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Quality Assurance Record

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1	02/07/2025	A. Osborne	C. Townsend	C. Townsend	1 st Issue
2	17/07/2025	A. Osborne	C. Townsend	C. Townsend	2 nd Issue
3	27/02/2026	A. Osborne	C. Townsend	C. Townsend	3 rd Issue

Limitation of Liability and Use

The work described in this report was undertaken for the party or parties stated; for the purpose or purposes stated; to the time and budget constraints stated. No liability is accepted for use by other parties or for other purposes, or unreasonably beyond the terms and parameters of its commission and its delivery to normal professional standards.

1. INTRODUCTION

1.1 Purpose of this Report

Townsend Water Engineering Ltd. has been appointed by Breck Homes for a Flood Risk Assessment (FRA) for a residential development of 84 dwellings at the land to the north of Huyton Lane, Knowsley, L36 7SB (Grid Ref: 344432, 391326). This report has been prepared in support of the planning permission for the development.

The report is based on the available flood risk information for the site detailed in Section 1.2 and prepared in accordance with the planning policy requirements set out in Section 1.3. The scope of the FRA is consistent with the 'Site Specific Flood Risk Assessment Checklist' from the National Planning Policy Framework (NPPF) and accompanying Planning Practice Guidance (PPG):

<https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section>

1.2 Sources of Information and Consultation

This Report has been informed by:

- Existing draft Site Plan drawings and respective topographic plan delivered by Breck Homes;
- GEOENVIRONMENTAL HUYTON LANE INTERPRETATIVE REPORT (Report Ref: A1356/18/B.0) December 2018;
- UU Sewer Map;
- BGS website <http://mapapps.bgs.ac.uk/geologyofbritain/home.html?mode=boreholes>;
- Defra Magic Map <https://magic.defra.gov.uk/magicmap.aspx>;
- Cranfield University Soil Mapping <http://www.landis.org.uk/soilscapes/>;
- The EA online flood maps;
- Flood Zone Map <https://flood-map-for-planning.service.gov.uk/>; and
- Flood Risk Map: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>.

1.3 Policy Context

This report has been prepared in accordance with the relevant national, regional and local planning policy and statutory guidance as follows:

- National policy contained within the National Planning Policy Framework (NPPF) dated December 2024; and
- The NPPF Planning Practice Guidance (PPG) dated in December 2024.

1.4 Structure of this Report

The Report has been prepared based on the following structure:

- Section 2 refers to spatial planning considerations by reference to the proposed land use, flood zoning and NPPF vulnerability;
- Section 3 presents the assessment of existing flood risk at the site;
- Section 4 presents the proposed development and findings of flooding;
- Section 5 presents an outline of Ironside Farrar drainage strategy design; and
- Section 6 provides a summary of the assessments.

Additional Appendices are provided that deal with the following:

- Appendix A: Topographical Survey
- Appendix B: Ground Testing Report
- Appendix C: EA Flood Levels
- Appendix D: EA Communications about Flood Zones
- Appendix E: LLFA Communications
- Appendix F: Site Layout
- Appendix G: Impermeable Area
- Appendix H: Ironside Farrar Drainage Strategy and Calculations
- Appendix I: Flood Routing
- Appendix J: Simple Pollution Index Approach

2. SPATIAL PLANNING CONSIDERATION

2.1 Location and Background

The location of the proposed development site is shown in Figure 1 and Figure 2, with location details found in Table 1. The site is located at the land to the north of Huyton Lane, Knowsley, L36 7SB (Grid Ref: 344432, 391326).

The proposed development is for the construction of 84 dwellings with access roads and car parking. The development site is 2.216ha and is currently Huyton Cricket & Bowling Club.

Table 1: Site Details Grid Reference Details Taken from the Site <https://www.streetmap.co.uk/>

Reference	Value
OS X (Eastings)	344432
OS Y (Northings)	391326
Nearest Post Code	L36 7SB
Nat. Grid	SJ 44414 91323

The site is surrounded by residential areas. The River Alt runs along the sites northern border – this is an ordinary watercourse that is culverted in the north-east. St Aidens Primary School is to the north-east of the site. Huyton Lane is to the south of the site, from which the site is accessed. These features are shown in figure 2 and 3.

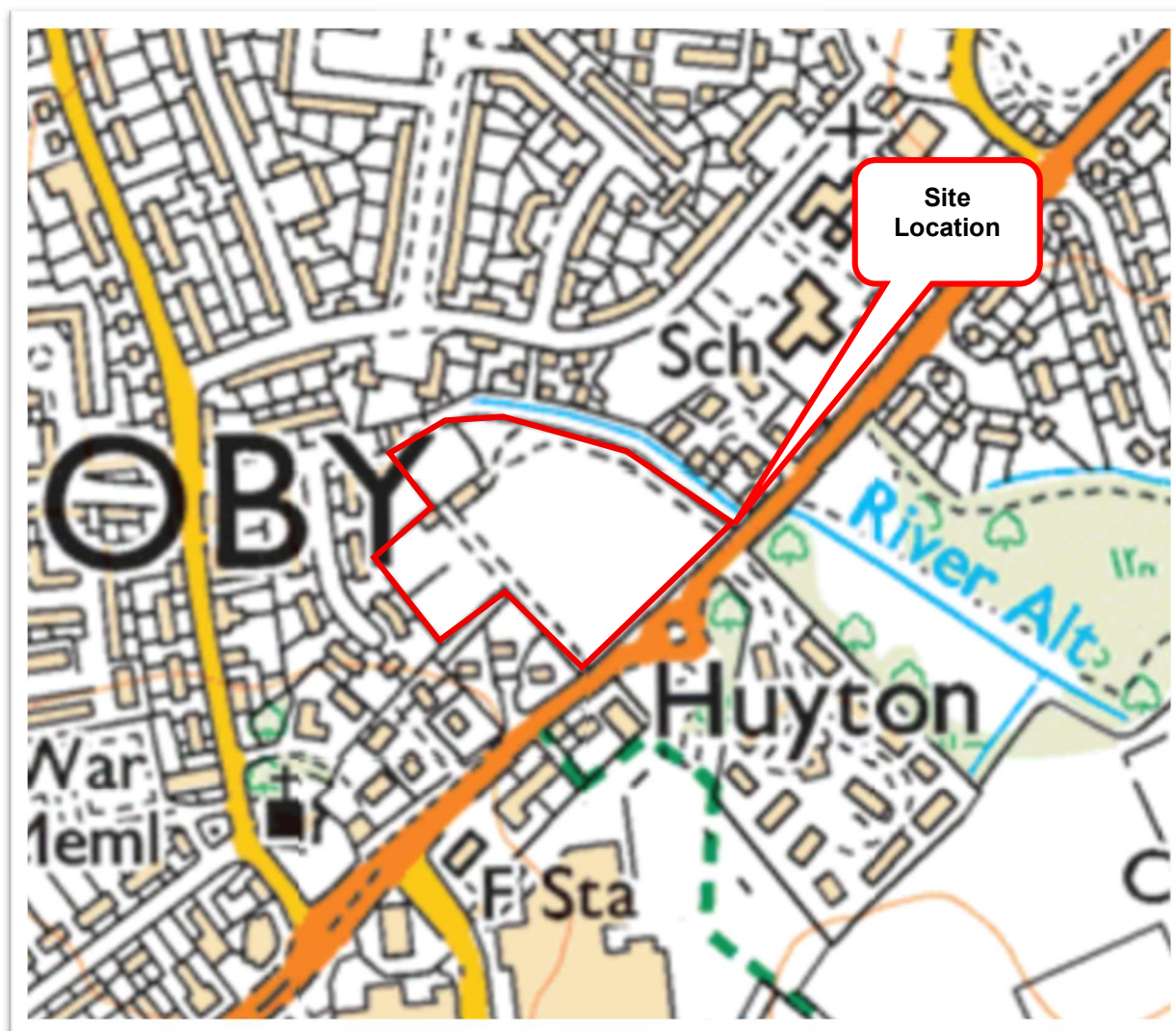


Figure 1: Site Location (Source: Bing OS Map)



Figure 2: Aerial View of the Site (Source: Google Maps)

2.2 Topography

The existing ground elevations on site is shown in the topographic drawing (Figure 3 and Appendix A). They indicate that the site falls from south to north, towards the watercourse in the north. Ground levels vary between 31.24mAOD in the north to 33.49mAOD in the south-west. The River Alt goes into a culvert on the northern boundary.

