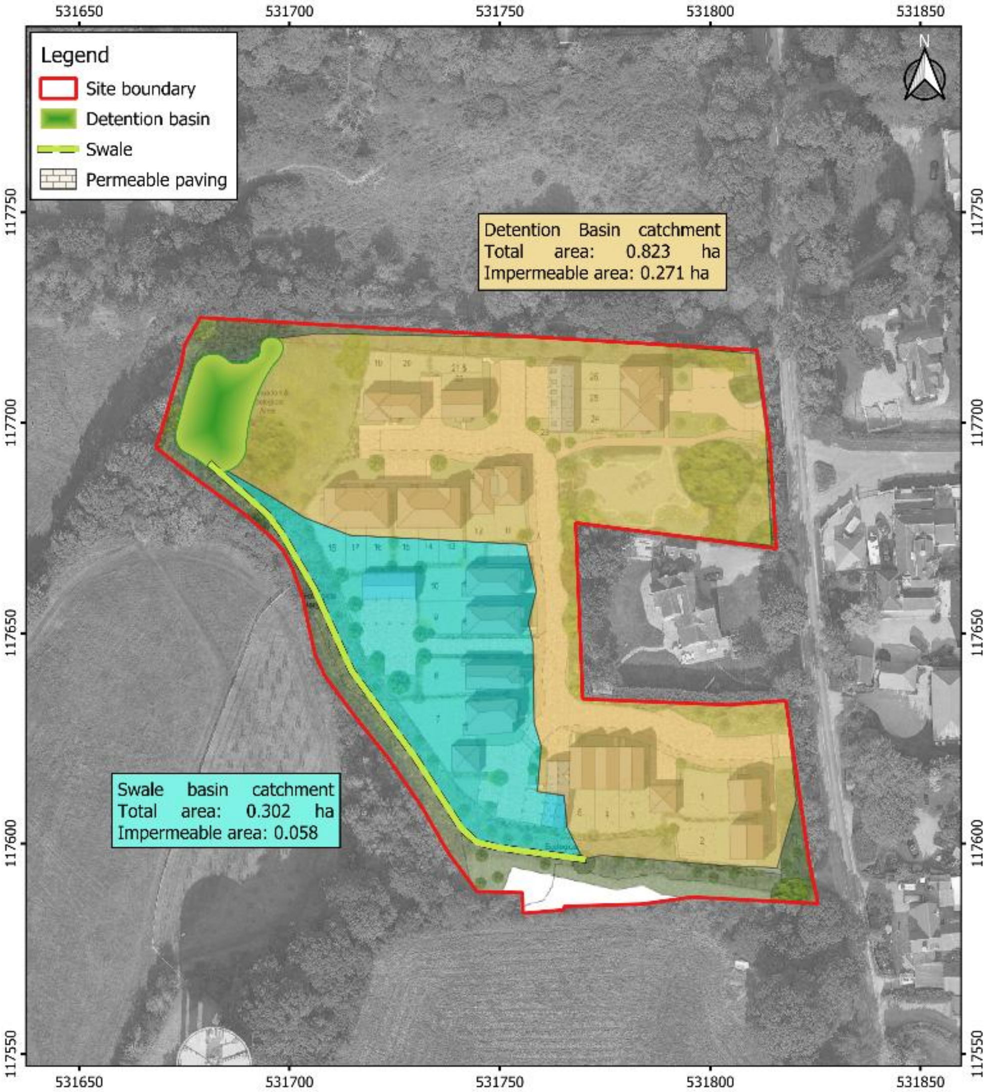
The Weald Clay Formation underlying the Site is not sufficiently permeable to allow surface water from the proposed development to be discharged to ground using infiltration techniques. The results of the on-site soakaway testing undertaken indicated negligible infiltration potential, with water levels not dropping in the two trial pits over a period of three hours.

There are no surface water or combined sewers in the immediate vicinity of the Site (see Appendix D). The Site is located immediately adjacent to an Ordinary Watercourse (se Figure 2-3). Therefore, water will be discharged to this feature at a limited rate (below the Q1 greenfield flow rate); this represents a continuation of the current runoff regime with some betterment with regards to discharge rates under storm conditions.

Water will pass through a number of SuDS features before discharging to the adjacent watercourse. These include a large swale, a detention basin and permeable paving distributed throughout the Site. These features will slow the progress of water to the discharge point, provide attenuation capacity as well as amenity, water quality and biodiversity benefits.

