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Land south of Crawley Road: Flood Risk Assessment and Outline Drainage Strategy

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Land south of Crawley Road: Flood Risk Assessment and Outline Drainage Strategy

Client

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1. Introduction

1.1. Instruction

Aqua Terra Consulting Ltd (Aqua Terra) was instructed by Fairfax Acquisitions Ltd (Fairfax; the Client) to provide a Flood Risk Assessment (FRA) and Outline Drainage strategy (ODS) for a proposed residential development at New House Farm, off Crawley Road, Horsham (the Site).

1.2. Background

Fairfax are seeking planning permission for a residential development that aims to construct 120 new housing units, with the associated green areas, access roads, parking areas and SuDS features.

The FRA and ODS provide information on the nature of flood risk at the Site, the risk posed by the development to off-site flood risk, and follows Government guidance with regards to development, flood risk and surface water management.

1.3. Scope of the report

The assessment has been undertaken in accordance with the standing advice and requirements of the Environment Agency for Flood Risk Assessments as outlined in the Communities and Local Governments Technical Guidance to the National Planning Policy Framework (NPPF).

The assessment has:

- Considered the procedures of the Planning Policy Guidance and Local Authority Guidance;
- Considered the Council Local Flood Risk Management Strategy and the Council Strategic Flood Risk Assessment;
- Considered the site constraints;
- Investigated all potential risks of current and future flooding to the site;
- Considered the impact the development may have elsewhere with regards to flood risk;
- Considered and developed design proposals to mitigate any potential risk of flooding determined to be present; and
- Development of an outline SuDS strategy to mitigate any 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:

- The proposed development plans as provided by the Client (Appendix B);
- Data collected during a Site walkover on 19th May 2023;
- LiDAR Digital Terrain Model (DTM) data obtained through data.gov.uk;
- Environment Agency (EA) flood risk data;
- Soilsmap soil mapping;
- British Geological Survey (BGS) mapping and borehole logs;
- Horsham District Council Level 1 Strategic Flood Risk Assessment (**AECOM, 2024**);
- Land South of Old Crawley Road, Faygate, Flood Risk Assessment (**Temple, 2020**);
- Horsham District Planning Framework (**HDC, 2015**);
- West Sussex Local Flood Risk Management Strategy (**WSCC, 2025**);
- Hydrological descriptor data from the Flood Estimation Handbook (FEH) website (UK Centre for Ecology & Hydrology, 2026);
- DEFRA National Standards for SuDS (2025); and,

- The CIRIA SuDS Manual (CIRIA, 2015).

1.5. Limitations

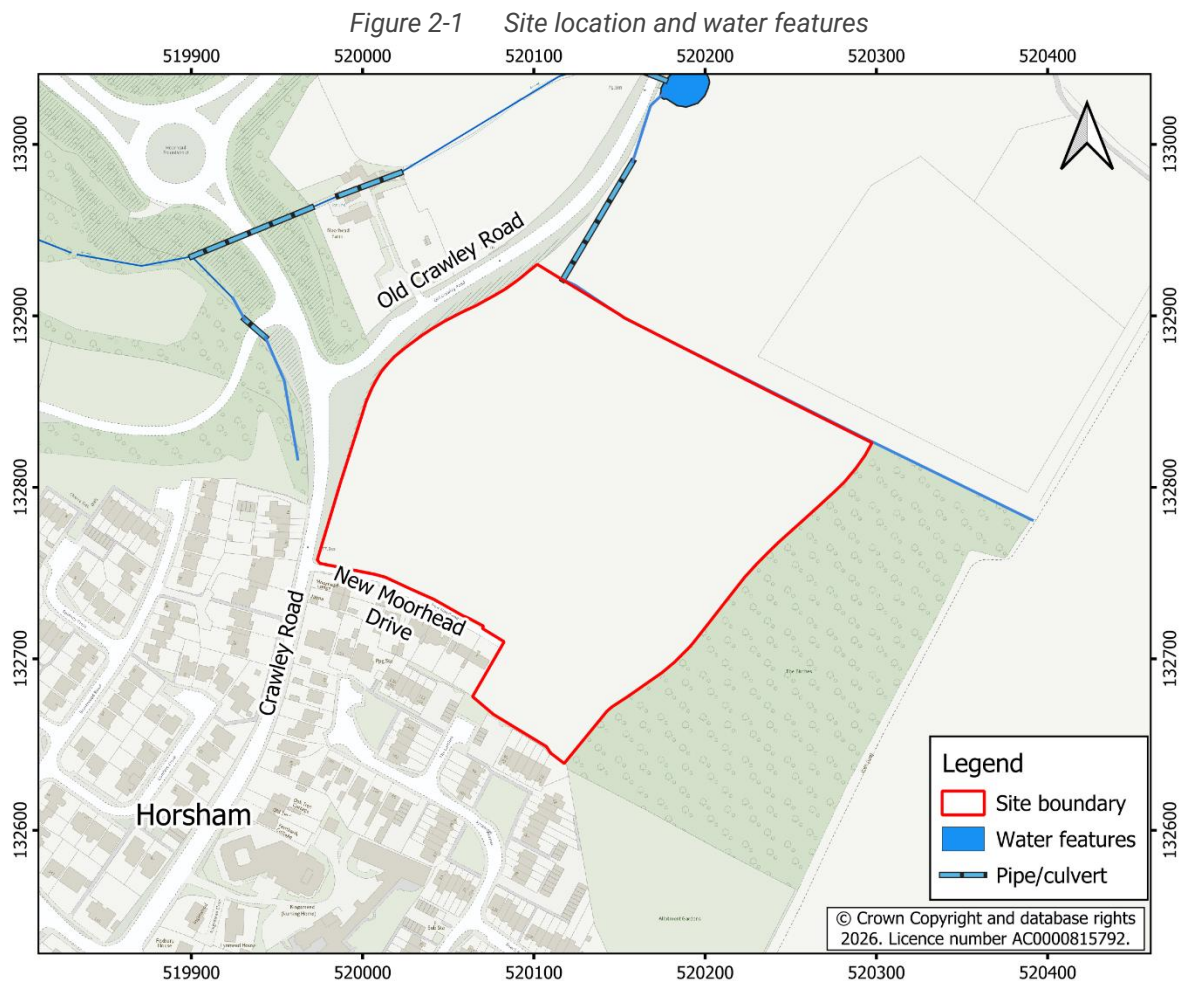
This report is written strictly for the benefit of the Client and bound by the conditions presented in Appendix A.

2. Site Description

2.1. Site setting and surrounding area

The Site is located on the outskirts of Horsham, off Crawley Road in West Sussex (see Figure 2-1). The nearest postcode is RH12 4RY, and the National Grid Reference for the approximate centre of the Site is TQ 20130 32790.

The Site covers an area of 4.96 Ha. It is bounded to the west by Crawley Road, and to the northwest by Old Crawley Road. To the south are residential properties located on New Moorhead Drive. To the east is an area of woodland, and to the north is agricultural land.



The current site layout is shown in Figure 2-2. The Site comprises an (arable) agricultural field. There is access to the field via a farm gate in the northwest, off Old Crawley Road

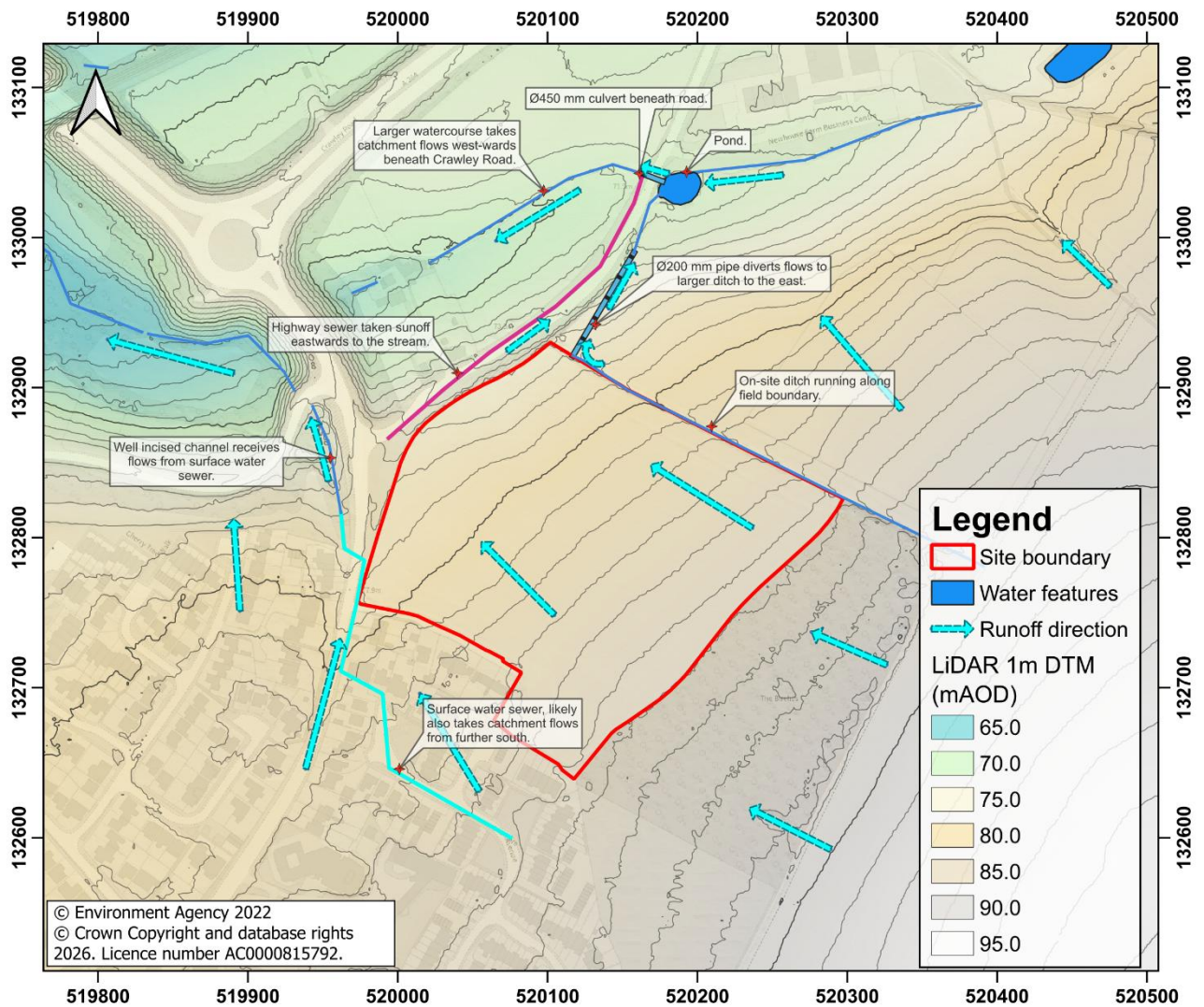
Figure 2-2 Current site layout / condition



2.2. Topography

According to 1 m LiDAR DTM data (see Figure 2-3), ground elevations at the Site slope north-westwards, and range between 86.1 mAOD at the south-eastern border and 75.6 mAOD at the north-western border. The unnamed stream c. 90 m northwest of the Site lies within a westward-sloping valley, and is culverted beneath Crawley Road. Runoff over the area flows in a broadly north-western direction, towards the valley.