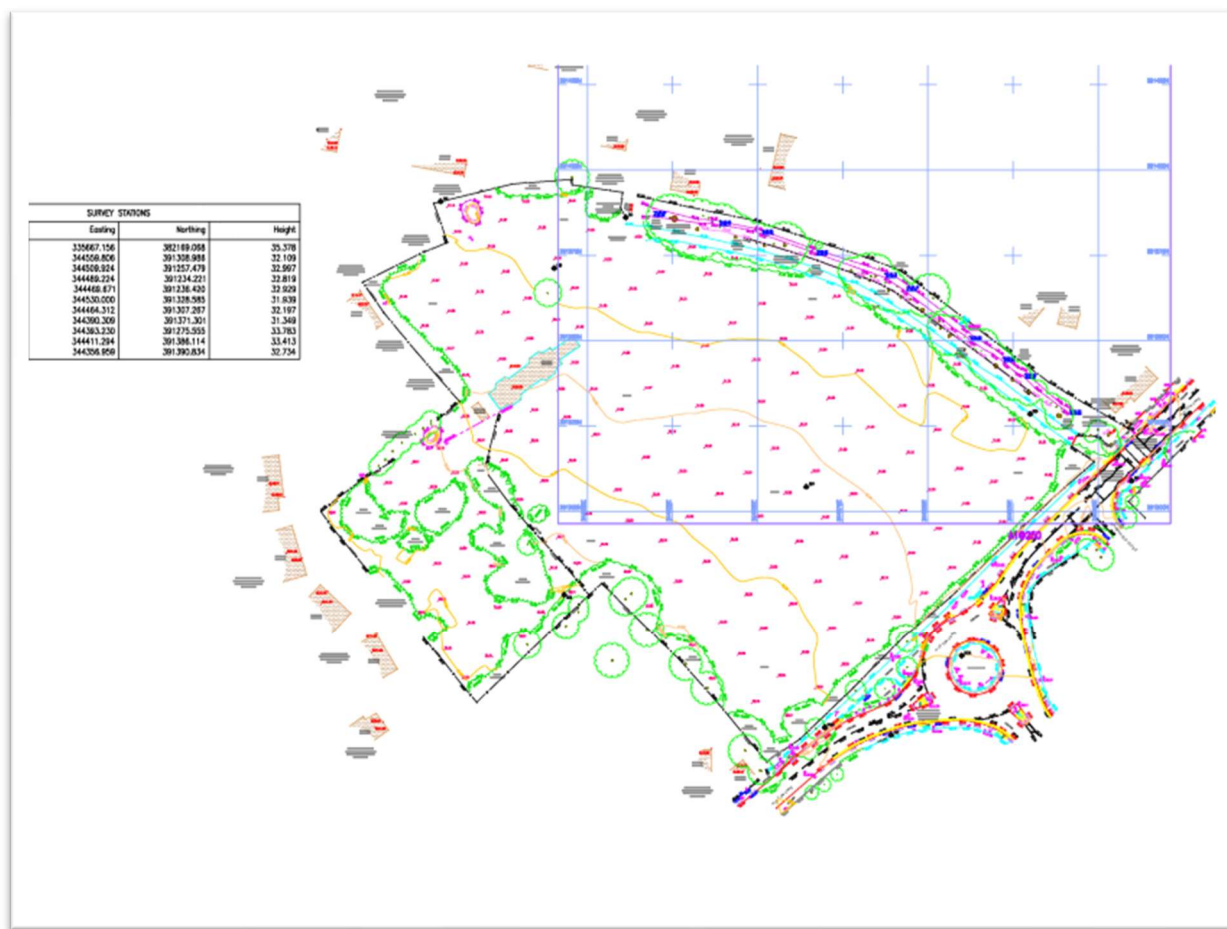


Figure 3: Topographical Survey

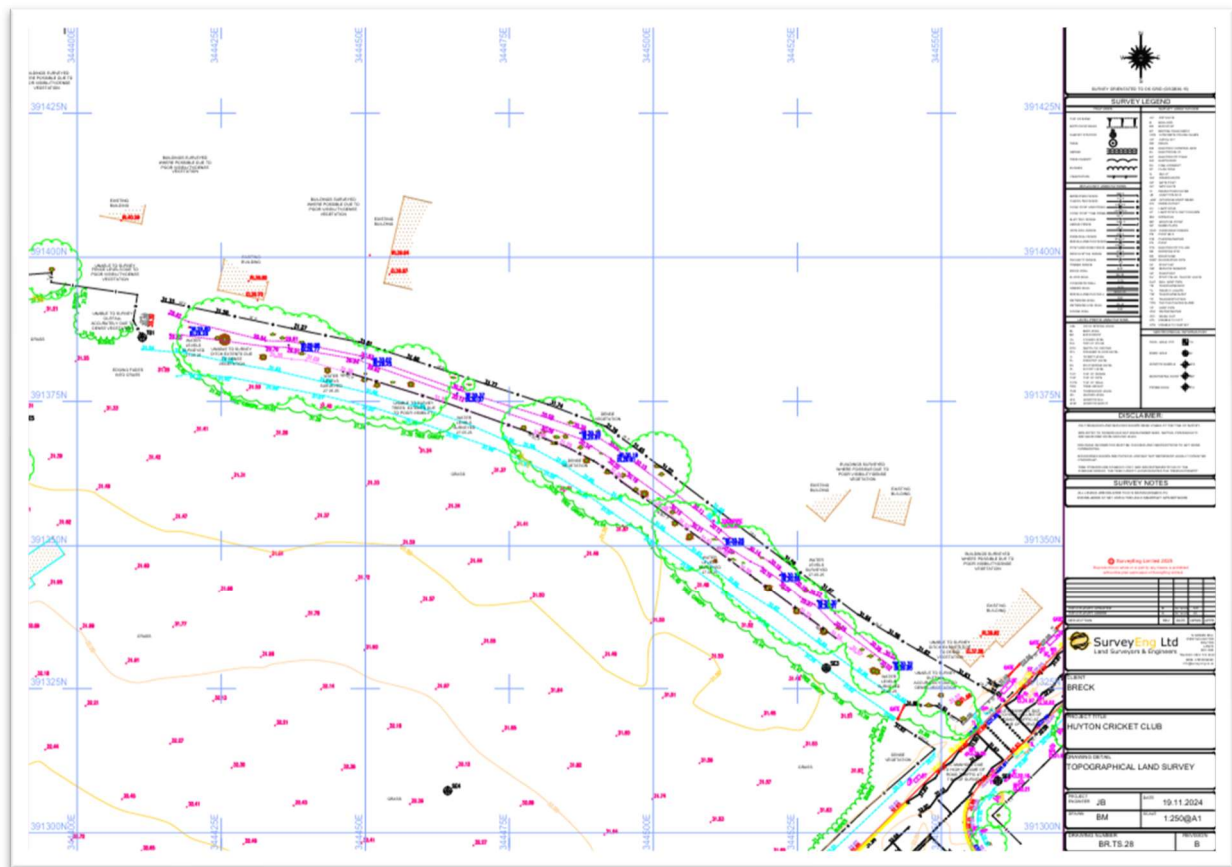


Figure 4: Topographical Levels Along Watercourse

2.3 Geology and Soil

The geology at the site has been obtained from the British Geological Survey (BGS) website. The bedrock beneath the site is described as 'Pennine Middle Coal Measures Formation - Mudstone, siltstone and sandstone'. Superficial deposits are described as 'Till, Devensian - Diamicton'. (Figure 5: Bedrock underneath the Site (Source: BGS Bedrock Geology Mapping)).