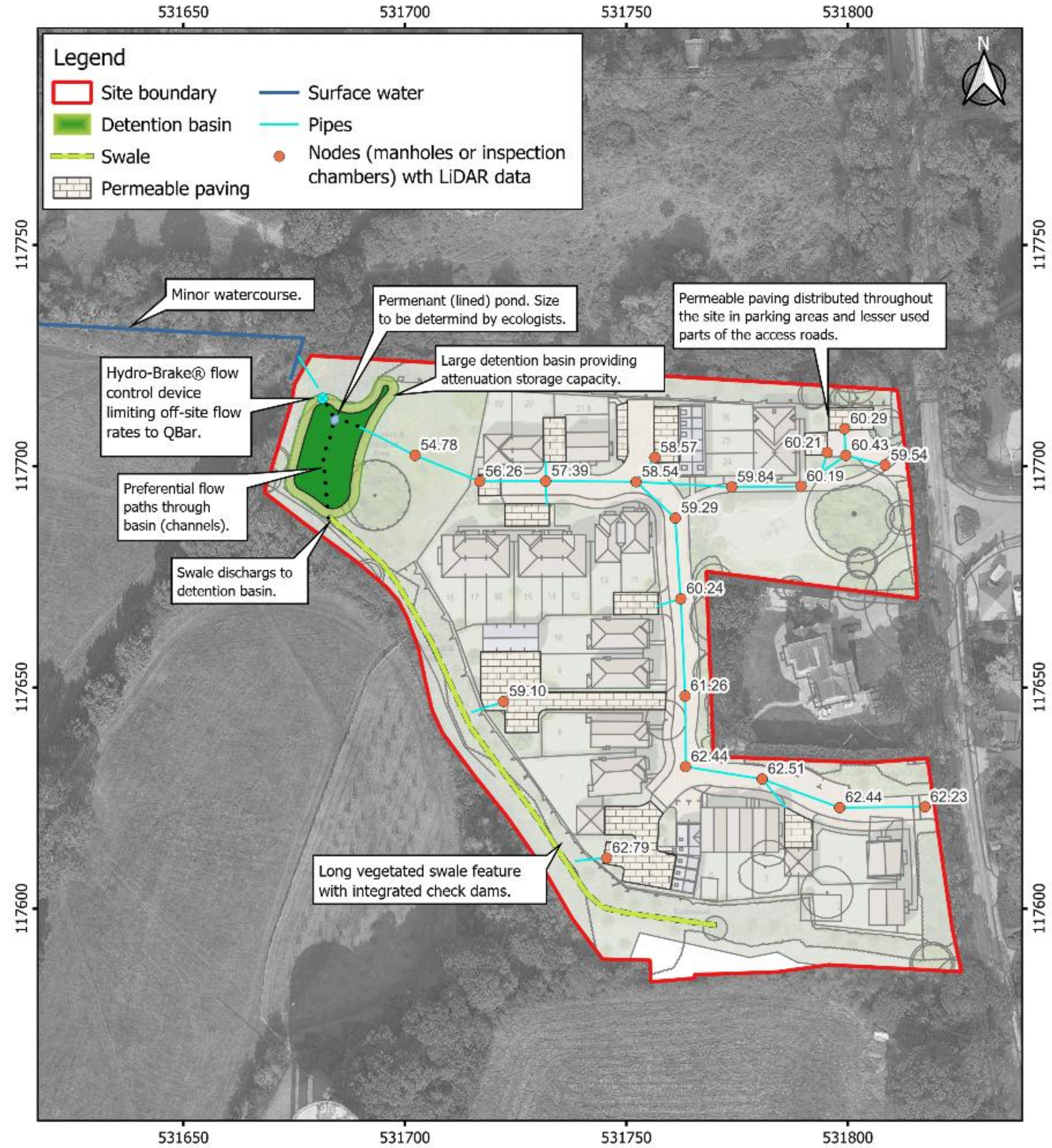
The post-development Site has been sub-divided into two catchment areas that will each drain via gravity to one of the two principal SuDS features (the swale and detention pond - note that the swale will ultimately drain to the detention basin and then to the adjacent watercourse). These sub-catchments have been delineated based on the development layout plan included in Appendix C and LiDAR Digital Terrain Model (DTM) data.

Figure 8-1 Catchment areas serving the proposed SuDS features



The Site is not expected to require land raising/ lowering to accommodate a gravity driven drainage system; there is already a gradient to the northwest across the Site. An initial drainage network has been drafted based upon the proposed development layout and the current Site topography (see Figure 8-2). Indicative key node (manholes or inspection chambers) locations are included in Figure 8-2 along with current ground levels at each location (extracted from LiDAR data).

Figure 8-2 Outline drainage strategy



8.4. SuDS features design

The initial design of the SuDS features has been undertaken using the Causeway "Flow" v 10.4 industry standard software. Simulations were run for the 1 in 30-year event plus a 40% CCA and the 1 in 100-year event plus a 45% CCA (as defined by the EA for the Adur and Ouse Management Catchment for the 2070s epoch).

Hydrological descriptors for the Site were obtained from the Flood Estimation Handbook (FEH) website (CEH, 2024). These are shown in Table 8.2 below.

Table 8.2 FEH Hydrological Descriptors

Catchment Descriptor	Abbreviation	Value
Base Flow Index associated with each HOST soil class	BFIHOST19	0.236
Proportion of time when soil moisture deficit was equal to, or below, 6mm during 1961-90	PROPWET	0.34 (i.e. 34% of the time)
Average Annual Rainfall (1961 – 1990)	SAAR	855 mm

GIS software was used to calculate the total area within the sub-catchment draining to each SuDS feature as well as the impermeable area within each (see Table 8.3 below). Note that the impermeable area values have been uplifted by 12% in the calculations to account for urban creep and a small amount of runoff from residual green spaces.

Table 8.3 Catchment areas draining to each SuDS feature

Catchment	Total area (ha)	Contributing impermeable runoff area in catchment(ha)	Uplifted areas used in calculations (ha)
Swale catchment	0.302	0.058	0.064
Detention basin catchment	0.823	0.271	0.298

The dimensions/ details of each SuDS feature are presented below (see Table 8.4). The infiltration rate for all SuDS features was set to zero, based on evidence reviewed to date it appears infiltration at the Site is likely to be impeded.

Note that the Site has a gradient to the northwest so some check dams within the swale would maximise the storage capacity available. This fine tuning of the scheme can be achieved during the detailed design phase and for now single invert/ bank levels have been utilised to demonstrate the broad feasibility of the scheme. The swale would be located in the ecological buffer zone along the western Site boundary and would be planted with trees, rather than being lined with grass.

The storage capacity provided by the permeable paving has not been explicitly included in the modelling process at this stage but the areas proposed to be covered with permeable paving were excluded in the overall impermeable area values used in the calculations.

A Hydro-Brake flow control device has been included to limit off-site discharge from the detention basin to the adjacent watercourse to 10 l/s. A peak discharge rate of 10 l/s represents a significant reduction in peak discharge rates for all storm events above (and including) the 1 in 1 year event (80% reduction with respect to the 1 in 100 year event).