Figure 2-3 Existing ground elevations (LiDAR data) and inferred flow directions



2.3. Soils, geology and hydrogeology

According to Soilsmap mapping and British Geological Survey (BGS) 1:50,000 scale mapping, the general geological sequence underlying the Site is as follows:

- Soils: "Slightly acid loamy and clayey soils with impeded drainage" over the western half of the Site, and "Freely draining slightly acid loamy soils" over the eastern half.
- Superficial deposits: None.
- Bedrock: Upper Tunbridge Wells Sand (sandstone and mudstone).

Nearby historical borehole logs within the BGS database confirm this succession and those closest are summarised in Table 2-1.

Table 2-1 Strata encountered in nearby historical borehole logs

Borehole ref.	Strata	Maximum depth (m bgl)
TQ23SW16 (15m northwest)	Clayey TOPSOIL	0.15
	MADE GROUND: Ashes, slag and tarmac	1.1
	Very stiff, light brown, silty, very stony CLAY	1.55
	Highly weathered, very weak, friable, silty SANDSTONE	3.55
TQ23SW15 (75m northwest)	TOPSOIL	0.2
	Stiff, brown silty, sandy, stony CLAY	0.65
	SILTSTONE fragments in a stiff, grey-brown, very sandy clay matrix	4.15
	Completely weathered, silty MUDSTONE	4.2
TQ13SE194 (160m southwest)	Fill	0.1
	Pale grey, orange/brown mottled clayey, sandy SILT with sandstone pieces	1.0
	Hard cemented dark red sand and SANDSTONE	1.3

The Upper Tunbridge Wells Sand is classified as a Secondary A aquifer, which 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.

Groundwater vulnerability on Site is classed as High. The Site is not within a groundwater Source Protection Zone (SPZ).

2.4. Hydrology

Water features in the Site's vicinity are illustrated within Figure 2-1.

The northern Site boundary is delineated by a mature hedgerow which has a ditch running alongside it (within the site boundary). This ditch is approximately 1 m deep (see Figure 2-4), and at its western end has a Ø6" (150 mm) pipe and headwall which formerly discharged to a chamber at Old Crawley Road. The chamber on Old Crawley Road is now silted up and a Ø10" (200 mm) pipe has been installed to divert flows to the larger ditch to the east. The flows end up in the same watercourse, but this diverts flows away from Old Crawley Road, which may have historically experience surface water flooding issues, based upon a review of the topography.



Figure 2-4 On-site ditch running along field boundary (left) and dissused outlet and headwall (right)



Figure 2-5 Diversion feature within on-site ditch (left) and outlet of diversion pipe (right)

Approximately 90 m northwest of the Site is the small unnamed stream (into which flows the catchment flows (including site runoff) and inflows from Old Crawley Road). It is an Ordinary Watercourse and runs in a westward direction towards the Channels Brook (Figure 2-6). Channels Brooks is a Main River located c. 600 m north of the Site; it is part of the Arun catchment.

Hydrological descriptors for the Site are provided in Table 2-2.

Table 2-2 Hydrological point descriptors

Descriptor	Value
NGR	TQ 20061 32813
BFIHOST19	0.571
PROPWET	0.36
SAAR9120	836 mm



Figure 2-6 Unnamed watercourse on north side of Old Crawley Road

2.5. Current drainage arrangements

The Site is currently undeveloped and lacks a formal surface water drainage system. As such, surface water runoff is expected to infiltrate directly into the ground or flow overland following the natural topographical gradients towards Old Crawley Road (see Figure 2-3), expediated by the ditch that runs along the northern boundary of the Site.

3. Proposed Development

The illustrative masterplan for the Site is provided in Appendix B.

The proposed development aims to construct 120 new residential housing units. The scheme will include associated internal access roads, private driveways, parking areas, and landscaped green spaces throughout the Site.

A range of Sustainable Drainage System (SuDS) features (see Section 7) will also be incorporated to manage surface water runoff and enhance the ecological and visual quality of the development.

The Site is currently used as agricultural land, which is classified as "Less Vulnerable" in terms of flood risk vulnerability. Following development, the residential development would be classified as "More Vulnerable".

A total lifespan of 100 years has been considered within this assessment.

4. Flood Risk to the Development

4.1. Rivers and Seas

The EA's flood risk for planning data is shown in Figure 4-1 and definitions of each Flood Zone are included in Table 4-1.

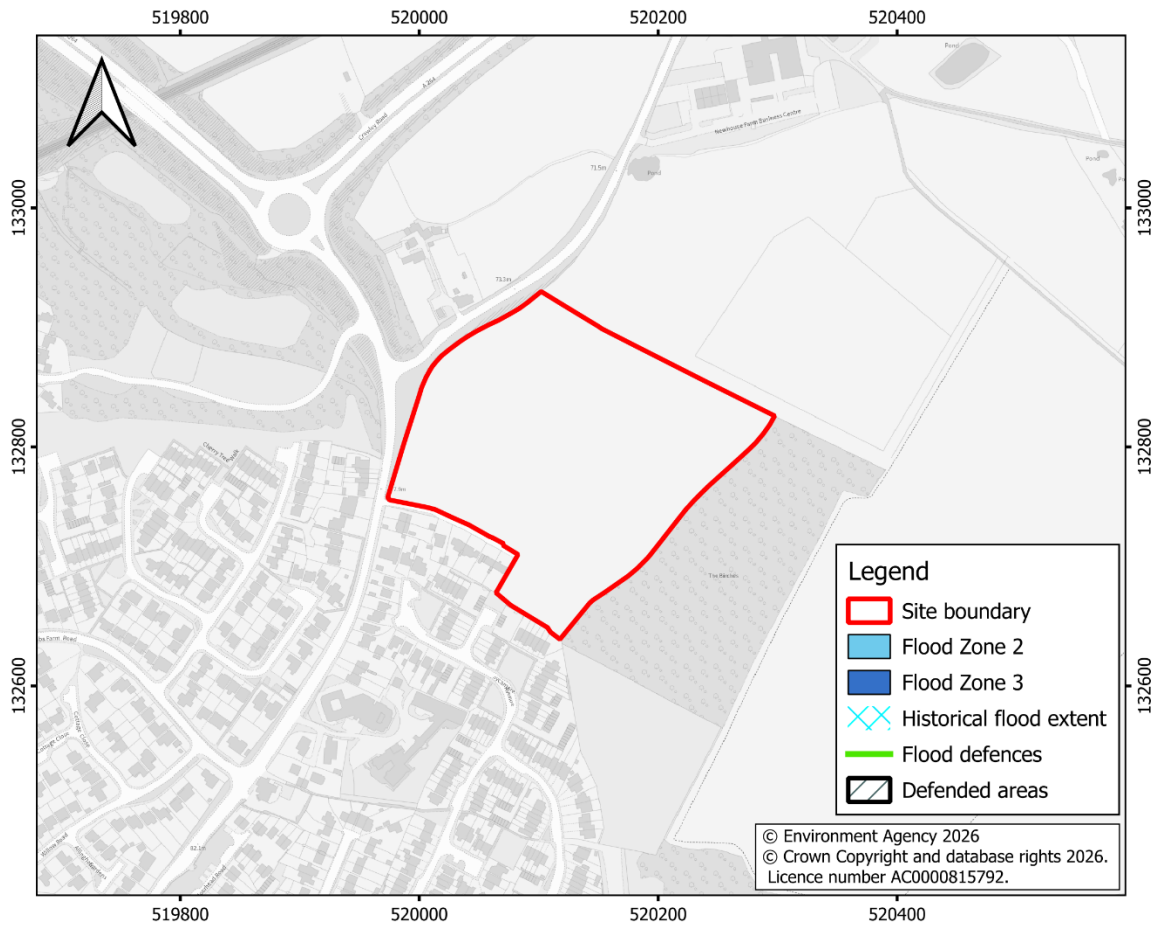
The entire Site is within Flood Zone 1 and therefore at very low risk of fluvial flooding. This would remain the case after considering the future influence of climate change.

Neither the SFRA (AECOM, 2024) nor the EA database of historical flooding contains any evidence of fluvial flooding having occurred in this area.

Table 4-1 EA Flood Zone definitions

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Figure 4-1 EA Flood Risk for Planning data