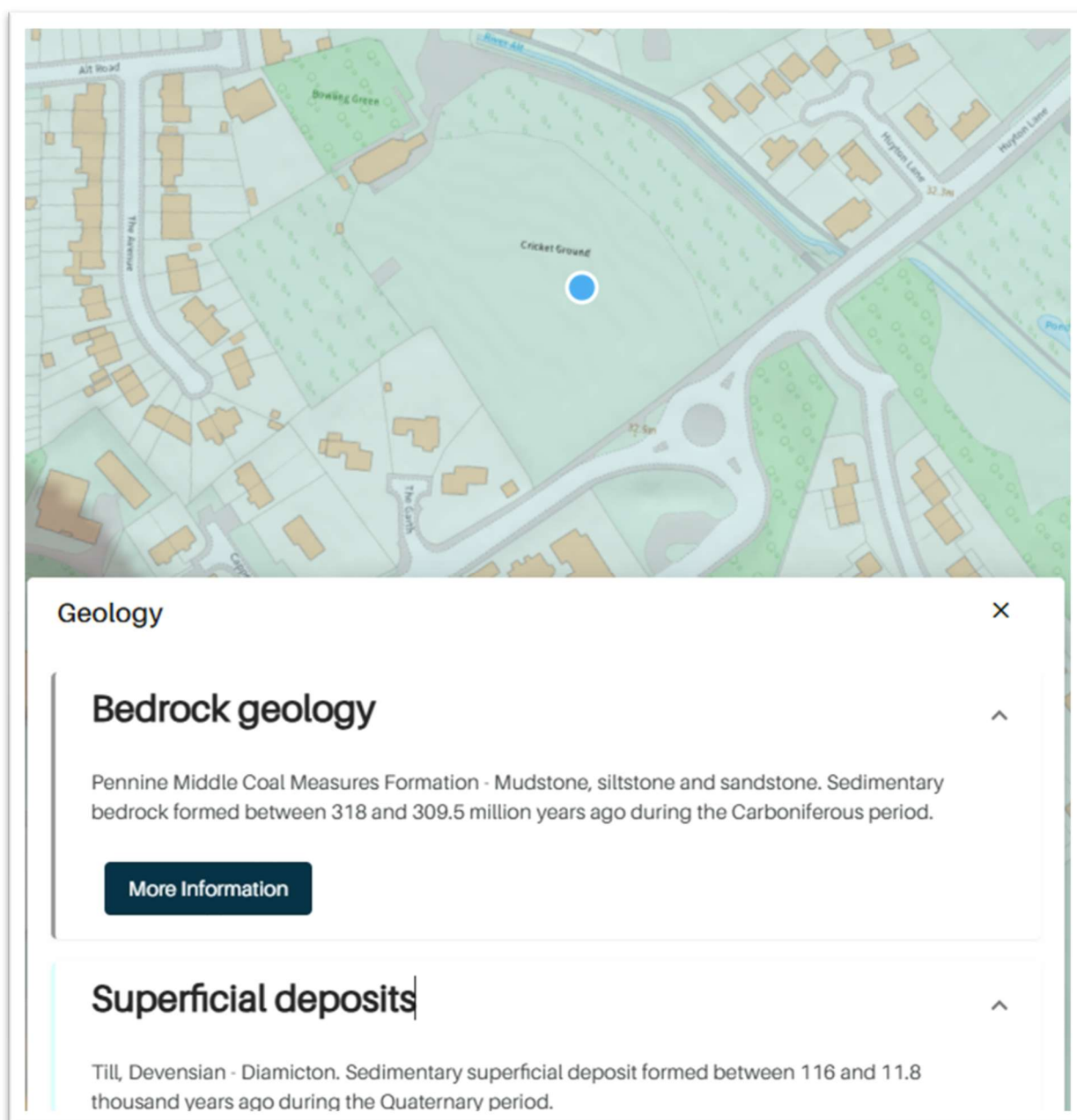


Figure 5: Bedrock underneath the Site (Source: BGS Bedrock Geology Mapping)

Soilscapes Viewer describes the soil conditions at the site as 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' with impeded drainage. Please see Figure 6 below.

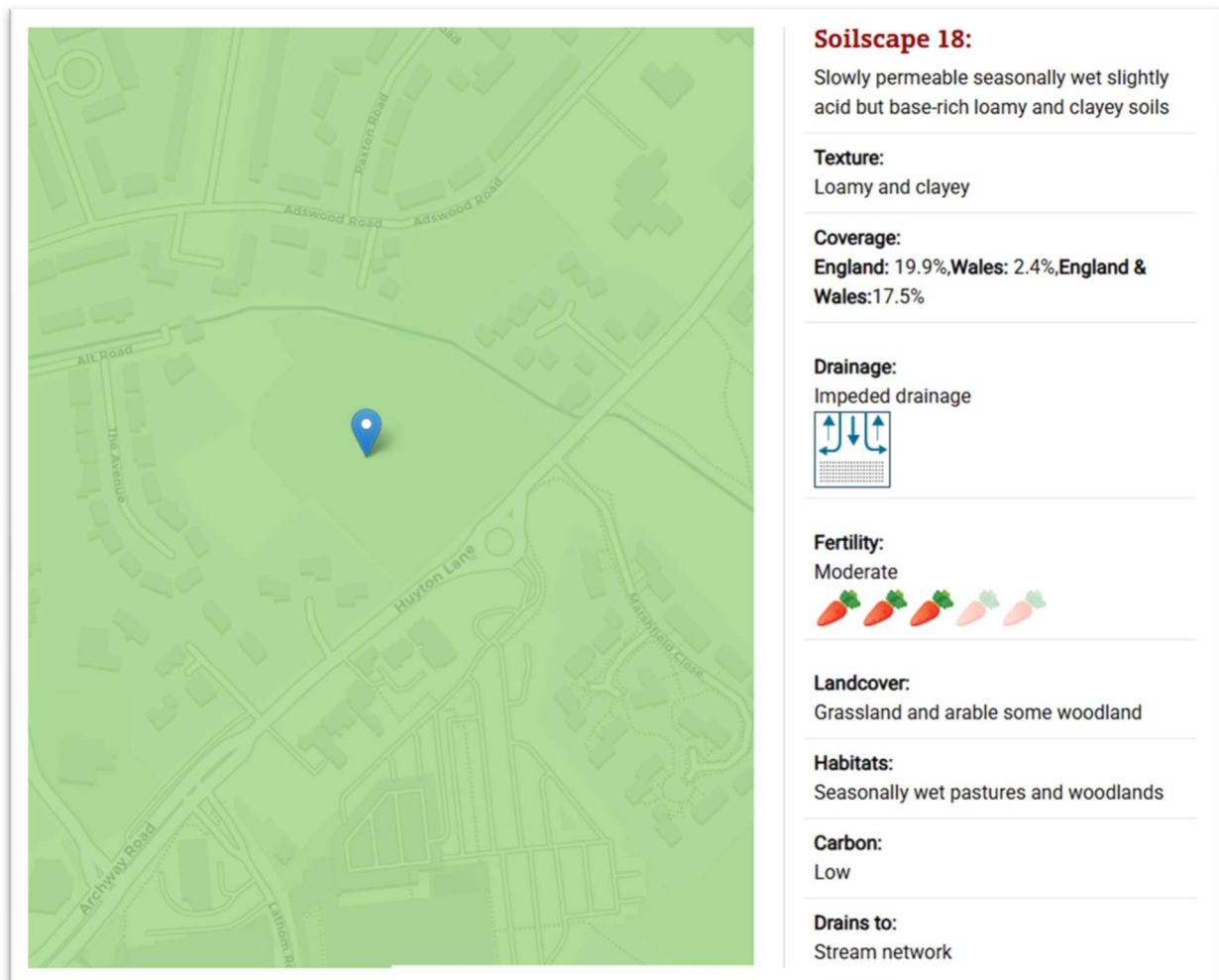


Figure 6: Soilscape

Within the Geo-environmental report undertaken by Earth Environmental and Geotechnical in December 2018, infiltration testing results were between 2.72×10^{-7} and 9.45×10^{-9} m/s. Therefore, soakaways are not recommended at this site. Please see an extract of the report below:

6.6 Soakaways

Falling head test were carried out in the installed windowless sample boreholes. The natural ground shows variability across the site for deep soakaways.