Appendix E contains the output from the drainage model simulations. This confirms that, based on the parameters described above, the proposed drainage scheme will be able to manage all runoff generated during the 1 in 100 year storm event with a 45% allowance for climate change. The simulated maximum water levels within each feature is within 300 mm of the bank level for each of the SuDS features, but these features are relatively shallow (<0.70 m). A summary of the performance of each feature is included in Table 8.5.

Table 8.4 Details of SuDS features

Feature	Feature invert level (m aOD)	Bank elevation (m aOD)	Feature Depth (m)	Side slopes	Area of base (m^2)	Surface area at bank (m^2)	Total volume (m^3)	Outfall	Outfall elevation (m aOD)
Swale	Variable	Variable	0.30	1:3	41.8	377	c. 223	Weir	53.98
Detention basin	52.3	53.0 (minimum)	0.70	1:3	270	431	250	Hydro-Brake	52.3

Table 8.5 Performance of the SuDS features under a 1 in 100 year + 45% storm event.

Feature	Critical duration (mins)	Max. water level (m aOD)	Min. freeboard remaining (m)	Half drain time (mins)
Swale	30 (Winter)	53.94*	0.01	n/a
Detention basin	180 (Winter)	52.88	0.11	n/a

** Estimated peak elevation near outfall to detention basin.*

It should be noted that the Flow model calculations for the SuDS features are conservative, as they assume that these are the only SuDS features that will serve the proposed development. As the detailed layout plan evolves, it will be possible to include further SuDS techniques within the development layout in order to enhance the 'SuDS Management Train'. Techniques such as rainwater capture and re-use and bio-retention areas will be considered during the development of the detailed layout to maximise water efficiency, water quality, biodiversity, health and wellbeing, and amenity benefits.

8.5. Exceedance routes

The available freeboard within each feature will ensure that their respective capacity will, in reality, be somewhat greater than the 1 in 100-year (plus 45% for climate change) event. Due consideration, however, also needs to be given to the exceedance routes that could occur during events above the design standard of the various components of the proposed SuDS Strategy (i.e. surface water sewers, swale and the detention basin). Figure 8-3 shows exceedance routes for two scenarios:

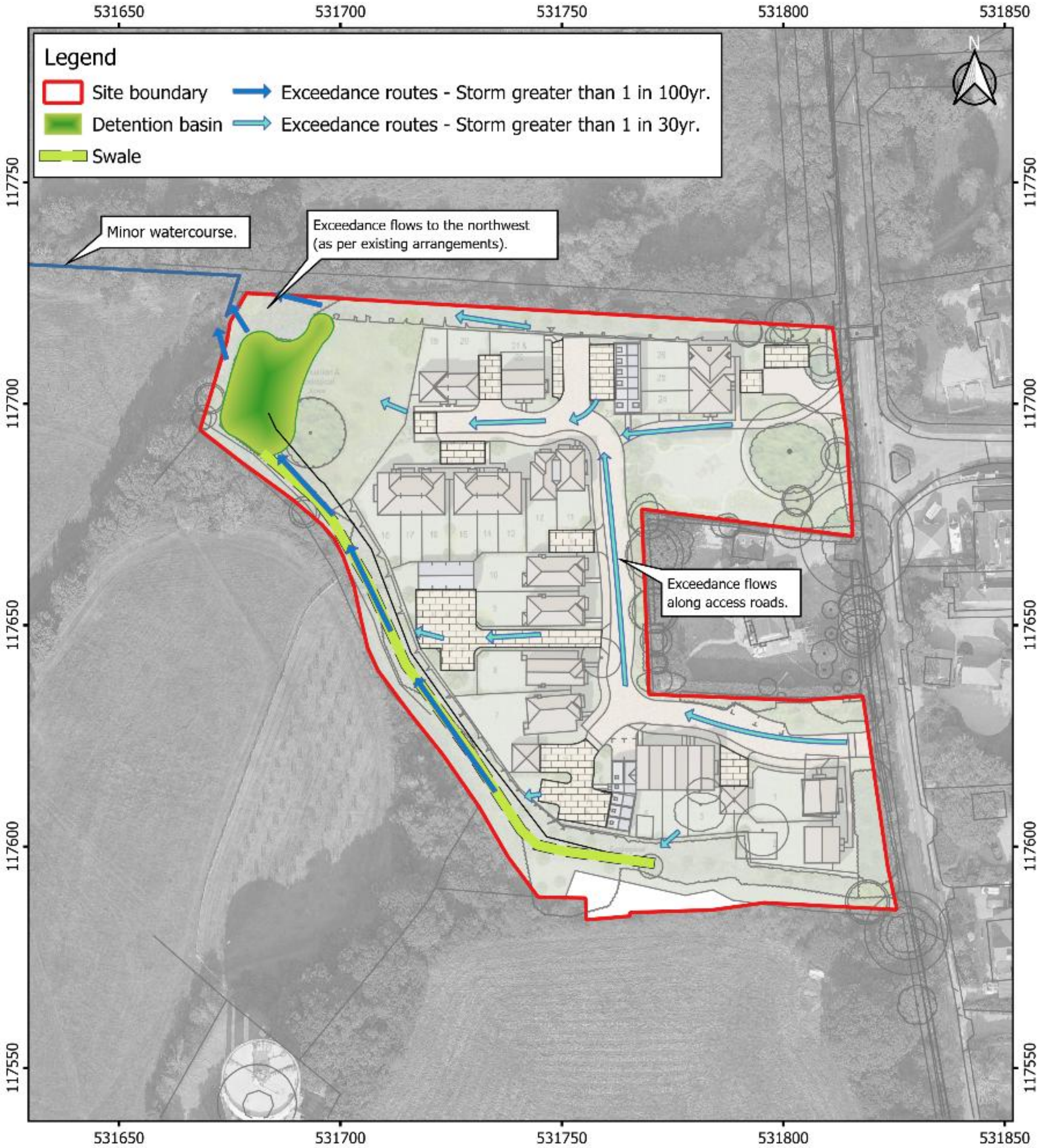
- Surcharging water from the proposed surface water sewers under storm conditions ranging from the 1 in 30-year event to the 1 in 100-year event plus climate change.