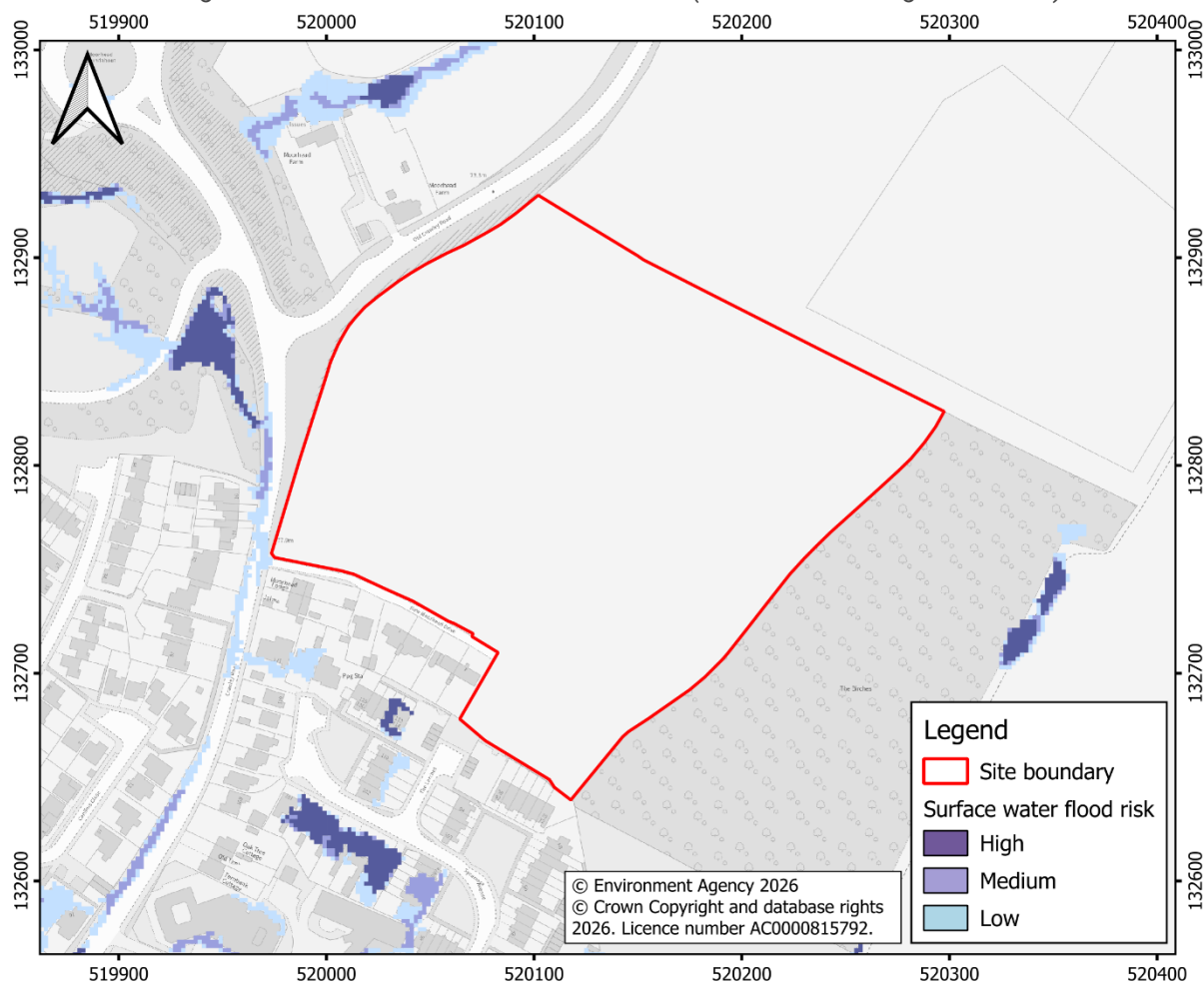
4.2. Surface Water

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. This data includes the 'Central' climate change allowance for the 2050s epoch (2040-2060).

The entire Site has Very Low risk of surface water flooding.

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



4.3. Groundwater

Groundwater flooding is caused by the natural emergence of water at surface level originating from underlying permeable sediments or rocks (aquifers). The groundwater may emerge as one or more-point discharges (springs) or as diffuse upwelling of water over an extended area. Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than hours or days.

Horsham District SFRA (AECOM, 2024) places the Site in an area with Negligible risk of groundwater flooding.

4.4. Sewers

Sewer flooding can occur during periods of intense rainfall and/or if a sewer becomes blocked with debris.

Horsham District Level 1 SFRA (AECOM, 2024) contains records of sewer flooding in the area, provided by Southern Water. There have been between 41-120 sewer flood incidents in the greater RH12 post code area between 2014-2024.

Given the Site's rural location and limited presence of on-site public sewer infrastructure, the risk of sewer flooding is considered to be Low.

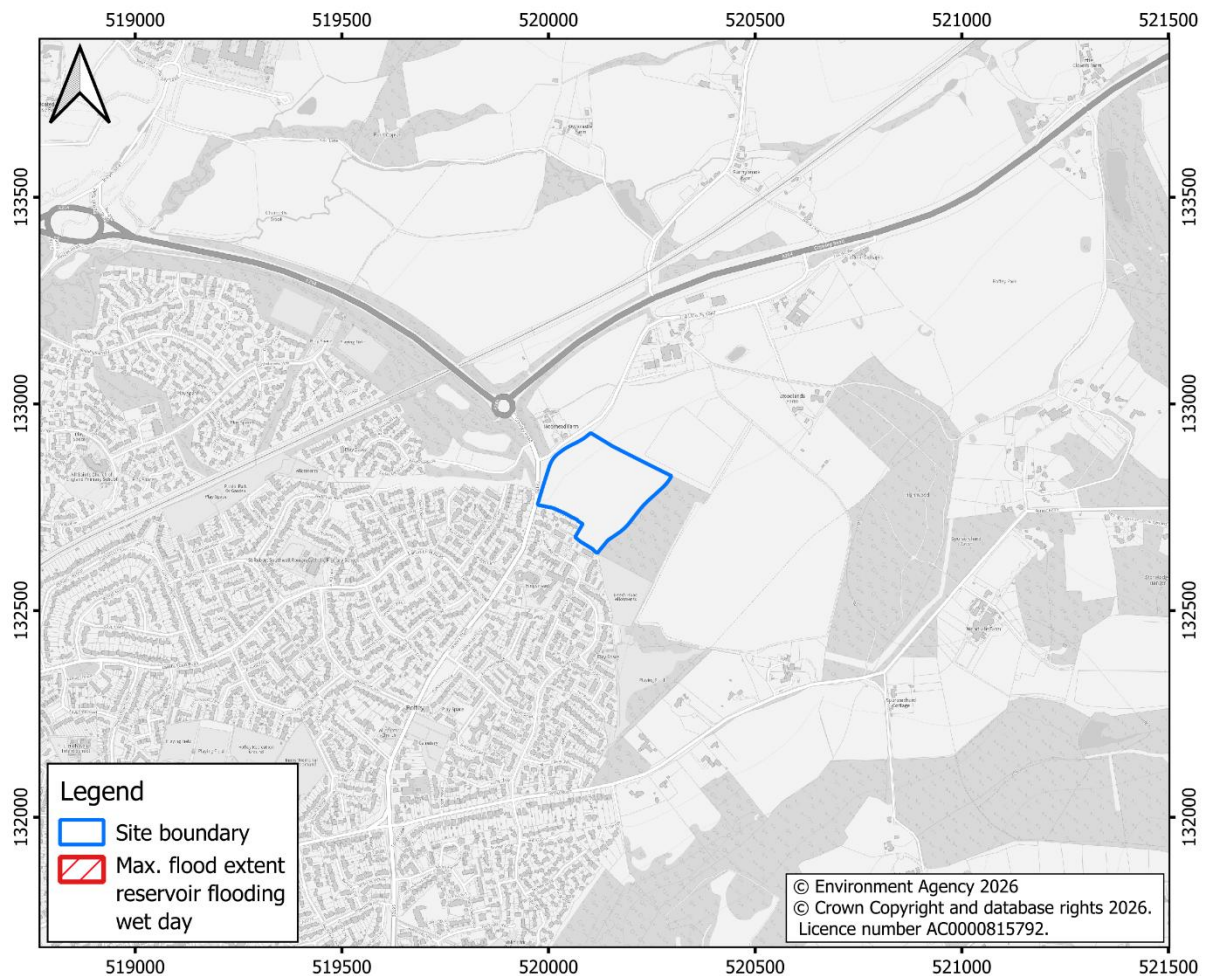
4.5. Reservoirs

The risk of reservoir flooding is related to the failure of a large water storage reservoir. The risk of failure is considered to be extremely low (DEFRA, 2010), therefore the mapped flood extent represents a worst-case scenario.

According to the EA's data, the Site is not at risk of flooding in the event of reservoir failure (see Figure 4-3).

There are no other large water bearing features in the area of interest which may impact flood risk at the Site.

Figure 4-3 EA's risk of flooding from reservoir failure (wet day scenario)



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 Site is entirely within Flood Zone 1, and is not thought to be at risk of flooding from surface water, groundwater, sewer or reservoirs. The Site will have a residential use, which has a "More vulnerable" flood risk vulnerability classification.

According to the NPPF (see Table 5-1), "More Vulnerable" site uses are considered appropriate within Flood Zone 1 and a Sequential Test / Exception Test is not required.

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.

✗ Development should not be permitted.

6. Mitigation

6.1. Fluvial/tidal/reservoir flooding mitigation

The Site lies entirely within Flood Zone 1, and there are no flood risks from reservoirs. Therefore, no mitigation measures are necessary.

6.2. Groundwater flooding mitigation

Given the Negligible risk of groundwater flooding in the Site's area, no mitigation measures are deemed necessary.

6.3. Mitigation of sewer flooding to the Site

Non-return valves to sewer connections are a viable mitigation against sewer flooding. However, the risk of sewer flooding is considered to be Low in this instance.

6.4. Mitigation of surface water flooding to the Site

Given the Very Low risk of surface water flooding in the entire Site's area, no mitigation measures are deemed necessary.

6.5. Mitigation of surface water flooding from the Site

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;
 - the assessment of overland flows and temporary flood storage across the Site.

An Outline Drainage Strategy has been created to demonstrate that there will be no increase in runoff from the Site under a range of design storm scenarios, and that all Site runoff will be sustainably managed in accordance with the local and national policy and guidance. This includes suitable allowances for future increases in rainfall intensity caused by climate change. The Drainage Strategy is presented in Section 7.

6.6. Flood evacuation plan

Given that all residential areas are located in Flood Zone 1 and there are no flood risks from other sources, a flood warning and evacuation plan is not required in this instance.

7. Drainage Strategy

7.1. Introduction

The proposed residential development will be located on 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.

This drainage strategy has been prepared in accordance with the DEFRA (2025) National Standards for SuDS and with the requirements of West Sussex County Council as the Lead Local Flood Authority (LLFA).

The 2025 Standards establish a national framework for the design, delivery and adoption of SuDS, consistent with the implementation of Schedule 3 of the Flood and Water Management Act. They set out clear requirements across four outcome areas:

1. Peak flow control – development should not increase flood risk off-site and peak discharges should be limited to greenfield rates.
2. Runoff volume control – post-development runoff volume should not exceed the equivalent greenfield volume for the 1 in 100 year, 6-hour event, with long-term storage provided where necessary.
3. Water quality – SuDS must prevent deterioration of receiving water bodies, with pollutant mitigation demonstrated through the Simple Index Approach or equivalent.
4. Amenity and biodiversity – SuDS should deliver wider benefits including habitat creation, biodiversity enhancement and opportunities for public amenity.

The design of the proposed SuDS for this site has been assessed against each of these outcome areas and is described in the following sections. The strategy also accounts for climate change allowances, urban creep, exceedance routing and maintenance/adoption arrangements, as required under the 2025 Standards.

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.