Better permeability rates were encountered in WS202 (2.72×10^{-7}), WS203 (2.78×10^{-7}), WS206 (3.37×10^{-8}), WS208 (2.78×10^{-7}), WS209 (1.42×10^{-8}) and WS210 (2.84×10^{-8}) with the poorest rate encountered as 9.45×10^{-9} in WS204.

Figure 7: Geo-Environmental Report from Earth Environmental and Geotechnical

Based on these findings, it is believed that infiltration is unsuitable at this site.

2.4 Climate Change Allowances for River Flow

The Environment Agency and NPPF require a consideration of the impacts of climate change in Flood Risk Assessments (FRA). In May 2022, the Environment Agency updated the climate change allowances required in Flood Risk Assessments (last updated 27 May 2022); this advice updates previous climate change allowances to support the NPPF (DCLG, 2021).

The advice splits the country into regions and gives climate change split into central, high, upper. According to the guidance the development should use **44%** for river flows for more vulnerable development. Please see below the climate change map for river flow allowances:

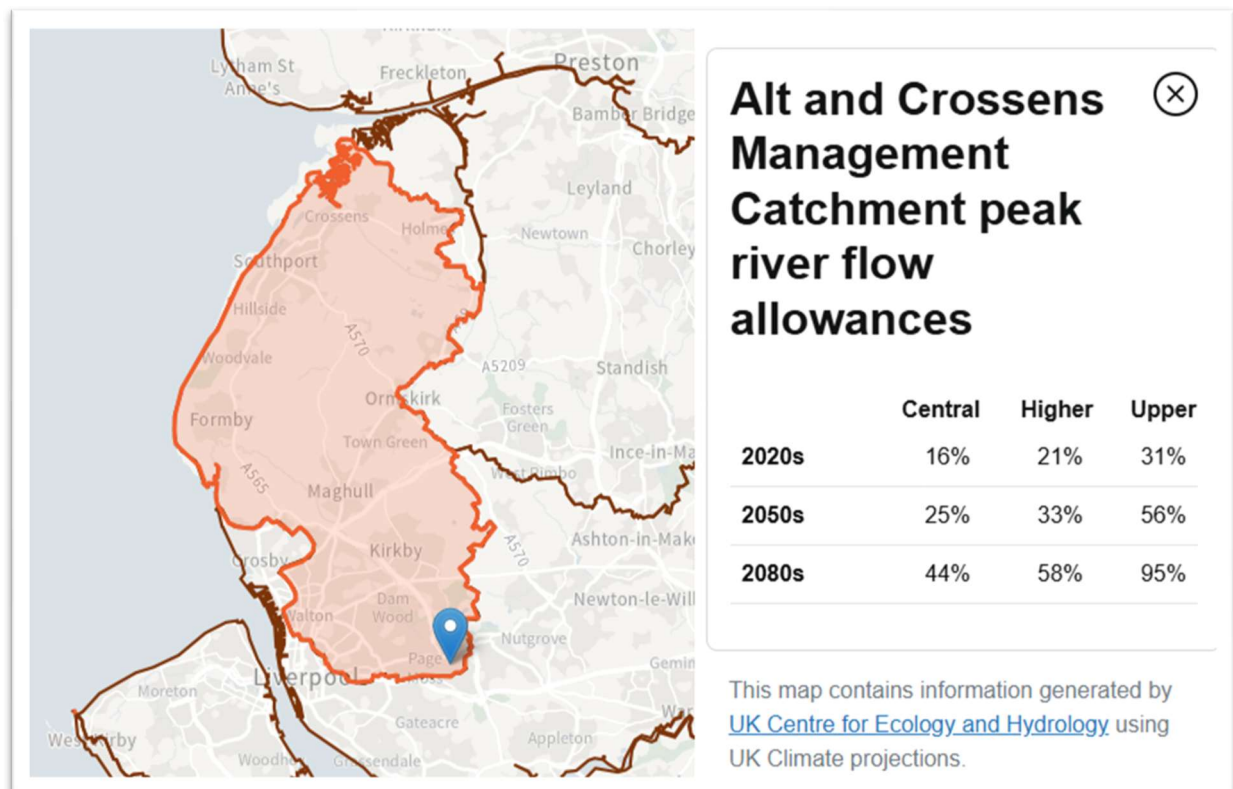


Figure 8: Peak River Flow Allowances

2.5 Climate Change Allowances for Rainfall

Figure 9 shows anticipated changes in small catchments, recommending a progressive increase, reaching **45%** for the 'Upper End' allowance by 2125. This allowance would be recommended for this proposed development, which is classified as 'More Vulnerable' and has been taken to have a 100-year design life. The **45%** climate change allowance is based on the 90th percentile, meaning that there is a 90% chance that rainfall will not increase by more than the **45%** increment.

