



Bold Forest Garden Village

Surface Water Drainage Strategy Overview

St Helen's Council

Prepared by:

SLR Consulting Limited

3rd Floor, Summit House, 12 Red Lion Square,
London, WC1R 4QH

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Basis of Report

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Acronyms and Abbreviations

aOD	Above Ordnance Datum
BFGV	Bold Forest Garden Village
BGS	British Geological Society
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
NGR	National Grid Reference
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
SPZ	Source Protection Zone
WwTW	Wastewater Treatment Works



1.0 Introduction

St Helens Borough Council's Local Planning Authority (the Council) has appointed SLR Consulting Limited (SLR) to deliver a Masterplan Framework for Bold Forest Garden Village (BFGV).

This report is a drainage strategy overview which is intended to describe baseline hydrological conditions on the site and identify the approach to drainage that is required for the masterplan. The report has been prepared under the direction of a Technical Director who specialises in flood risk, drainage and associated planning matters. Where relevant reporting has been completed in accordance with guidance presented within the National Planning Policy Framework¹ (NPPF) and its associated Planning Practice Guidance² (PPG), taking due account of current best practice documents relating to the assessment of flood risk published by the British Standards Institution BS8533³ and local planning policies.

1.1 Site Location

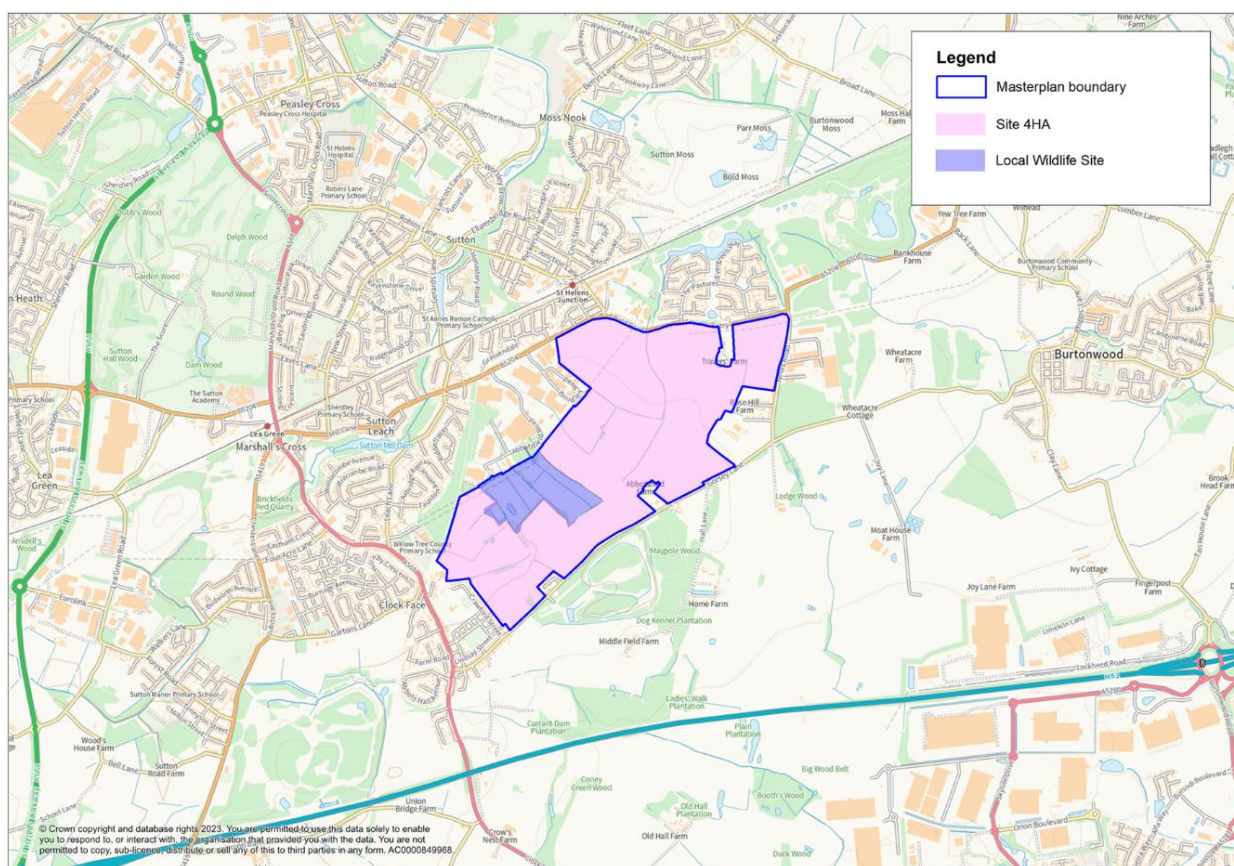
The BFGV site is located on the southeastern edge of St Helens, Merseyside. Centred on the National Grid Reference (NGR) SJ 53738 92310. The site is south of the B5204, north of Gorsey Lane and encompasses 132.86 ha.

This location and extent of the land are illustrated in Figure 1.

-
- 1 Revised National Planning Policy Framework: Communities and Local Government (Updated February 2025)
 - 2 Planning Practice Guidance for flood risk and coastal change: Communities and Local Government (March 2014, Updated September 2025)
 - 3 BS8533:2017, Assessing and managing flood risk in development: Code of Practice (December 2017)



Figure 1: Site Location Plan



1.2 Administrative Context

The site falls within the planning jurisdiction of St Helens Borough Council, which acts as the Lead Local Flood Authority (LLFA).

1.3 Development Proposal

The BFGV site was released from the Green Belt for the purposes of allocating it for residential development in the Local Plan⁴. Initial work undertaken by the Council indicates there to be a potential development capacity of approximately 3,000 dwellings.

This work is intended to inform the masterplanning of the site, which will likely encompass ancillary development, community facilities and open space.

⁴ St Helen's Local Plan , https://www.sthelens.gov.uk/media/4315/St-Helens-Borough-Local-Plan-up-to-2037/pdf/Local_Plan_Written_Statement_-_FINAL_adoption_version.pdf



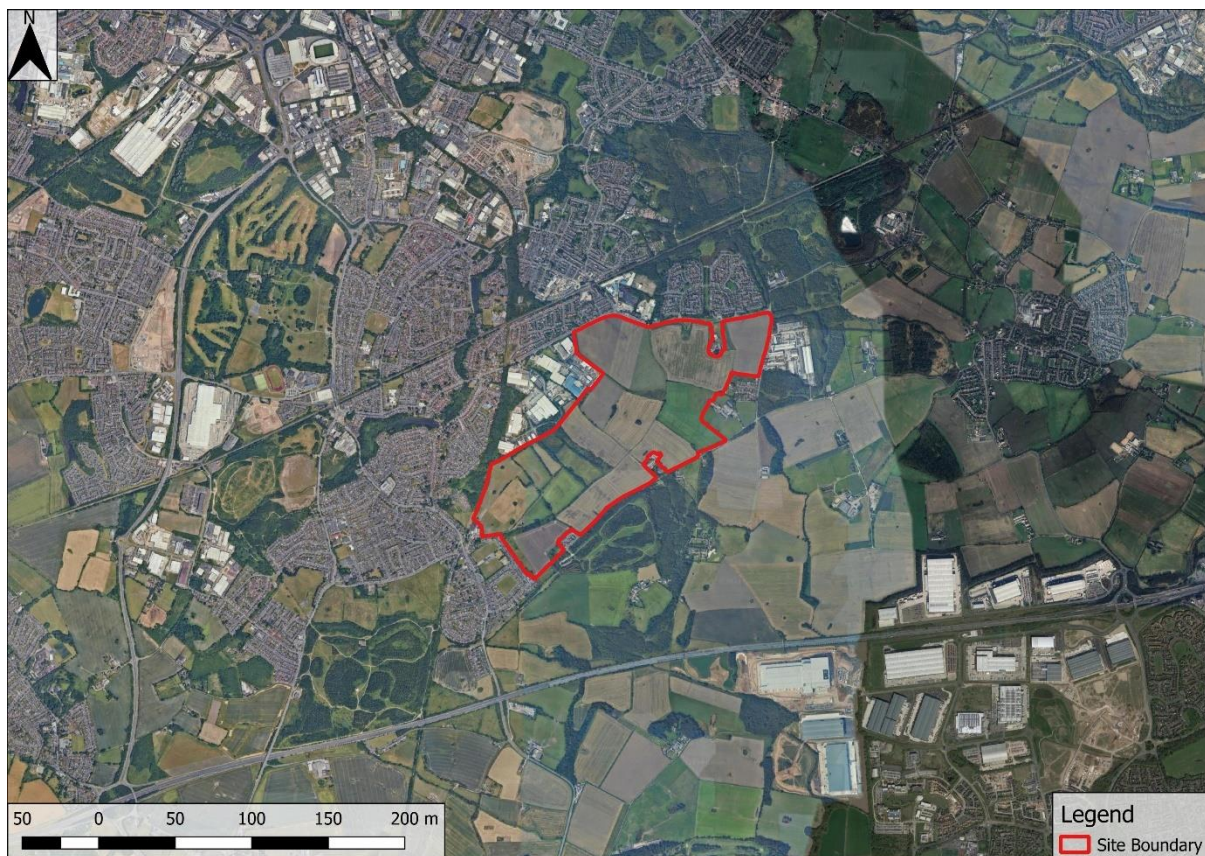
2.0 Baseline Context

The site comprises 15 land parcels under 12 different land ownerships. Aside from a local nature reserve to the northwest of the site, all land is comprised of arable farmland.

Residential areas border the site to the north and west with Clock Face Country Park and agricultural fields to the south. Reginald Road Industrial Estate and Bold Industrial Park respectively, lie on the west and east boundaries, alongside multiple private farms in proximity to the site.

Satellite imagery showing the land use across the site and the surrounding area is provided in Figure 2.

Figure 2: Satellite Imagery



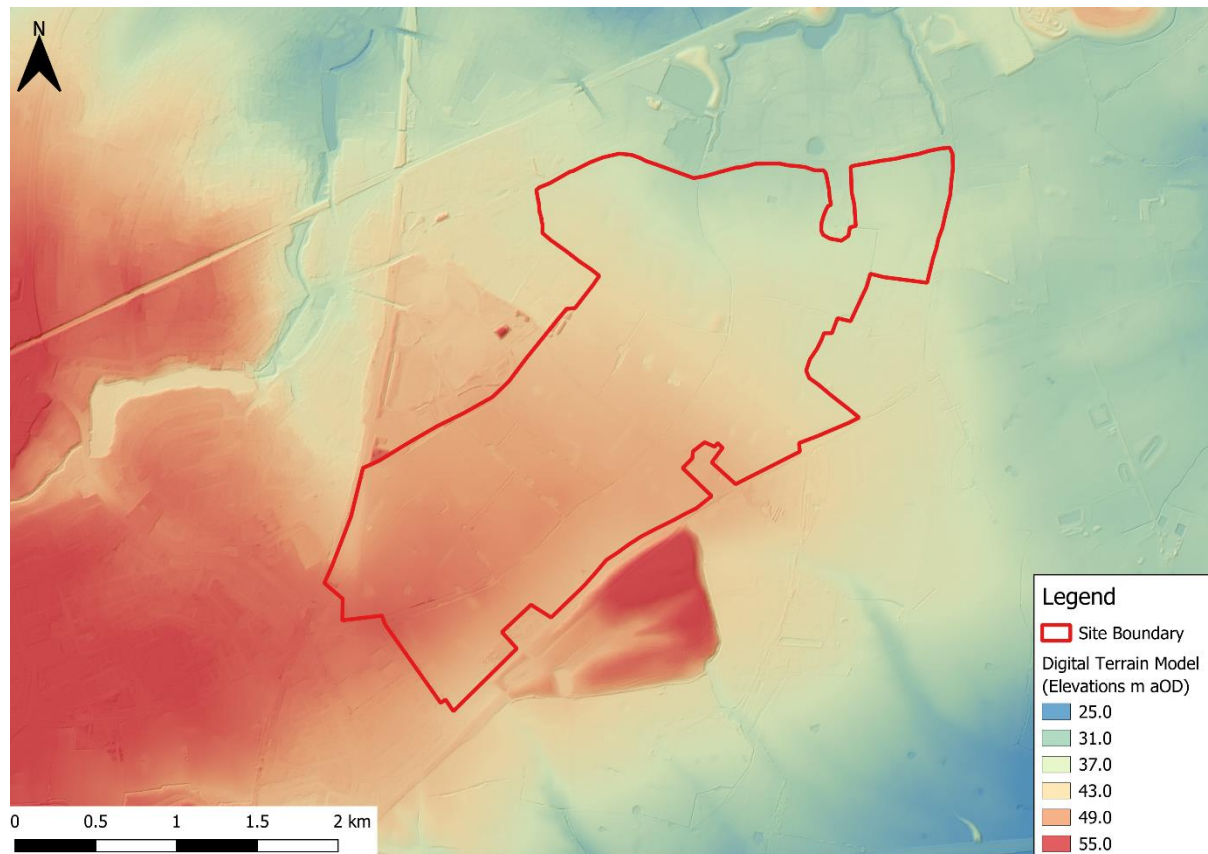
2.1 Topography

1 m resolution Light Detection and Ranging (LiDAR) elevation data has been obtained from the Department for Environment, Food and Rural Affairs (DEFRA) Survey Data Download website⁵. A plot of this data is provided in Figure 3. The elevation plot presented uses a Digital Terrain Model (DTM), which maps the surface elevations and therefore does not include features such as built developments and vegetation.

5 Defra Survey Data Download <https://environment.data.gov.uk/survey> (Accessed October 2024)



Figure 3: Local Topography



The highest elevation point of the site is to the west, where ground levels reach a maximum of 53 m above Ordnance Datum (aOD). Ground levels then slope away from this raised area towards the site boundary to the north, south and east. A large portion of the site slopes in a northeasterly direction towards the lowest point in the northeast corner, sitting at 33 m aOD.

On the opposite side of Gorsey Lane, to the south of the site, lies Clock Face County Park. This is a former colliery; areas within the county park are artificially raised with ground elevations up to 58 m aOD.

Outside the site, elevations fall to the north, east and southeast (excluding Clock Face Country Park) and rise to the west.

2.2 Geology and Hydrogeology

2.2.1 Superficial Geology

The National Soils Resources Institute, Soilscales website⁶, indicates that the soils on the Site are “*slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils*” with “*impeded drainage*”.

British Geological Survey (BGS) mapping⁷ of the area indicates that the site is wholly underlain by superficial deposits of Till – Diamicton. This superficial Till is designated as a

6 Soilscales <https://www.landis.org.uk/soilscales/> (Accessed October 2024)

7 BGS Geology Viewer <https://geologyviewer.bgs.ac.uk/> (Accessed July 2025)



Secondary (undifferentiated) aquifer which is defined as *“aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value.”*

Based on available borehole records, the superficial cover is typically between 10 m and 20 m in thickness and is described as clay.

2.2.2 Solid Geology

The BGS mapping indicates that beneath the superficial deposits, the site is mostly underlain by the Sherwood Sandstone Group (Kinnerton Sandstone Formation and Chester Formation). Fracturing has however brought the deeper Pennine Coal Measures (Etruria Formation) to the surface in the central area of the site.

The Environment Agency have designated⁸ the Sherwood Sandstone Group, which underlies the majority of the site as a Principal Aquifer. These are defined as *“strategically important rock formations that have high permeability and water storage capacity, likely supporting water supplies on a strategic scale.”*

The Pennine Coal Measures are however designated as a Secondary A aquifer. These are defined as *“permeable layers that can support local water supplies and may form an important source of base flow to rivers.”*

2.2.3 Source Protection Zones

Environment Agency (EA) mapping highlights that parts of the site sit within a Zone 3 Source Protection Zone (SPZ). This is defined by the EA as *“the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.”*

This SPZ relates to abstractions to the east of the site from the Sherwood Sandstone aquifer.

While some consideration of pollutants entering the groundwater in these areas might be required, this is unlikely to constrain development on the site.

2.3 Local Hydrology

As the site consists of undeveloped fields, rainfall falling on the site will mostly infiltrate into the shallow soils to either be stored or evaporated during drier periods.

The low permeability shallow geology at the site means that infiltration to the deeper aquifer will be limited. Water logging during extended wet periods is therefore likely, along with lateral flows within the soils and surface runoff towards the local ditch network.

Whilst infiltration is a potential discharge route, it is likely that, due to the clay superficial geology, infiltration testing would fail on the site. However, this will need to be confirmed for each plot through targeted infiltration testing prior to individual planning applications coming forward to confirm the poor expected infiltration.

In advance of this, it is assumed that surface discharge will be required, and any potential drainage solutions on-site should mirror the existing drainage directions. This will ensure that the current drainage network on-site is maintained.

8 MAGIC Mapping Magic Map Application (defra.gov.uk) (Accessed July 2025)



In areas where the land is farmed (or has been farmed previously) field drainage networks are likely to have been installed to manage shallow water logging. These surface networks will route water towards adjacent ditches and ponds.

2.3.1 Ponds

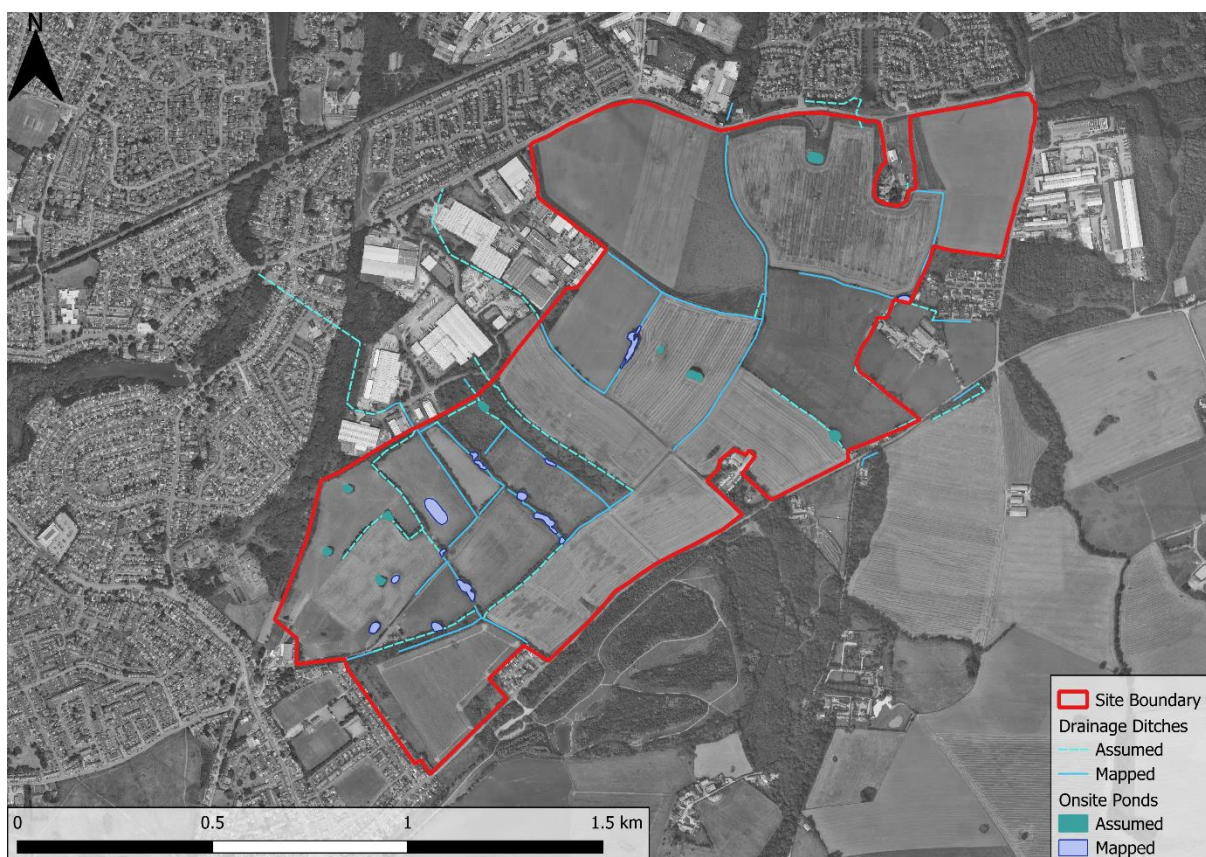
A series of ponds and depressions is present on the site, some of which can be seen on the LiDAR elevation plot in Figure 3. Some of these ponds are incorporated into a wider ditch network (see below in Figure 4); however, others are isolated offline ponds within fields.

The surface network of ditches and ponds was observed on the site visit, which took place on the 3rd of December 2024. However, due to limitations in access, not all ditches could be surveyed.

2.3.2 Site Drainage

Figure 4 demonstrates the system of manmade drainage ditches present on the site that typically delineate the fields. A larger A3 version of the figure can be found within Appendix A.

Figure 4: The System of Drainage Ditches



As discussed in Section 2.1 the land on the site slopes away from higher ground in the southwest to the north, south and east. The drainage network reflects this topography, collecting and conveying flows away from the central high land.

Based upon current available data, it is likely that surface water currently discharges from the site in a total of eleven locations with fourteen contributing catchments. These



catchments and discharge points have been mapped and illustrated in Figure 5 below and within Appendix A.

Currently offsite connections have not been fully confirmed. Those shown on plans are based on a site walkover completed in December 2024, Ordnance Survey mapping, utilities plans and LiDAR topographic data. Further work will be required to survey off-site connections to confirm the size, conditions and discharge locations.

Further details of the known outlets and the areas of uncertainty that require clarification are provided in Section 2.3.3 below.

Figure 5: Catchments and Drainage Ditch System on site



2.3.3 Wider Hydrology

Sutton Brook lies around 600m to the northwest of the site and flows in a northerly direction through the area of Sutton to the west of the site and then drains to the River Mersey via Sankey Brook.

- Catchments M and N drain northwards to meet the Sutton Brook at the northern site boundary (NGR SJ 54006 92996). There is an existing ordinary watercourse located within a ditch which flows within a culvert under Bold Road northwards towards Sutton Brook. While SLR have confirmed the presence of the culvert, the current condition and size are unknown.
 - Within Catchment M utilities plan indicates a surface water connection along the catchment's northern boundary under Bold Road northwards into the existing pond to the north. This connection has not been confirmed.