7.2. Greenfield runoff calculations and permissible discharge rates

The development areas within the Site were assessed using GIS software to quantify the areas of proposed impermeable surfacing, including roof areas and parking/turning areas (technically the parking areas will be permeable, but they will receive incoming rainfall). The total area draining to the proposed drainage infrastructure (the "positively drained area" in this instance) has been quantified as c. 4.394 ha.

The Institute of Hydrology Report 124 (IH124) method has been used to estimate the greenfield runoff rate for the Site. The 'QBAR' (i.e. 1 in 2.3 year return period) greenfield runoff rates are presented in Table 7-1.

Table 7-1 Greenfield runoff

Storm return period (yrs.)	Peak greenfield runoff rate (l/s)	Total greenfield runoff volume*
1	21.4	285
2.3 (Qbar)	25.1	562
30	60.3	1,132
100	80.2	1,455

* Volumes for the 1 in 1 and Qbar events were interpolated owing to limitation of the methodology for these return periods.

The 2025 National Standards for SuDS design stipulate that the permissible discharge rate for a site should be set at either the peak QBAR greenfield runoff rate or 3 l/s/ha, whichever is greater. 3 l/s/ha equates to 13.2 l/s in this instance, therefore the Qbar rate included within Table 7-2 may be used as the permissible discharge rate for the Site. In this case, this was rounded down to 15 l/s (below the Q1 flow rate), given the nature of the downstream catchment – see further discussion in Section 7.4.3).

7.3. Climate change

The potential increase in rainfall intensity associated with climate change needs to be considered when designing drainage strategies. The recommended allowances for rainfall intensity in the Arun and Western Streams Management Catchment are included in Table 7-2.

Table 7-2 Climate change allowances for rainfall in the Arun and Western Streams Management Catchment

Epoch	Central allowance	Upper end allowance
1 in 30 year (3.3%)		
2050s	20%	35%
2070s	25%	40%
1 in 100 (1.0%)		
2050s	20%	45%
2070s	25%	45%

The EA guidance for climate change allowances in flood risk assessments (Environment Agency, 2022) recommends designing development so that with the upper end allowances for the 1 in 100 year event:

- “there is no increase in flood risk elsewhere; and
- your development will be safe from surface water flooding”.

A default design lifespan of 100 years has been assumed in this instance, and the upper end allowances are applicable in runoff/drainage calculations for the proposed development (for residential development with lifetime beyond 2100). The required climate change allowances are 40% and 45% for the 1 in 30 and 1 in 100 year events, respectively.

7.4. Runoff destination

As per DEFRA (2025) SuDS Standards (Standard 1), the following runoff destination hierarchy is followed for the disposal of surface water from new developments, in order of priority:

1. Collection for non-potable use;
2. Infiltration to ground;
3. Discharge to a surface water body;
4. Discharge to a surface water sewer, or another piped surface drainage system;
5. Discharge to a combined sewer.

The following sections comment on the suitability of each of these measures in turn.

7.4.1. Collection for non-potable use

Some capture and reuse of rainfall at the Site is achievable for the proposed development.

Water recycling is recommended in the form of integrated tanks and external water butts, however, rainwater harvesting cannot be relied on for stormwater management unless sophisticated “smart” systems are employed to ensure storage features are empty ahead of incoming storm events.

These could be incorporated at detailed design; however, they will not be included in the outline design to ensure the system has sufficient capacity should they not be implemented, or fail to work consistently.

7.4.2. Infiltration to ground

The BGS geological data, detailed in Section 2.3, suggests that the Site would not be suitable for infiltration-based SuDS as it is underlain by clay dominated geological material.

Permeable paving remains a viable component of the drainage strategy, providing distributed attenuation storage and water treatment functionality across the development area.

7.4.3. Discharge to a surface water body

A ditch runs along the northern boundary of the existing Site. Flows in this feature are piped to the larger ditch to the north and the under Old Crawley Road via a pond and Ø450 mm culvert, towards Channels Brook (see Section 2.4).

It is proposed that surface water will be discharged to the ditch at a limited rate (at below 15 l/s). This should improve the situation with regards to flooding/drainage issues at Old Crawley Road (by diverting uncontrolled runoff from the Site to the road).

Any connection to an Ordinary Watercourse is likely to require Ordinary Watercourse Consent. The existing diversion feature would require an upgrade as it is currently covered with brash, as shown in Figure 2-5).

7.4.4. Discharge to a surface water or combined sewer

There is a surface water sewer located along the western site boundary. This discharges a small ravine located on the far side of Crawley Road (see Section 2.4). Southern Water asset location plans are included in Appendix C. Given the short distance and steep gradient to the outfall of the sewer, this would also seem to be a viable option for discharge from the Site. This provides a reliable alternative if the surface water discharge detailed above is not viable for any reason.

Additionally, the site discharge could have dual outlets, one to the surface water sewer and one to the ditch described above. This could be a preferable solution if the LLFA have any concerns over the conveyance capacity of the water features to the northeast of the Site. This could be a simple change to incorporate at the detailed design phase, if required, perhaps including an additional detention basin in the west.

7.5. Attenuation storage requirements

In order for the Site to meet the permissible discharge rates, the provision of attenuation storage will be required.

The required attenuation storage volume was calculated using Flow+ industry standard drainage design software, for a 1 in 100 year event, assuming a permissible discharge rate of 15 l/s and a positively drained input area of 4.40 ha, and an impermeable area of 1.85 ha. The impermeable area input value was uplifted by additional 15% in the calculations to account for urban creep and a small amount of runoff from residual green spaces. A 45% climate change uplift was also included (see Section 7.3).

The calculated attenuation storage volume ranges between **1,767-2,465 m³**.

7.6. Proposed SuDS Management Train

A SuDS Management Train has been designed which comprises rainwater interception and re-use, source control techniques (permeable paving) green water conveyance infrastructure and site control techniques (an attenuation basin). The SuDS Management Train would ensure that the Proposed Development would: a) not result in an increase in surface water flood risk elsewhere; b) encourage rainwater interception and re-use; and c) provide water quality treatment benefits. The following sections describe the various components of the SuDS Management Train that will be delivered by the proposed development.

7.6.1. Source control (rainwater harvesting)

Rainwater harvesting tanks could be used within the residential and commercial units to capture and re-use roof runoff for non-potable purposes (e.g. for toilet flushing). This has the benefit of reducing both the demand for potable water and the volume of surface water runoff requiring disposal. Rainwater harvesting for each unit will be included as part of the detailed design of the Proposed Development.

It is difficult to accurately determine the volume of roof runoff that would be intercepted and re-used by each individual rainwater harvesting system (this will be a detailed design consideration). The inclusion of rainwater interception and re-use systems in this way will, however, reduce the overall volume of runoff that will need to be stored by each subsequent element of the SuDS Management Train.

7.6.2. Source Control (permeable paving)

Permeable paving is suitable for use on private driveways, parking areas and local access roads. In addition to attenuating runoff, permeable paving blocks have the capacity to infiltrate (to the sub-base) very high intensity rainfall events and are expected to manage the peak intensity associated with a short-duration (15-minute), summer profile, 1 in 100-year (+45% climate change) rainfall event at the Site.

The paving blocks would be constructed over gravel sub-grade layers, underlain by a geo-membrane. These gravel layers provide attenuation storage capacity and deliver water quality benefits, as microbial communities that develop within the sub-grade material are effective at breaking down hydrocarbons.

There is a total area of 0.57 ha of permeable paving over the Site area. Assuming a gravel sub-grade depth of 0.75 m and a void space ratio of 0.3, it is estimated that permeable paving would provide c. 1,282 m³ of attenuation capacity. The depth and final design of these features will be confirmed at the detailed design phase.

7.6.3. Site control measures

To meet the attenuation storage requirements for the Site, a detention basin will be placed at the downgradient section of the Site.

The basin will have a surface area of 1,370 m² and mean depth of 1.0, giving a total capacity of c. 1,185 m³.

Total attenuation storage requirements and provision for the Site are shown in Figure 7-1. A conservative assumption has been made that the rainwater harvesting systems and conveyance swales will provide no attenuation.

Table 7-3 Total attenuation storage requirements and provisions

Attenuation storage volume requirement (1 in 100 year +40% climate change), m ³	Permeable paving attenuation storage volume, m ³	Infiltration basin storage volume, m ³	Total attenuation storage volume, m ³
1,767-2,465	1,282	1,185	2,473

The attenuation storage requirements for the Site will be met by the combination of the detention basin and permeable paving.

The detention basin will drain by gravity to the adjacent ditch. Outflows from the detention basin will be controlled by a flow control chamber. A Hydro-Brake® (or similar flow control device) will be used to ensure that the permissible discharge rate defined above is not exceeded under the design storm events.

7.7. Catchment areas and drainage layout

The post-development Site has been sub-divided into two catchment areas that will each drain via gravity to the detention basin. These sub-catchments (presented in Figure 7-1) have been delineated based on the development layout plan included in Appendix B and LiDAR Digital Terrain Model (DTM) data.

Surface runoff at the Site will primarily be conveyed via an underground gravity-driven drainage system that follows the road network. Indicative key node (manholes or inspection chambers) locations are included in Figure 7-1 along with (current) ground elevation at each location (extracted from LiDAR DTM data), and impermeable areas draining each sub-catchment within the Site. Land raising is not expected to be required to deliver a gravity driven drainage network. Grassed swales are also included in various parts of the Site to convey runoff where possible.

The outline drainage strategy layout is presented in Figure 7-2, which includes details of the proposed SuDS features.