Under this scenario, water would surcharge from manholes/inspection chambers and be conveyed along the road surfaces to the detention basin (via the swale in the case of the western part of the Site). These exceedance flows would be shallow and contained within road kerbing. These exceedance routes have been calculated using the proposed stormwater drainage routes (see Figure 8-2) and the existing LiDAR DTM data.

- Over-topping of the SuDS features under events well in excess of the 1 in 100 year plus 45% return period - which has been used for the feature design in this instance.

Under these extreme events, exceedance flows from the SuDS features will run off along the existing preferential surface water flow pathway (i.e. to the northwest) to the adjacent watercourse.

Figure 8-3 Exceedance flow routes



8.6. Water quality

SuDS techniques can be used to effectively manage the quality of surface water flowing across a site. Different methods can be used to intercept pollutants and allow them to degrade or be stored in-situ without impacting the quality of water further downstream. Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals and various organic and inorganic contaminants). Therefore, the first 5mm to 10 mm of rainfall (i.e. the 'first flush') should be adequately treated using SuDS.

The proposed development will include residential dwellings, low traffic roads and driveways. The CIRIA SuDS manual categorises runoff from residential dwellings as presenting a very low water quality hazard and runoff from low usage roads and residential driveways as presenting a low hazard rating (see Table 8.6).

Table 8.6 Water quality hazard ratings (CIRIA, 2015)

Land use	Hazard level
Residential roof drainage	Very Low
Residential, amenity uses including low usage car parking spaces and roads, other roof drainage.	Low
Commercial uses including car parking spaces and roads (excluding low usage roads, trunk roads and motorways).	Medium
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemical and fuels (other than domestic fuel oil) are delivered, handled, stored used or manufactured, industrial sites.	High
Trunk roads and motorways	High

The CIRIA SuDS manual (CIRIA, 2015) advocates a qualitative approach to designing a SuDS scheme for a site with a low hazard rating. This should provide adequate controls on pollutants contained in runoff water.

As the proposed development is residential in nature with a low hazard rating, hazard indices of 0.5 for total suspended solids (TSS), 0.4 for metals and 0.4 for hydrocarbons are considered applicable.

The measures detailed in Table 8.7 are examples which are suitable for inclusion in a drainage strategy for a residential development to mitigate a potential increase in sediment load within on-site and off-site runoff – note text in bold are measures included in this SuDS Strategy. Removal indices are included for each feature type relative to the specific pollutant.

Table 8.7 Mitigation indices for SuDS components (discharges to surface water)

Component Type	TSS	Metals	Hydrocarbons
Filter drain	0.4	0.4	0.4
Swale	**0.5**	**0.6**	**0.6**
Permeable paving	**0.7**	**0.6**	**0.7**
Detention basin	**0.5**	**0.5**	**0.6**
Pond	0.7	0.7	0.5

The sequence of a swale (and/or permeable paving) and detention basin included within the SuDS Strategy for the proposed development will provide adequate treatment to mitigate the low hazard associated with runoff from the development.

Sediment traps (i.e. sumps within the inspection chambers of the final manhole upstream of each feature) will be used to facilitate the maintenance of these features and reduce the build-up of potentially polluted material.

All runoff from roads will pass through at least one water treatment feature prior to discharging to a watercourse (to be included at the detailed design phase).

8.7. SuDS maintenance

Inspection and long-term maintenance of SuDS components ensures efficient operation and prevents failure.

This section outlines the maintenance and management schedules for the proposed stormwater drainage system. The schedules have been formulated in line with guidelines contained within the CIRIA SuDS Manual. There are three categories of maintenance activities referred to in this report:

- **Regular maintenance** – tasks which are required to be undertaken on a weekly or monthly basis, or as required.
- **Occasional maintenance** – tasks which are required to be undertaken periodically, typically at intervals of three months or more.
- **Remedial maintenance** – tasks which are not required on a regular basis but are done when necessary.

This section is intended to give an overview of the operation and maintenance for the range of drainage features included within the surface water drainage strategy and in relation to typical/ standard details only.

Maintenance schedules for the proposed SuDS components are provided in the following tables. These requirements will be implemented following the completion of the proposed development, and will be undertaken either by the Lead Local Flood Authority, a private management company or by the local water company, subject to discussions regarding this responsibility. These schedules are not exhaustive and should be reassessed at regular intervals to determine if any additional maintenance requirements are required to preserve the performance and condition of the drainage system.