- Catchments E, G, H, I, J all drain westwards off the site towards the Sutton Brook, SLR has confirmed the presence of ditches leading offsite towards the industrial estate. Onward routing for these ditches is currently unclear and will need to be confirmed at a later stage; however, they likely discharge into the Sutton Brook, which flows through the area of Sutton through culverts under Reginald Road Industrial Park.

Whittle Brook is present around 500m to the south of the site and flows in an easterly direction towards Warrington also discharging ultimately into the River Mersey.

- Catchments A, C, L drain southwards away from the site to meet the Whittle Brook (NGR SJ 53693 90821). SLR has confirmed a culvert located at the southern end of Catchment C, which drains towards Clock Face County Park. The flows are believed to head toward the far side of the County Park flowing towards the motorway. However, the current onward routing is unknown; further work will be required to investigate the flow direction and where the connection through the Clock Face County Park goes.
- Catchment F appears to initially drain to the east then immediately south to meet the Whittle Brook below the Lingley Mere Business Park to the south of the site (NGR SJ 55430 89812). The size, conditions and nature of this onward connection are currently unknown and will need to be confirmed at a future development stage.

Surface water which falls within catchment B is currently thought to drain to the lowest elevation area of the parcel, comprising an assumed pond (or potentially an area of frequent water logging) in the treeline of the western site boundary (NGR SJ 52940 91979). Here, surface water likely infiltrates into the shallow soil or evaporates during drier periods. Anecdotal information provided by the LLFA indicates that surface water infiltrating into the shallow soils can remerge on the western side of the abandoned railway line.

During the site visit, it was noted that surface water which fell on catchment K ran with the gradient into the drainage ditch segregating catchments K and D, where it flowed off the site into the neighbouring land. After which, the drainage ditch is presumed to be culverted northwards passing underneath Travers' Entry and into the drainage system within the residential area to the north. The onward route of connection through and downstream of this residential area is currently unknown and will need to be confirmed at a later stage; however, it is considered likely that these networks ultimately drain into Sutton Brook.

Catchment D slopes to the north away from the ditch that separates catchments K and D. After both the site visit and desktop review, it was also noted that catchment D had no clear outfall away from the site. Surface water appears to run to the most northeasterly corner of the field, where in a storm event it likely flows over the junction of Travers' Entry and Bold Lane as overland flow to either a field drainage ditch on the east side or west side of the junction. Further investigation is required to determine the exact route of this surface water flow away from the site and whether any third-party agreements would be required to create a formal outfall.



3.0 Planning Policy and Guidance

3.1 Proposal Summary

The work within this document is provided to support the development of a preferred option masterplan for Bold Forest Garden Village.

In relation to the flood risk vulnerability, as outlined in Annex 3 of the NPPF⁸, the proposed residential scheme is classified as 'Dwelling Houses' which is classified as a 'More Vulnerable' development type.

In line with guidance for residential development, this assessment considers the risk posed to the scheme with an anticipated lifetime of 100 years.

3.2 National Planning Policy

This drainage strategy overview has been completed in accordance with the guidance presented in the NPPF¹ and with reference to national technical standards.

Current national planning policy guidance and best practice, require development proposals in all flood zones to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

3.3 Local Planning Policy

Local development is currently guided by the St Helens Borough Local Plan up to 2037⁹ which was adopted in July 2022.

From the St Helens Borough Local Plan up to 2037, policies of specific relevance to this baseline report, including Policy LPC12: Flood Risk and Water Management. While it is noted that parts of this may be superseded with the National Technical Standards for SuDS¹⁰ this policy is reproduced below.

Policy LPC12: Flood Risk and Water Management

1. The Impact of development proposals on flood risk and water management assets will be considered in accordance with case law, legislation, and the National Planning Policy Framework.

2. Measures to manage or mitigate flood risk associated with or caused by new development much (as appropriate having regard to its scale and nature):

- a) be designed to contribute to the biodiversity of the Borough unless it has been demonstrated that this would not be technically feasible;*
- b) protect heritage assets (such as buried archaeology);*
- c) be fully described in the development proposal; and*
- d) be funded by the developer, including long-term maintenance.*

9 St Helens Borough Local Plan up to 2037, St Helens Borough Council, 2022, - Local Plan Written Statement - FINAL adoption version 16.06.2022 (sthelens.gov.uk)

10 National standards for sustainable drainage systems (SuDS), Updated 30 July 2025



3. Any proposal for major development* on a site that would abut, run along, or straddle any watercourse* in the Borough, must include measurements to temporarily attenuate and filter flood water in order to: improve water quality; reduce peak flows during flooding; and reduce downstream flood risk, unless it has been demonstrated that this is not feasible or viable. In cases where measures are not currently feasible or viable, the development must not compromise the ability to implement such measures in the future.

4. The Flood Water Storage Safeguarding Areas as defined on the Policies Map shall be safeguarded for the provision of flood storage. Development within or adjacent to these areas that would have a negative impact on their function as a flood storage area or on their potential to be developed for flood storage infrastructure will not be permitted.

Water Quality

5. Development that would adversely affect the quality or quantity of water in any watercourse or of groundwater or cause deterioration in water body or element classification levels defined in the Water Framework Directive (WFD) (or in any national regulations covering this matter) will not be permitted. Any planning application for development that could (without effective mitigation) cause such harm must be supported by a Construction Management Plan sets out how the water environment will be protected during the construction process.

Sustainable Drainage Systems

6. inclusion of sustainable drainage systems within proposed major development sites will be assessed in accordance with national policy. Surface water should be managed in accordance with the following hierarchy (with a) being the preferred option and d) being the least favourable option):

- a) an adequate soakaway or other form of infiltration system;
- b) an attenuated discharge to watercourse
- c) an attenuated discharge to public surface water sewer;
- d) an attenuated discharge to public combined sewer.

7. Surface water management infrastructure within new developments should, where feasible, include above ground features designed to deliver benefits to biodiversity and/or landscape.

8. Discharge of surface water to a public sewer will not be permitted unless clear evidence has been submitted demonstrating why no suitable alternative option(s) exist. Development proposals should identify how any necessary surface water drainage infrastructure will be appropriately maintained. The drainage proposals on all sites should be designed to address the drainage needs of the whole site. Where development would proceed in different phases or with multiple developers involved, the drainage proposals should cover all phases and the full construction period. Any development proposal should demonstrate unfettered rights to discharge between various phases.

9. If a development on a greenfield site would discharge to a public sewer, the rates of proposed discharge (peak flow and overall volume) from the development should not exceed the existing greenfield run-off rates. If a development on a previously developed site would discharge to a public sewer, the discharge rates (peak flow and overall volume) must be as close as reasonably practicable to those that would apply if the site were a greenfield site. As a guideline, a reduction of at least 30% may be sought, rising to at least 50% in Critical Drainage Areas or in areas identified as having an intermediate or high risk of surface water



flooding. Storm water storage capacity should normally include an allowance of 40% to address the likely future effects of climate change.

10. Proposals for the soft or hard landscaping of any development site should, where practicable, demonstrably reduce the expected rate of surface water discharge from the site.

11. Applications for planning permission should have regard to the St Helens Borough Council Sustainable Drainage Systems Guidance.

Protection of water and wastewater assets

12. Development that would compromise the physical integrity or the effective maintenance of any water or wastewater infrastructure asset will not be permitted.

Drainage submitted as part of the application should be submitted alongside the LLFA SuDS Assessment Checklist¹¹.

Drainage has been undertaken in alignment with the Sustainable Drainage Systems Design and technical guidance produced by St Helens¹².

3.4 Flood Risk and Planning

3.4.1 Flood Zone Classification

The definition of Flood Zones is provided in PPG Table 1: Flood Zones:

- Zone 1 - Low Probability (Flood Zone 1) is defined as land which could be at risk of flooding from fluvial or tidal flood events with less than 0.1% annual probability of occurrence (1:1,000 year) i.e. considered to be at 'low probability' of flooding.
- Zone 2 - Medium Probability (Flood Zone 2) is defined as land which could be at risk of flooding with an annual probability of occurrence between 1% (1:100 year) and 0.1% (1:1,000 year) from fluvial sources and between 0.5% (1:200 year) and 0.1% (1:1,000 year) from tidal sources i.e. considered to be at 'medium probability' of flooding.
- Zone 3a - High Probability (Flood Zone 3a) is defined as land which could be at risk of flooding with an annual probability of occurrence greater than 1% (1:100 year) from fluvial sources and greater than 0.5% (1:200 year) from tidal sources i.e. considered to be at 'high probability' of flooding.
- Zone 3b - the Functional Floodplain (Flood Zone 3b) This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of a functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:
 - land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
 - land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

11 St. Helens Council SuDS Submission Application and Approval Checklist, Accessed from: <https://www.sthelens.gov.uk/article/7555/Sustainable-drainage>

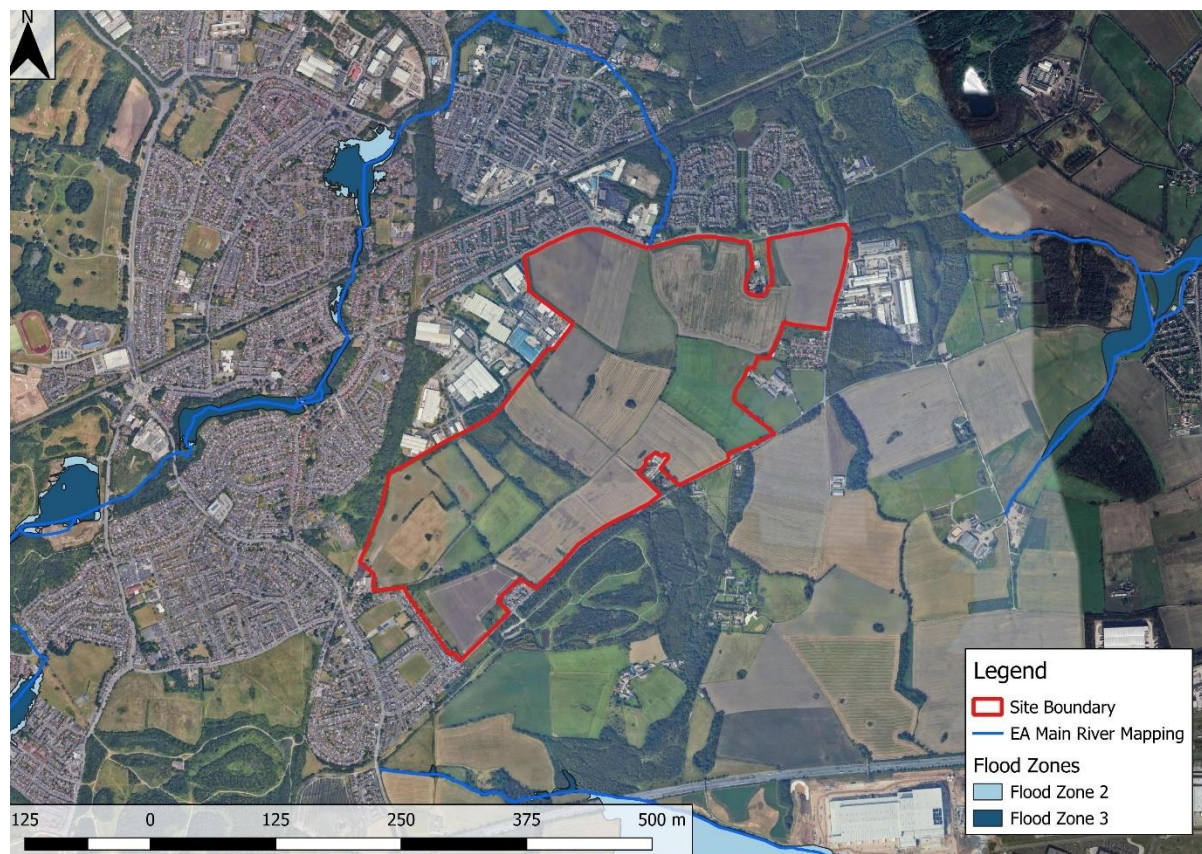
12 St. Helens Council, Sustainable Drainage Systems, Design and Technical Guidance 2020, Flood and Water Management Act 2010, May 2020.



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.

Based on the Flood Map for Planning¹³, the Site is located wholly within Flood Zone 1. An extract illustrating this is provided in Figure 6.

Figure 6: Flood Zone Designation Mapping



3.4.2 Flood Risk Compatibility

As discussed in Section 3.4.1, the site is located in Flood Zones 1 and, as detailed in Section 3.1, the proposed scheme is classified within Annex 3 of NPPF¹ as a '*More Vulnerable*' development type.

PPG Table 3: Flood risk vulnerability and flood zone 'incompatibility' (reproduced as Table 3-1) confirms that, with respect to flood risk, '*More Vulnerable*' development types are considered appropriate in Flood Zones 1 and that the Exception Test is not required.

¹³ Flood Map for Planning, get flood risk information for planning in England, Environment Agency, Accessed at <https://flood-map-for-planning.service.gov.uk/>



Table 3-1: Flood Risk Vulnerability and Flood Zone 'Incompatibility'

Flood Risk Vulnerability Classification (PPG Table 2)		Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone (PPG Table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	Exception Test Required	✓	✓	✓
	Zone 3a†	Exception Test Required	x	Exception Test Required	✓	✓
	Zone 3b* (functional floodplain)	Exception Test Required	x	x	x	✓

Key:

- ✓ Exception test is not required
- x Development should not be permitted
- † In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
- * In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:
 - remain operational and safe for users in times of flood;
 - result in no net loss of floodplain storage;
 - not impede water flows and not increase flood risk elsewhere.

3.4.3 Sequential Test

With reference to the NPPF, the Sequential Test gives preference to locating new development in areas that are at the lowest risk of flooding.

In paragraph 170, NPPF sets out that:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future)."

Paragraph 172 confirms that this process should take into account:

"all sources of flood risk and the current and future impacts of climate change".

As the site has been allocated, the Sequential Test can be assumed to be passed and no further consideration of this is required.

3.5 Climate Change

In February 2016, the Environment Agency issued updated guidance¹⁴ on the impacts of climate change on flood risk in the UK to support the NPPF. This was most recently updated in December 2023 and advice sets out that peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave height are all expected to increase in the future as a

¹⁴ Environment Agency, Flood Risk Assessments: Climate change allowances. February 2016, Updated May 2022, Accessed at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>



result of climate change. Consideration of the changes to these parameters should use the allowances outlined below based on the anticipated lifetime of the development.

Allowances in relation to offshore wind speed and extreme wave height are only relevant to sites situated on the open coast. The Site is located within Flood Zone 1 and away from tidal and larger fluvial water bodies. As such, only changes to peak rainfall intensity (and the impact of this on groundwater and flows in ditches) will need to be considered further.

The guidance acknowledges that there is uncertainty with respect to the absolute levels of change that are likely to occur. As such, the document provides estimates of possible changes that reflect a range of different emission scenarios.

3.5.1 Peak Rainfall Intensity

For peak rainfall intensity the PPG guidance states that for flood risk assessments for developments with a lifetime beyond 2100 (i.e. residential development), the upper end allowances for the 2070s epoch for both the 1% and 3.3% Annual Exceedance probability (AEP) storm event must be used.

Table 2: Peak Rainfall Intensity Allowances

Management Catchment	Annual Exceedance Probability (%)	Allowance Category	Total potential change anticipated for the 2050s	Total potential change anticipated for the 2070s
Lower Mersey	3.3	Upper End	35%	40%
	1	Upper End	40%	45%

In line with guidance, the 3.3% AEP + 40% and 1% AEP + 45% climate change allowances should be considered during development.



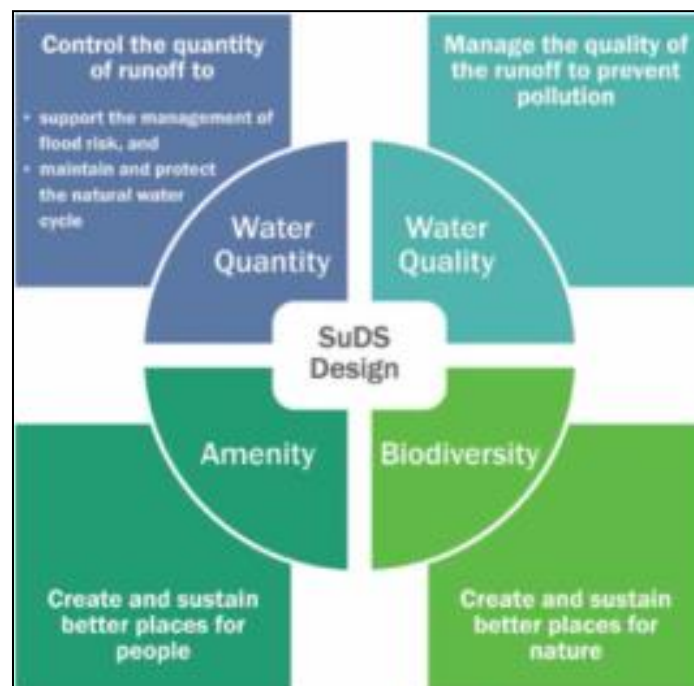
4.0 Sustainable Drainage Principles

This surface water drainage strategy overview will identify the approach to drainage that is required for the master plan. A future SWDS being developed will set out the requirements for drainage that will be implemented at the site to ensure that it is developed in line with best practice and the requirements of both national policy and SCC, in their role as the LLFA for the area.

4.1 Key Principals of Surface Water Management

Current best practice guidance document: The Sustainable Drainage System (SuDS) Manual (CIRIA Report C753)¹⁵, promotes sustainable water management through the use of SuDS. There are four main categories of SuDS, which are referred to as the 'four pillars of SuDS design' as depicted in Figure 7.

Figure 7: Four Pillars of SuDS (extract from CIRIA Report C753)



The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train'. The hierarchy of techniques is identified as:

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting).
- Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).



- Regional Control – management of runoff from several sites, typically in a retention pond or wetland.

4.2 Existing Surface Water Drainage Regime

As the site consists of undeveloped fields, rainfall falling on the site will mostly infiltrate into the shallow soils to either be stored or evaporated during drier periods. The low permeability shallow geology, see Section 2.2, reduces the ability for water to discharge to the ground. During heavy rainfall, there is the potential for the ground to become saturated, resulting in surface water runoff towards the existing onsite ditch network. During SLR's site visit in December 2024, water logging was noted in several areas across the site.

The onsite drainage network reflects the prevailing slope, conveying flows from the higher ground in the southwest to the north, south and east. Based upon current available data, it is likely that surface water currently discharges from the site in a total of eleven locations with fourteen contributing catchments (Appendix A).

To comply with current guidance and best practice, Sustainable Drainage Systems (SuDS) will be required in order to ensure that the peak rate of runoff from the site to the drainage channels to the north is not increased. SuDS will be required to provide further water quality and biodiversity improvements.

4.2.1 Pre-Development Runoff Rates (Greenfield)

Greenfield runoff rates for the site were estimated through the application of the Revitalised Flood Hydrograph Model (ReFH2). ReFH2 is recommended by the Environment Agency as the methodology for estimating flood peaks and hydrographs for small catchments¹⁶. The parameters applied for the ReFH2 model have been assessed and reviewed.

The reported Base Flow Index (BFHOST19) measures the catchment's responsiveness and is reported as 0.361. This reflects the mapped geology of Till, Devensian (Clay).

The results from ReFH2 are presented in full in Appendix B, with the results summarised in Table 3.

Table 3: Greenfield Runoff Rates Analysis

Annual Probability (%)	Site Greenfield Runoff Rate Predevelopment (l/s/ha)	Whole Site Greenfield Runoff Rate ¹ (l/s)
100	5.0	669.2
50	5.6	745.1
3.3	11.1	1475.1
1	13.9	1849.7

1 Site Red Line Boundary: 132.86ha

16 Environment Agency, Estimating flood peaks and hydrographs for small catchments: Phase 1, Project: SC090031, May 2012



4.2.2 Pre-Development Runoff Volumes (Greenfield)

The ReFH2 modelling, as outlined above, has also been used to calculate the greenfield runoff volumes for a 6-hour duration storm. These are summarised in Table 4.

Table 4: Greenfield Runoff Volume Analysis

Annual Probability (%)	Site Greenfield Runoff Volume (m ³ /ha)	Whole Site Greenfield Runoff Volume (m ³) ¹
100	70.4	9357.8
50	78.1	10376.4
3.3	148.9	19785.4
1	188.4	25035.9

¹ Site Red Line Boundary: 132.86ha

4.3 Influences on the Use of SuDS

A number of potential constraints and design considerations for site drainage exist. These are discussed below.

4.3.1 Geology and Infiltration Testing

As discussed in Section 2.2, the superficial deposits (clay) on the site are of low permeability. Infiltration onsite is therefore likely to be limited. Infiltration testing in line with BRE 365 will be required on site and the permeability will need to be confirmed for each plot as the development continues.

Taking a conservative approach, no infiltration has been assumed for the site; however, this will need to be confirmed on a plot-by-plot basis as individual sites come forward for planning. Unless otherwise agreed with the LLFA this should be confirmed through infiltration testing undertaken in lien with BRE365.

4.3.2 Spatial Constraints

The scheme must take into account the space requirements of the proposed residential units and the existing ditch network. The layout of the basins needs to ensure that the existing system of ditches is maintained to help provide the required amenity and biodiversity benefits.

The SuDS strategy needs to respond to the layout to ensure that the surface water runoff from increases in impermeable areas is managed.

4.3.3 Site Topography

The site's highest elevations are situated to the west with ground levels sloping away to the north, south and east. The predominant prevailing slope across much of the site is however towards the northeast. SuDS features will need to account for the onsite slopes and be located down gradient of impermeable surfaces. SuDS will need to account for any steep areas which limit the amount of storage that can be provided within lateral features.



4.3.4 Outfalls

As discussed in 2.3.3, the existing onsite catchments drain towards 11 existing outfalls from the site via the existing surface water network, which consists of a series of onsite ditches. The SuDS system needs to integrate into the existing SuDS basin to ensure that baseflows are ensured.

In some places, however, the outfalls are into urban networks with existing flood risk concerns, and/or baseflows are not environmentally important to the immediate receiving network. In these instances, opportunities may exist to divert flows to help manage local flood risk concerns.

4.3.5 Ecological Requirements

The Local Wildlife site, which is a parcel towards the centre of the site, is described as including areas of 'wet grassland'. The 'wet grassland' is considered to be in poor condition due to a lack of water. Care will need to be taken within the process of development to avoid further drying out these areas.