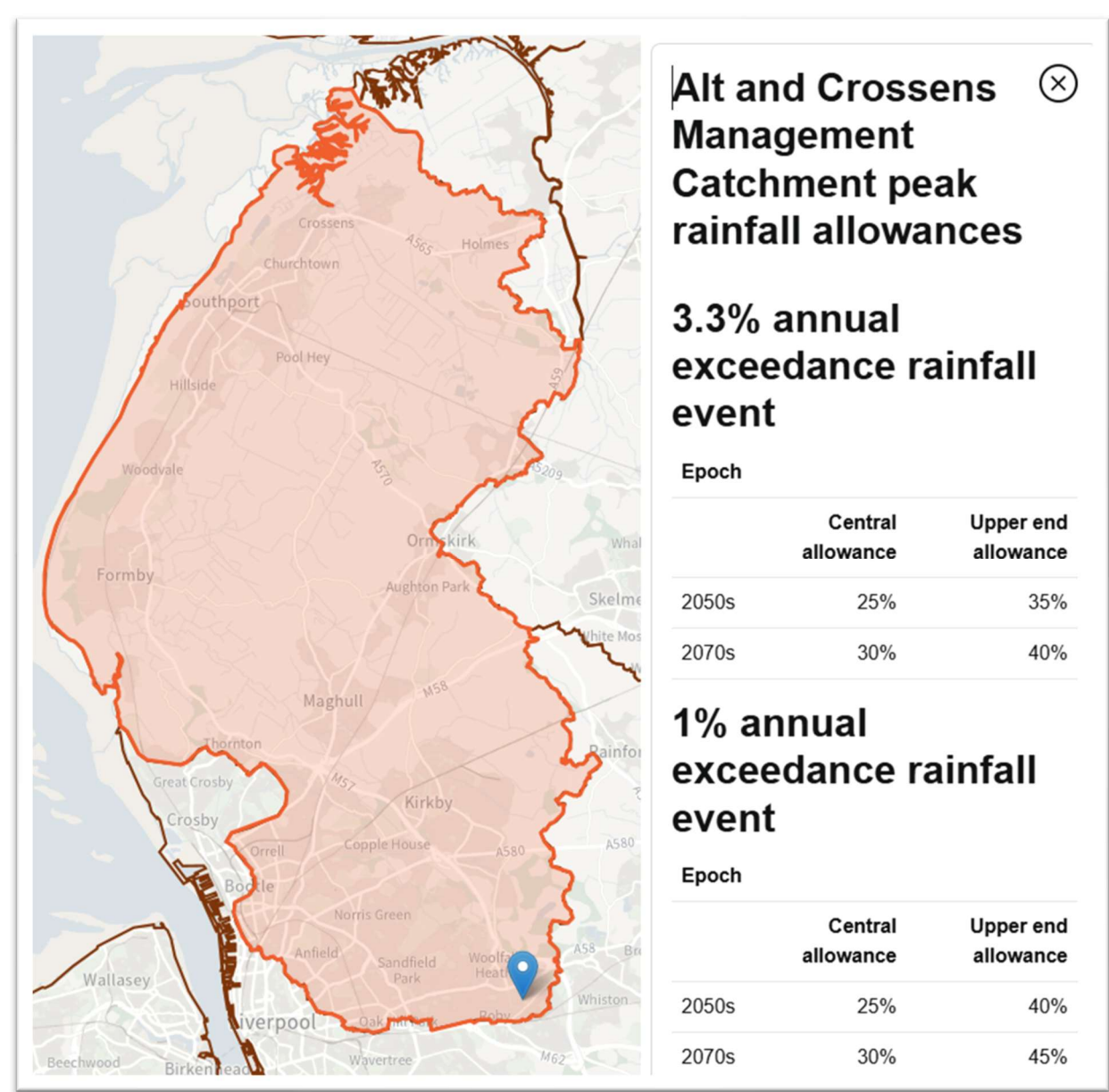


Figure 9: Peak Rainfall Intensity Allowance in Small and Urban Catchments

3. FLOOD HAZARD FOR EXISTING SITE

3.1 Source of Flood Risk

Flood sources and their possibilities at the site is further described below.

3.2 Fluvial Flood Risk

The proposed site is mostly within Flood Zone 1 (area at low risk of flooding). Flood Zone 1 has an estimated less than 1 in 1000-year return period. However, the northern part of the site is in a Flood Zone 2 and 3. Areas within Flood Zone 2 have between a 1 in 1000 (0.1%) and 1 in 100 (1%) annual probability of flooding in any given year. Flood Zone 2 is considered a medium risk. Areas within Flood Zone 3 have a 1 in 100 (1%) or greater annual probability of flooding in any given year, considered to be high risk. Please see Figure 10:

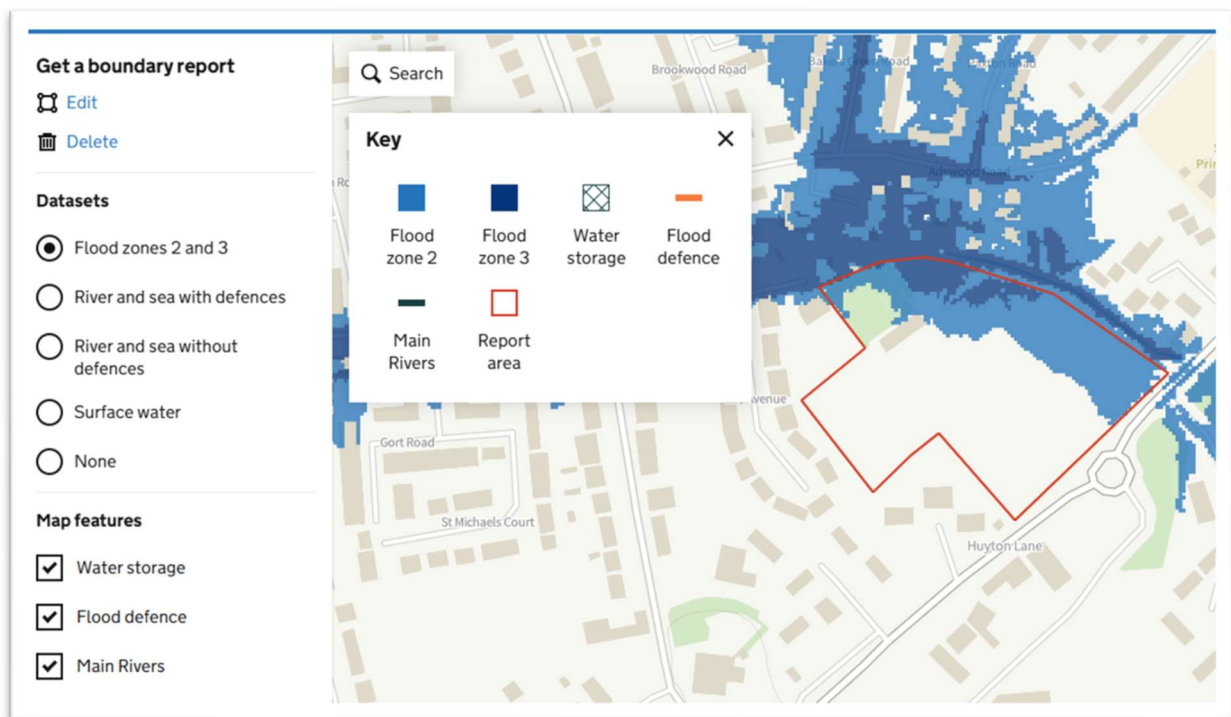


Figure 10: Environment Agency (EA) Flood Map

Townsend Water Engineering put the proposed site layout over the Flood Map for Planning Flood Zone Map using ArcGIS. It shows that 3 dwellings are placed within Flood Zone 3 (plots 43, 44 and 49). Please see Figure 11.



Figure 11: Flood Zones over Proposed Layout

However, on the flood maps for planning rivers and seas flood risk maps, the site is flood free. Please see the rivers and seas flood maps with and without defences in Figure 12 and Figure 13.