Table 8.8 Management and maintenance requirements for pipes and manholes

Maintenance schedule	Required action	Maintenance frequency
Regular maintenance	Remove any accumulation of silt, sediment, leaves and debris etc	Monthly, or as required
	Inspect for evidence of poor operation	Monthly (during the first year), then half yearly
Occasional maintenance	High pressure water jet removal of silt build-up and avoid blockages, particularly at bends or changes in direction	Six monthly, or as required
	Remove or control tree roots where they are encroaching pipe runs, using recommended methods	As required
Remedial actions	Clear pipework and gully grates of blockages	As required
	Replace any damaged or failed pipes, gullies or manholes	As required

Table 8.9 Management and maintenance requirements for permeable paving

Maintenance schedule	Required action	Maintenance frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required.
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth - if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 8.10 Management and maintenance requirements for swales

Maintenance schedule	Required action	Maintenance frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Manage vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly

Maintenance schedule	Required action	Maintenance frequency
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or as required
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required, or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required

Table 8.11 Management and maintenance requirements for detention basins

Maintenance schedule	Required action	Maintenance frequency
Regular maintenance	Remove any accumulation of silt, sediment, leaves and debris etc	Monthly, or as required
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start), or as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required

Maintenance schedule	Required action	Maintenance frequency
	Remove sediment from outlets, forebays and main basin when required	Every 5 years, or as required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Table 8.12 Management and maintenance requirements for control devices

SuDS Device	Maintenance requirements	Maintenance frequency
Regular maintenance	Inspect/check pipework to ensure that the flow control is in good condition and operating as designed	Monthly
	Inspect for evidence of poor operation	Monthly, or as required
Occasional maintenance	High pressure water jet removal of silt build-up	Six monthly, or as required
Remedial actions	Clear pipework of blockages	As required
	Replace the flow control if it becomes damaged	As required

8.8. Further SuDS considerations

Rainwater harvesting (i.e. the use of water butts or more sophisticated tank systems) could be implemented at the Site to capture and reuse runoff at source. These systems collect water from clean surfaces (such as rooftops) for (generally non-potable) use on-site. Rainwater harvesting is particularly useful at sites with a low infiltration potential and limited space for attenuation features. It also has wider sustainability benefits with regards to lowering the water supply demand.

Additional SuDS options that may be considered for the Site are as follows:

- Rainwater harvesting/water butts are primarily used to collect rainwater from impermeable areas and roofs for the use within development buildings and other miscellaneous usage. Due to the relatively small amounts of attenuation provided by rainwater harvesting tanks in this instance and the requirement to retain water for non- potable uses such as toilet flushing or garden maintenance, the volume of runoff which could be attenuated by rainwater harvesting has not been considered within the report. Cost in regard to rainwater harvesting is mainly due to the provision of a storage tank, pumps and pipework which is required for the system to be fully operational.
- Raingardens and ponds are additional attenuation features which could be located across the Site. These would also provide increased biodiversity and amenity benefits.

8.9. Biodiversity and amenity

SuDS schemes present opportunities to enhance habitat for wildlife on-site and this often improves the biodiversity of the surrounding areas. Ponds, constructed wetlands and other surface water features are landscape assets that have amenity value and improve the aesthetics of a site more than conventional drainage systems. The use of a grassed detention basin and a large swale (with larger, more mature vegetation along the tops of the banks) will enhance the biodiversity and amenity value of the Site post-development. Ecological diversity should be enhanced by the use of native planting within each feature.

9. Conclusions

The Site is entirely within Flood Zone 1. As noted in Section 4, there is a small area of High risk of shallow (0.2 to 0.3 m deep) surface water flooding at the Site, and Very Low to Low risk of flooding from fluvial, groundwater, sewer and catastrophic sources.

The proposed development will be residential in nature, with a vulnerability classification of 'More Vulnerable' with regards to flood risk. All types of development are permissible within Flood Zone 1.

Given the apparent low flood risk present at the Site, no specific mitigation measures are proposed other than the implementation of a Sustainable Drainage Strategy to manage the area of High surface water flood risk at the south of the Site, and to mitigate any potential increases in off-site flood risk.

This report provides an Outline SuDS Strategy for the Site. A combination of SuDS features including permeable paving, attenuation/conveyance swale and a detention basin will be used to manage surface water runoff effectively from the Site for the lifetime of the development.

SuDS features will be used to intercept, store and transfer surface water runoff across the Site, before discharging to the nearby drainage channel (adjacent to the northwest of the Site) at a controlled rate of 10 l/s (below the greenfield Q1 peak runoff rate) via a hydro-brake. It is recommended that the capacity and condition of the ordinary watercourse to the northwest of the Site (proposed surface water runoff discharge location) is surveyed in due course to verify its suitability as a discharge receptor.

A preliminary assessment of the performance of the proposed system under the 1 in 100 year + 45% climate change storm was undertaken and shows that the proposed swale and basin are capable of accommodating and conveying the required stormwater runoff rates and volumes.

Appropriate management and maintenance arrangements for the proposed SuDS scheme will be in place throughout the lifetime of the proposed development.

10. References

Aegaea. (2024). *Level 1 Strategic Flood Risk Assessment. Mid Sussex District Council.*

CEH. (2024). *The Flood Estimation Handbook (FEH) Online Service, Centrefor Ecology & Hydrology, Wallingford, Oxon, UK.*

CIRIA. (2015). *The SuDS Manual V2. C753* .

DEFRA. (2015). *Non-Statutory Technical Standards for SuDS.*

DEFRA. (2015). *Sustainable drainage systems: non-statutory technical standards.*

Environment Agency. (2013). *Guidance on rainfall runoff management from developments.*

Ground and Environmental Services Limited. (2021). *Batchelors Farm - Phase 2 Geo-Environmental Investigation.*

UK Centre for Ecology & Hydrology. (2022). *Flood Estimation Handbook Web Service*. Retrieved from https://fehweb.ceh.ac.uk/GB/map

West Sussex County Council. (2018). *West Sussex LLFA Policy for the Management of Surface Water.*

Appendix A Report conditions

AQUA TERRA

CONSULTING

Report Conditions

This report has been prepared by Aqua Terra Consulting Ltd. (Aqua Terra) in its professional capacity as soil and groundwater specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client and is provided by Aqua Terra solely for the internal use of its client.

The advice and opinions in this report should be read and relied on only in the context of the report, taking account of the terms of reference agreed with the client. The findings are based on the information made available to Aqua Terra at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology, and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

Where necessary and appropriate, the report represents and relies on published information from third party, publicly and commercially available sources which is used in good faith of its accuracy and efficacy. Aqua Terra cannot accept responsibility for the work of others.