Furthermore, opportunities exist through the process of development to direct more water into the wildlife site or to alter the systems within the wildlife site to better retain flows on that land. To maximise benefit, it may be necessary to avoid / minimise upstream features that will intercept and encourage infiltration and evaporation of smaller storms. This should, however, only occur where there is a clear and agreed ecological benefit to this and not as a way of saving money or increasing development area.

Great crested newts have been identified in a number of the existing ponds on site. For these ponds particular care is required to ensure that features are not dried out because of development, but that also significant unattenuated flows into these features is avoided.

4.3.6 Water Quality

While there is a general requirement to ensure that the water quality of stormwater discharges from the site is high, there is a particular sensitivity where runoff drains directly into the Local wildlife Site. For these areas in particular the SuDS should be designed to clean flows prior to discharge.

4.3.7 Interception Storage

In line with national guidelines and St Helens Local Standards C, the first 5mm for the majority of rainfall events (summer storms) should not result in runoff from the site to surface waters or piped drainage systems. To help comply with this technical standard it is expected that rainwater harvesting would be incorporated within the scheme where applicable. This would include the use of water butts on residential units and the direction of stormwater to attenuation basins where water would be 'lost' to soils or the atmosphere.

Beyond this, the use of naturalised SuDS features that are unlined should be maximised wherever possible. This will allow for losses through evaporation (in summer) and, to a limited degree, to the ground even where the ground is not sufficiently permeable to allow for infiltration drainage.

It is noted that in any areas where a potential for shallow winter groundwater is identified, SuDS features will likely need to be lined to prevent groundwater ingress.



4.3.8 Naturalisation of Existing Channels

The existing channels are mostly straight and aligned along the current field boundaries. There may be opportunities as the scheme design is developed to introduce meanders and to change the form and flow regime of these channels towards a naturalised state.

Any changes to the channels will need to consider both flood risk and biodiversity net gain. This will be explored in a multidisciplinary way (i.e. in collaboration with landscape and ecology) at the plot level and in collaboration with key parties as individual areas of the site come forward for planning .

4.3.9 Phasing

Details of phasing will be brought forward during further detailed design. However, where appropriate, key aspects on phasing are discussed within Section 4.5. This identifies areas where drainage of one part of the site relies upon the provision of downstream SuDS within a different catchment or landownership.

4.4 Proposed Discharge Location

As outlined within the SuDS Manual¹⁷ and St Helens Council, there is a hierarchy to the disposal of water discharge locations. This is as follows.

- Option 1: Rainfall Harvesting
- Option 2: Discharge to the ground (infiltration);
- Option 3: Attenuated discharge to a surface water body;
- Option 4: Discharge to a public surface water sewer,
- Option 6: Discharge to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewage undertaker.

A summary of the review of the disposal hierarchy for the site is provided in Table 5.

Table 5: Available Discharge Locations

Discharge Location	Discussion	Available Option (Y/N)
Water reuse and recycling.	It is assumed that rainfall harvesting will be used where it is reasonably possible, including on the roof drainage downpipes for individual private properties, such that water can be collected and used by residents for external irrigation. Taking a precautionary approach, these features are not considered in any calculations.	Yes
Discharge to Ground (infiltration)	As discussed in Section 2.2, the superficial deposits (clay) on the site are of low permeability. Infiltration onsite is therefore likely to be limited. Infiltration testing in line with BRE 365 will be required on site for each plot as the development continues. As such, at this time, discharging to the ground via infiltration has been assumed not to be feasible.	No (Future testing will be required to confirm)

17 Report C753, The SuDS Manual; CIRIA (2015). Report C753, November 2015.



Discharge Location	Discussion	Available Option (Y/N)
Discharge to Surface Waters	As discussed in Section 2.3, there is a ditch system throughout the site, which discharges at several different outfalls. Discharging into this ditch system is deemed viable. Upstream attenuation will be provided to attenuate storm flows to the 1 in 1 greenfield rates to ensure that the downstream flood risk is not increased.	Yes
Discharge to Public Surface Water Sewers	According to United Utilities, there are several surface water sewers in the vicinity of the site. However, there are more preferable discharge options available.	No
Discharge to Public Combined Sewer	According to United Utilities are several adopted public combined water sewers present close to the site. Discharge to a public combined water sewer is therefore deemed not viable.	No

4.5 Conceptual Surface Water Drainage Strategy

The sustainable drainage network for the site has been designed to accommodate guidance by St Helens Borough Council in its role as the LLFA. The proposed drainage has accommodated surface SuDS features where it is reasonably practical and will be subject to more detailed drainage design on a plot-by-plot basis as the scheme develops.

The surface water drainage strategy will be brought forward in conjunction with a SuDS design brief, which will provide a framework for the detailed design process to ensure that the high aspirations within the conceptual scheme are best delivered.

Phasing

The scheme will require some strategic SuDS area/features that serve multiple plots. For these, careful consideration of phasing and space within the masterplan will be required. The scheme has made a series of design assumptions which will require more detailed design as the scheme develops.

From the perspective of storm water management phasing would ideally progress from lower area around the margin to higher land in the centre and west of the site. If this is not possible for practical or commercial reasons downstream SuDS features to attenuate and hold flows, and also conveyance features to connect upstream areas to those, may need to be delivered at an early stage to facilitate development on upgradient plots. These interdependencies are discussed in Table 6.

If these cannot be provided, then temporary measures for management of stormwater may be required to avoid uncontrolled runoff and flooding. Any such temporary measures will need to be aligned with policy and best practice in case future phases of development are delayed.

Care will also be required to avoid creating ransom strips between different plots that prevent later phases of development from connecting into the strategic storm water network.

Source Control

Source control measures act to manage storm water at or close to where it falls so that it does not enter the drainage system or is delayed/attenuated before it enters the drainage system. Source Control measures are critical for maintaining groundwater recharge and the quality of surface water discharge. Source control measures will also be important in helping



the development meet wider sustainability objectives in terms of reducing water usage and creating an ecologically diverse and interesting environment at a plot level.

It is assumed that source control measures will be used both at the plot level and within the public realm. However, based on conservative principles the attenuation from plot-level features has not been included within the initial drainage strategy set out in this document.

Conveyance

Conveyance features are required to move excess storm water that cannot be accommodated in local source control features toward areas where water can be attenuated and controlled prior to discharge into one of the surrounding systems.

Where possible, conveyance of storm water through the site will be achieved using unlined SuDS to promote infiltration (at low rates). The onsite aspiration is to avoid pipework in favour of conveying storm flows within SuDS features. It is, however, acknowledged that some short lengths of pipe connection will be required in certain locations, for example, to facilitate crossing over other services.

At a strategic level, the site aims to convey flows using the existing onsite ditch network as much as possible. Where there is no existing onsite network, or where discharging to this network is too complicated or ecologically not preferable, the preference for conveyance would be a series of swales. These swales would be positioned along key flow pathways through the site. The swales would be designed in line with guidance provided by St. Helens Borough Council.

Attenuation Control

Attenuation areas will provide space for excess storm flows from larger storms to be held and controlled before onward discharge into the adjacent natural channels at a low greenfield (1 in 1) rate.

The scheme has been designed such that these attenuation areas are provided throughout the site. The final form and detail of these areas still need to be progressed. The basins will avoid hard engineering infrastructure where possible and will reflect details of the final landscaping strategy and also the existing landscape character in which it will sit.

Over and beyond these detailed design decisions, the following general principles have been applied or assumed to estimate the size of the proposed feature and the area on site that would be required to accommodate it.

- The required volume of the basins has been estimated using the '*Storage Estimate*' tool within Flow¹⁸.
- Basin side slopes have been estimated at a maximum of 1 in 4 slope.
- Basin depth has been assumed to be a maximum of 2m, within the wildlife site maximum basin depths have been assumed to be shallower at 0.5m.
- The impermeable area has been estimated at 82.5%. This assumes a development density of 50% with 100% runoff from developed surfaces and 50% runoff from landscaped areas. This number also includes urban creep applied as an additional 10%.

18 Causeway Flow, Drainage Design, V14.0 December 2024, Copyright 1988-2025



- The upper volume estimation for a 1 in 100-year storm + 45% storm has been used for the volume requirement.
- Peak discharge from the basin has been taken as the 1 in 1 annual probability greenfield rate.
- No infiltration has been assumed.

The key parameters for the basins required within each drainage area are set out within Table 6 with a description provided for each catchment setting out how conceptually the stormwater drainage would function.

A full site-wide plan of the proposed SuDS strategy, illustrating the location, scale and linkages between features can be found in Appendix A.

Full details of the final form and function of the basins will be set out as part of the detailed design, with specific statements confirming how landscape, amenity and ecology benefits will be appropriately achieved. It is, however, envisaged that most basins will consist of shallow tiered depressions integrated into the wider landscaping with grassed edges, wetland bases and small areas of permanent open water.

This approach also ensures that a high level of pollution control is achieved. The detailed design for the site will seek to confirm this using the Simple Index Approach outlined within the SuDS Manual to quantify the benefits to the water quality of the SuDS Management Train.

Of note following discussions with ecologists some attenuation is proposed within the wildlife site. This would take the form of shallow flooding across a large area of grassland to promote and improve target habitats. Robust upstream pollution control and some attenuation will be required upstream of any such areas. This would include the use of features such as reed beds or smaller basins to ensure water is already clean before draining from the residential area onto land set aside for ecology.

4.6 SuDS Design Brief

The discussion above is focussed on the strategic approach for draining the site; however as set out in the discussion relating to source control and conveyance the aspiration for the drainage of the BFGN site go significantly beyond this.

A SuDS Design Brief has therefore been developed and is included in Appendix E. This expands upon how the drainage of storm water will be integrated into development on the site at a plot level, at a street level and across more strategic drainage features. Ensuring that individual scheme coming forward are aligned within the strategic drainage strategy and the SuDS Design Brief will ensure that potential benefits relating to biodiversity, amenity, water quality and hydraulic control are maximised.



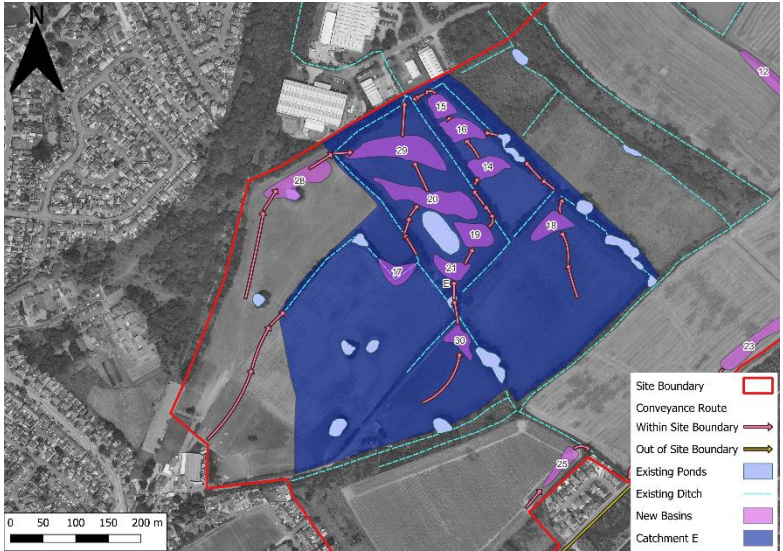
Table 6: Catchment Parameters

Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
A	12.17	10.04	60.84	856.66	4887	7206	This catchment comprises land that drains southwards towards and along Gorsey Lane, which is located along the southeastern boundary. Flows will follow the prevailing slope, draining towards the Gorsey Lane where they will be attenuated within a series of attenuation basins (Basin 22, 23 and 24). It is envisaged that conveyance between the attenuation basins will be via a series of swales, which would intercept surface water flows during large storm events. The outfall from catchment A is the ditch that is culverted under Gorsey Lane. Both the outfall and the onward conveyance route would need to be confirmed during further detailed design as the development progresses.	
B	7.37	6.08	36.84	518.64	2959	4364	Currently, water from within this catchment drains towards the site's western boundary, where it pools at the base of the old railway line. A series of conveyance features, likely swales, are proposed to intercept water draining towards the western boundary and direct it towards basin 28. Catchment B will outfall in a northeastern direction into the existing ditch network within the existing wildlife site. The increased catchment area will help to 'wet up' the wildlife site, facilitating the creation of new wet habitats. A second series of conveyance features will intercept water from the southern part of this catchment and convey flows towards the wildlife site where attenuation will be provided. This should create additional wet habitat in the wildlife site. Flows conveyed from this area will require enhanced upstream pollution control to ensure that there are no adverse impacts on water quality within the nature reserve.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
C	0.74	N/A	N/A	N/A	N/A	N/A	This catchment comprises the land on either side of an existing ditch, which connects to a ditch that drains south-eastwards towards Gorsey Lane. At the point of connection into the southeastern ditch, there is an additional ditch that heads northeast. While some flows may head in a northeastern direction, the majority of flows are believed to flow towards the southeastern ditch. No new development is planned directly adjacent to this ditch, with any flows entering this catchment being attenuated in upstream SuDS features. Therefore, no SuDS features are proposed within this small linear catchment.	
D	9.41	7.76	47.05	662.53	3776	5569	Within this section, the prevailing slope is towards the northeast and the northeast corner of the site. Surface water appears to currently run to the most northeasterly corner of the field, where in a storm event it likely flows over the junction of Travers' Entry and Bold Lane as overland flow to either a field drainage ditch on the east side or the west side of the junction. Proposed SuDS will maintain the current outfall direction with a swale located along the northern boundary of the site directing flow towards Basin 01. A new formal piped outlet across the road to the adjacent ditch network will be required, reducing the potential for surface water flooding across the road.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m ³)	Quick Storage Estimate Lower Estimate (m ³)	Quick Storage Estimate Upper Estimate (m ³)	Description	Drainage Diagram
E	20.42	6.26	102.10	1437.61	3247	4658	Catchment E covers a large area within the wildlife site, with no residential development planned inside it, and no attenuation needed for this zone. Therefore, the impermeable area used in calculations is based on the development area outside the wildlife site. Pollution control measures and attenuation in the form of basins 17, 18, and 30 will be required upstream of the wildlife site to clean and control the peak rate of water flow and thereby prevent ecological harm. These basins are designed to provide the required attenuation at a maximum depth of 1.5m. Outflows from the features are directed towards the wildlife site to ensure regular water flow for ecological enhancement. To promote wet habitat creation within the wildlife site, the surrounding ditches will need modifications to redirect flows onto the land rather than around the periphery of the site. A series of low embankments (around 0.5m high) would be built across the wildlife site to intercept and hold these flows. Small seepage points within the embankments will allow flows to pass through gradually and disperse as overland flow, progressively wetting the lower areas. This approach would form a sequence of basins (essentially wet grassland and shallow wetlands) that are larger and shallower than the SuDS basins proposed in other parts of the site. Basins 14, 15, and 16 are assumed to have a maximum water depth of 0. 0.2m. Basins 17 and 18 are estimated at 0.4m deep, while basins 19, 20, 21, and 29 are assumed to be 0.3m deep. The planned routing for water into and through these zones has also been specified to avoid drying out existing ponds along the northeast boundary, which serve as important habitat for great crested newts. Water passing through this system would rejoin the ditch network to the north and eventually discharge into Sutton Brook. This system will need to be designed to meet the greenfield runoff target at the upstream boundary of the wildlife site. Full hydraulic modelling of the network (including the shallow basins within the wildlife site and outflows from Catchment B) will be required to assess performance under a range of conditions. This will help confirm the degree to which the ecological basins can meet the flow objectives.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
F	11.55	9.53	57.77	813.44	4638	6840	Runoff from Catchment F currently follows the prevailing slope towards the eastern corner of the site at Gorsey Lane. It is proposed that attenuation is provided within basins 11 and 26, with conveyance within the existing onsite ditches. The outfall is via the existing outfall, which is believed to initially drain to the east then immediately south to meet the Whittle Brook below the Lingley Mere Business Park to the south of the site.	
G	7.96	6.56	39.78	560.14	3182	4708	Currently, catchment G is believed to drain generally towards the north-west. There is an outfall at the north-western corner of this catchment, which drains via a culvert within the Reginald Road Industrial Estate. The LLFA has indicated that the network downstream of this outfall is prone to flooding. To alleviate this existing flood risk issue, the drainage within this catchment will be diverted away from the outfall. Flows from the western part will be directed to basin 13 which will outfall to swales to the north-east into catchment H. Flows from the eastern part will be directed to basin 12 which will discharge to the north into the existing ditch system. Both routes will eventually outfall off-site within catchment N, beneath Travers' Entry. The western flow route will be contingent on the construction of downstream SuDS and the conveyance system, which will need to be considered during the detailed design for the site.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
H	6.34	5.23	31.69	446.22	2546	3754	Runoff from Catchment H currently flows in a northward direction towards an existing ditch at its northern boundary. There is a small pipe located within the current ditch which is believed to direct flows westwards within the sewer network with the eventual outfall at Sutton Brook. It has been agreed with the LLFA that there would be a benefit in diverting storm flows away from this system. It is envisaged that conveyance within an existing ditch to the east of the catchment and a new conveyance swale along the western boundary would direct water northwards towards basin 10. This would provide attenuation with the new outfall being to the north into a swale within catchment N. The onward flows would be contingent on the construction of downstream SuDS within an earlier phase.	
I	Nature Reserve	Nature Reserve	Nature Reserve	Nature Reserve	Nature Reserve	Nature Reserve	Catchment I is located entirely within the existing wildlife site. As such no development is planned within this catchment. This includes no planned SuDS.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
J	Nature Reserve	Nature Reserve	Nature Reserve	Nature Reserve	Nature Reserve	Nature Reserve	Catchment J is located within the existing wildlife site. As such no development is planned within this catchment. This includes no planned SuDS.	
K	11.94	9.85	59.70	840.51	4794	7070	Currently, the surface water from catchment K drains to a ditch system to the east. The onward routing of this network has not been confirmed and further surveying will be required to confirm this. Utility plans suggest there may be an onward connection north-westwards towards the ditch within catchment N. Otherwise, it is assumed that the connection would be northwards towards the residential area on the far side of Travers' Entry. The SuDS strategy for this catchment routes flows towards the existing ditch system, which is located along the eastern boundary of the catchment. Three attenuation basins (basin 04, 03 and 02) would provide upstream attenuation before water discharges into the existing ditch.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
L	8.95	7.39	44.76	630.26	3597	5305	Runoff from this catchment area currently drains southwards towards Gorsey Lane and onwards towards Whittle Brook. Attenuation would be provided on the downstream edge of the catchment, either within Basin 23 or 19. Onwards flows from basin 19 would be eastwards into the ditch along the eastern boundary which then flows southwards towards Clock Face County Park. Flows from Basin 23 would be via a new outfall passing under Gorsey Lane. Details of the onward connection of this outfall will need to be confirmed and agreed with third-party landowners on the south side of the road at a later stage.	
M	12.16	10.03	60.81	856.27	4881	7198	The prevailing slope in this catchment is northwards towards the site boundary along Travers' Entry / Bold Road (B5204). A new attenuation basin (basin 05) is proposed towards the northern boundary of the site. The outfall from this basin would be directed westwards towards the existing site outfall within Catchment N. The conveyance westwards is likely to be via a swale.	



Catchment	Catchment Area (ha)	Impermeable Area ¹ (ha)	Target Peak Runoff Rate (l/s)	Target 6hr Peak Runoff Volume (m³)	Quick Storage Estimate Lower Estimate (m³)	Quick Storage Estimate Upper Estimate (m³)	Description	Drainage Diagram
N	31.00	25.57	154.99	2182.31	12436	18352	The prevailing slope in this catchment is north-eastwards towards the existing outfall which is culverted under Travers' Entry / Bold Road (B5204). A series of linked attenuation basins is proposed towards the centre of the catchment which attenuate flows along a proposed green corridor. This green corridor will be used to receive and convey flows from the upgradient area including catchments G and H. Flows along the eastern boundary of the catchment will be maintained within the existing ditch with flows along the western boundary collected and conveyed within a series of swales. Flows within the southern part of the catchment would be directed northwards, either within the existing ditch network or via new conveyance features.	

¹ Assumed at 82.5% of the catchment area



5.0 Foul Drainage

The foul water network local to the BFGN site has been adopted and is maintained by United Utilities, who are the statutory sewage undertakers. The United Utilities foul water network serves local properties, flowing either towards St Helens Wastewater Treatment Works (WwTW) to the north or towards Widnes WwTW to the south.

5.1 Current Networks

There are several foul water assets surrounding the site at present. Gravity drainage is indicated along Bold and Reginald Road heading towards a combined sewer which drains along Normans Road towards St Helens WwTW. Further drainage towards St Helens WwTW can be found along Abbotsfield Road and Brindley Road, which drain towards Reginald Road. Sewer drainage at the western edge of the industrial estate to the northwest of the site drains towards a combined foul water system that runs northwards through Sutton Leach along Clock Face Road and Leach Lane.

The remainder of the site drains towards Widnes WwTW. A pumping station can be found to the east of Neills Road. Water drains under gravity towards this pumping station before a rising main heads south along Neills Road and then west along Gorsey Lane, discharging into a gravity system along Gorsey Lane. Foul water drains along Crawford Street, head southwards joining the foul water sewer along Gorsey Lane which heads across fields southwards towards the M62. Lastly, there is an overflow system leading from the pumping station that flows under gravity to the north, discharging into ditches east of Celandine Way.

5.2 Overview of Strategy

It is proposed that foul flows from the site will be discharged under gravity towards the existing foul water network that surrounds the site. The site has been split into 4 catchments, which are demonstrated within Appendix D. The following has been based on our best estimates for the direction of foul water flows and would be guided by United Utilities in later consultations.