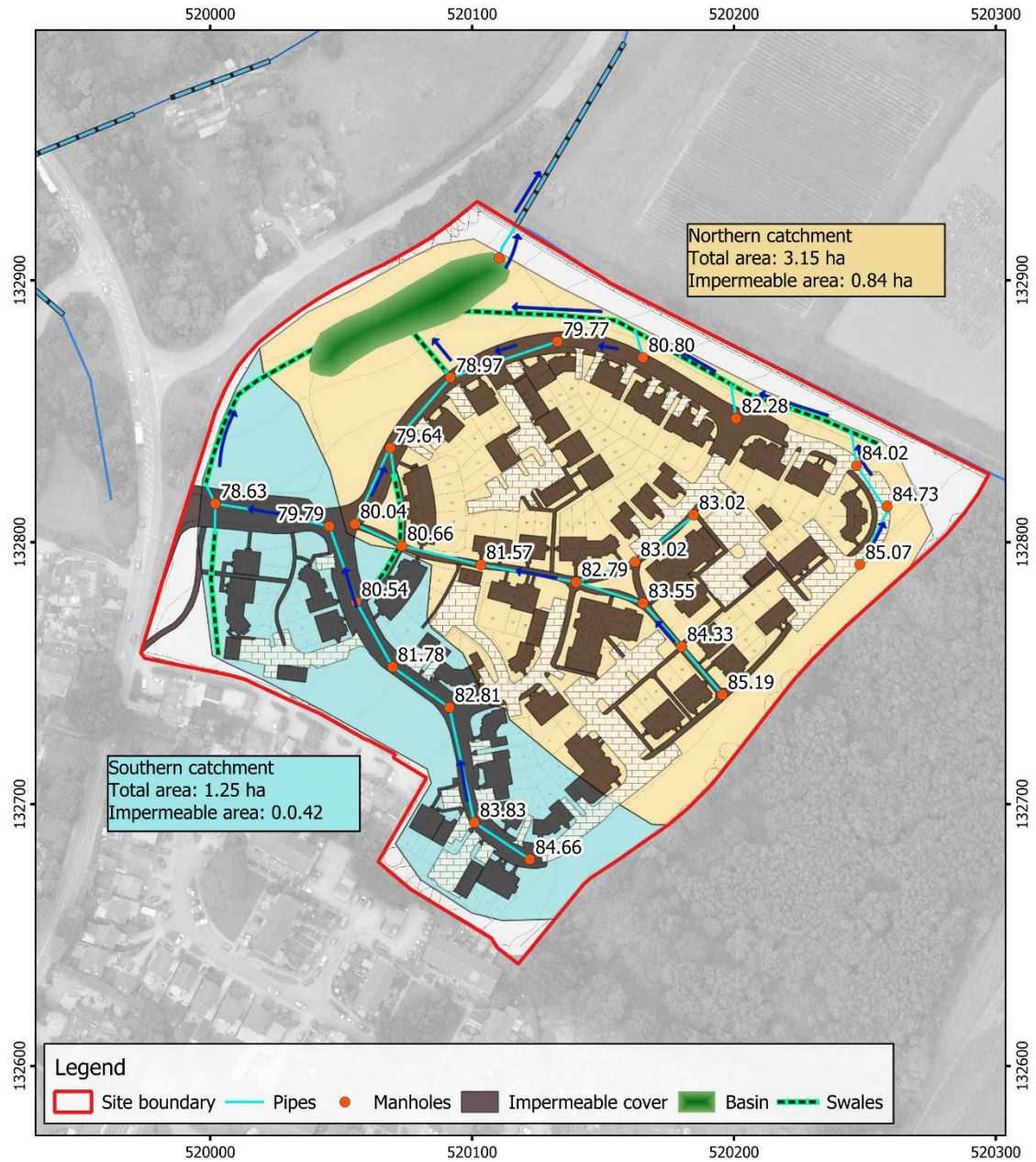


Figure 7-1 Post development catchment areas

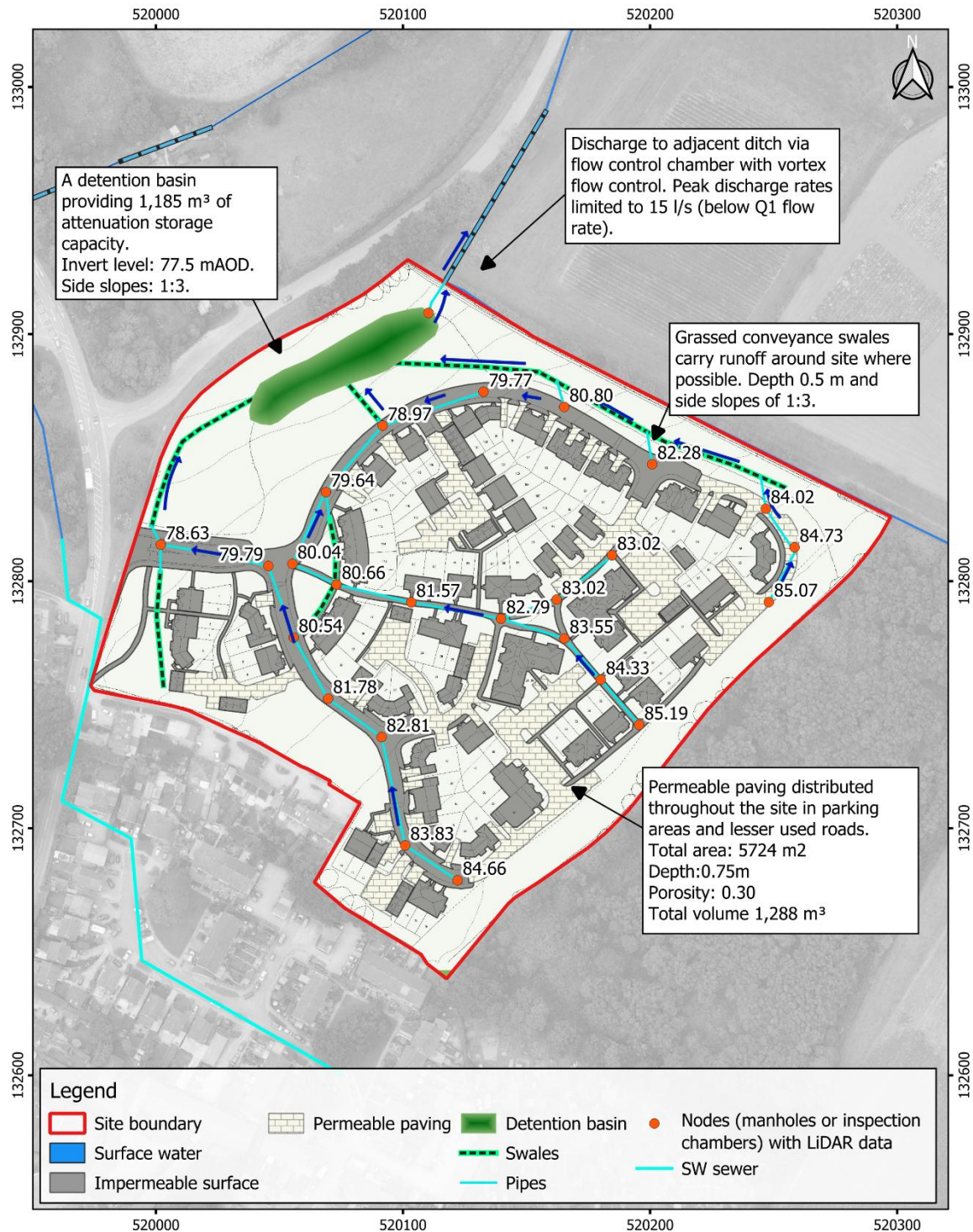


Figure 7-2 Outline drainage strategy

7.8. Performance calculations

The initial design of the SuDS features has been undertaken using the Causeway “Flow+” v 17 industry standard software. Simulations were run for the 1 in 1, 1 in 30-year+40% and the 1 in 100-year + 45% event (allowance given for climate change as defined above). The input hydrological descriptors for the Site were obtained from the Flood Estimation Handbook (FEH); these are shown in Table 2-2.

The catchment areas and impermeable surface area draining to each feature were delineated within GIS as discussed in Section 7.7. An additional 15% uplift was included to the impermeable surface area to account for urban creep and a small amount of runoff from residual green spaces. A Cv value of 1.00 was utilised for both summer and winter storms.

The basin was added as a depth area feature, with a volume of 1185 m³ and the permeable paving areas were added as permeable car parks (a single feature was used to represent all permeable paving areas within each catchment, which is considered a suitable level of detail for an outline design). 50% of the impermeable area within each catchment was added to the respective permeable paving feature, with the remainder being added directly to the basin.

The infiltration rate for all SuDS features was set to zero. Based on the evidence reviewed to date it appears that infiltration is not a viable option for water disposal at the Site.

Appendix D contains the output from the Flow drainage 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 30 year + 40% event and the 1 in 100 year +45% storm events, with no flooding expected.

The peak simulated outflow rates and total volumes from the detention basin (i.e./ the post-development off-site discharge rate) are presented in Table 7-4, along with the greenfield equivalent value and the calculated change for each scenario (a reduction in each case).

Table 7-4 Summary of drainage simulation results

Storm return period (yrs.)	Greenfield runoff rate (l/s)	Post-dev discharge rate (l/s)	Change (l/s)	Greenfield runoff volume (m ³)*	Post-dev discharge vol (m ³)*	Change (m ³)
1	21.4	3.1	-18.3	285	77	-208
30	25.1	12.3	-12.8	562	265	-298
100	60.3	15.0	-45.3	1,132	348	-784

* 360 minute duration event

This illustrates that there will be a **large overall reduction in peak runoff rates and volumes** from the site post-development. In particular, the post development outflow rate under the 1 in 1 year event drops by 86%.

The outlet from the SuDS can be configured such that there is no outflow from Site under the 5 mm rainfall event, meeting the “first flush” criterion (National Standard 2). This has been demonstrated within this drainage model, as shown in Appendix D – there is no discharge from the site under this event.

At least 300 mm freeboard remains between the peak water levels and the bank elevation under the 1 in 100 year +45% storm event within the basin.

7.9. Exceedance routes

Due consideration 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, swales and the detention basin). The exceedance routes have been identified using the proposed drainage layout (Figure 7-2) and the post-development topographical data.

Figure 7-3 shows exceedance routes for two scenarios:

Scenario 1: 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 and inspection chambers and would be conveyed predominantly along the road surface towards the detention basin. These exceedance flows are expected to remain shallow and largely contained within the road kerbs.

Scenario 2: 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 follow the local topography and run off along the existing preferential surface water flow pathways (i.e. to the northwest). Overflow features with erosion protection will be incorporated into the detention basin design to direct potential exceedance flows away from the developed areas (to the northwest).