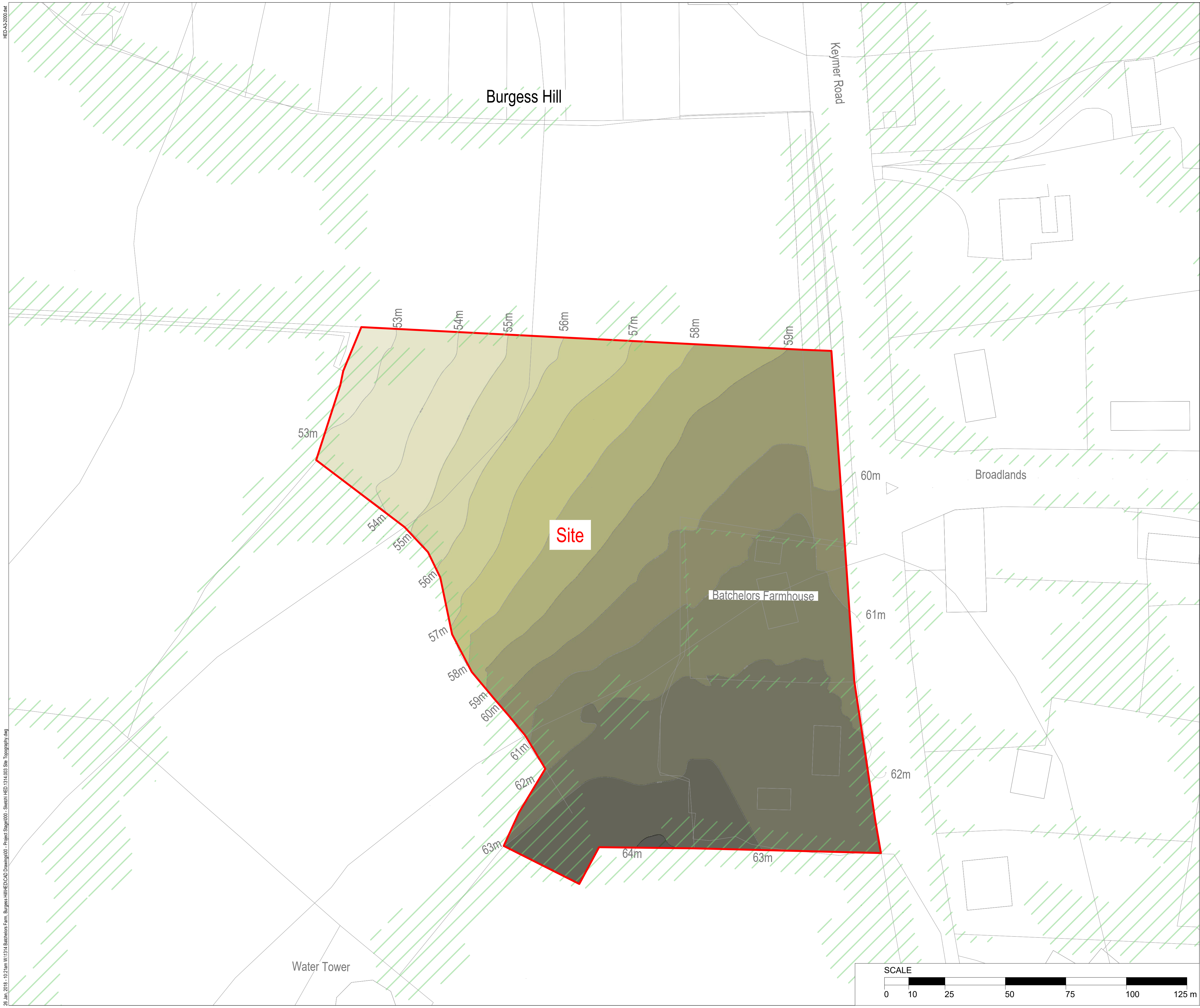
Site investigation results necessarily rely on tests and observations within exploratory holes only. The inherent variation in ground conditions mean that the results may not be representative of ground conditions between exploratory holes. Aqua Terra take no responsibility for variation in ground conditions between exploratory positions.

This report is confidential to the client. The client may submit the report to regulatory bodies, where appropriate. Should the client wish to release this report to any other third party for that party's reliance, Aqua Terra may, by prior written agreement, agree to such release, if it is acknowledged that Aqua Terra accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known. Aqua Terra accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual, or otherwise, against Aqua Terra except as expressly agreed with Aqua Terra in writing. Aqua Terra reserves the right to withhold and/ or negotiate the transference of reliance on this report, subject to legal and commercial review.

Appendix B Topographical Site survey

AQUA TERRA

CONSULTING



LEGEND

- 52-53m
- 53-54m
- 54-55m
- 55-56m
- 56-57m
- 57-58m
- 58-59m
- 59-60m
- 60-61m
- 61-62m
- 62-63m
- 63-64m
- 64-65m
- Contours
- Existing Vegetation

Notes:
*Trees referenced from Arboricultural Constraints Report Sept. 2017 and Site Survey Nov. 2017

REVISIONS

H E D
Hyland Edgar Driver
Landscape Architects and Urban Designers
One Wessex Way Colden Common Winchester Hampshire SO21 1WG
Telephone 01962 711600 Facsimile 01962 713945

PROJECT
Land at Batchelors Farm, Burgess Hill ,
RH15 0BQ, West Sussex

SUBJECT
On Site Topography

DRAFT
For Planning

DATE	25.01.2018	DRAWN BY	MA
SCALE	1:1500@A3	CHECKED BY	JW
DRAWING NUMBER	HED.1314.003	REVISION	-
DRAWING STATUS	B		

A - PRELIMINARY
B - ISSUED FOR PLANNING
C - ISSUED FOR DESIGN /INFORMATION
D - ISSUED FOR TENDER
E - ISSUED FOR APPROVAL
F - ISSUED FOR CONSTRUCTION
G - AS BUILT

Appendix C Site development plans

AQUA TERRA

CONSULTING

Boundaries

The existing boundary vegetation will be supplemented with significant planting of new native thicket and trees, to provide a dense landscaped boundary between the new houses and the adjacent Batchelor's Farm open space.