The following has been estimated:

- **Southern (Orange Catchment):** This catchment has an estimated housing of 550-650 units. Assumed gravity drainage is towards Widnes WwTW using the existing foul water drainage route. Potential manhole connections would be at manholes 2301, 6602 and 9902 along Gorsey Road.
- **Western (Pink/Purple Catchment):** This catchment has an estimated housing of 300-400 units. Assumed gravity discharge is towards St Helens WwTW using the existing foul drainage route through Abbotsfield Road Industrial Park. Onward flow is considered to be to the northwest and then northwards along Leach Lane. A potential onsite pumping station may be needed for flows from the low point located at the base of the abandoned rail tracks at the northwest corner of the site. The estimated Manhole Connection would be at manhole 2303 located on Abbotsfield Road.
- **Northern (Blue Catchment):** This catchment has an estimated housing of 1250-1350 units. Assumed gravity discharge is towards St Helens WwTW using the existing foul drainage network. Flows are indicated to either be routed along Reginald Road Industrial Estate and along the B5204 north-eastwards, or from the site's northern boundary, westwards along the B5204. There is the potential to also route flows northwards from the site's northern boundary towards the existing

pumping station located along The Pastures. Estimated Manhole Connection would be:

- Reginald Road Industrial Estate: Manhole 4403, 5604 and 6603
- Bold Road (B5204): 7003
- Towards The Pastures: 1007
- **Eastern (Green Catchment):** This catchment has an estimated housing of 750-850 units. There are several foul drainage options for this section, as no obvious gravity drainage options exist. We envisage the main options to be:
 - Expand the existing pumping station capacity along Neills Road with foul water flows draining under gravity towards the site's northeastern corner. Foul flows would then be pumped southwards along Neills Road and Gorsey Lane towards Widnes WwTW.
 - Divert flows towards St Helens WwTW via either:
 - A new foul water flow route northwards across the B5204 connecting into the pumping station at The Pastures. Estimated Manhole Connection: 7007 and 7805
 - A new onsite pumping station directing flows eastwards towards the connection along Normans Road. Estimated Manhole Connection: 7003
 - A combination of both options, with some flows routed southwards towards Gorsey Lane and some westwards towards Normans Road. Estimated Manhole Connection: 7003 and 7805.

Final foul water catchments and connections and will be guided by United Utilities in later consultations and flexibility exists to adapt the catchment illustrated to direct more flows to certain networks if this would better utilise the remaining existing system capacity. It is envisaged that all foul water drainage infrastructure associated with the proposed development would be designed to adoptable standards and adopted by United Utilities.

6.0 Conclusion

St Helens Borough Council's Local Planning Authority (the Council) has appointed SLR Consulting Limited (SLR) to deliver a Masterplan Framework for Bold Forest Garden Village (BFGV).

The highest point on the site is to the southwest. Ground levels slope away from this raised area towards the site boundary to the north, south and east.

The shallow geology at the site consists of a low permeability soil and a significant thickness of Till. This will restrict infiltration and, during wet periods, result in flows progressing towards the local ditch network via both surface runoff and shallow sub surface flow pathways.

The solid geology of the site comprises units from the Sherwood Sandstone Group and units from the Pennine Coal Measures. Both groups are considered as aquifers and the presence of the potable abstraction from the Sherwood Sandstone in the east results in parts of the site falling within Source Protection Zone 3 (total catchment). Due to the low permeability of superficial deposits the risk posed to deeper groundwater from any development is low.

6.1 Flood Risk

The site is located in Flood Zone 1. This indicates that the risk of fluvial and tidal flooding is low. The flood screening assessment undertaken confirmed this understanding and also indicates that the risk of flooding posed to possible future development on the site from groundwater, sewer, reservoirs, canal and infrastructure failure is all low. These potential sources of flood risk do not require detailed consideration.

Available mapping indicates that while the majority of the site is at very low risk of surface water flooding small areas, particularly along the ditch network, may be vulnerable. More detailed consideration as to whether this might constrain development in certain areas, or otherwise how this might influence masterplanning and design for development on the site, will be required.

6.2 Stormwater Drainage

In terms of drainage, this document outlines the overall principles for the drainage strategy. For each of the mapped catchments, the proposed attenuation sizing and outfall are indicated.

Further detail on how stormwater drainage will be integrated into individual development schemes on the site as they come forward is set out in a SuDS Design Brief. If individual schemes are brought forward in line with the overall drainage strategy for the site and SuDS Design Brief this will ensure that potential benefits to biodiversity, amenity, water quality and hydraulic control are all maximised.

The SuDS strategy will be subjected to more detailed design and refinement as the development is brought forward.

6.3 Foul Drainage

The foul water drainage infrastructure in the area at and around the site is all owned and controlled by United Utilities. Areas to the north of the site are drained towards St Helens WwTW and areas to the south are drained towards Widnes WwTW.

It is envisaged that as the site is developed, foul flows would be split between these two foul water drainage catchments. Initial proposals are presented showing approximate foul drainage catchment areas with suggested points of connection.

The final approach will need to be led by and agreed with United Utilities with reference the available capacity at the WwTWs and in the local networks connecting to these. Flexibility exists to adapt the catchment illustrated to direct more flows to certain networks if this would better utilise the remaining existing system capacity.

Appendix A Site Drainage Diagrams

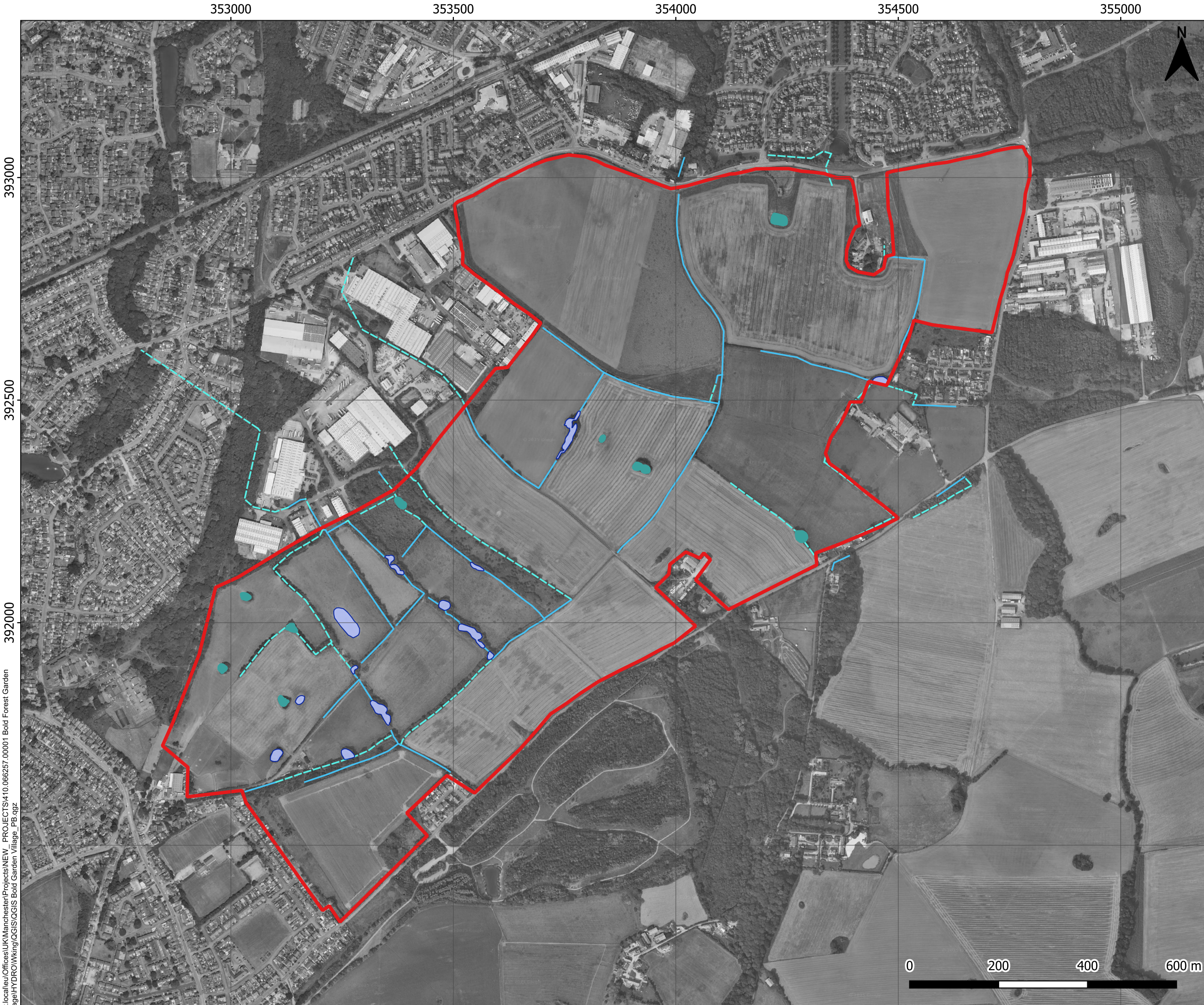
Bold Forest Garden Village

Surface Water Drainage Strategy Overview

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025



LEGEND

Site Boundary

Drainage Ditches

- Assumed
- Mapped
- Potential

Onsite Ponds

- Assumed
- Mapped

Notes

Bold Forest Garden Village

SLR

www.slrconsulting.com

BOLD FOREST GARDEN VILLAGE

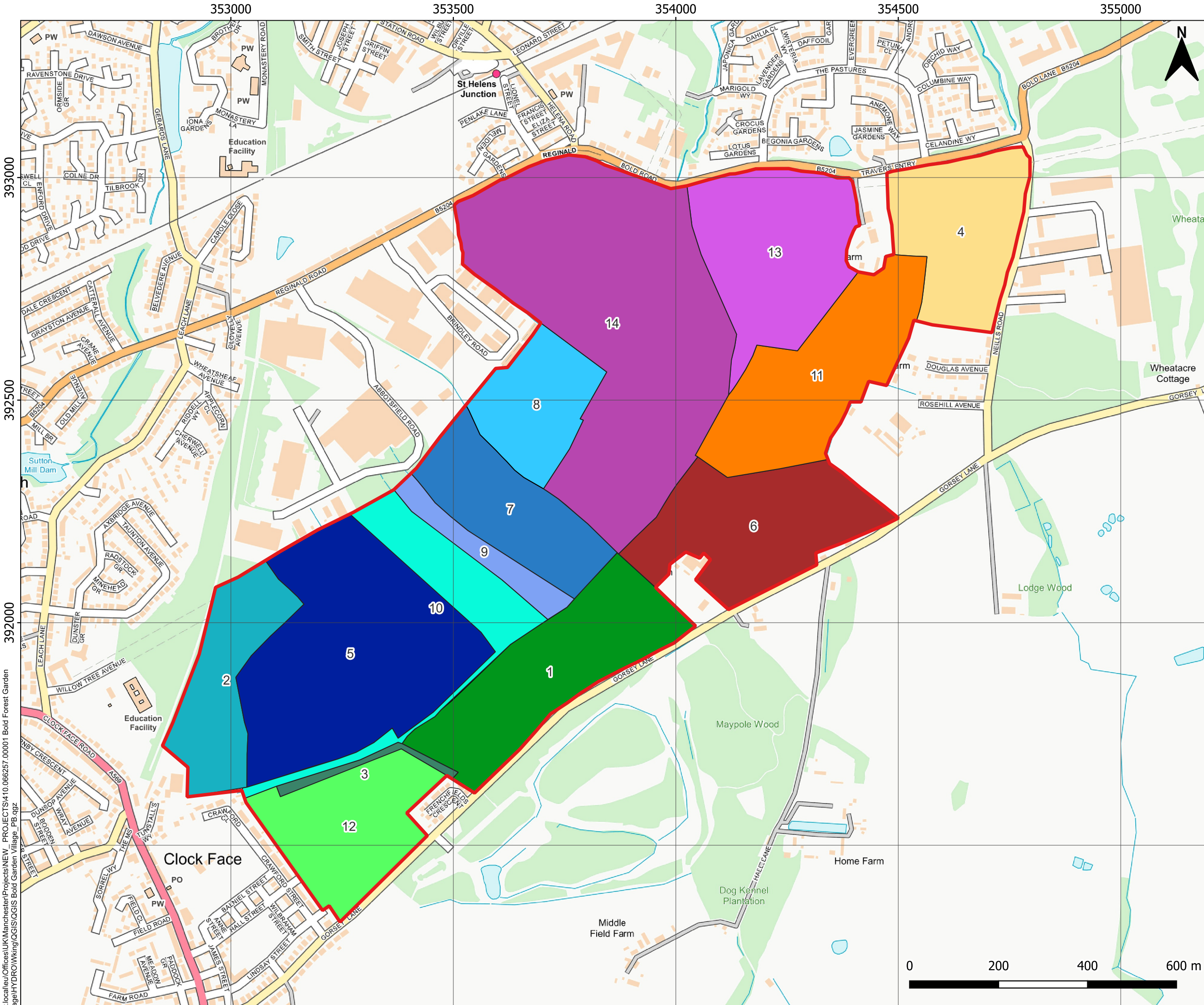
BASELINE REPORT

ONSITE DRAINAGE

Appendix A

Scale 1:8,000 @ A3

Date APRIL 2025



LEGEND

Site Boundary

Onsite Catchments

1

2

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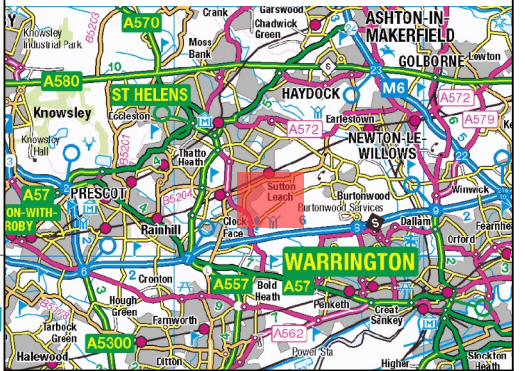
11

12

13

14

Notes



Bold Forest Garden Village

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BOLD FOREST GARDEN VILLAGE

BASELINE REPORT

ONSITE CATCHMENTS

Appendix A

Scale1:8,000 @ A3

DateAPRIL 2025

Appendix B ReFH2 Results

Bold Forest Garden Village

Surface Water Drainage Strategy Overview

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025

St Helen's Council

Bold Forest Garen Village

SLR Project No.: 403.065666.00001

26 August 2025

Revision: 01

ReFH2 Greenfield Runoff Analysis Methodology and Summary of Results

1.0 Introduction and Background

Greenfield runoff rates are required to inform a drainage strategy and allowable discharge rates at land situated at National Grid Reference (NGR) TA 03271 35325. All calculations in this report are based off an area of 1ha.

This document sets out the methodology applied to assess the Greenfield Runoff Rates and Volumes for the Site and summarises the results of this analysis.

2.0 Methodology

This methodology follows the guidance set out in the ReFH Technical Guide Greenfield Runoff Rate and Values¹ for the assessment of Greenfield Runoff Rates and Volumes using the ReFH2 software². This follows the guidance set out by the Environment Agency in the Flood Estimation Guidelines³, recommendations made in the Estimating flood peaks and hydrographs for small catchments research project⁴ and Construction Industry Research and Information Association (CIRIA) SuDS Manual (C753)⁵.

The latest best practice guidance recommends that for plot scale areas of less than 0.5km² (50ha) in size, greenfield runoff calculations are estimated based on an area of 0.5km² and then rescaled to the actual size of the catchment.

Design rainfall depths and catchment characteristics are obtained from the FEH Webservice⁶. The time to peak (Tp) and baseflow lag (BL) parameters for a 0.5km² catchment or development area if great than 0.5km² are then calculated using the plot scale equations in ReFH2, assuming an Aerial Reduction Factor (ARF) of 1 for the design rainfall

1 <https://refhdocs.hydrosolutions.co.uk/Drainage-Design-Applications/Greenfield-Runoff-Rates-and-Volumes/>

2 <https://www.hydrosolutions.co.uk/software/refh-2/>

3 <https://www.gov.uk/government/publications/flood-estimation-guidelines>

4 <https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/review-of-methodology-for-estimating-flood-peaks-and-hydrographs-for-small-catchments>

5 CIRIA, The SuDS Manual (C753). December 2015

6 <https://fehweb.ceh.ac.uk/>

and using the default Seasonal Correction Factor (SCF) for the winter storm and default rainfall event duration and timestep.

The area is then updated to the development area or 1ha (to obtain the per hectare greenfield runoff rate) maintaining an ARF of 1 and the rainfall event duration, timestep, T_p and BL parameters for a 0.5km² catchment. With the “as rural” total peak flow results providing the Greenfield Runoff Rate for the development area (or if the area is set to 1ha the per hectare Greenfield Runoff Rate).

The Greenfield Runoff Volumes are then estimated using the same parameters as for the Greenfield Runoff Rates, with the rainfall event duration updated to be 6 hours and a timestep of 8 minutes. The “as rural” direct runoff volume results provide the Greenfield Runoff Volumes for the development area (or if the area is set to 1ha the per hectare Greenfield Runoff Volume).



3.0 Analysis

3.1 Data Import

The FEH point descriptors for the site have been obtained from the FEH Webservice⁶ for the Site. These have been reviewed and found to be representative of the conditions at the Site. The FEH Descriptors of the site are presented in Table 3-1.

Table 3-1: FEH Descriptors

Descriptor	Value
Point Descriptor	E: 353996 N:392958
SAAR (mm)	852
PROPWET	0.37
BFIHOST19	0.361

A review of BGS GeoIndex 1:50,000 scale Bedrock and Superficial deposits mapping indicates that the site is underlain by the principal aquifer of the Sherwood Sandstone Group and overlain by superficial deposits of the Till (Diamicton). This is reflected in the BFIHOST19 value of 0.361 indicating that the catchment has a low permeability.

3.2 Peak Rainfall Intensity Climate Change Allowances

The most recent advice on peak rainfall intensity climate change is provided by the Environment Agency⁷. In line with this advice, the 2070s Upper End allowance of 45% for the 1% AEP event has been applied.

3.3 Initial Catchment Area Runoff Parameters

The initial ReFH2 rainfall, Tp and BL parameters of 1.582 hrs and 30.852 respectively have been estimated based on a catchment area of 0.05km² (1ha).

3.4 Rainfall Parameters

The following rainfall events have been assessed:

- 100% AEP – 1:1 year;
- 50% AEP – 1:2 year – Approximately QMED;
- 3.3% AEP – 1:30 year;
- 3.3% AEP + 40% CC;
- 1% AEP – 1:100 year;
- 1% AEP + 45% CC; and
- 0.1% AEP – 1:1000 year.

⁷ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>



The ARF is updated from the default value of 0.979 to 1.000.

3.5 50ha Runoff and Rainfall Parameters

Based on the analysis of a 0.5km² (50ha) catchment, the Tp and BL parameters have been estimated as 1.582 hrs and 30.852. The rainfall event duration for the 0.01km² catchment of 02:45:00 hh:mm:ss and a timestep of 00:15:00 has been adopted.

3.6 Greenfield Runoff Rate Rescaling

To obtain the per hectare Greenfield Runoff Rate, the catchment area was updated to be 1ha, with the recommended rainfall event duration, timestep, Tp and BL for a 0.01km² catchment retained along with an ARF value of 1 and the default winter storm seasonality.

3.7 Greenfield Runoff Volumes

To obtain the Greenfield Runoff Volumes for drained area of the development, the rainfall event duration and timestep was updated to be 06:00:00 hh:mm:ss and 00:08:00 hh:mm:ss respectively. Tp and BL for the recommended duration storm on a 0.01km² catchment was retained along with an ARF value of 1 and the default winter storm seasonality.



4.0 Summary of Results

The following tables summarise the Greenfield Runoff Rates, Greenfield Runoff Volumes results of the ReFH2 analysis and the Project SC090031 screening tool estimates as a comparison. These values will corroborate what is provided within the ReFH2 output reports.

Table 4-1: Greenfield Runoff Rates for 1ha Area

Annual Exceedance Probability	ReFH2 Greenfield Rates (l/s/ha)
100% (1 in 1 year)	5.0
50% (1 in 2 year) – Approximately QMED	5.6
3.3% (1 in 30 year)	11.1
3.3% + 40% Climate Change	15.8
1.0% (1 in 100 year)	13.9
1.0% + 45% Climate Change	20.8

Table 4-2: 6-Hour Greenfield Runoff Volumes for 1ha Area

Annual Exceedance Probability	Greenfield Runoff Volume (m ³)
100% (1 in 1 year)	70.4
50% (1 in 2 year)	78.1
3.3% (1 in 30 year)	148.9
3.3% + 40% Climate Change	217.7
1.0% (1 in 100 year)	188.4
1.0% + 45% Climate Change	289.6



UK Design Flood Estimation

Generated on 26 August 2025 09:07:59 by pbrookes
Printed from the ReFH2 Flood Modelling software package, version 4.1.8879.22466

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 85FC-1F51

Site name: FEH_Point_Descriptors_353996_392958_v5_0_1

Easting: 353996

Northing: 392958

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.01 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH22 (mm):	42.15	Total runoff (ML):	0.14
Total Rainfall (mm):	28.79	Total flow (ML):	0.29
Peak Rainfall (mm):	6.54	Peak flow (m ³ /s):	0.01

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.

** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:45:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.68	No
ARF (Areal reduction factor)	1 [0.99]	Yes
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	122.23	No
Cmax (mm)	279.65	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.58 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	30.85 [22.92]	Yes
BR	1.05	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m ³ /s)	0	No
Exporting drained area (km ²)	0	No
Urban area (km ²)	0	No
Effective URBEXT2000	0	n/a
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00:00	0.6322	0.0000	0.2770	0.0000	0.000481	0.000481
00:15:00	1.0592	0.0000	0.4674	0.0000	0.000477	0.000502
00:30:00	1.7652	0.0000	0.7878	0.0001	0.000474	0.000591
00:45:00	2.9188	0.0000	1.3271	0.0003	0.000472	0.000795
01:00:00	4.7501	0.0000	2.2249	0.0007	0.000473	0.00119
01:15:00	6.5434	0.0000	3.1970	0.0014	0.000478	0.00191
01:30:00	4.7501	0.0000	2.4167	0.0026	0.000491	0.00313
01:45:00	2.9188	0.0000	1.5250	0.0043	0.000517	0.00485
02:00:00	1.7652	0.0000	0.9371	0.0063	0.000558	0.00685
02:15:00	1.0592	0.0000	0.5676	0.0083	0.000615	0.00894
02:30:00	0.6322	0.0000	0.3407	0.0102	0.000688	0.0109
02:45:00	0.0000	0.0000	0.0000	0.0118	0.000776	0.0126
03:00:00	0.0000	0.0000	0.0000	0.0127	0.000873	0.0136
03:15:00	0.0000	0.0000	0.0000	0.0128	0.000974	0.0138
03:30:00	0.0000	0.0000	0.0000	0.0122	0.00107	0.0133
03:45:00	0.0000	0.0000	0.0000	0.0113	0.00116	0.0124
04:00:00	0.0000	0.0000	0.0000	0.0101	0.00124	0.0113
04:15:00	0.0000	0.0000	0.0000	0.0089	0.00131	0.0102
04:30:00	0.0000	0.0000	0.0000	0.0077	0.00137	0.00903
04:45:00	0.0000	0.0000	0.0000	0.0066	0.00142	0.00805
05:00:00	0.0000	0.0000	0.0000	0.0057	0.00146	0.00721
05:15:00	0.0000	0.0000	0.0000	0.0050	0.0015	0.00646
05:30:00	0.0000	0.0000	0.0000	0.0042	0.00152	0.00576
05:45:00	0.0000	0.0000	0.0000	0.0036	0.00154	0.0051
06:00:00	0.0000	0.0000	0.0000	0.0029	0.00156	0.00446
06:15:00	0.0000	0.0000	0.0000	0.0023	0.00157	0.00384
06:30:00	0.0000	0.0000	0.0000	0.0017	0.00157	0.00324
06:45:00	0.0000	0.0000	0.0000	0.0011	0.00157	0.0027
07:00:00	0.0000	0.0000	0.0000	0.0007	0.00157	0.00225
07:15:00	0.0000	0.0000	0.0000	0.0004	0.00156	0.00193
07:30:00	0.0000	0.0000	0.0000	0.0002	0.00155	0.00173
07:45:00	0.0000	0.0000	0.0000	0.0001	0.00154	0.00162
08:00:00	0.0000	0.0000	0.0000	0.0000	0.00152	0.00155
08:15:00	0.0000	0.0000	0.0000	0.0000	0.00151	0.00152

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0015	0.0015
08:45:00	0.0000	0.0000	0.0000	0.0000	0.00149	0.00149
09:00:00	0.0000	0.0000	0.0000	0.0000	0.00148	0.00148
09:15:00	0.0000	0.0000	0.0000	0.0000	0.00146	0.00146
09:30:00	0.0000	0.0000	0.0000	0.0000	0.00145	0.00145
09:45:00	0.0000	0.0000	0.0000	0.0000	0.00144	0.00144
10:00:00	0.0000	0.0000	0.0000	0.0000	0.00143	0.00143
10:15:00	0.0000	0.0000	0.0000	0.0000	0.00142	0.00142
10:30:00	0.0000	0.0000	0.0000	0.0000	0.00141	0.00141
10:45:00	0.0000	0.0000	0.0000	0.0000	0.00139	0.00139
11:00:00	0.0000	0.0000	0.0000	0.0000	0.00138	0.00138
11:15:00	0.0000	0.0000	0.0000	0.0000	0.00137	0.00137
11:30:00	0.0000	0.0000	0.0000	0.0000	0.00136	0.00136
11:45:00	0.0000	0.0000	0.0000	0.0000	0.00135	0.00135
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00134	0.00134
12:15:00	0.0000	0.0000	0.0000	0.0000	0.00133	0.00133
12:30:00	0.0000	0.0000	0.0000	0.0000	0.00132	0.00132
12:45:00	0.0000	0.0000	0.0000	0.0000	0.00131	0.00131
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0013	0.0013
13:15:00	0.0000	0.0000	0.0000	0.0000	0.00129	0.00129
13:30:00	0.0000	0.0000	0.0000	0.0000	0.00128	0.00128
13:45:00	0.0000	0.0000	0.0000	0.0000	0.00126	0.00126
14:00:00	0.0000	0.0000	0.0000	0.0000	0.00125	0.00125
14:15:00	0.0000	0.0000	0.0000	0.0000	0.00124	0.00124
14:30:00	0.0000	0.0000	0.0000	0.0000	0.00123	0.00123
14:45:00	0.0000	0.0000	0.0000	0.0000	0.00122	0.00122
15:00:00	0.0000	0.0000	0.0000	0.0000	0.00121	0.00121
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012
15:45:00	0.0000	0.0000	0.0000	0.0000	0.00119	0.00119
16:00:00	0.0000	0.0000	0.0000	0.0000	0.00118	0.00118
16:15:00	0.0000	0.0000	0.0000	0.0000	0.00117	0.00117
16:30:00	0.0000	0.0000	0.0000	0.0000	0.00116	0.00116
16:45:00	0.0000	0.0000	0.0000	0.0000	0.00115	0.00115
17:00:00	0.0000	0.0000	0.0000	0.0000	0.00114	0.00114

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
17:15:00	0.0000	0.0000	0.0000	0.0000	0.00113	0.00113
17:30:00	0.0000	0.0000	0.0000	0.0000	0.00112	0.00112
17:45:00	0.0000	0.0000	0.0000	0.0000	0.00111	0.00111
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0011	0.0011
18:15:00	0.0000	0.0000	0.0000	0.0000	0.00109	0.00109
18:30:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
18:45:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
19:00:00	0.0000	0.0000	0.0000	0.0000	0.00107	0.00107
19:15:00	0.0000	0.0000	0.0000	0.0000	0.00106	0.00106
19:30:00	0.0000	0.0000	0.0000	0.0000	0.00105	0.00105
19:45:00	0.0000	0.0000	0.0000	0.0000	0.00104	0.00104
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
20:15:00	0.0000	0.0000	0.0000	0.0000	0.00102	0.00102
20:30:00	0.0000	0.0000	0.0000	0.0000	0.00102	0.00102
20:45:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101
21:00:00	0.0000	0.0000	0.0000	0.0000	0.001	0.001
21:15:00	0.0000	0.0000	0.0000	0.0000	0.000992	0.000992
21:30:00	0.0000	0.0000	0.0000	0.0000	0.000984	0.000984
21:45:00	0.0000	0.0000	0.0000	0.0000	0.000976	0.000976
22:00:00	0.0000	0.0000	0.0000	0.0000	0.000968	0.000968
22:15:00	0.0000	0.0000	0.0000	0.0000	0.00096	0.00096
22:30:00	0.0000	0.0000	0.0000	0.0000	0.000952	0.000952
22:45:00	0.0000	0.0000	0.0000	0.0000	0.000945	0.000945
23:00:00	0.0000	0.0000	0.0000	0.0000	0.000937	0.000937
23:15:00	0.0000	0.0000	0.0000	0.0000	0.00093	0.00093
23:30:00	0.0000	0.0000	0.0000	0.0000	0.000922	0.000922
23:45:00	0.0000	0.0000	0.0000	0.0000	0.000915	0.000915
24:00:00	0.0000	0.0000	0.0000	0.0000	0.000907	0.000907
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0009	0.0009
24:30:00	0.0000	0.0000	0.0000	0.0000	0.000893	0.000893
24:45:00	0.0000	0.0000	0.0000	0.0000	0.000885	0.000885
25:00:00	0.0000	0.0000	0.0000	0.0000	0.000878	0.000878
25:15:00	0.0000	0.0000	0.0000	0.0000	0.000871	0.000871
25:30:00	0.0000	0.0000	0.0000	0.0000	0.000864	0.000864
25:45:00	0.0000	0.0000	0.0000	0.0000	0.000857	0.000857

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00085	0.00085
26:15:00	0.0000	0.0000	0.0000	0.0000	0.000843	0.000843
26:30:00	0.0000	0.0000	0.0000	0.0000	0.000837	0.000837
26:45:00	0.0000	0.0000	0.0000	0.0000	0.00083	0.00083
27:00:00	0.0000	0.0000	0.0000	0.0000	0.000823	0.000823
27:15:00	0.0000	0.0000	0.0000	0.0000	0.000817	0.000817
27:30:00	0.0000	0.0000	0.0000	0.0000	0.00081	0.00081
27:45:00	0.0000	0.0000	0.0000	0.0000	0.000803	0.000803
28:00:00	0.0000	0.0000	0.0000	0.0000	0.000797	0.000797
28:15:00	0.0000	0.0000	0.0000	0.0000	0.00079	0.00079
28:30:00	0.0000	0.0000	0.0000	0.0000	0.000784	0.000784
28:45:00	0.0000	0.0000	0.0000	0.0000	0.000778	0.000778
29:00:00	0.0000	0.0000	0.0000	0.0000	0.000771	0.000771
29:15:00	0.0000	0.0000	0.0000	0.0000	0.000765	0.000765
29:30:00	0.0000	0.0000	0.0000	0.0000	0.000759	0.000759
29:45:00	0.0000	0.0000	0.0000	0.0000	0.000753	0.000753
30:00:00	0.0000	0.0000	0.0000	0.0000	0.000747	0.000747
30:15:00	0.0000	0.0000	0.0000	0.0000	0.000741	0.000741
30:30:00	0.0000	0.0000	0.0000	0.0000	0.000735	0.000735
30:45:00	0.0000	0.0000	0.0000	0.0000	0.000729	0.000729
31:00:00	0.0000	0.0000	0.0000	0.0000	0.000723	0.000723
31:15:00	0.0000	0.0000	0.0000	0.0000	0.000717	0.000717
31:30:00	0.0000	0.0000	0.0000	0.0000	0.000711	0.000711
31:45:00	0.0000	0.0000	0.0000	0.0000	0.000706	0.000706
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0007	0.0007
32:15:00	0.0000	0.0000	0.0000	0.0000	0.000694	0.000694
32:30:00	0.0000	0.0000	0.0000	0.0000	0.000689	0.000689
32:45:00	0.0000	0.0000	0.0000	0.0000	0.000683	0.000683
33:00:00	0.0000	0.0000	0.0000	0.0000	0.000678	0.000678
33:15:00	0.0000	0.0000	0.0000	0.0000	0.000672	0.000672
33:30:00	0.0000	0.0000	0.0000	0.0000	0.000667	0.000667
33:45:00	0.0000	0.0000	0.0000	0.0000	0.000661	0.000661
34:00:00	0.0000	0.0000	0.0000	0.0000	0.000656	0.000656
34:15:00	0.0000	0.0000	0.0000	0.0000	0.000651	0.000651
34:30:00	0.0000	0.0000	0.0000	0.0000	0.000646	0.000646

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
34:45:00	0.0000	0.0000	0.0000	0.0000	0.00064	0.00064
35:00:00	0.0000	0.0000	0.0000	0.0000	0.000635	0.000635
35:15:00	0.0000	0.0000	0.0000	0.0000	0.00063	0.00063
35:30:00	0.0000	0.0000	0.0000	0.0000	0.000625	0.000625
35:45:00	0.0000	0.0000	0.0000	0.0000	0.00062	0.00062
36:00:00	0.0000	0.0000	0.0000	0.0000	0.000615	0.000615
36:15:00	0.0000	0.0000	0.0000	0.0000	0.00061	0.00061
36:30:00	0.0000	0.0000	0.0000	0.0000	0.000605	0.000605
36:45:00	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006
37:00:00	0.0000	0.0000	0.0000	0.0000	0.000595	0.000595
37:15:00	0.0000	0.0000	0.0000	0.0000	0.00059	0.00059
37:30:00	0.0000	0.0000	0.0000	0.0000	0.000586	0.000586
37:45:00	0.0000	0.0000	0.0000	0.0000	0.000581	0.000581
38:00:00	0.0000	0.0000	0.0000	0.0000	0.000576	0.000576
38:15:00	0.0000	0.0000	0.0000	0.0000	0.000572	0.000572
38:30:00	0.0000	0.0000	0.0000	0.0000	0.000567	0.000567
38:45:00	0.0000	0.0000	0.0000	0.0000	0.000562	0.000562
39:00:00	0.0000	0.0000	0.0000	0.0000	0.000558	0.000558
39:15:00	0.0000	0.0000	0.0000	0.0000	0.000553	0.000553
39:30:00	0.0000	0.0000	0.0000	0.0000	0.000549	0.000549
39:45:00	0.0000	0.0000	0.0000	0.0000	0.000545	0.000545
40:00:00	0.0000	0.0000	0.0000	0.0000	0.00054	0.00054
40:15:00	0.0000	0.0000	0.0000	0.0000	0.000536	0.000536
40:30:00	0.0000	0.0000	0.0000	0.0000	0.000531	0.000531
40:45:00	0.0000	0.0000	0.0000	0.0000	0.000527	0.000527
41:00:00	0.0000	0.0000	0.0000	0.0000	0.000523	0.000523
41:15:00	0.0000	0.0000	0.0000	0.0000	0.000519	0.000519
41:30:00	0.0000	0.0000	0.0000	0.0000	0.000514	0.000514
41:45:00	0.0000	0.0000	0.0000	0.0000	0.00051	0.00051
42:00:00	0.0000	0.0000	0.0000	0.0000	0.000506	0.000506
42:15:00	0.0000	0.0000	0.0000	0.0000	0.000502	0.000502
42:30:00	0.0000	0.0000	0.0000	0.0000	0.000498	0.000498
42:45:00	0.0000	0.0000	0.0000	0.0000	0.000494	0.000494
43:00:00	0.0000	0.0000	0.0000	0.0000	0.00049	0.00049
43:15:00	0.0000	0.0000	0.0000	0.0000	0.000486	0.000486

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.35	No
BFIHOST19	0.36	No
PROPWET	0.37	No
SAAR (mm)	852	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on 26 August 2025 09:08:42 by pbrookes
Printed from the ReFH2 Flood Modelling software package, version 4.1.8879.22466

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: D40B-4F25

Site name: FEH_Point_Descriptors_353996_392958_v5_0_1

Easting: 353996

Northing: 392958

Country: England, Wales or Northern Ireland

Catchment Area (km²): 0.01 [0.5]*

Using plot scale calculations: Yes

Model: 2.3

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH22 (mm):	50.25	Total runoff (ML):	0.19
Total Rainfall (mm):	37.53	Total flow (ML):	0.38
Peak Rainfall (mm):	2.20	Peak flow (m³/s):	0.01

Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.
* Indicates that the user locked the duration/timestep

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:00:00 [02:45:00]	Yes
Timestep (hh:mm:ss)	00:08:00 [00:15:00]	Yes
SCF (Seasonal correction factor)	0.75	No
ARF (Areal reduction factor)	1 [1]	Yes
Seasonality	Winter	No

Loss model parameters

Name	Value	User-defined?
Cini (mm)	122.23	No
Cmax (mm)	279.65	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.58 [1]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m ³ /s)	0	No
BL (hr)	30.85 [22.92]	Yes
BR	0.98	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m ³ /s)	0	No
Exporting drained area (km ²)	0	No
Urban area (km ²)	0	No
Effective URBEXT2000	0	n/a
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m³/s)	Net Rain (mm)	Runoff (m³/s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00:00	0.1639	0.0000	0.0717	0.0000	0.000481	0.000481
00:08:00	0.1860	0.0000	0.0815	0.0000	0.000479	0.000483
00:16:00	0.2112	0.0000	0.0926	0.0000	0.000477	0.000491
00:24:00	0.2396	0.0000	0.1053	0.0000	0.000475	0.000509
00:32:00	0.2719	0.0000	0.1197	0.0001	0.000473	0.000536
00:40:00	0.3084	0.0000	0.1361	0.0001	0.000472	0.000573
00:48:00	0.3497	0.0000	0.1548	0.0002	0.00047	0.000624
00:56:00	0.3964	0.0000	0.1760	0.0002	0.000469	0.000689
01:04:00	0.4492	0.0000	0.2001	0.0003	0.000469	0.00077
01:12:00	0.5088	0.0000	0.2275	0.0004	0.000468	0.000869
01:20:00	0.5761	0.0000	0.2588	0.0005	0.000468	0.00099
01:28:00	0.6520	0.0000	0.2943	0.0007	0.000469	0.00113
01:36:00	0.7376	0.0000	0.3347	0.0008	0.000471	0.00131
01:44:00	0.8339	0.0000	0.3808	0.0010	0.000474	0.0015
01:52:00	0.9421	0.0000	0.4332	0.0012	0.000477	0.00172
02:00:00	1.0634	0.0000	0.4928	0.0015	0.000482	0.00197
02:08:00	1.1993	0.0000	0.5606	0.0018	0.000488	0.00225
02:16:00	1.3507	0.0000	0.6375	0.0021	0.000495	0.00256
02:24:00	1.5186	0.0000	0.7246	0.0024	0.000504	0.00291
02:32:00	1.7031	0.0000	0.8224	0.0028	0.000515	0.0033
02:40:00	1.9018	0.0000	0.9307	0.0032	0.000528	0.00375
02:48:00	2.1026	0.0000	1.0368	0.0037	0.000543	0.00425
02:56:00	2.1981	0.0000	1.1008	0.0043	0.00056	0.00482
03:04:00	2.1026	0.0000	1.0692	0.0049	0.00058	0.00546
03:12:00	1.9018	0.0000	0.9807	0.0056	0.000603	0.00616
03:20:00	1.7031	0.0000	0.8891	0.0063	0.000629	0.00691
03:28:00	1.5186	0.0000	0.8016	0.0070	0.000659	0.00771
03:36:00	1.3507	0.0000	0.7199	0.0078	0.000691	0.00853
03:44:00	1.1993	0.0000	0.6446	0.0086	0.000727	0.00935
03:52:00	1.0634	0.0000	0.5759	0.0094	0.000765	0.0102
04:00:00	0.9421	0.0000	0.5136	0.0102	0.000807	0.011
04:08:00	0.8339	0.0000	0.4572	0.0109	0.000851	0.0117
04:16:00	0.7376	0.0000	0.4065	0.0115	0.000897	0.0124
04:24:00	0.6520	0.0000	0.3610	0.0120	0.000945	0.013

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
04:32:00	0.5761	0.0000	0.3202	0.0125	0.000994	0.0135
04:40:00	0.5088	0.0000	0.2838	0.0128	0.00104	0.0138
04:48:00	0.4492	0.0000	0.2513	0.0130	0.0011	0.0141
04:56:00	0.3964	0.0000	0.2224	0.0130	0.00115	0.0142
05:04:00	0.3497	0.0000	0.1966	0.0130	0.0012	0.0142
05:12:00	0.3084	0.0000	0.1738	0.0129	0.00124	0.0141
05:20:00	0.2719	0.0000	0.1535	0.0126	0.00129	0.0139
05:28:00	0.2396	0.0000	0.1355	0.0124	0.00134	0.0137
05:36:00	0.2112	0.0000	0.1180	0.0120	0.00138	0.0134
05:44:00	0.1860	0.0000	0.1041	0.0116	0.00143	0.013
05:52:00	0.1639	0.0000	0.0918	0.0112	0.00147	0.0127
06:00:00	0.0000	0.0000	0.0000	0.0107	0.00151	0.0122
06:08:00	0.0000	0.0000	0.0000	0.0103	0.00154	0.0118
06:16:00	0.0000	0.0000	0.0000	0.0098	0.00158	0.0114
06:24:00	0.0000	0.0000	0.0000	0.0093	0.00161	0.0109
06:32:00	0.0000	0.0000	0.0000	0.0088	0.00164	0.0104
06:40:00	0.0000	0.0000	0.0000	0.0083	0.00166	0.00995
06:48:00	0.0000	0.0000	0.0000	0.0078	0.00169	0.00948
06:56:00	0.0000	0.0000	0.0000	0.0073	0.00171	0.00899
07:04:00	0.0000	0.0000	0.0000	0.0068	0.00173	0.00851
07:12:00	0.0000	0.0000	0.0000	0.0063	0.00175	0.00803
07:20:00	0.0000	0.0000	0.0000	0.0058	0.00177	0.00756
07:28:00	0.0000	0.0000	0.0000	0.0053	0.00178	0.00708
07:36:00	0.0000	0.0000	0.0000	0.0048	0.0018	0.00661
07:44:00	0.0000	0.0000	0.0000	0.0044	0.00181	0.00616
07:52:00	0.0000	0.0000	0.0000	0.0039	0.00181	0.00573
08:00:00	0.0000	0.0000	0.0000	0.0035	0.00182	0.00532
08:08:00	0.0000	0.0000	0.0000	0.0031	0.00183	0.00493
08:16:00	0.0000	0.0000	0.0000	0.0027	0.00183	0.00456
08:24:00	0.0000	0.0000	0.0000	0.0024	0.00183	0.00422
08:32:00	0.0000	0.0000	0.0000	0.0021	0.00183	0.00391
08:40:00	0.0000	0.0000	0.0000	0.0018	0.00183	0.00363
08:48:00	0.0000	0.0000	0.0000	0.0015	0.00183	0.00337
08:56:00	0.0000	0.0000	0.0000	0.0013	0.00183	0.00315
09:04:00	0.0000	0.0000	0.0000	0.0011	0.00182	0.00295

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
09:12:00	0.0000	0.0000	0.0000	0.0010	0.00182	0.00278
09:20:00	0.0000	0.0000	0.0000	0.0008	0.00182	0.00263
09:28:00	0.0000	0.0000	0.0000	0.0007	0.00181	0.00249
09:36:00	0.0000	0.0000	0.0000	0.0006	0.0018	0.00238
09:44:00	0.0000	0.0000	0.0000	0.0005	0.0018	0.00227
09:52:00	0.0000	0.0000	0.0000	0.0004	0.00179	0.00218
10:00:00	0.0000	0.0000	0.0000	0.0003	0.00179	0.0021
10:08:00	0.0000	0.0000	0.0000	0.0003	0.00178	0.00204
10:16:00	0.0000	0.0000	0.0000	0.0002	0.00177	0.00198
10:24:00	0.0000	0.0000	0.0000	0.0002	0.00177	0.00192
10:32:00	0.0000	0.0000	0.0000	0.0001	0.00176	0.00188
10:40:00	0.0000	0.0000	0.0000	0.0001	0.00175	0.00184
10:48:00	0.0000	0.0000	0.0000	0.0001	0.00174	0.00181
10:56:00	0.0000	0.0000	0.0000	0.0000	0.00174	0.00178
11:04:00	0.0000	0.0000	0.0000	0.0000	0.00173	0.00176
11:12:00	0.0000	0.0000	0.0000	0.0000	0.00172	0.00174
11:20:00	0.0000	0.0000	0.0000	0.0000	0.00171	0.00172
11:28:00	0.0000	0.0000	0.0000	0.0000	0.00171	0.00171
11:36:00	0.0000	0.0000	0.0000	0.0000	0.0017	0.0017
11:44:00	0.0000	0.0000	0.0000	0.0000	0.00169	0.00169
11:52:00	0.0000	0.0000	0.0000	0.0000	0.00169	0.00169
12:00:00	0.0000	0.0000	0.0000	0.0000	0.00168	0.00168
12:08:00	0.0000	0.0000	0.0000	0.0000	0.00167	0.00167
12:16:00	0.0000	0.0000	0.0000	0.0000	0.00166	0.00166
12:24:00	0.0000	0.0000	0.0000	0.0000	0.00166	0.00166
12:32:00	0.0000	0.0000	0.0000	0.0000	0.00165	0.00165
12:40:00	0.0000	0.0000	0.0000	0.0000	0.00164	0.00164
12:48:00	0.0000	0.0000	0.0000	0.0000	0.00164	0.00164
12:56:00	0.0000	0.0000	0.0000	0.0000	0.00163	0.00163
13:04:00	0.0000	0.0000	0.0000	0.0000	0.00162	0.00162
13:12:00	0.0000	0.0000	0.0000	0.0000	0.00161	0.00161
13:20:00	0.0000	0.0000	0.0000	0.0000	0.00161	0.00161
13:28:00	0.0000	0.0000	0.0000	0.0000	0.0016	0.0016
13:36:00	0.0000	0.0000	0.0000	0.0000	0.00159	0.00159
13:44:00	0.0000	0.0000	0.0000	0.0000	0.00159	0.00159