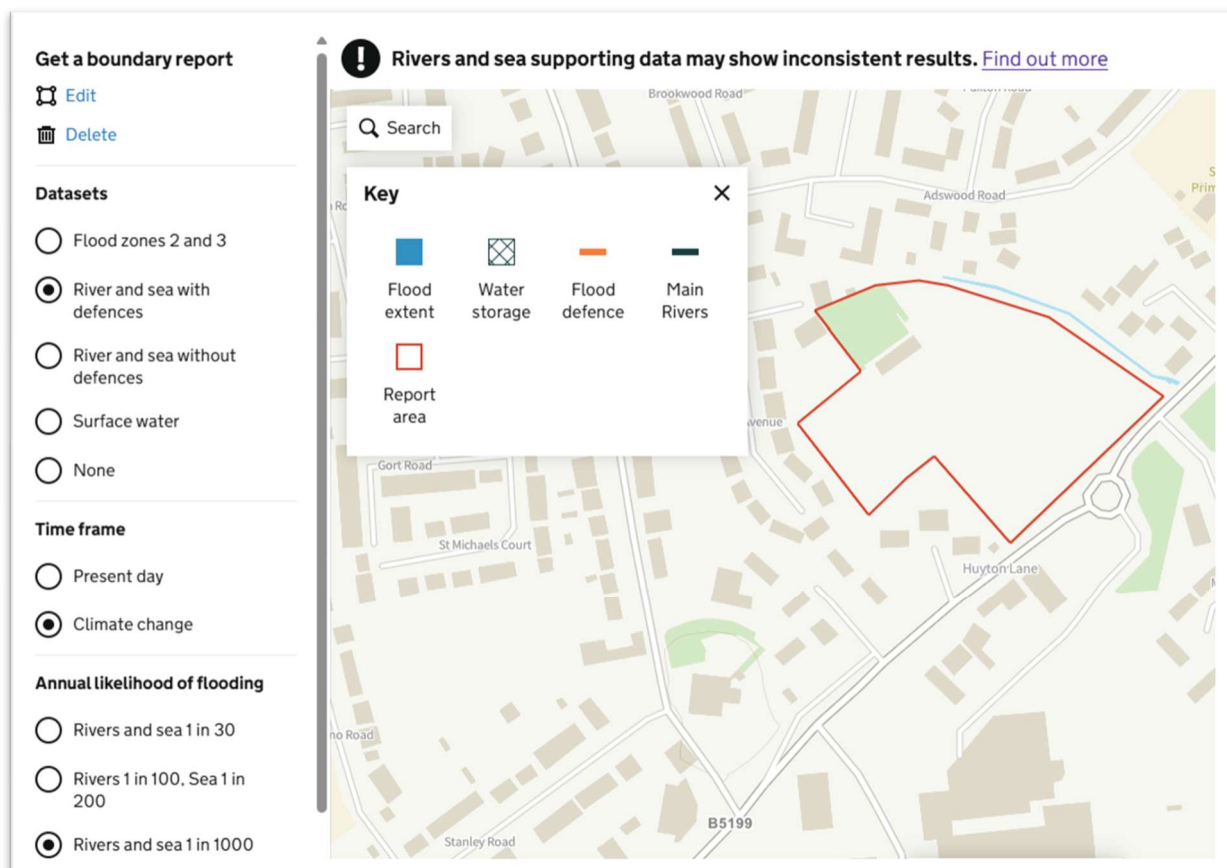


Figure 12: Rivers and Sea with Defences 1 in 1000 + CC

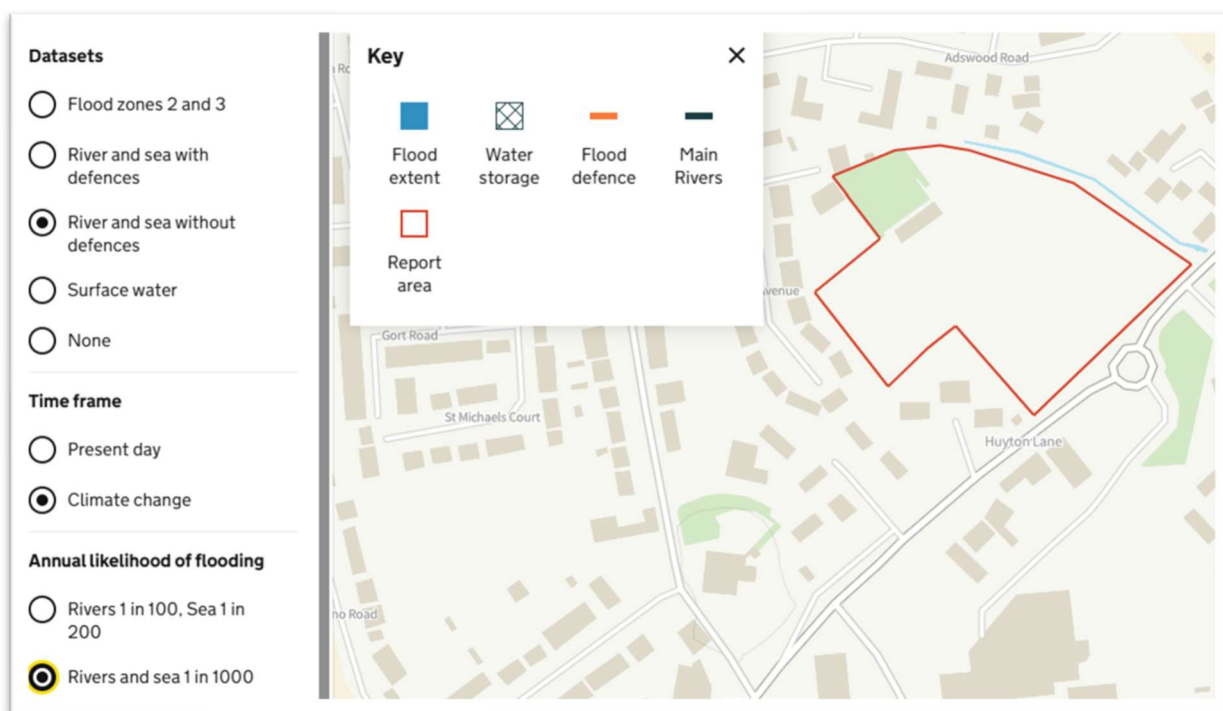
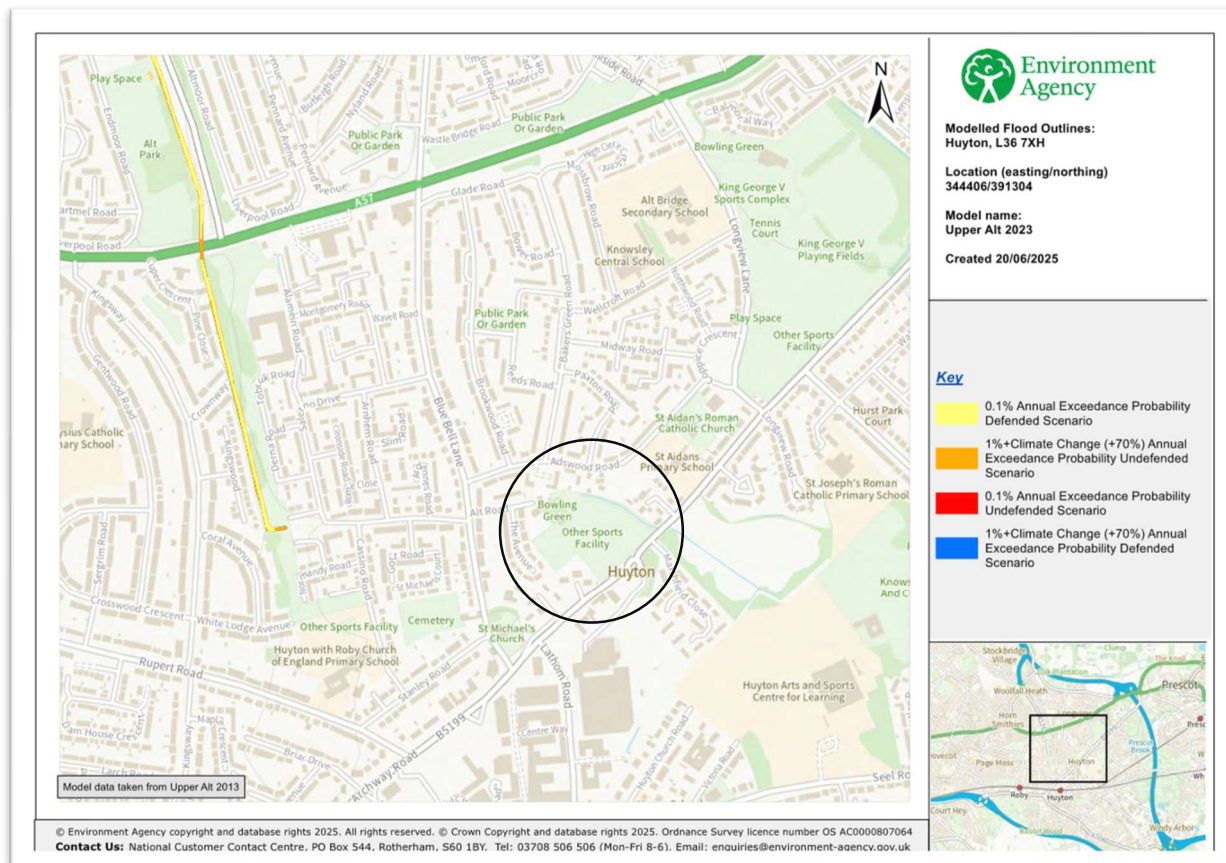


Figure 13: Rivers and Sea without Defences 1 in 1000 + CC

We made inquiries to the Environment Agency and acquired their flood data. The Environment Agency local hydraulic model of the River Alt indicates that the watercourse does not flood the site. Please see below the graphic from the product data from the Environment Agency information, which indicates the site does not flood from the River Alt. For the full results please see Appendix C.



Further clarification was sought to understand how the site was situated in a Flood Zone 2 and 3. The Flood Zone 2 and 3 map was designed by a direct rainfall method. Please see an extract from the Environment Agency letter which can be found in Appendix C:

'The site has placed in Flood Zones 3 and 2 because of direct rainfall modelling on the site (part of National Modelling undertaken). This direct rainfall method was applied to the surface water mapping and outputs linked to watercourses have been copied into the Flood Map for Planning. You will be able to see that the surface water mapped extents and the Flood Zones match in this area'.