Residential Landscaping

New ornamental shrubs and hedges will be planted throughout the development. That will provide seasonal and floral interest and benefit local wildlife.

Biodiversity

The western area of the Site will be dedicated for biodiversity enhancements and public access restricted. Enhancements will include a mosaic of scrub and grassland habitats and areas of marginal aquatic vegetation in the SuDs basin.

The Existing boundary vegetation will be enhanced to provide ecological corridors around the periphery of the site. Native tree and shrub planting will provide foraging opporunities for a variety of wildlife.

Keymer Road Frontage

Sections of existing hedgerow will require removal to provide access into the Site. New sections of native hedgerows and trees can be planted to compensate for this loss and to ensure the vegetated characteristics of Keymer Road are respected. The new entrance would be overlooked by the new houses to provide a positive frontage to the road.

Proposed Planting Palette

The following planting palette is proposed for the new native hedgerow and thicket planting, reflecting the character of the surrounding landscape.

Native Thicket Planting

Viburnum lantana	Wayfaring Tree
Carpinus betulus	Common Hornbeam
Castanea sativa	Sweet Chestnut
Quercus robur	English Oak
Prunus spinosa	Blackthorn
Crataegus monogyna	Common Hawthorn
Corylus avellana	Common Hazel
Taxus baccata	Common Yew
Lonicera periclymenum	Common Honeysuckle

Native Hedge Planting

Crataegus monogyna	Common Hawthorn
Prunus spinosa	Blackthorn
Cornus sanguinea	Common Dogwood
Corylus avellana	Common Hazel
Acer campestre	Field Maple
Viburnum lantana	Wayfaring Tree

LEGEND

- APPLICATION BOUNDARY
- EXISTING TREES / VEGETATION
- TREES / VEGETATION REMOVED
- THICKET MIX
- FOCAL TREE
- NATIVE & AVENUE TREES
- GARDEN TREES
- ORNAMENTAL HEDGE PLANTING
- NATIVE HEDGE PLANTING
- ORNAMENTAL SHRUB / HERBACEOUS / GRASS PLANTING
- MAINTENANCE GATE
- POST AND RAIL FENCING
- TIMBER SEAT
- AMENITY GRASS TURF
- WILDFLOWER MEADOW MIX: Emorsgate EM2F Standard General Purpose Wild Flowers, or similar approved. Final mix to be confirmed following soil testing.
- MOWN GRASS FOOTPATH
- TIMBER PLAY SCULPTURE / LAP
- PAVEMENTS

Rev	Date	By	Description
C	07/04/25	TV	Minor amends to thicket planting
B	04/04/25	TV	Comments from ecologist

CSA environmental

Dixies Barns, High Street,
Ashwell, Hertfordshire SG7 5NT

t 01462 743647
e ashwell@csaenvironmental.co.uk
w csaenvironmental.co.uk

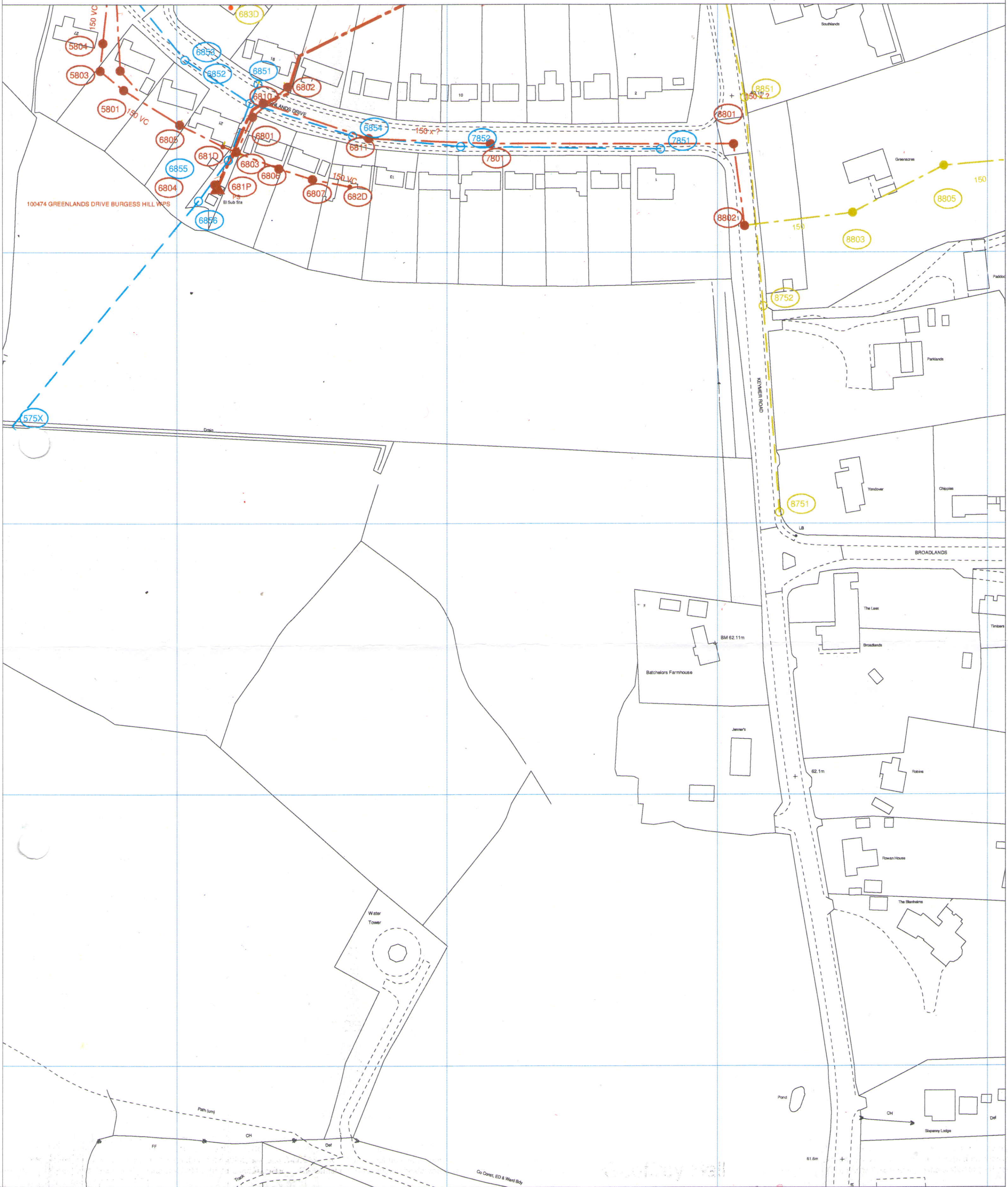
Project	Land Either Side of Batchelors Farm, Burgess Hill
Title	Landscape Strategy Plan
Client	SDP