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
13:52:00	0.0000	0.0000	0.0000	0.0000	0.00158	0.00158
14:00:00	0.0000	0.0000	0.0000	0.0000	0.00157	0.00157
14:08:00	0.0000	0.0000	0.0000	0.0000	0.00157	0.00157
14:16:00	0.0000	0.0000	0.0000	0.0000	0.00156	0.00156
14:24:00	0.0000	0.0000	0.0000	0.0000	0.00155	0.00155
14:32:00	0.0000	0.0000	0.0000	0.0000	0.00155	0.00155
14:40:00	0.0000	0.0000	0.0000	0.0000	0.00154	0.00154
14:48:00	0.0000	0.0000	0.0000	0.0000	0.00153	0.00153
14:56:00	0.0000	0.0000	0.0000	0.0000	0.00153	0.00153
15:04:00	0.0000	0.0000	0.0000	0.0000	0.00152	0.00152
15:12:00	0.0000	0.0000	0.0000	0.0000	0.00151	0.00151
15:20:00	0.0000	0.0000	0.0000	0.0000	0.00151	0.00151
15:28:00	0.0000	0.0000	0.0000	0.0000	0.0015	0.0015
15:36:00	0.0000	0.0000	0.0000	0.0000	0.00149	0.00149
15:44:00	0.0000	0.0000	0.0000	0.0000	0.00149	0.00149
15:52:00	0.0000	0.0000	0.0000	0.0000	0.00148	0.00148
16:00:00	0.0000	0.0000	0.0000	0.0000	0.00147	0.00147
16:08:00	0.0000	0.0000	0.0000	0.0000	0.00147	0.00147
16:16:00	0.0000	0.0000	0.0000	0.0000	0.00146	0.00146
16:24:00	0.0000	0.0000	0.0000	0.0000	0.00146	0.00146
16:32:00	0.0000	0.0000	0.0000	0.0000	0.00145	0.00145
16:40:00	0.0000	0.0000	0.0000	0.0000	0.00144	0.00144
16:48:00	0.0000	0.0000	0.0000	0.0000	0.00144	0.00144
16:56:00	0.0000	0.0000	0.0000	0.0000	0.00143	0.00143
17:04:00	0.0000	0.0000	0.0000	0.0000	0.00142	0.00142
17:12:00	0.0000	0.0000	0.0000	0.0000	0.00142	0.00142
17:20:00	0.0000	0.0000	0.0000	0.0000	0.00141	0.00141
17:28:00	0.0000	0.0000	0.0000	0.0000	0.00141	0.00141
17:36:00	0.0000	0.0000	0.0000	0.0000	0.0014	0.0014
17:44:00	0.0000	0.0000	0.0000	0.0000	0.00139	0.00139
17:52:00	0.0000	0.0000	0.0000	0.0000	0.00139	0.00139
18:00:00	0.0000	0.0000	0.0000	0.0000	0.00138	0.00138
18:08:00	0.0000	0.0000	0.0000	0.0000	0.00138	0.00138
18:16:00	0.0000	0.0000	0.0000	0.0000	0.00137	0.00137
18:24:00	0.0000	0.0000	0.0000	0.0000	0.00136	0.00136

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
18:32:00	0.0000	0.0000	0.0000	0.0000	0.00136	0.00136
18:40:00	0.0000	0.0000	0.0000	0.0000	0.00135	0.00135
18:48:00	0.0000	0.0000	0.0000	0.0000	0.00135	0.00135
18:56:00	0.0000	0.0000	0.0000	0.0000	0.00134	0.00134
19:04:00	0.0000	0.0000	0.0000	0.0000	0.00133	0.00133
19:12:00	0.0000	0.0000	0.0000	0.0000	0.00133	0.00133
19:20:00	0.0000	0.0000	0.0000	0.0000	0.00132	0.00132
19:28:00	0.0000	0.0000	0.0000	0.0000	0.00132	0.00132
19:36:00	0.0000	0.0000	0.0000	0.0000	0.00131	0.00131
19:44:00	0.0000	0.0000	0.0000	0.0000	0.00131	0.00131
19:52:00	0.0000	0.0000	0.0000	0.0000	0.0013	0.0013
20:00:00	0.0000	0.0000	0.0000	0.0000	0.00129	0.00129
20:08:00	0.0000	0.0000	0.0000	0.0000	0.00129	0.00129
20:16:00	0.0000	0.0000	0.0000	0.0000	0.00128	0.00128
20:24:00	0.0000	0.0000	0.0000	0.0000	0.00128	0.00128
20:32:00	0.0000	0.0000	0.0000	0.0000	0.00127	0.00127
20:40:00	0.0000	0.0000	0.0000	0.0000	0.00127	0.00127
20:48:00	0.0000	0.0000	0.0000	0.0000	0.00126	0.00126
20:56:00	0.0000	0.0000	0.0000	0.0000	0.00126	0.00126
21:04:00	0.0000	0.0000	0.0000	0.0000	0.00125	0.00125
21:12:00	0.0000	0.0000	0.0000	0.0000	0.00125	0.00125
21:20:00	0.0000	0.0000	0.0000	0.0000	0.00124	0.00124
21:28:00	0.0000	0.0000	0.0000	0.0000	0.00123	0.00123
21:36:00	0.0000	0.0000	0.0000	0.0000	0.00123	0.00123
21:44:00	0.0000	0.0000	0.0000	0.0000	0.00122	0.00122
21:52:00	0.0000	0.0000	0.0000	0.0000	0.00122	0.00122
22:00:00	0.0000	0.0000	0.0000	0.0000	0.00121	0.00121
22:08:00	0.0000	0.0000	0.0000	0.0000	0.00121	0.00121
22:16:00	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012
22:24:00	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012
22:32:00	0.0000	0.0000	0.0000	0.0000	0.00119	0.00119
22:40:00	0.0000	0.0000	0.0000	0.0000	0.00119	0.00119
22:48:00	0.0000	0.0000	0.0000	0.0000	0.00118	0.00118
22:56:00	0.0000	0.0000	0.0000	0.0000	0.00118	0.00118
23:04:00	0.0000	0.0000	0.0000	0.0000	0.00117	0.00117

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
23:12:00	0.0000	0.0000	0.0000	0.0000	0.00117	0.00117
23:20:00	0.0000	0.0000	0.0000	0.0000	0.00116	0.00116
23:28:00	0.0000	0.0000	0.0000	0.0000	0.00116	0.00116
23:36:00	0.0000	0.0000	0.0000	0.0000	0.00115	0.00115
23:44:00	0.0000	0.0000	0.0000	0.0000	0.00115	0.00115
23:52:00	0.0000	0.0000	0.0000	0.0000	0.00114	0.00114
24:00:00	0.0000	0.0000	0.0000	0.0000	0.00114	0.00114
24:08:00	0.0000	0.0000	0.0000	0.0000	0.00113	0.00113
24:16:00	0.0000	0.0000	0.0000	0.0000	0.00113	0.00113
24:24:00	0.0000	0.0000	0.0000	0.0000	0.00112	0.00112
24:32:00	0.0000	0.0000	0.0000	0.0000	0.00112	0.00112
24:40:00	0.0000	0.0000	0.0000	0.0000	0.00111	0.00111
24:48:00	0.0000	0.0000	0.0000	0.0000	0.00111	0.00111
24:56:00	0.0000	0.0000	0.0000	0.0000	0.0011	0.0011
25:04:00	0.0000	0.0000	0.0000	0.0000	0.0011	0.0011
25:12:00	0.0000	0.0000	0.0000	0.0000	0.00109	0.00109
25:20:00	0.0000	0.0000	0.0000	0.0000	0.00109	0.00109
25:28:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
25:36:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
25:44:00	0.0000	0.0000	0.0000	0.0000	0.00108	0.00108
25:52:00	0.0000	0.0000	0.0000	0.0000	0.00107	0.00107
26:00:00	0.0000	0.0000	0.0000	0.0000	0.00107	0.00107
26:08:00	0.0000	0.0000	0.0000	0.0000	0.00106	0.00106
26:16:00	0.0000	0.0000	0.0000	0.0000	0.00106	0.00106
26:24:00	0.0000	0.0000	0.0000	0.0000	0.00105	0.00105
26:32:00	0.0000	0.0000	0.0000	0.0000	0.00105	0.00105
26:40:00	0.0000	0.0000	0.0000	0.0000	0.00104	0.00104
26:48:00	0.0000	0.0000	0.0000	0.0000	0.00104	0.00104
26:56:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
27:04:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
27:12:00	0.0000	0.0000	0.0000	0.0000	0.00103	0.00103
27:20:00	0.0000	0.0000	0.0000	0.0000	0.00102	0.00102
27:28:00	0.0000	0.0000	0.0000	0.0000	0.00102	0.00102
27:36:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101
27:44:00	0.0000	0.0000	0.0000	0.0000	0.00101	0.00101

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
27:52:00	0.0000	0.0000	0.0000	0.0000	0.001	0.001
28:00:00	0.0000	0.0000	0.0000	0.0000	0.000999	0.000999
28:08:00	0.0000	0.0000	0.0000	0.0000	0.000995	0.000995
28:16:00	0.0000	0.0000	0.0000	0.0000	0.000991	0.000991
28:24:00	0.0000	0.0000	0.0000	0.0000	0.000986	0.000986
28:32:00	0.0000	0.0000	0.0000	0.0000	0.000982	0.000982
28:40:00	0.0000	0.0000	0.0000	0.0000	0.000978	0.000978
28:48:00	0.0000	0.0000	0.0000	0.0000	0.000974	0.000974
28:56:00	0.0000	0.0000	0.0000	0.0000	0.000969	0.000969
29:04:00	0.0000	0.0000	0.0000	0.0000	0.000965	0.000965
29:12:00	0.0000	0.0000	0.0000	0.0000	0.000961	0.000961
29:20:00	0.0000	0.0000	0.0000	0.0000	0.000957	0.000957
29:28:00	0.0000	0.0000	0.0000	0.0000	0.000953	0.000953
29:36:00	0.0000	0.0000	0.0000	0.0000	0.000949	0.000949
29:44:00	0.0000	0.0000	0.0000	0.0000	0.000945	0.000945
29:52:00	0.0000	0.0000	0.0000	0.0000	0.00094	0.00094
30:00:00	0.0000	0.0000	0.0000	0.0000	0.000936	0.000936
30:08:00	0.0000	0.0000	0.0000	0.0000	0.000932	0.000932
30:16:00	0.0000	0.0000	0.0000	0.0000	0.000928	0.000928
30:24:00	0.0000	0.0000	0.0000	0.0000	0.000924	0.000924
30:32:00	0.0000	0.0000	0.0000	0.0000	0.00092	0.00092
30:40:00	0.0000	0.0000	0.0000	0.0000	0.000916	0.000916
30:48:00	0.0000	0.0000	0.0000	0.0000	0.000912	0.000912
30:56:00	0.0000	0.0000	0.0000	0.0000	0.000909	0.000909
31:04:00	0.0000	0.0000	0.0000	0.0000	0.000905	0.000905
31:12:00	0.0000	0.0000	0.0000	0.0000	0.000901	0.000901
31:20:00	0.0000	0.0000	0.0000	0.0000	0.000897	0.000897
31:28:00	0.0000	0.0000	0.0000	0.0000	0.000893	0.000893
31:36:00	0.0000	0.0000	0.0000	0.0000	0.000889	0.000889
31:44:00	0.0000	0.0000	0.0000	0.0000	0.000885	0.000885
31:52:00	0.0000	0.0000	0.0000	0.0000	0.000881	0.000881
32:00:00	0.0000	0.0000	0.0000	0.0000	0.000878	0.000878
32:08:00	0.0000	0.0000	0.0000	0.0000	0.000874	0.000874
32:16:00	0.0000	0.0000	0.0000	0.0000	0.00087	0.00087
32:24:00	0.0000	0.0000	0.0000	0.0000	0.000866	0.000866

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
32:32:00	0.0000	0.0000	0.0000	0.0000	0.000863	0.000863
32:40:00	0.0000	0.0000	0.0000	0.0000	0.000859	0.000859
32:48:00	0.0000	0.0000	0.0000	0.0000	0.000855	0.000855
32:56:00	0.0000	0.0000	0.0000	0.0000	0.000852	0.000852
33:04:00	0.0000	0.0000	0.0000	0.0000	0.000848	0.000848
33:12:00	0.0000	0.0000	0.0000	0.0000	0.000844	0.000844
33:20:00	0.0000	0.0000	0.0000	0.0000	0.000841	0.000841
33:28:00	0.0000	0.0000	0.0000	0.0000	0.000837	0.000837
33:36:00	0.0000	0.0000	0.0000	0.0000	0.000833	0.000833
33:44:00	0.0000	0.0000	0.0000	0.0000	0.00083	0.00083
33:52:00	0.0000	0.0000	0.0000	0.0000	0.000826	0.000826
34:00:00	0.0000	0.0000	0.0000	0.0000	0.000823	0.000823
34:08:00	0.0000	0.0000	0.0000	0.0000	0.000819	0.000819
34:16:00	0.0000	0.0000	0.0000	0.0000	0.000815	0.000815
34:24:00	0.0000	0.0000	0.0000	0.0000	0.000812	0.000812
34:32:00	0.0000	0.0000	0.0000	0.0000	0.000808	0.000808
34:40:00	0.0000	0.0000	0.0000	0.0000	0.000805	0.000805
34:48:00	0.0000	0.0000	0.0000	0.0000	0.000802	0.000802
34:56:00	0.0000	0.0000	0.0000	0.0000	0.000798	0.000798
35:04:00	0.0000	0.0000	0.0000	0.0000	0.000795	0.000795
35:12:00	0.0000	0.0000	0.0000	0.0000	0.000791	0.000791
35:20:00	0.0000	0.0000	0.0000	0.0000	0.000788	0.000788
35:28:00	0.0000	0.0000	0.0000	0.0000	0.000784	0.000784
35:36:00	0.0000	0.0000	0.0000	0.0000	0.000781	0.000781
35:44:00	0.0000	0.0000	0.0000	0.0000	0.000778	0.000778
35:52:00	0.0000	0.0000	0.0000	0.0000	0.000774	0.000774
36:00:00	0.0000	0.0000	0.0000	0.0000	0.000771	0.000771
36:08:00	0.0000	0.0000	0.0000	0.0000	0.000768	0.000768
36:16:00	0.0000	0.0000	0.0000	0.0000	0.000764	0.000764
36:24:00	0.0000	0.0000	0.0000	0.0000	0.000761	0.000761
36:32:00	0.0000	0.0000	0.0000	0.0000	0.000758	0.000758
36:40:00	0.0000	0.0000	0.0000	0.0000	0.000754	0.000754
36:48:00	0.0000	0.0000	0.0000	0.0000	0.000751	0.000751
36:56:00	0.0000	0.0000	0.0000	0.0000	0.000748	0.000748
37:04:00	0.0000	0.0000	0.0000	0.0000	0.000745	0.000745

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
37:12:00	0.0000	0.0000	0.0000	0.0000	0.000742	0.000742
37:20:00	0.0000	0.0000	0.0000	0.0000	0.000738	0.000738
37:28:00	0.0000	0.0000	0.0000	0.0000	0.000735	0.000735
37:36:00	0.0000	0.0000	0.0000	0.0000	0.000732	0.000732
37:44:00	0.0000	0.0000	0.0000	0.0000	0.000729	0.000729
37:52:00	0.0000	0.0000	0.0000	0.0000	0.000726	0.000726
38:00:00	0.0000	0.0000	0.0000	0.0000	0.000723	0.000723
38:08:00	0.0000	0.0000	0.0000	0.0000	0.000719	0.000719
38:16:00	0.0000	0.0000	0.0000	0.0000	0.000716	0.000716
38:24:00	0.0000	0.0000	0.0000	0.0000	0.000713	0.000713
38:32:00	0.0000	0.0000	0.0000	0.0000	0.00071	0.00071
38:40:00	0.0000	0.0000	0.0000	0.0000	0.000707	0.000707
38:48:00	0.0000	0.0000	0.0000	0.0000	0.000704	0.000704
38:56:00	0.0000	0.0000	0.0000	0.0000	0.000701	0.000701
39:04:00	0.0000	0.0000	0.0000	0.0000	0.000698	0.000698
39:12:00	0.0000	0.0000	0.0000	0.0000	0.000695	0.000695
39:20:00	0.0000	0.0000	0.0000	0.0000	0.000692	0.000692
39:28:00	0.0000	0.0000	0.0000	0.0000	0.000689	0.000689
39:36:00	0.0000	0.0000	0.0000	0.0000	0.000686	0.000686
39:44:00	0.0000	0.0000	0.0000	0.0000	0.000683	0.000683
39:52:00	0.0000	0.0000	0.0000	0.0000	0.00068	0.00068
40:00:00	0.0000	0.0000	0.0000	0.0000	0.000677	0.000677
40:08:00	0.0000	0.0000	0.0000	0.0000	0.000674	0.000674
40:16:00	0.0000	0.0000	0.0000	0.0000	0.000671	0.000671
40:24:00	0.0000	0.0000	0.0000	0.0000	0.000668	0.000668
40:32:00	0.0000	0.0000	0.0000	0.0000	0.000666	0.000666
40:40:00	0.0000	0.0000	0.0000	0.0000	0.000663	0.000663
40:48:00	0.0000	0.0000	0.0000	0.0000	0.00066	0.00066
40:56:00	0.0000	0.0000	0.0000	0.0000	0.000657	0.000657
41:04:00	0.0000	0.0000	0.0000	0.0000	0.000654	0.000654
41:12:00	0.0000	0.0000	0.0000	0.0000	0.000651	0.000651
41:20:00	0.0000	0.0000	0.0000	0.0000	0.000649	0.000649
41:28:00	0.0000	0.0000	0.0000	0.0000	0.000646	0.000646
41:36:00	0.0000	0.0000	0.0000	0.0000	0.000643	0.000643
41:44:00	0.0000	0.0000	0.0000	0.0000	0.00064	0.00064

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
41:52:00	0.0000	0.0000	0.0000	0.0000	0.000637	0.000637
42:00:00	0.0000	0.0000	0.0000	0.0000	0.000635	0.000635
42:08:00	0.0000	0.0000	0.0000	0.0000	0.000632	0.000632
42:16:00	0.0000	0.0000	0.0000	0.0000	0.000629	0.000629
42:24:00	0.0000	0.0000	0.0000	0.0000	0.000627	0.000627
42:32:00	0.0000	0.0000	0.0000	0.0000	0.000624	0.000624
42:40:00	0.0000	0.0000	0.0000	0.0000	0.000621	0.000621
42:48:00	0.0000	0.0000	0.0000	0.0000	0.000618	0.000618
42:56:00	0.0000	0.0000	0.0000	0.0000	0.000616	0.000616
43:04:00	0.0000	0.0000	0.0000	0.0000	0.000613	0.000613
43:12:00	0.0000	0.0000	0.0000	0.0000	0.00061	0.00061
43:20:00	0.0000	0.0000	0.0000	0.0000	0.000608	0.000608
43:28:00	0.0000	0.0000	0.0000	0.0000	0.000605	0.000605
43:36:00	0.0000	0.0000	0.0000	0.0000	0.000603	0.000603
43:44:00	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006
43:52:00	0.0000	0.0000	0.0000	0.0000	0.000597	0.000597
44:00:00	0.0000	0.0000	0.0000	0.0000	0.000595	0.000595
44:08:00	0.0000	0.0000	0.0000	0.0000	0.000592	0.000592
44:16:00	0.0000	0.0000	0.0000	0.0000	0.00059	0.00059
44:24:00	0.0000	0.0000	0.0000	0.0000	0.000587	0.000587
44:32:00	0.0000	0.0000	0.0000	0.0000	0.000585	0.000585
44:40:00	0.0000	0.0000	0.0000	0.0000	0.000582	0.000582
44:48:00	0.0000	0.0000	0.0000	0.0000	0.00058	0.00058
44:56:00	0.0000	0.0000	0.0000	0.0000	0.000577	0.000577
45:04:00	0.0000	0.0000	0.0000	0.0000	0.000575	0.000575
45:12:00	0.0000	0.0000	0.0000	0.0000	0.000572	0.000572
45:20:00	0.0000	0.0000	0.0000	0.0000	0.00057	0.00057
45:28:00	0.0000	0.0000	0.0000	0.0000	0.000567	0.000567
45:36:00	0.0000	0.0000	0.0000	0.0000	0.000565	0.000565
45:44:00	0.0000	0.0000	0.0000	0.0000	0.000562	0.000562
45:52:00	0.0000	0.0000	0.0000	0.0000	0.00056	0.00056
46:00:00	0.0000	0.0000	0.0000	0.0000	0.000558	0.000558
46:08:00	0.0000	0.0000	0.0000	0.0000	0.000555	0.000555
46:16:00	0.0000	0.0000	0.0000	0.0000	0.000553	0.000553
46:24:00	0.0000	0.0000	0.0000	0.0000	0.00055	0.00055