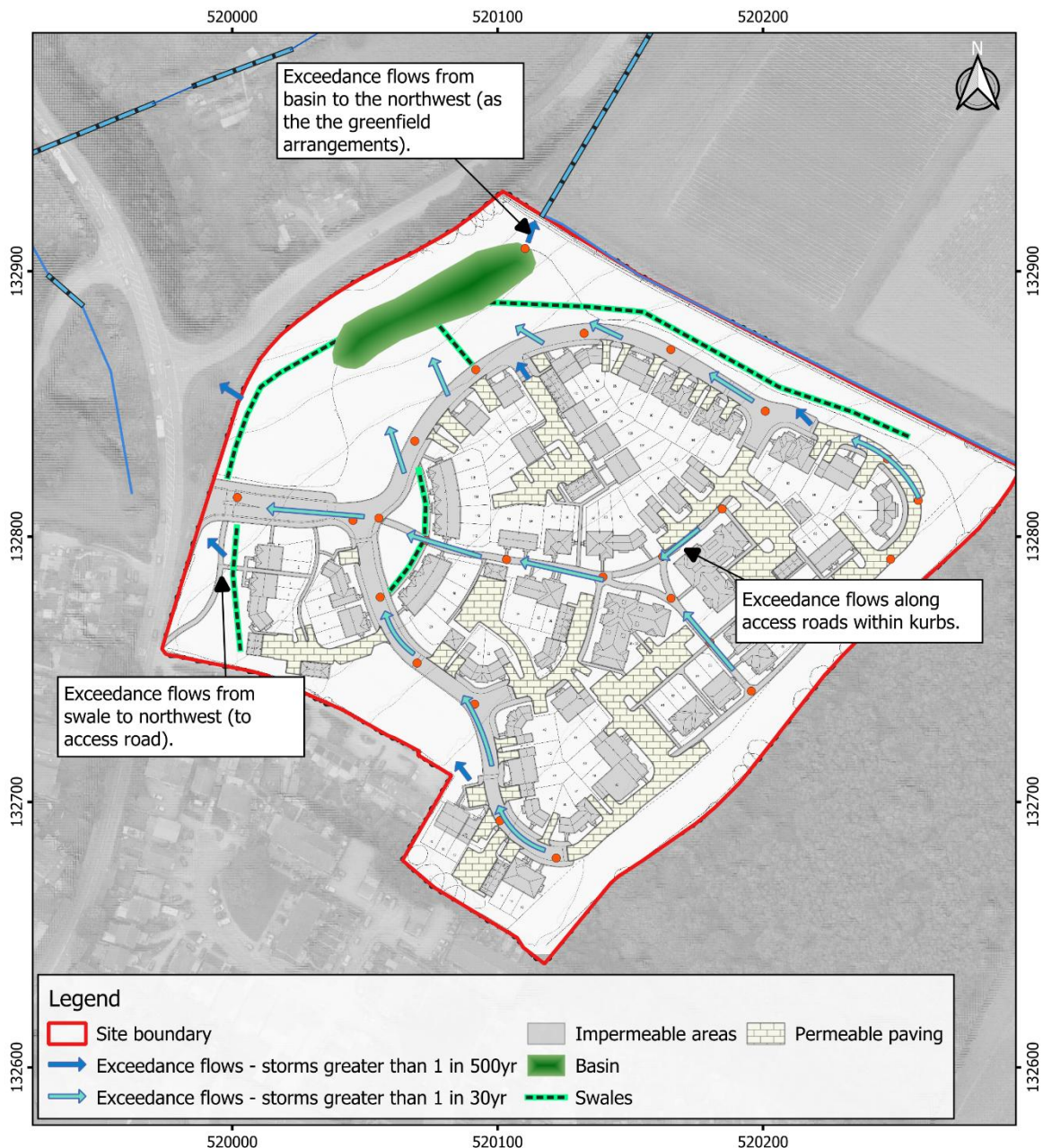


Figure 7-3 Exceedance flow routes

7.10. 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 5-10 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 (Table 7.5).

Table 7.5 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
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.

An assessment of the pollution hazard level for the proposed development has been undertaken in accordance with the CIRIA SuDS manual (CIRIA, 2015). The qualitative indices approach to designing a SuDS scheme has been applied to quantify the influence of the proposed SuDS features on site runoff. The results are presented in Table 7.6.

The sequence of permeable paving, swale and detention basin included within the SuDS Strategy 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 controlled waters.

Land south of Crawley Road: Flood Risk Assessment and Outline Drainage Strategy
P25134_R2

Table 7.6 CIRIA indices method water quality assessment

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 2	Swale				
Component 3	Detention basin				
SuDS Pollution Mitigation Indices					
TSS	>0.95				
Metals	>0.95				
Hydrocarbons	>0.95				
Groundwater protection type	None				
Groundwater protection					
Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices		Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
TSS	>0.95				
Metals	>0.95				
Hydrocarbons	>0.95				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

7.11. Foul drainage

A pre-planning application was submitted to Southern Water in February 2026 to assess the capacity within the public sewer network to receive foul water discharge from the proposed development.

A connection could be made to the existing foul water network to the south of the Site (see asset location plans within Appendix C). Southern Water have stated that there is currently insufficient capacity in the adjacent foul water sewer network to serve the development, and local upgrades would be required (see Appendix C)

7.12. 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 swales (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.

8. Conclusions

The flood risk assessment has been undertaken in accordance with the standing advice and requirements of the Environment Agency (EA) for Flood Risk Assessments as outlined in the Planning Policy Guidance to the National Planning Policy Framework (NPPF). The drainage strategy has been prepared in accordance with the DEFRA (2025) National Standards for SuDS and the requirements of the local Council as the Lead Local Flood Authority (LLFA).

The assessment has:

- Investigated all reasonably foreseeable potential risks of flooding to the Site.
- Considered the impact the development may have elsewhere with regards to flooding.

The report concludes that:

- Following development, the Site's flood risk vulnerability classification would change from "Less Vulnerable" to "More Vulnerable".
- The entire Site is within Flood Zone 1.
- The Site has Very Low risk of surface water flooding, Negligible risk of groundwater flooding, Low risk of sewer flooding, and it is not in an area at risk of flooding from a reservoir failure.
- The Site is not known to have flooded in the past.
- The proposed development at the Site is appropriate according to the NPPF.
- A combination of SuDS features including permeable paving, swales and a detention basin will be used to manage surface water runoff effectively from the Site for the lifetime of the development.

9. References

- AECOM. (2024). *Horsham District Council Level 1 Strategic Flood Risk Assessment* .
- CEH. (2026). *The Flood Estimation Handbook (FEH) Online Service*, Centre for Ecology & Hydrology, Wallingford, Oxon, UK.
- CIRIA. (2015). *The SuDS Manual V2. C753* .
- DEFRA. (2010). *Press release on reservoir flood map release for public use*.
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- Environment Agency. (2013). *Guidance on rainfall runoff management from developments*.
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- HDC. (2015). *Horsham District Planning Framework*.
- Temple. (2020). *Land South of Old Crawley Road, Faygate, Flood Risk Assessment* .
- UK Centre for Ecology & Hydrology. (2026). *Flood Estimation Handbook Web Service*. Retrieved from
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- WSCC. (2025). *West Sussex Local Flood Risk Management Strategy: 2025 - 2030*.

Appendix A Report conditions



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.

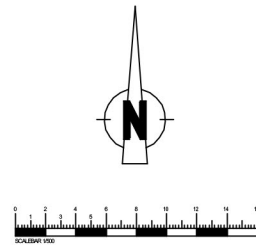
Where necessary and appropriate, the report represents and relies on published information from third party, publicly and commercially available sources which is used in good faith of its accuracy and efficacy. Aqua Terra cannot accept responsibility for the work of others.

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 Development plans





F C P LAND 4 LTD

project:
Land off:

CRAWLEY ROAD,
FAYGATE

title:
ILLUSTRATIVE BASE MASTERPLAN

date: Feb '25 **scale:** 1 : 500 @ A1

drawing number: 2126/PL.05	Rev. J
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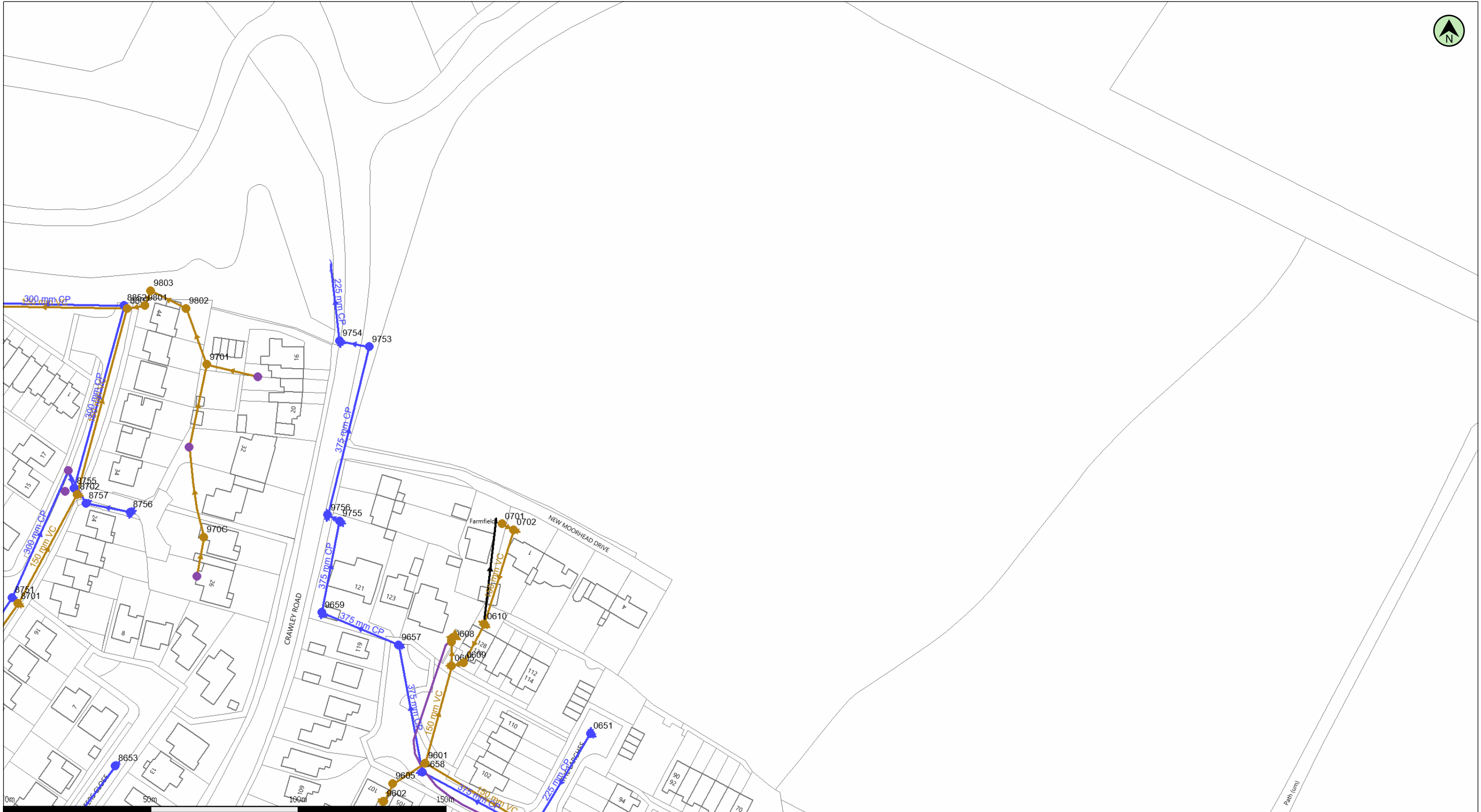
Paul Hewett R.I.B.A.