Scale	1:1000 @ A3	Drawn	TV
Date	April 2025	Checked	CA
Drawing No.	CSA/6314/105	Rev	C

Appendix D Sewer asset location plans

AQUA TERRA
CONSULTING

SOUTHERN WATER



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

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

O.S. REF: TQ3117NE	Scale: 1:1250	Printed By: Giri	Date: 9-2-2018
Screen Print		Site Plan	
WARNING: BAC pipes are constructed of Bonded Asbestos Cement		Requested By:	
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement			

Appendix E Drainage calculations

AQUA TERRA
CONSULTING

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	30	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

	Name	T of E (mins)	Cover Level (m)	Node Type	Depth (m)
	Detention basin		53.000	Junction	0.700
✓	Outfall	5.00	52.500	Junction	1.300
✓	Dummy outfall		51.500	Junction	0.380
✓	Swale 2		53.930	Junction	0.300
✓	Swale 1	5.00	63.310	Junction	0.300

Links (Results)

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.991	99.6	0.0	1.200	0.280	0.280	0.000	0.0	0	0.000
1.000	2.505	4415.8	0.0	-0.450	-0.450	-0.450	0.000	0.0	0	0.000

Simulation Settings

Rainfall Methodology	FEH-13	Skip Steady State	x	1 year (l/s)	13.8
Rainfall Events	Singular	Drain Down Time (mins)	240	2 year (l/s)	16.2
Summer CV	0.750	Additional Storage (m³/ha)	20.0	30 year (l/s)	39.4
Winter CV	0.840	Starting Level (m)		100 year (l/s)	50.8
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	40	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Betterment (%)	0
Greenfield Method	ReFH2 Legacy	Q 1 year (l/s)	13.8
Region	England, Wales, NI	Q 2 year (l/s)	16.2
Include Baseflow	x	Q 30 year (l/s)	39.4
Positively Drained Area (ha)	1.125	Q 100 year (l/s)	50.8

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Detention basin	168	52.407	0.107	10.3	30.7916	0.0000	OK
240 minute winter	Outfall	168	51.216	0.016	6.0	0.0000	0.0000	OK
240 minute winter	Dummy outfall	168	51.136	0.016	6.0	0.0000	0.0000	OK
15 minute winter	Swale 2	27	53.694	0.064	4.5	0.0000	0.0000	OK
15 minute winter	Swale 1	26	63.053	0.043	4.7	0.2886	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Detention basin	Outfall	6.0				55.0
Outfall	Dummy outfall	6.0	0.730	0.060	0.0384	55.0
Swale 2	Detention basin	4.4				4.3
Swale 1	Swale 2	4.5	0.349	0.001	0.3885	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Detention basin	164	52.739	0.439	47.7	145.7398	0.0000	OK
60 minute summer	Outfall	144	51.222	0.022	10.0	0.0000	0.0000	OK
30 minute winter	Dummy outfall	104	51.142	0.022	10.0	0.0000	0.0000	OK
30 minute winter	Swale 2	33	53.843	0.213	24.7	0.0000	0.0000	OK
15 minute winter	Swale 1	25	63.104	0.094	26.1	0.6296	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Detention basin	Outfall	10.0				286.2
Outfall	Dummy outfall	10.0	0.889	0.100	0.0528	112.2
Swale 2	Detention basin	23.7				31.9
Swale 1	Swale 2	25.5	0.432	0.006	2.5012	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	Detention basin	180	52.886	0.586	62.0	205.9327	0.0000	OK
15 minute winter	Outfall	95	51.222	0.022	10.0	0.0000	0.0000	OK
15 minute summer	Dummy outfall	73	51.142	0.022	10.0	0.0000	0.0000	OK
30 minute winter	Swale 2	34	53.924	0.294	32.9	0.0000	0.0000	OK
15 minute winter	Swale 1	25	63.116	0.106	34.3	0.7083	0.0000	OK

US Node	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
Detention basin	Outfall	10.0				110.1
Outfall	Dummy outfall	10.0	0.889	0.100	0.0528	98.8
Swale 2	Detention basin	30.6				42.3
Swale 1	Swale 2	33.6	0.428	0.008	3.9944	