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (m ³ /s)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m ³ /s)	Total Flow (m ³ /s)
46:32:00	0.0000	0.0000	0.0000	0.0000	0.000548	0.000548
46:40:00	0.0000	0.0000	0.0000	0.0000	0.000546	0.000546
46:48:00	0.0000	0.0000	0.0000	0.0000	0.000543	0.000543
46:56:00	0.0000	0.0000	0.0000	0.0000	0.000541	0.000541
47:04:00	0.0000	0.0000	0.0000	0.0000	0.000539	0.000539
47:12:00	0.0000	0.0000	0.0000	0.0000	0.000536	0.000536
47:20:00	0.0000	0.0000	0.0000	0.0000	0.000534	0.000534
47:28:00	0.0000	0.0000	0.0000	0.0000	0.000532	0.000532
47:36:00	0.0000	0.0000	0.0000	0.0000	0.000529	0.000529
47:44:00	0.0000	0.0000	0.0000	0.0000	0.000527	0.000527
47:52:00	0.0000	0.0000	0.0000	0.0000	0.000525	0.000525
48:00:00	0.0000	0.0000	0.0000	0.0000	0.000523	0.000523
48:08:00	0.0000	0.0000	0.0000	0.0000	0.00052	0.00052
48:16:00	0.0000	0.0000	0.0000	0.0000	0.000518	0.000518
48:24:00	0.0000	0.0000	0.0000	0.0000	0.000516	0.000516
48:32:00	0.0000	0.0000	0.0000	0.0000	0.000514	0.000514
48:40:00	0.0000	0.0000	0.0000	0.0000	0.000511	0.000511
48:48:00	0.0000	0.0000	0.0000	0.0000	0.000509	0.000509
48:56:00	0.0000	0.0000	0.0000	0.0000	0.000507	0.000507
49:04:00	0.0000	0.0000	0.0000	0.0000	0.000505	0.000505
49:12:00	0.0000	0.0000	0.0000	0.0000	0.000503	0.000503
49:20:00	0.0000	0.0000	0.0000	0.0000	0.0005	0.0005
49:28:00	0.0000	0.0000	0.0000	0.0000	0.000498	0.000498
49:36:00	0.0000	0.0000	0.0000	0.0000	0.000496	0.000496
49:44:00	0.0000	0.0000	0.0000	0.0000	0.000494	0.000494
49:52:00	0.0000	0.0000	0.0000	0.0000	0.000492	0.000492
50:00:00	0.0000	0.0000	0.0000	0.0000	0.00049	0.00049
50:08:00	0.0000	0.0000	0.0000	0.0000	0.000488	0.000488
50:16:00	0.0000	0.0000	0.0000	0.0000	0.000485	0.000485

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.35	No
BFIHOST19	0.36	No
PROPWET	0.37	No
SAAR (mm)	852	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

Appendix C Drainage Plans

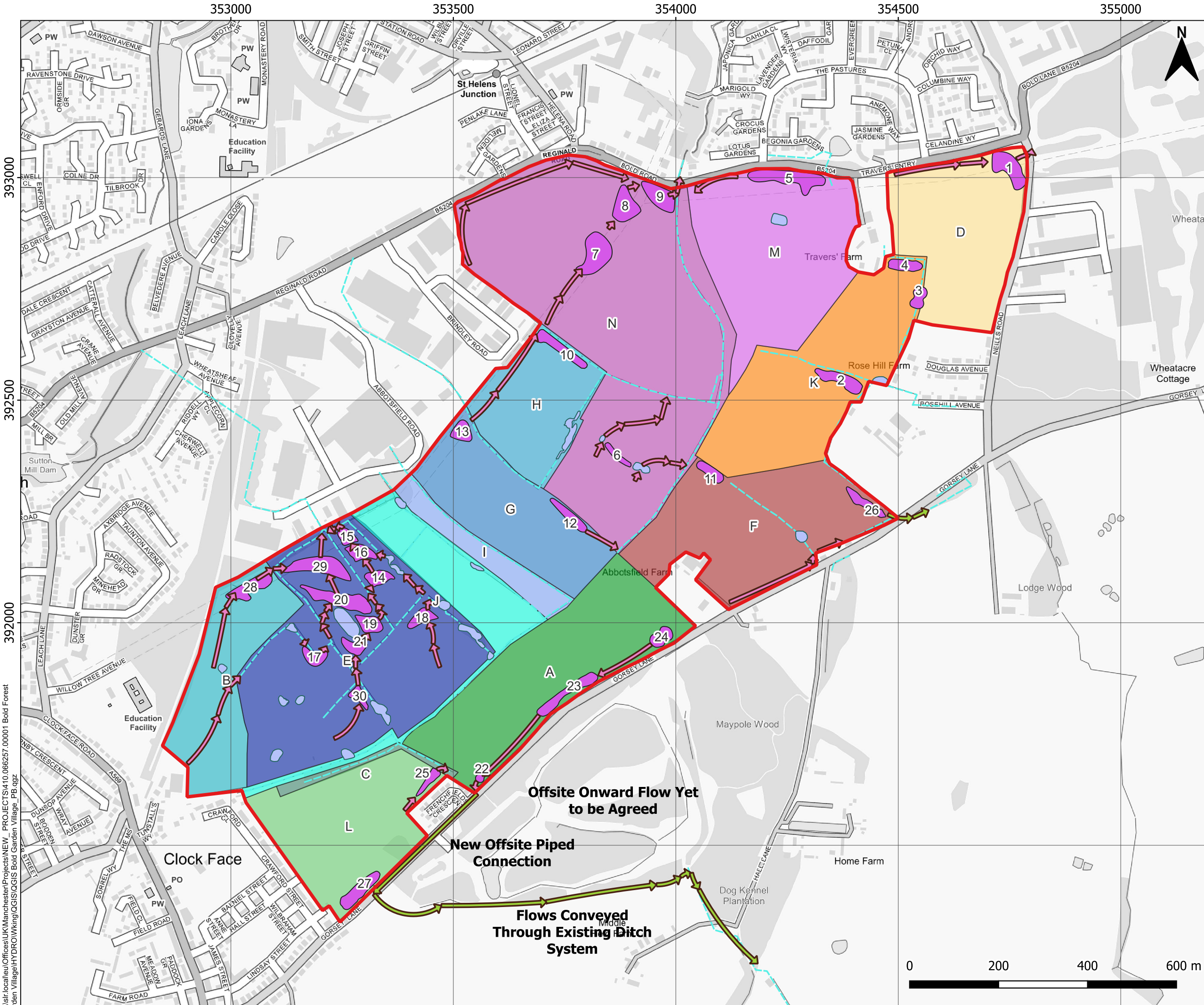
Bold Forest Garden Village

Surface Water Drainage Strategy Overview

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025



LEGEND

Site Boundary

Proposed Attenuation

Existing Drainage Ditches

Existing Ponds

Conveyance Route

Within Site Boundary

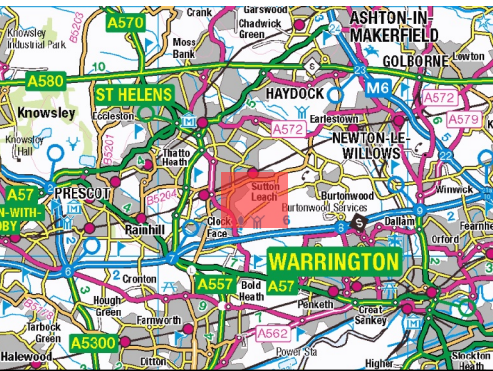
Outside Site Boundary

Catchments PB

A
B
C
D
E
F
G
H
I
J
K
L
M
N

Notes

DRAFT VERSION



Bold Forest Garden Village

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BOLD FOREST GARDEN VILLAGE

BASELINE REPORT

DRAFT ONSITE ATTENUATION

Appendix A

Scale 1:8,000 @ A3

Date SEPTEMBER 2025

\\slr\local\slr\UK\Manchester\Projects\NEW_PROJECTS\10.066257.00001 Bold Forest Garden Village\HYDROW\GIS\QGIS Bold Garden Village_PB.qgz

Appendix D Foul Water Diagram

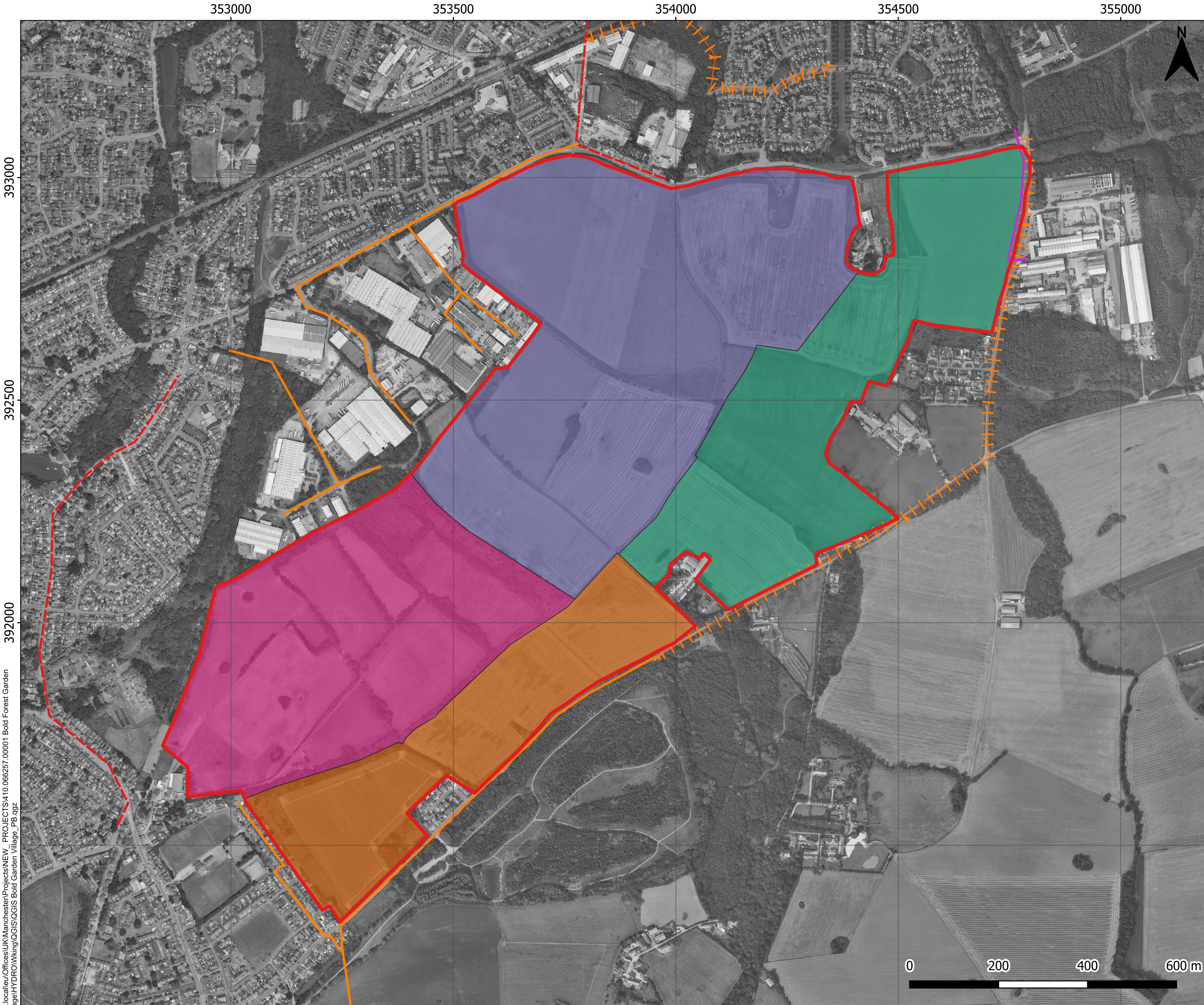
Bold Forest Garden Village

Surface Water Drainage Strategy Overview

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025



LEGEND

Site Boundary

Mapped Foul Water Pipes

Combined

Foul

Rising

Overflow

Foul Water Catchment Direction

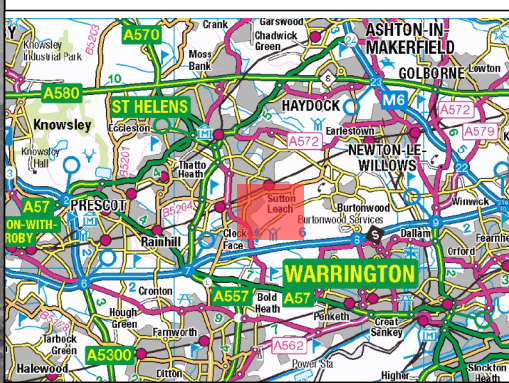
South

East

North

West

Notes



Bold Forest Garden Village

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BOLD FOREST GARDEN VILLAGE

UNITED UTILITIES DATA

ONSITE FOUL CATCHMENTS

Appendix A

Scale1:8,000 @ A3

DateMAY 2025



Appendix E SuDS Design Brief

Bold Forest Garden Village

Surface Water Drainage Strategy Overview

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025



Bold Forest Garden Village

Sustainable Drainage Design Brief

St Helen's Council

Prepared by:

SLR Consulting Limited

3rd Floor, Summit House, 12 Red Lion Square,
London, WC1R 4QH

SLR Project No.: 403.065666.00001

Client Reference No: UK.130570

30 October 2025

Revision: 02

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
01	2 October 2025	PB	DW	DW
02	30 October 2025	DW	MB	MB

Basis of Report

This document has been prepared by SLR Consulting Limited (SLR) with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with St Helen's Council (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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1.0 Introduction

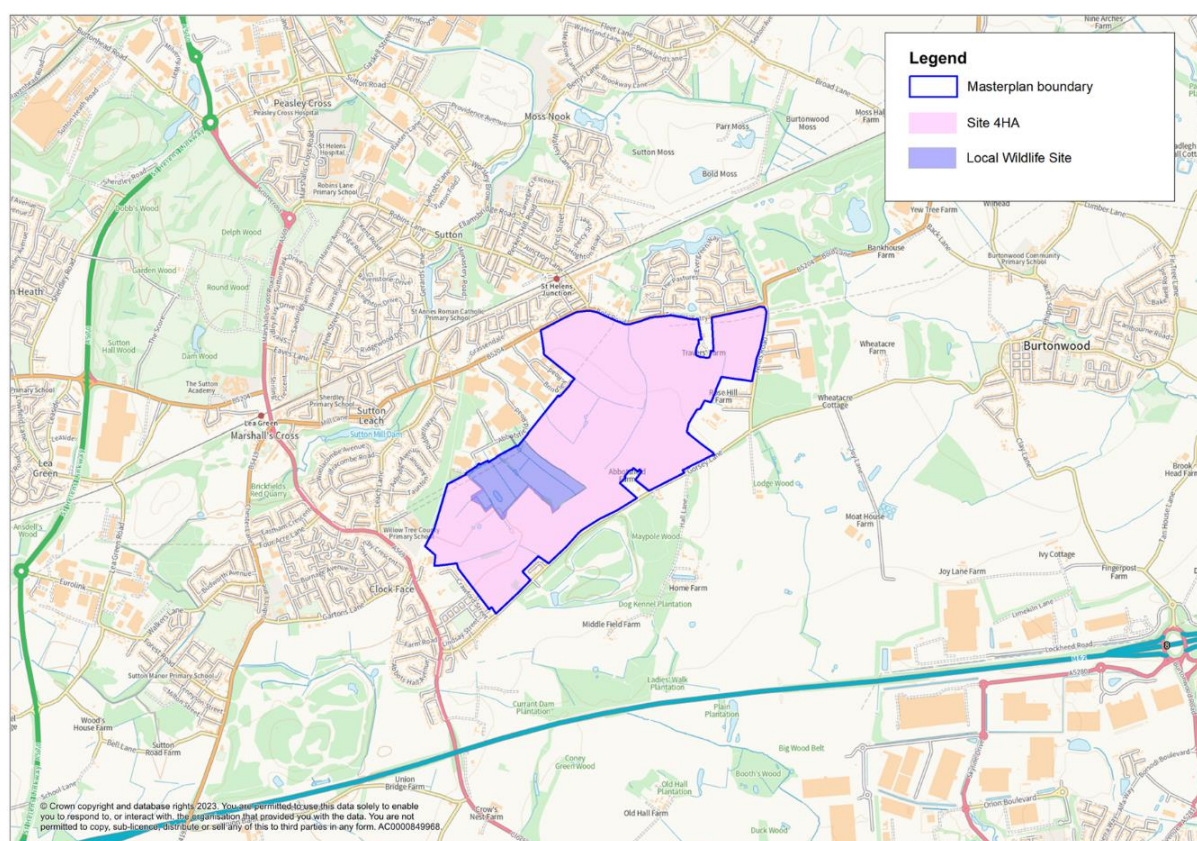
St Helens Borough Council's Local Planning Authority (the Council) has appointed SLR Consulting Limited (SLR) to deliver a Masterplan Framework for Bold Forest Garden Village (BFGV). This sustainable drainage (SuDS) design brief has been prepared in support of ongoing works on the BFGV.

1.1 Site Location and Context

The BFGV site is located on the southeastern edge of St Helens, Merseyside. Centred on the National Grid Reference (NGR) SJ 53738 92310. The site is south of the B5204, north of Gorsey Lane and encompasses 132.86 ha.

This location and extent of the land are illustrated in Figure 1.

Figure 1: Site Location Plan



The site comprises 15 land parcels under 12 different land ownerships. Aside from a local nature reserve to the northwest of the site, all land is comprised of arable farmland.

Residential areas border the site to the north and west with Clock Face Country Park and agricultural fields to the south. Reginald Road Industrial Estate and Bold Industrial Park respectively, lie on the west and east boundaries, alongside multiple private farms in proximity to the site.



1.2 Proposed Development

The BFGV site was released from the Green Belt for the purposes of allocating it for residential development in the Local Plan¹. Initial work undertaken by the Council indicates there to be a potential development capacity of approximately 3,000 dwellings.

This work is intended to inform the masterplanning of the site, which will likely encompass ancillary development, community facilities and open space.

1.3 Objective of SuDS Design Brief

This version of the design brief has been created as part of initial discussions with key stakeholders for the project. The design brief will be updated, extended and appended to the Surface Water Drainage Strategy (SWDS) prepared and submitted in support of a future outline planning application for the scheme.

Once completed the SWDS will provide an overview of drainage within the scheme demonstrating that within the masterplan sufficient space has been allowed in appropriate areas of the Site to ensure key design objectives are achieved. The SWDS will also set out areas where phasing for the proposed development is essential for the delivery of the scheme and confirm which key elements of drainage infrastructure are required to support each phase.

Further details of the proposed drainage arrangements within each phase and the detailed design of the strategic infrastructure will then be developed on a phase-by-phase basis. The designs will take account of the preferred character of development by a given house builder and any changes in best practice, climate change guidance or SuDS technology that are available at that point. These details will be subject to approval from St Helens Council drainage team (the Lead Local Flood Authority) as part of a separate reserved matters application.

This SuDS design brief aims to provide a framework for the detailed design process to ensure that the high aspirations within the outline scheme are best delivered. Where a detailed scheme comes forward in line with the SuDS design brief there will be a presumption that the drainage strategy will be approved. If designs are presented that are contrary to the design brief, these will need to be justified and would only be accepted subject to acceptance from St Helens Council that these changes are warranted. Changes will need to be viewed holistically and give rise to wider benefits that outweigh the negative impacts on drainage.

¹ St Helen's Local Plan , https://www.sthelens.gov.uk/media/4315/St-Helens-Borough-Local-Plan-up-to-2037/pdf/Local_Plan_Written_Statement_-_FINAL_adoption_version.pdf



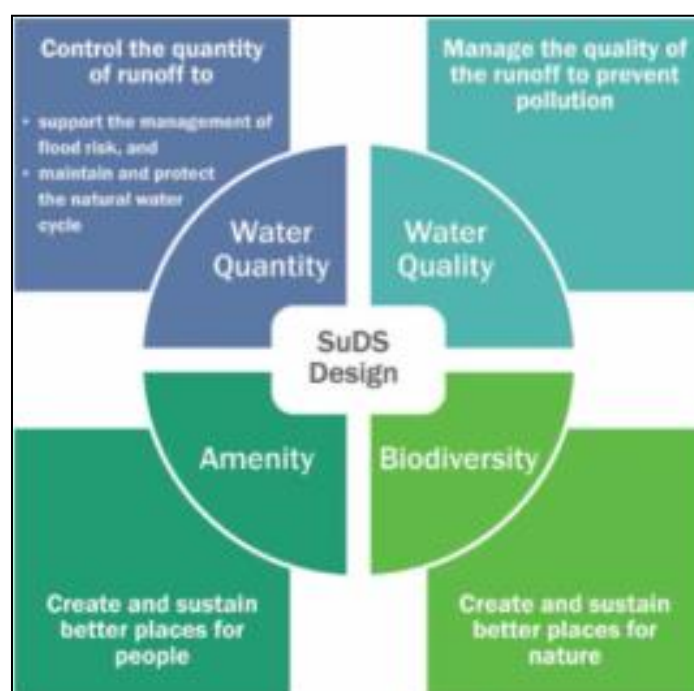
2.0 Sustainable Drainage Principles

The SWDS being developed will set out the requirements for drainage that will be implemented at the site to ensure that it is developed in line with best practice and the requirements of both national policy and St Helens Council, in their role as the LLFA for the area.

2.1 Key Principals of Surface Water Management

Current best practice guidance documents: The Sustainable Drainage System (SuDS) Manual (CIRIA Report C753)² and the National Standards for Sustainable Drainage Systems (SuDS)³ promotes sustainable water management through the use of SuDS. There are four main categories of SuDS which are referred to as the 'four pillars of SuDS design' as depicted in Figure 2.

Figure 2: Four Pillars of SuDS (extract from CIRIA Report C753)



The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train'. The hierarchy of techniques is identified as:

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting).
- Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).

2 Report C753, The SuDS Manual; CIRIA (2015). Report C753, November 2015.

3 National standards for sustainable drainage systems (SuDS), Department for Environment, Food & Rural Affairs, July 2025. Accessed at: <https://www.gov.uk/government/publications/national-standards-for-sustainable-drainage-systems/national-standards-for-sustainable-drainage-systems-suds>



- Regional Control – management of runoff from several sites, typically in a retention pond or wetland.

2.1.1 National Policy Context

Current national planning policy guidance and best practice, namely NPPF and PPG, require development proposals in all flood zones to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

2.1.2 Local Policy Context

St Helens Council has published its own Surface Water Drainage (SuDS) guidance- Design and Technical Guidance in 2020⁴. The guide is intended to provide direction on the Council's requirements for SuDS on all major developments.

Relevant sections of the guidance have been reproduced within Appendix B, it is noted that certain criterion from the document are superseded by the high aspirations set out within this SuDS Design Brief document.

Drainage submitted as part of the application should be submitted alongside the LLFA SuDS Assessment Checklist⁵.