CHARTERED ARCHITECT

Paul Hewett BA(Hons) DipArch(Hons) R.I.B.A.
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51 Foxdale Drive : Angmering : West Sussex
BN16 4HF
Tel: 01903 778701
email: hewett439@btinternet.com

Appendix C Sewer asset plan





(c) Crown copyright and database rights 2023 Ordnance Survey 100031673

Date: 16/08/23

Scale: 1:1250

Map Centre: 520106,132769

Data updated: 05/05/23

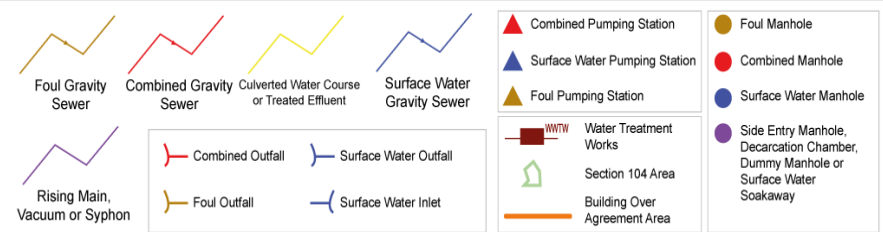
Our Ref: 1252007 - 2

Wastewater Plan A3

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. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2023 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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



gillian@yellowsubgeo.com	
NewHouseFarm	





Henry Kelly
10 St Hubert Road
Waterlooville
Hampshire
PO8 0EJ

Your ref
24539

Our ref
DSA000051797

Date
3rd of March 2026

Contact
Tel 0330 303 0119

Dear Mr Kelly,
Level 1 Capacity Check Enquiry: Land South of Crawley Road.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

The enquiry has been assessed to determine the capacity available for **1.08 l/s** at manhole reference **TQ20320701 Grid Reference: 520026, 132729**.

There is currently inadequate capacity within the foul sewerage network to accommodate a foul flow of **1.08 l/s** for the above development at manhole reference **TQ20320701 Grid Reference: 520026, 132729**. The proposed development would increase flows to the public sewerage system which may increase the risk of flooding to existing properties and land. Additional off-site sewers or improvements to existing sewers will be required to provide sufficient capacity to service the development. Southern Water has a duty to provide Network capacity from the point of practical connection (point of equivalent or larger diameter pipe) funded by the New Infrastructure Charge.

Southern Water aim to provide this within 24 months following the date that planning has been granted for developments not identified as strategic sites in our current business plan. Strategic sites are larger developments and will often take longer than 24 months for a full solution to be provided.

The nearest point where capacity is currently available is at **Horsham New WTW**. Rights are not issued for a direct connection to Wastewater Treatment Works (WTW). Please note that connection to the WTW will have to be agreed by Southern Water Services before being carried out.

New Infrastructure Charging

Please note as of 1st April 2018 we have moved to the "New Connections Services Charging Arrangements". We understand that this may cause uncertainty for customers, particularly where they may have already committed to a development based on previous charging arrangements. We have worked with our stakeholders and Water UK to agree a set of principles by which we will base



our charges. Please read through our new charging arrangement documents available at the following link: [Connecting Charging Arrangements - Southern Water](#)

Alternatively, New Appointees and Variations (NAVs), also known as 'inset' companies, can provide new connection services or take ownership of the new water and wastewater connection infrastructure provided for a new development. NAVs are appointed by Ofwat and replace the regional water company. It is for the developer to choose whether to use a NAV or the regional water company to supply services for new sites, according to certain legal criteria.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter. **Any revisions in flow rate or alternative point of connection will require a new Pre-Planning Application to be submitted.**

Should it be necessary to contact us please quote our above reference number in all communications relating to this application by email at southernwaterplanning@southernwater.co.uk

Yours sincerely,

Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

Appendix D Drainage model calculations



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	5	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	10.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Trapezoidal-500w Link Type

Template	Freeform Carrier	Side Slope (1:X)	2.0
Shape	Trapezoidal	Auto Increment (mm)	50
Barrels	1	Follow Ground	x
Width (mm)	500		

Available Diameters (mm)

100

Nodes

Name	Area (ha)	Add Area (%)	T of E (mins)	Cover Level (m)	Node Type	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
✓ Ditch 2				77.400	Junction	11.093	85.731	0.600	76.800
✓ Ditch 1			10.00	78.200	Junction	25.347	79.200	1.200	77.000
Detention basin	0.630			78.500	Junction	-15.462	43.873	1.000	77.500
Per paving - south	0.210	15	10.00	82.000	Junction	-10.381	-89.280	0.750	81.250
Per paving - north	0.420	15	10.00	83.000	Junction	100.107	-20.718	0.750	82.250

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.679	78.4	100	Trapezoidal-500w	78.200	77.000	1.100	77.400	76.800	0.500
				Link	US Node	Node Type	DS Node	Node Type		
				1.000	Ditch 1	Junction	Ditch 2	Junction		

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

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

Node Per paving - north Offline Head/Flow Control

Flap Valve x | Loop to Node Detention basin | Invert Level (m) 82.250

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.010	0.000	0.050	0.000	0.600	5.000	0.750	100.000

Node Per paving - south Offline Head/Flow Control

Flap Valve x | Loop to Node Detention basin | Invert Level (m) 81.250

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.010	0.000	0.050	0.000	0.600	5.000	0.750	100.000

Node Detention basin Offline Head/Flow Control

Flap Valve x | Loop to Node Ditch 1 | Invert Level (m) 77.500

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.010	0.000	0.050	0.000	0.400	15.000	0.850	15.000	0.900	100.000

Node Detention basin Depth/Area Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Safety Factor 2.0 | Invert Level (m) 77.500
Side Inf Coefficient (m/hr) 0.00000 | Porosity 1.00 | Time to half empty (mins) 225

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	1000.0	1000.0	1.000	1370.0	1389.5

Node Per paving - south Carpark Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Invert Level (m) 81.250 | Slope (1:X) 1000.0
Side Inf Coefficient (m/hr) 0.00000 | Time to half empty (mins) 240 | Depth (m) 0.750
Safety Factor 2.0 | Width (m) 110.000 | Inf Depth (m)
Porosity 1.00 | Length (m) 10.000

Node Per paving - north Carpark Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Invert Level (m) 82.250 | Slope (1:X) 1000.0
Side Inf Coefficient (m/hr) 0.00000 | Time to half empty (mins) 0 | Depth (m) 0.750
Safety Factor 2.0 | Width (m) 450.000 | Inf Depth (m)
Porosity 1.00 | Length (m) 10.000

Approval Results

The network has been designed using IDF rainfall
It contains 5 nodes (1 outfall) and 1 link
The total impermeable area is 1.355 ha
3 offline loops have been defined
3 structures have been defined, providing 3283m³ of storage below the flood risk level
Infiltration has not been utilised
Simulations have been completed using FEH-22 summer and winter storms from 15 to 1440 minute duration

No manholes are smaller than that required by the library

No connections have combined exit and entry losses less than the recommended total

No circular links have diameters < 150mm

No links have lengths > 100.000m

	US Node	DS Node	Link	Length (m)
✓	Ditch 1	Ditch 2	1.000	15.679

No links have lengths that differ from their coordinated length by more than 1.000m

	US Node	DS Node	Link	Length (m)	Coordinate Length (m)
✓	Ditch 1	Ditch 2	1.000	15.679	15.679

No links cross one or more other links

1 link has cover depth outside the range 1.200-3.000m

	US Node	DS Node	Link	Minimum Depth (m)	Maximum Depth (m)
x	Ditch 1	Ditch 2	1.000	0.500	1.100

No nodes have backdrops outside the range 0.200-1.500m

No links have full bore velocity outside the range 1.000-3.000m/s

	US Node	DS Node	Link	Velocity (m/s)
✓	Ditch 1	Ditch 2	1.000	1.760

1 link has peak proportional velocity outside the range 0.750-3.000m/s during the 5 year return period

	US Node	DS Node	Link	Velocity (m/s)	Event
x	Ditch 1	Ditch 2	1.000	0.632	5 year 960 minute summer

No links have a surcharged depth greater than 0.100m during the 5 year return period

	US Node	DS Node	Link	Surcharged Depth (m)
✓	Ditch 1	Ditch 2	1.000	0.000

No nodes flood during the 30 year return period

	Node	Flood (m³)
✓	Ditch 2	0.0000
✓	Ditch 1	0.0000
✓	Detention basin	0.0000
✓	Per paving - south	0.0000
✓	Per paving - north	0.0000

The time to half empty test has not been completed

No outfalls have a discharge rate greater than 21.4l/s during the 1 year return period

US Node	DS Node	Link	Discharge Rate (l/s)	Event
✓ Ditch 1	Ditch 2	1.000	3.1	1 year 1440 minute summer

No outfalls have a discharge rate greater than 60.3l/s during the 30 year return period

US Node	DS Node	Link	Discharge Rate (l/s)	Event
✓ Ditch 1	Ditch 2	1.000	12.3	30 year +40% CC 480 minute summer

No outfalls have a discharge rate greater than 80.2l/s during the 100 year return period

US Node	DS Node	Link	Discharge Rate (l/s)	Event
✓ Ditch 1	Ditch 2	1.000	15.0	100 year +45% CC 180 minute summer

No outfalls have a discharge volume greater than 285m³ during the 1 year 360 minute storm

US Node	DS Node	Link	Discharge Volume (m ³)	Event
✓ Ditch 1	Ditch 2	1.000	77.8	1 year 360 minute winter

No outfalls have a positive discharge during the 1 year return period (first 5mm)