Therefore, the Flood Zone 2 and 3 is based on surface water maps and not fluvial. This will be discussed in further in detailed in section 3.2.1. However, this site should be designated as Flood Zone 1, as it is not fluvial flooding that it affects the site, but surface water flooding. Please see below the definition of Flood Zone 1:

Areas deemed to be in Flood Zone 1 have been shown to be at less than 0.1% chance of flooding in any year. Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).

Furthermore, the likely reason the Flood Zone maps indicate flooding in this area is because the direct rainfall model probably does not take account of the culvert at the north-east corner of the site. Therefore, we believe that the existing local model is a more realistic view of the flooding.

The most recent comments from the Planning authority confirms the site is in a flood zone 1.

3.2.1 Surface Water

The EA surface water flood extents and flood depth have been obtained from the EA open dataset. The site is at risk of surface water flooding in the 1 in 100-year AEP in the north, this flood outline increases in the 1 in 1000 year AEP. Please see Figure 14 and Figure 15.

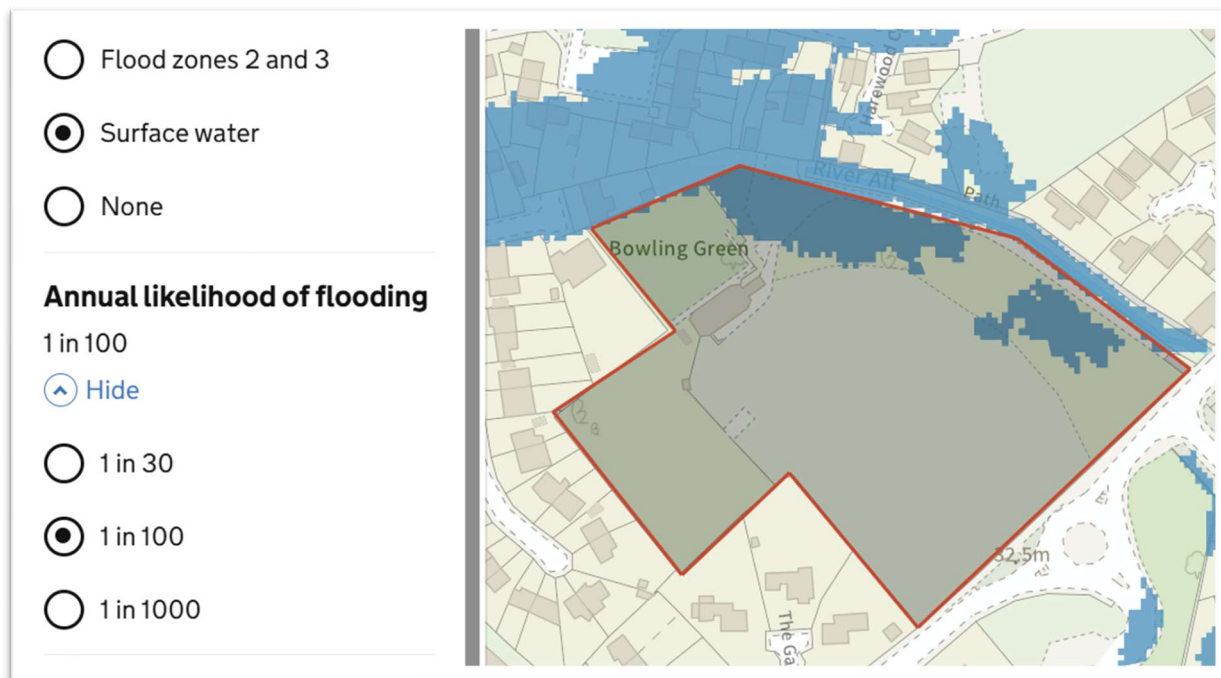


Figure 14: Extent of Flooding from Surface Water 1 in 100 Year AEP (Source: EA Open Dataset)

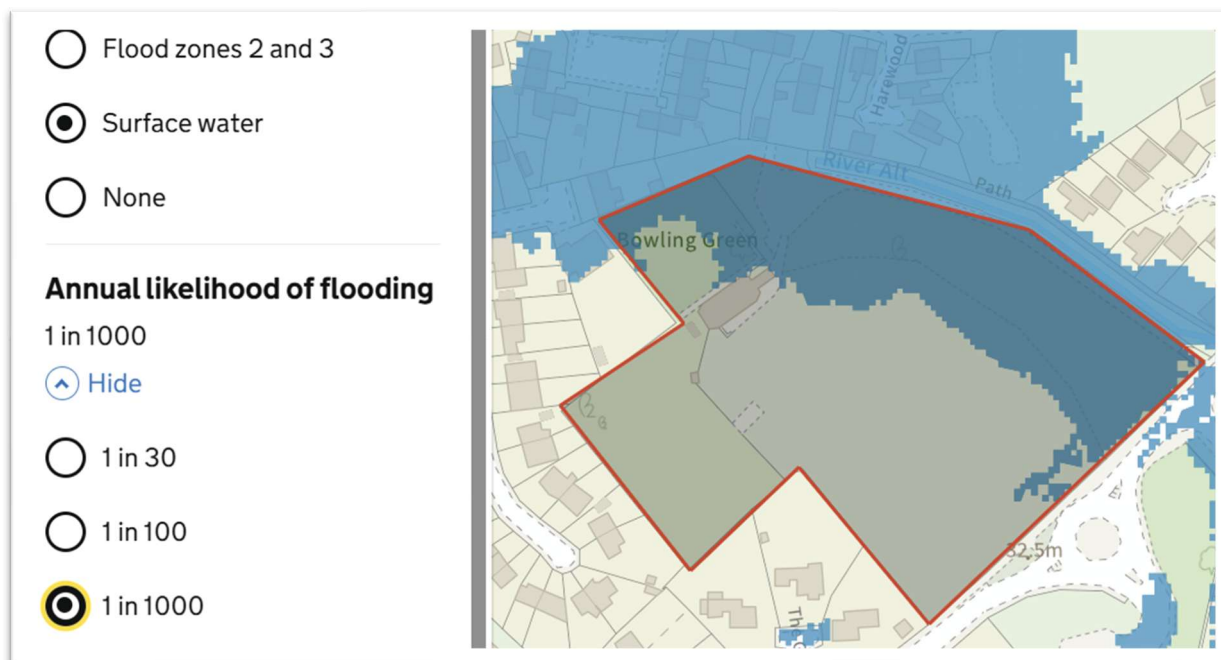


Figure 15: Extent of Flooding from Surface Water 1 in 1000 Year AEP (Source: EA Open Dataset)

Therefore, there is a risk of surface water flooding to the site in the north.

We obtained the surface water flood depth to 20cm, 30cm, 60cm and 90cm for the site on the Long Term Flood Risk checker. Please see Figure 16.