2.2 Drainage Strategy Overview

As a greenfield site, consisting of undeveloped fields, rainfall falling on the site will mostly infiltrate into the shallow soils to either be stored or evaporated during drier periods. While this will need to be confirmed for each plot the working assumption is that low-permeability shallow geology is dominant and that this reduces the ability for water to discharge to the ground. During heavy rainfall, there is therefore the potential for the ground to become saturated, resulting in surface water runoff discharging from the land as overland flow into one of the small ditches across the site.

The drainage strategy for the development seeks to mirror this existing drainage pattern encouraging infiltration and evaporation of storm water (where feasible) but allowing controlled and restricted runoff towards the local channels for larger storms and during extended wet winter periods.

To achieve this, storm water within the scheme will be managed using sustainable drainage systems (SuDS) such as raingardens, swales and wetlands as well as downstream basins and ponds that all seek to encourage infiltration and to slow and clean water as it discharges through and from the site. The SuDS will also be designed to enhance amenity and biodiversity by creating pockets of wet habitats through the site. The scheme will require some strategic SuDS area/features that serve multiple plots. For these, careful consideration of phasing and space within the masterplan will be required.

Source control measures such as property-level rainfall harvesting, permeable paving (not for individual properties, but potential for communal car parks), rain gardens and tree pits will be used throughout the site. Excess stormwater discharging from these and any hard surfaces, will be collected and conveyed by a network of swales and existing drainage ditches routed alongside roads and pedestrian routes to areas where stormwater for larger

4 St. Helens Council, Sustainable Drainage Systems, Design and Technical Guidance 2020, Flood and Water Management Act 2010, May 2020

5 St. Helens Council SuDS Submission Application and Approval Checklist, Accessed from: <https://www.sthelens.gov.uk/article/7555/Sustainable-drainage>



events can be controlled prior to discharge into one of the streams that pass through the site.

The features for storm water control will be integrated into the landscape design and the form and planting will seek to reflect both ground conditions and the character of the local area and so may include meadows, wet woodland, or open water. Each area will be sympathetically landscaped using a shallow profile (typical side slopes 1 in 4) and planting to avoid the need for the basin as a whole or wetter areas within the basin to be fenced off.

Once finalised this SuDS Design brief will form an integral part of that SWDS confirming the required standards for plot level drainage as well as details of the strategic SuDS element that needs to be captured during the process of detailed design.



3.0 SuDS Design Brief

SuDS measures can be broadly classified into the following areas;

- Source Control
- Conveyance
- Attenuation Control

3.1 Source Control

Source control measures act to manage storm water at or close to where it falls so that it does not enter the drainage system or is delayed/attenuated before it enters the drainage system. Source Control measures are critical for maintaining groundwater recharge and the quality of surface water discharge. Source control measures will also be important in helping the development meet wider sustainability objectives in terms of reducing water usage and creating an ecologically diverse and interesting environment at a plot level

Source control measures will be the primary control for storm water for the large majority of storms across the site and as a minimum, the source control measures will be sufficient to intercept and hold the first 5mm of a summer storm. This is in line with guidance provided by St Helens Council.

The following Source control hierarchy will be used on the site at an individual building plot level is as followed;

- 1 Green roofs,
- 2 SuDS Pods
- 3 Rain gardens,
- 4 Property-level rainfall harvesting for external irrigation (water butts),

The Source control hierarchy should be followed in order with a minimum of at least two of these techniques employed on each building (or building plot) constructed on the site.

Beyond the individual plot boundaries, the amount of hard standing will be minimised through good design and the use of reinforced vegetated tracks (grass paving etc) where vehicle access is only occasionally required (i.e. through public open space or into SuDS basins).

Source control measures will also be implemented within the public realm and street areas. These measures will include;

- Permeable paving for parking bays;
- Tree pits in all locations where landscaping design specifies tree planting along roads;
- Roadside collection swales and rain gardens (subject to adoption); and
- Roadside filter drains only where the above measures are not reasonably possible or to link other SuDS features together.

These measures will be incorporated into all streets on the site to remove the need for traditional storm water gullies and piped drainage connections. Storm water will be directed to discharge directly to the source control features located within or immediately to one side of the road.

In all cases, more than 5% of land coverage within individual development parcels will be utilised for source control SuDS measures.



3.2 Conveyance

Conveyance features are required to move excess storm water that cannot be accommodated in local source control features toward areas where water can be attenuated and controlled prior to discharge into one of the surrounding natural channels.

Where possible conveyance of storm water through the site will be achieved using unlined SuDS to promote infiltration (at low rates). The onsite aspiration is to avoid pipework in favour of conveying storm flows within SuDS features. It is however acknowledged that some short lengths of pipe connection will be required in certain locations, for example, to facilitate crossing over other services.

Local Scale

Conveyance via SuDS will be achieved through linking smaller source control areas together allowing excess water to cascade down the system into subsequent areas. This will maximise the use of local storage and infiltration capacity prior to onward discharge.

Strategic Scale

At a more strategic level, water will be transported via the existing onsite ditch network highlighted within the Surface Water Drainage Scheme (SWDS). These ditches are the existing conveyance mechanism, providing an important habitat that enhances the public domain.

Where it is not possible to convey flows within the existing ditch system, flows will be transferred through new swales that are intended to provide new wetland habitat and clean water.

Each swale will be designed in line with St Helens Council guidance to ensure that it has;

- a base width of between 0.5m and 2m (depending on modelled inflows),
- a maximum depth of 0.5m and a freeboard of 150mm during design flow conditions,
- a minimum length of 30m,
- a maximum side slope of 1 in 4,
- a maximum longitudinal gradient (without checks) of 1 in 40,
- a maximum longitudinal gradient of 1 in 10, and
- a maximum length without checks on the flow of 50m (overflow weirs or similar).

Over and above these criteria the swales should ideally be designed with variety in their course and profile to better replicate natural channels.

Immediately upstream of flow checks (check dams etc) opportunities should be taken to create wider and more open areas that are normally wet (lined) and slightly deeper than the swale itself. These wetland areas should be planted with reeds or other wetland planting of local origin. Once mature the vegetation will further slow and filter storm flows progressing along the swale.

Easements of 3m along swale features should be allowed for access. Within these easements, no raised structures will be permitted

3.3 Attenuation Control

Attenuation areas will provide space for excess storm flows from larger storms to be held and controlled before onward discharge into the adjacent natural channels at a low greenfield (1 in 1) rate.



The scheme has been designed such that these attenuation areas are provided throughout the site and downgradient of individual development parcels. However, the final form and detail of these areas still need to be progressed.

Opportunities should also be sought to incorporate smaller basins through the scheme particularly within areas of public open space. This would be in addition to rather than a replacement to the wider SuDS network planned.

The basins will avoid hard engineering infrastructure where possible and will reflect details of the final landscaping strategy and also the existing landscape character in which it will sit. For example:

- Attenuation basins close to the wildlife site might be planted with trees and act as wet woodland with wetland areas at the base.
- Attenuation basins within the existing farmland areas of the site might be a mixture of grassland and open water reflecting the adjacent farmland.

Full details of the final form and function of the basins will be set out as a part of the detailed design with specific statements confirming how landscape, amenity and ecology benefits will be appropriately achieved. This will include details of the proposed planting strategy which will be developed incorporating recommendations contained within the planting guidance produced by St Helens Council.

Over and beyond these detailed design decisions, the following general design principles will be applied to all basins:

- Side slopes into the basins will be no steeper than 1 in 4 with platforms included to break up the slope such that, once completed and operational, no fencing will be required to restrict access into the basins.
- One flank of each basin will be constructed at a grade of 1 in 10 to facilitate vehicle access into the basin for long-term maintenance
- An easement of 3m around the outside of each basin will be provided to allow access for long-term maintenance. Within this easement, no raised structures or tree planting is permitted.
- The maximum excavated basin depth (from average external ground level to outfall invert) will be 2.0m
- Areas within the base of the basin can be locally lowered beneath 2.0m to create areas of permanent open water and wetland where required to achieve ecological and amenity objectives. The profile across the lowered areas should ensure that normal water depths do not exceed 0.3m for the first 2m (from the edge of the permanent water features). This is to manage health and safety concerns and provide habitat for marginal vegetation growth.
- If necessary, areas of permanent open water can be clay-lined to minimise losses via infiltration, this would ensure the ecological value of the area is maintained during the summer. Away from areas designed to be permanent open water, the basins will be unlined to promote infiltration at limited rates.
- Reinforced grass spillways will be constructed on the downgradient side of each basin to allow the overflow of exceedance flows in the event of a blockage or any extreme storms beyond design standards.
- Pedestrian and cycle routes into and through the peripheral areas of the basins are to be encouraged to integrate the basin areas into the wider public open space. The basin design will ensure that the annual probability of these routes flooding will be less than 1 in 30 including an appropriate climate change uplift.



- Outfalls from basins will seek to minimise hard/concrete infrastructure in favour of naturalised outflow channels with necessary structures constructed using vegetated reinforced bag work or other similar approaches that result in green vegetated finishes.
- Outfall structures should be set back from the existing natural channels with the final discharge towards those channels during storm events achieved using naturalised channels or depressions.

3.4 SuDS Checklist

A SuDS checklist is provided in Appendix A. This is intended to provide an easy reference to consider whether individual strategies developed and brought forward with the Bold Forest Garden Village are in line with the requirements specified in the SuDS design brief.

This check list should be considered in addition to and not instead of the check St Helens SuDS Assessment Checklist⁶.

6 St Helens SuDS Checklist, V1, https://www.sthelens.gov.uk/media/6361/STH-SuDS-Assessment-Checklist-v1/xls/STH_SuDS_Assessment_Checklist_v1_1.xlsx?m=1686773844250



Appendix A SuDS Check List

Bold Forest Garden Village

Sustainable Drainage Design Brief

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025



St Helens Garden Neighbourhood – SuDS Design Code Checklist		
A. Source Control		
A1	Has the Source Control hierarchy been applied at a plot level	
A2	Have at least two source control measures been utilised on each building or building plot	
A3	Are all roadside parking bays specified to be permeable	
A4	Has all tree planting along roads been specified as tree pits that receive storm runoff	
A5	Is all road drainage being routed to source control features	
A6	Has at least 5% of land at a development parcel level been used for local source control SuDS measures	
A7	Will source control measure be effective in intercepting the first 5mm of summer rainfall	
B. Conveyance		
B1	Has the drainage design avoided the need for traditional piped road drainage	
B2	Are source control features and areas effectively linked to create conveyance	
B3	Do the profiles and dimension of the larger swales meet the following criteria; • a base width of between 0.5m and 2m (depending on modelled inflows), • a maximum depth of 0.5m and a freeboard of 150mm during design flow conditions, • minimum length 30m • a maximum side slope of 1 in 4, • a maximum longitudinal gradient of 1 in 40 (without checks), • a maximum longitudinal gradient of 1 in 10 • a maximum length without checks on the flow of 50m (overflow weirs or similar).	
B4	Do the swales include variety in the form and profile to better replicate a natural channel.	
B5	Are lined and widened wetland areas included upgradient of flow checks.	
B6	Are planting details provided for the wetland areas and does the planting mix specify an approximate mix of local origin.	
B7	Is a 3m maintenance access easement provided along swales.	
C. Attenuation Control		
C1	Is the peak rate of discharge from the basin restricted to the QBAR greenfield runoff rate from the land that actively drains to the basin.	
C2	Are the basin side slopes a maximum gradient of 1 in 4 or less	



St Helens Garden Neighbourhood – SuDS Design Code Checklist		
C3	Has one flank been specified with a gradient of 1 in 10 or less for vehicle access	
C4	Is a 3m maintenance access easement provided around the edge of the basin.	
C5	Can it be confirmed that no fencing is required and that any areas of deep water (>0.3m) are at least 2m back from the normal water's edge.	
C6	Has a landscape statement been provided and does this evidence that reasonable measures have been made to integrate the SuDS basin in the existing and development landscape.	
C7	Has an amenity statement been provided and does this evidence that reasonable measures have been made to integrate basins into the wider public open space provision through use of access routes and play area.	
C8	Has an ecology statement been provided and does this evidence that reasonable measures have been made to maximise the ecological potential for the SuDS basins through the inclusion wet features	
C9	Are planting details provided for wetland areas and does this specify appropriate wetland mix of local origin.	
C10	Has an exceedance overflow route / spillway been specified as part of the basin design.	
C11	Has the outfall for the basin been specified to minimise the use of hard structures and maximise vegetated surfaces.	
C12	Is the discharge route from the basin towards the receiving watercourse naturalised	
C13	Have the use of small-scale basin features been considered within Public Open Spaces	



Appendix B St Helen's Technical Guidance

Bold Forest Garden Village

Sustainable Drainage Design Brief

St Helen's Council

SLR Project No.: 403.065666.00001

30 October 2025



Guidance from St Helens Council has been reproduced within the section below, full details of the guidance are available within the guidance document⁴.

Drainage Hierarchy

Order of Preference for Connection	
(1) Surface water is collected for site use (domestic, industrial etc.)	Preferred  Least Preferred
(2) Discharge to the ground via infiltration	
(3) Discharge to a watercourse or surface water body	
(4) Discharge to surface water sewer which discharges to a watercourse etc.	
(5) Discharge to surface water sewer which discharges to a treatment centre etc.	
(6) Discharge to combined sewer	

Drainage Design

All connecting manholes should be included in the model. Representation of the hard surfaces draining to the network should be accurately allocated to the drainage system and all manholes should normally be included in the model. Surface water drainage should be designed for runoff from roofs and subject to the agreement of the Undertaker, roads (including verges) and other hard-standing areas. For these areas impermeable runoff coefficient of 100% shall be assumed.

An additional increase in the paved surface area of 10% shall be assumed for all areas to allow for future urban expansion (extensions and additional paved areas) unless this would produce a figure greater than 100% of the site. Refer to Section 6.3 for further information. Design event rainfall should be based on the use of the most recent version of the Flood Estimation Handbook specific to the location of the development. An allowance for climate change of an additional 40% (by factoring the rainfall intensity hyetograph values) should be applied unless otherwise specified.

Urban Creep

Urban creep is the gradual loss of permeable surfaces within urban areas which results in increased surface water runoff. Typical examples of urban creep include the creation of patios, the paving over of front gardens to generate space for parking or small-scale house extensions. To ensure that SuDS schemes can cope with future demand, an allowance for urban creep must be made in the design calculations. St. Helens Council will expect the SuDS design to include an allowance for an increase in impermeable area to accommodate urban creep as set out in Table 6a.



Table 6a: Urban Creep Allowance

Residential Development Density (dwellings/ha)	Change Allowance (% of impermeable area)
≤ 25	10*(Default value suggested by Ciria)
30	8
35	6
45	4
≥ 50	2
Flats and Apartments	0

Attenuation Storage

The limiting discharge rates from the site should normally be assessed using the Flood Estimation for Small Catchments (Institute of Hydrology, 1994). For areas smaller than 50 ha it should be applied for 50 ha and linearly interpolated to the development area. Values should be determined for the 1 in 1 year, 1 in 30 year and 1 in 100 years as a minimum. An example calculation and tool for assessing greenfield runoff rates in the St.Helens Council area is provided in Appendix B.

The maximum 1-year water level in attenuation storage should not cause significant backing up of flows in the incoming sewer and a 1-year, 1-hour duration event should not surcharge the drainage network.

Peak flow rate and volume

In low rainfall, there should be no discharge to a surface water body, or sewer that results from the first 5mm of any rainfall event. In low permeability soils where this is not achievable, the developer shall demonstrate to the Council that infiltration has been encouraged through the SuDS management train. In high rainfall either of the two approaches below must be used to manage the surface discharge:

Peak Flow Control

S2- For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

S3- For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume Control

S4- Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5- Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.



S6- Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Approach 1: Restricting both the peak flow rate and volume of runoff: The peak flow rates for the: 1 in 1 year rainfall event and 1 in 100 year rainfall event; must not be greater than the equivalent greenfield runoff rates for these events. The critical duration rainfall event must be used to calculate the required storage volume for the 1 in 100 year rainfall event. The volume of runoff must not be greater than the greenfield runoff volume from the site for the 1 in 100 year, 6 hour rainfall event.

Climate change should be considered in attenuation storage calculations by increasing the rainfall depth using a climate change factor. Current Environment Agency guidance should be referenced to apply the appropriate climate change factors relevant to the location and design life of the proposed development.

Approach 2: Restricting the peak flow rate:- The critical duration rainfall event must be used to calculate the required storage volume for the 1 in 100 year rainfall event.

- The flow rate discharged: For the 1 in 1 year event, must not be greater than either the greenfield runoff rate from the site for the 1 in 1 year event, or 2 litres per second per hectare (l/s/ha);
- And for the 1 in 100 year event must not be greater than either the greenfield mean annual flood for the site, or 2 litres per second per hectare (l/s/ha).

Exceedance

The design of the drainage system must take into account the impact of rainfall falling on any part of the site and also any estimated surface runoff flowing onto the site from adjacent areas. Drainage systems must be designed so that, unless an area is designated for flood management in the Local Flood Risk Management Strategy, flooding from the drainage system does not occur: on any part of the site for a 1 in 30 year rainfall event; and during a 1 in 100 year rainfall event in any part of a building (including a basement) or utility plant susceptible to water (e.g. pumping station or electricity substation) or on neighbouring sites during a 1 in 100 year rainfall event.

Flows that exceed the design criteria must be managed in flood conveyance routes, preferably in green networks, that minimise the risks to people and property both on and off the site. When considering exceedance routes, particular attention should be paid to: The position of walls, bunds and other obstructions that may direct water but must not cause ponding; the location and form of buildings (e.g. terraces and linked detached properties) that must not impede flows or cause ponding; The finished floor levels relative to surrounding ground. Submitted drawings and calculations must identify sources of water entering a site pre development, how flows will be routed through a site, where flows leave the site pre development and where they leave the site post development. For highway adoption, private or nonadopted areas (e.g. driveways) must actively place in measures to reduce water flow to adoptable areas.

Local Standard M - Multiple Benefits

The SuDS design must demonstrate, where appropriate, how environmental site constraints have been considered and how the features design will provide multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure and the enhancement of historical features. CIRIA has developed a freely available tool with associated guidance which makes it easier to assess the benefits of SuDS. The BeST (Benefits of SuDS Tool) can be accessed via the Susdrain website.



Phased Development and Drainage Strategies

For phased developments, the LLFA will expect planning applications to be accompanied by a Drainage Strategy which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase. Expected that the whole development discharge rate is assessed as one value, then broken down to individual phases/sections. Any alterations to individual phases/section discharge rates will change the allowable rates for the additional phases (totalling no greater than the overall site value).

Permeable Paving

The use of permeable paving systems should not be used in domestic situations where maintenance is the responsibility of the individual dwelling owners where the component attenuated storage is counted as a percentage of the sites overall surface water storage. In this case certain property owners would in effect have greater responsibility of maintenance, this is due to cumulative flows and any failure would affect multiple adjacent dwellings. Other options for storage requirements must be investigated.

Permeable systems will be considered only while used in a groundwater infiltration system or where the permeable paving system or equivalent is not included as part of the sites storage and climate change volumes. Full construction detail and assessment of permeable paving system must be provided as part of the full planning submission.

Pollution Prevention and Control

St.Helens Council will expect the SuDS to demonstrate how pollutants are prevented or controlled as part of the SuDS scheme. This should include consideration of the sensitivity of receiving waterbodies and particular attention should be given to the first 5mm of rainfall ('first flush' that mobilises the most pollutants).

Swales Design

Reference building regulations in distance easements of infiltration potential near or affecting buildings / structures. Swale systems should be designed for temporary storage (30 to 100 year event) or conveyance. Swales should be used as source controls only.

- Swales should be Trapezoidal or parabolic in cross section;
- The side slopes of a swale shall be a maximum of 1 vertically to 4 horizontally;
- Base shall be a minimum of 0.5m and a maximum of 2m wide and designed to avoid formation of rills;
- Depth shall be between (400-600mm) and achieve a freeboard of 150mm during design flow conditions;
- Swales shall be no less than 30m in length, the longitudinal slope of the swale shall not exceed 1 vertically to 40 horizontally without the use of check dams and shall not exceed 1 vertically to 10 horizontally.
- Designed so flow from a 1 in 1 year 30-minute storm event does not exceed 0.3m/s or 100mm in depth;
- The average velocity should be calculated using Manning's equation with a roughness coefficient of 0.025 for flows up to the grass height. Grass height in the channel should be assumed to be 100-150mm;
- Flow above grass height, friction factor can be reduced to 0.01 for analysis of exceedance storm event;
- Storage volumes for the 1 in 1 year design event should dissipate within 24 hours, so that subsequent storms can be accommodated in terms of storage and treatment;
- Where practical, swales should form part of a wide blue/green network, designed for the temporary storage and conveyance of design exceedance storm events 30 to



100 year storm event. The maximum flow velocity should be below 1.0m/s. Higher velocities up to 2.0m/s may be permissible if erosion, soil stability and safety aspects can be demonstrated to the satisfaction of Council.

Detention Basin

Detention basins are surface storage basins or facilities that provide flow control through attenuation of storm water runoff. They also facilitate some settling of particulate pollutants. Detention basins are normally dry and in certain situations the land may also function as a recreational facility. However, basins can also be mixed, including both a permanently wet area for wildlife or treatment of the runoff and an area that is usually dry to cater for flood attenuation. Basins tend to be found towards the end of the SuDS management train, so are used if extended treatment of the runoff is required or if they are required for wildlife or landscape reasons.

- Maximum water depth should not exceed 3m although local safety considerations may reduce this further;
- Length/width ratio should be between 1:2 and 5:1;
- Contouring inside the basin can assist with defining areas likely to be inundated;
- Maximum side slopes of 1 in 4 to allow easy access;
- Sediment forebay or pre-treatment option will improve the water quality;
- Surface water bypass and drawdown is required to facilitate safe maintenance;
- Can be enhanced to improve ecological value;
- Large outlet pipes should be screened.
- Detention basin bases shall be designed with gentle inner slopes (1 to 100 maximum) towards the centre;
- Embankment inner slopes shall be less than 1 to 4;
- The maximum design water depth of the basins shall be 3m;
- The length to width ratio for online detention basins shall be between 5:1 to 2:1;
- The maximum volume of the detention basins shall be 5000m³.
- The drain down time should be a minimum of 24 hours, to allow for sedimentation to take place.





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