US Node	DS Node	Link	Discharge Rate (l/s)
✓ Ditch 1	Ditch 2	1.000	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	71.213	20.151	1 year 1440 minute summer	4.899	1.313
1 year 15 minute winter	49.974	20.151	1 year 1440 minute winter	3.292	1.313
1 year 30 minute summer	46.719	13.220	1 year (first 5mm) 15 minute summer	71.213	20.000
1 year 30 minute winter	32.785	13.220	1 year (first 5mm) 15 minute winter	49.974	20.000
1 year 60 minute summer	31.823	8.410	1 year (first 5mm) 30 minute summer	46.719	10.000
1 year 60 minute winter	21.142	8.410	1 year (first 5mm) 30 minute winter	32.785	10.000
1 year 120 minute summer	23.911	6.319	1 year (first 5mm) 60 minute summer	31.823	5.000
1 year 120 minute winter	15.886	6.319	1 year (first 5mm) 60 minute winter	21.142	5.000
1 year 180 minute summer	19.966	5.138	1 year (first 5mm) 120 minute summer	17.971	2.500
1 year 180 minute winter	12.979	5.138	1 year (first 5mm) 120 minute winter	13.952	2.500
1 year 240 minute summer	16.527	4.368	1 year (first 5mm) 180 minute summer	11.581	1.667
1 year 240 minute winter	10.980	4.368	1 year (first 5mm) 180 minute winter	9.965	1.667
1 year 360 minute summer	13.200	3.397	1 year (first 5mm) 240 minute summer	7.739	1.250
1 year 360 minute winter	8.580	3.397	1 year (first 5mm) 240 minute winter	7.600	1.250
1 year 480 minute summer	10.643	2.813	1 year (first 5mm) 360 minute summer	4.820	0.833
1 year 480 minute winter	7.071	2.813	1 year (first 5mm) 360 minute winter	5.085	0.833
1 year 600 minute summer	8.842	2.418	1 year (first 5mm) 480 minute summer	3.460	0.625
1 year 600 minute winter	6.041	2.418	1 year (first 5mm) 480 minute winter	4.011	0.625
1 year 720 minute summer	7.956	2.132	1 year (first 5mm) 600 minute summer	2.617	0.500
1 year 720 minute winter	5.347	2.132	1 year (first 5mm) 600 minute winter	2.946	0.500
1 year 960 minute summer	6.606	1.740	1 year (first 5mm) 720 minute summer	2.342	0.417
1 year 960 minute winter	4.376	1.740	1 year (first 5mm) 720 minute winter	2.344	0.417

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year (first 5mm) 960 minute summer	1.667	0.312	30 year +40% CC 240 minute summer	63.555	16.796
1 year (first 5mm) 960 minute winter	1.873	0.312	30 year +40% CC 240 minute winter	42.225	16.796
1 year (first 5mm) 1440 minute summer	1.008	0.208	30 year +40% CC 360 minute summer	47.862	12.316
1 year (first 5mm) 1440 minute winter	1.225	0.208	30 year +40% CC 360 minute winter	31.111	12.316
5 year 15 minute summer	170.956	48.375	30 year +40% CC 480 minute summer	37.309	9.860
5 year 15 minute winter	119.969	48.375	30 year +40% CC 480 minute winter	24.787	9.860
5 year 30 minute summer	112.328	31.785	30 year +40% CC 600 minute summer	30.309	8.290
5 year 30 minute winter	78.826	31.785	30 year +40% CC 600 minute winter	20.709	8.290
5 year 60 minute summer	75.763	20.022	30 year +40% CC 720 minute summer	26.838	7.193
5 year 60 minute winter	50.335	20.022	30 year +40% CC 720 minute winter	18.037	7.193
5 year 120 minute summer	48.684	12.866	30 year +40% CC 960 minute summer	21.828	5.748
5 year 120 minute winter	32.344	12.866	30 year +40% CC 960 minute winter	14.460	5.748
5 year 180 minute summer	38.049	9.791	30 year +40% CC 1440 minute summer	15.681	4.203
5 year 180 minute winter	24.733	9.791	30 year +40% CC 1440 minute winter	10.539	4.203
5 year 240 minute summer	30.309	8.010	100 year +45% CC 15 minute summer	510.688	144.507
5 year 240 minute winter	20.137	8.010	100 year +45% CC 15 minute winter	358.378	144.507
5 year 360 minute summer	23.187	5.967	100 year +45% CC 30 minute summer	343.197	97.113
5 year 360 minute winter	15.072	5.967	100 year +45% CC 30 minute winter	240.840	97.113
5 year 480 minute summer	18.226	4.817	100 year +45% CC 60 minute summer	235.396	62.208
5 year 480 minute winter	12.109	4.817	100 year +45% CC 60 minute winter	156.392	62.208
5 year 600 minute summer	14.882	4.071	100 year +45% CC 120 minute summer	138.932	36.716
5 year 600 minute winter	10.169	4.071	100 year +45% CC 120 minute winter	92.303	36.716
5 year 720 minute summer	13.222	3.544	100 year +45% CC 180 minute summer	104.747	26.955
5 year 720 minute winter	8.886	3.544	100 year +45% CC 180 minute winter	68.089	26.955
5 year 960 minute summer	10.794	2.842	100 year +45% CC 240 minute summer	81.880	21.639
5 year 960 minute winter	7.150	2.842	100 year +45% CC 240 minute winter	54.399	21.639
5 year 1440 minute summer	7.788	2.087	100 year +45% CC 360 minute summer	61.630	15.859
5 year 1440 minute winter	5.234	2.087	100 year +45% CC 360 minute winter	40.061	15.859
30 year +40% CC 15 minute summer	391.369	110.744	100 year +45% CC 480 minute summer	48.191	12.735
30 year +40% CC 15 minute winter	274.645	110.744	100 year +45% CC 480 minute winter	32.017	12.735
30 year +40% CC 30 minute summer	260.336	73.666	100 year +45% CC 600 minute summer	39.304	10.751
30 year +40% CC 30 minute winter	182.692	73.666	100 year +45% CC 600 minute winter	26.855	10.751
30 year +40% CC 60 minute summer	177.215	46.833	100 year +45% CC 720 minute summer	34.946	9.366
30 year +40% CC 60 minute winter	117.737	46.833	100 year +45% CC 720 minute winter	23.486	9.366
30 year +40% CC 120 minute summer	106.697	28.197	100 year +45% CC 960 minute summer	28.648	7.544
30 year +40% CC 120 minute winter	70.887	28.197	100 year +45% CC 960 minute winter	18.977	7.544
30 year +40% CC 180 minute summer	81.053	20.858	100 year +45% CC 1440 minute summer	20.782	5.570
30 year +40% CC 180 minute winter	52.686	20.858	100 year +45% CC 1440 minute winter	13.967	5.570

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.56%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	Ditch 2	900	76.812	0.012	3.1	0.0000	0.0000	OK
1440 minute summer	Ditch 1	900	77.012	0.012	3.1	0.0000	0.0000	OK
1440 minute summer	Detention basin	900	77.622	0.122	8.6	124.4891	0.0000	OK
1440 minute winter	Per paving - south	1410	81.320	0.070	2.2	71.3181	0.0000	OK
1440 minute summer	Per paving - north	1470	82.289	0.039	6.6	152.2259	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	Ditch 1	1.000	Ditch 2	3.1	0.507	0.025	0.0952	130.3
1440 minute summer	Detention basin	Head/Flow	Ditch 1	3.1				130.3
1440 minute winter	Per paving - south	Head/Flow	Detention basin	0.2				7.3
1440 minute summer	Per paving - north	Head/Flow	Detention basin	0.0				0.0

Results for 1 year (first 5mm) Critical Storm Duration. Lowest mass balance: 99.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	Ditch 2	1	76.800	0.000	0.0	0.0000	0.0000	OK
15 minute summer	Ditch 1	1	77.000	0.000	0.0	0.0000	0.0000	OK
480 minute winter	Detention basin	208	77.531	0.031	6.6	31.5362	0.0000	OK
240 minute winter	Per paving - south	116	81.266	0.016	4.6	12.1568	0.0000	OK
15 minute summer	Per paving - north	26	82.260	0.010	35.6	24.3952	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	Ditch 1	1.000	Ditch 2	0.0	0.000	0.000	0.0002	0.0
480 minute winter	Detention basin	Head/Flow	Ditch 1	0.0				0.0
240 minute winter	Per paving - south	Head/Flow	Detention basin	0.0				0.0
15 minute summer	Per paving - north	Head/Flow	Detention basin	0.0				0.0

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.72%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute summer	Ditch 2	630	76.817	0.016	5.6	0.0000	0.0000	OK
960 minute summer	Ditch 1	630	77.016	0.016	5.6	0.0000	0.0000	OK
960 minute summer	Detention basin	630	77.680	0.180	19.0	185.6556	0.0000	OK
1440 minute winter	Per paving - south	1380	81.350	0.100	3.5	104.6166	0.0000	OK
1440 minute summer	Per paving - north	1470	82.308	0.058	10.4	240.0181	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute summer	Ditch 1	1.000	Ditch 2	5.6	0.632	0.045	0.1379	193.4
960 minute summer	Detention basin	Head/Flow	Ditch 1	5.6				193.5
1440 minute winter	Per paving - south	Head/Flow	Detention basin	0.5				22.1
1440 minute summer	Per paving - north	Head/Flow	Detention basin	0.1				2.3

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute summer	Ditch 2	480	76.826	0.026	12.3	0.0000	0.0000	OK
720 minute summer	Ditch 1	480	77.026	0.026	12.3	0.0000	0.0000	OK
720 minute summer	Detention basin	480	77.837	0.337	47.5	357.7164	0.0000	OK
1440 minute winter	Per paving - south	1320	81.433	0.183	7.1	196.0315	0.0000	OK
1440 minute winter	Per paving - north	1440	82.359	0.109	14.1	469.5403	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute summer	Ditch 1	1.000	Ditch 2	12.3	0.843	0.100	0.2286	383.9
720 minute summer	Detention basin	Head/Flow	Ditch 1	12.3				384.0
1440 minute winter	Per paving - south	Head/Flow	Detention basin	1.2				65.5
1440 minute winter	Per paving - north	Head/Flow	Detention basin	0.5				25.1

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Ditch 2	180	76.830	0.030	15.0	0.0000	0.0000	OK
240 minute winter	Ditch 1	180	77.030	0.030	15.0	0.0000	0.0000	OK
720 minute summer	Detention basin	495	77.930	0.430	62.2	463.6822	0.0000	OK
1440 minute winter	Per paving - south	1290	81.487	0.237	9.4	255.0028	0.0000	OK
1440 minute winter	Per paving - north	1440	82.392	0.142	18.7	615.8088	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	Ditch 1	1.000	Ditch 2	15.0	0.904	0.122	0.2601	286.4
720 minute summer	Detention basin	Head/Flow	Ditch 1	15.0				510.2
1440 minute winter	Per paving - south	Head/Flow	Detention basin	1.7				94.3
1440 minute winter	Per paving - north	Head/Flow	Detention basin	0.8				40.9