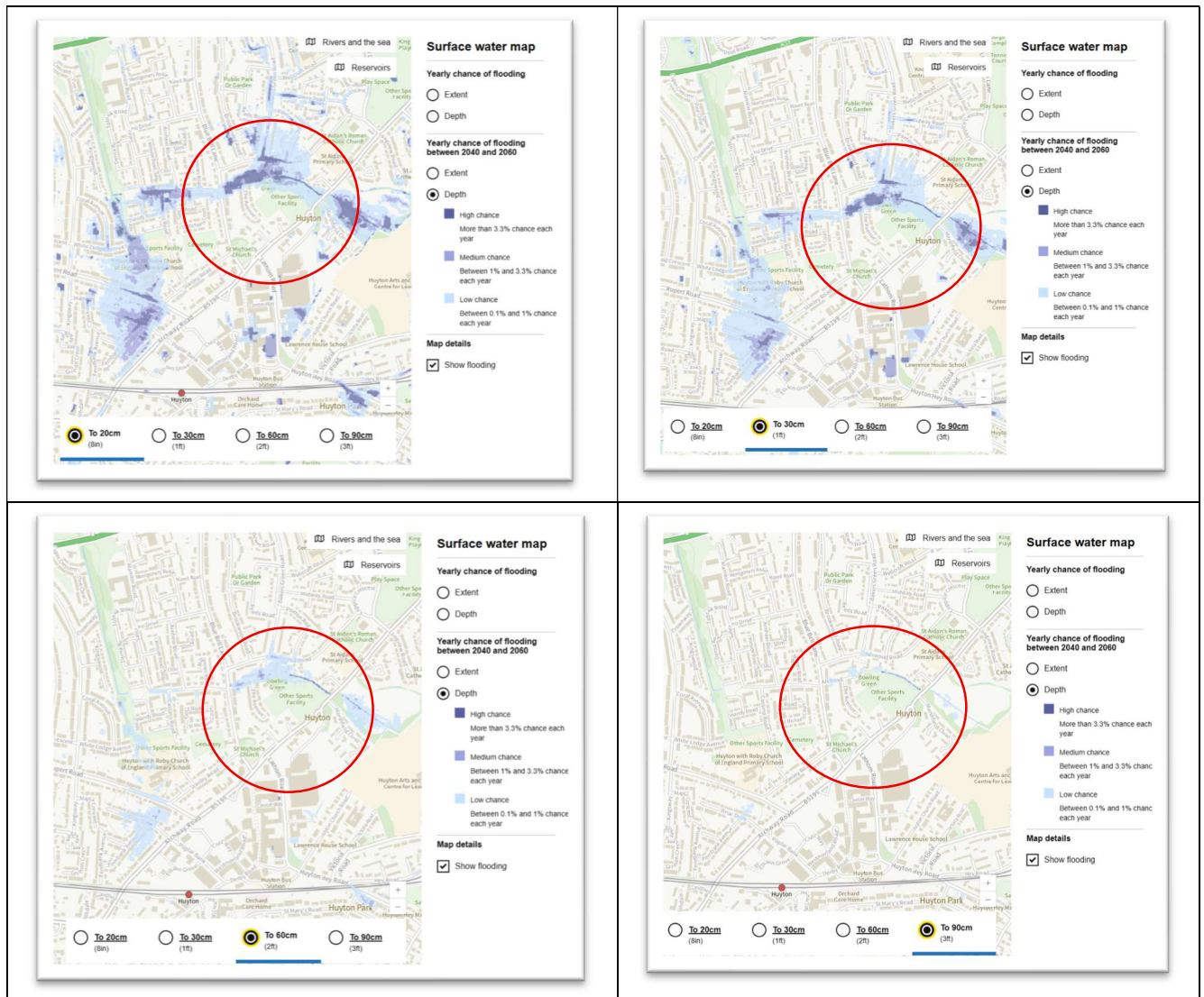


Figure 16: Surface Water Flood Depths at 20cm, 30cm, 60cm and 90cm (Source: EA Long Term Flood Risk Checker)

To investigate this further, we put the sites layout over the surface water flood depths, using ArcGIS. Please see Figure 17.

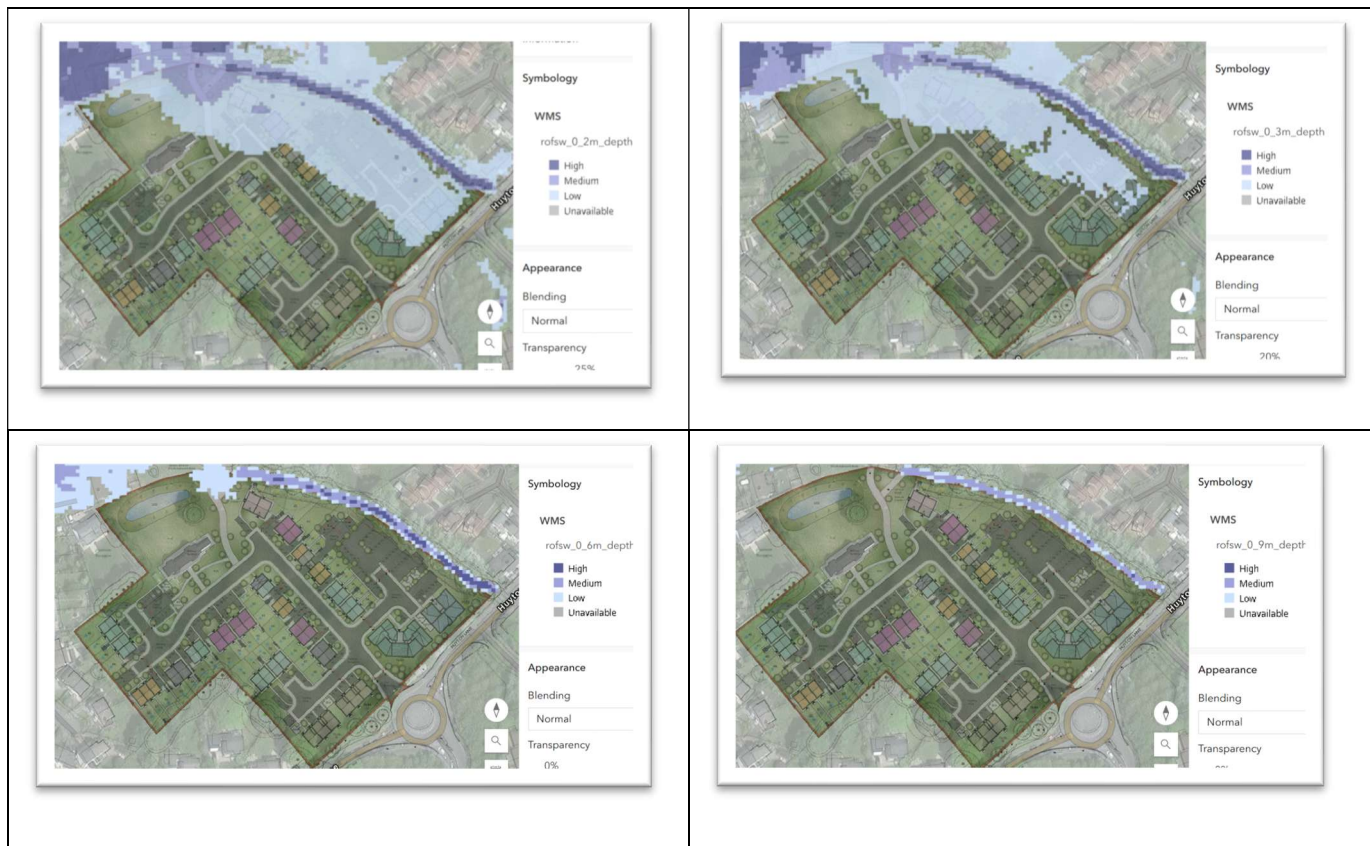


Figure 17: Surface Water Flood Depths at 20cm, 30cm, 60cm and 90cm Over Site Proposed Layout (Tool: ArcGIS)

As can be seen in Figure 17, plots 1-45 are at a low risk of surface water flooding up to 30cm depth. None of the dwellings are placed in areas at medium or high risk of surface water flooding.

Consultation was held with the Environment Agency, and they said we need to discuss this with the Lead Local Flood Authority (LLFA), to understand what is required, as it is their remit.

A pre app was undertaken with the LLFA and they have stated that the site is not at risk of surface water flooding, this is likely because they have issues with the new model that the surface water maps are built on. Please see Appendix D for the LLFA comments.

Therefore, the site is not at risk of surface water flooding.

3.2.2 Flood Risk from Reservoir /Canals / Other Artificial Sources

The EA Extent of Flooding from Reservoirs map (Figure 18:Extent of Flooding from Reservoirs (Source: EA Flood Warning Information Service)), based only on large reservoirs (over 25,000 m³ of water), shows that the site is within potential risk of flooding in the event of a breach from reservoirs. Flooding from reservoirs is considered to be extremely unlikely and the risk of flooding to the site is considered to be low.

There is no flood risk from canals or other artificial sources as there are no canals or artificial sources within the vicinity of the site.

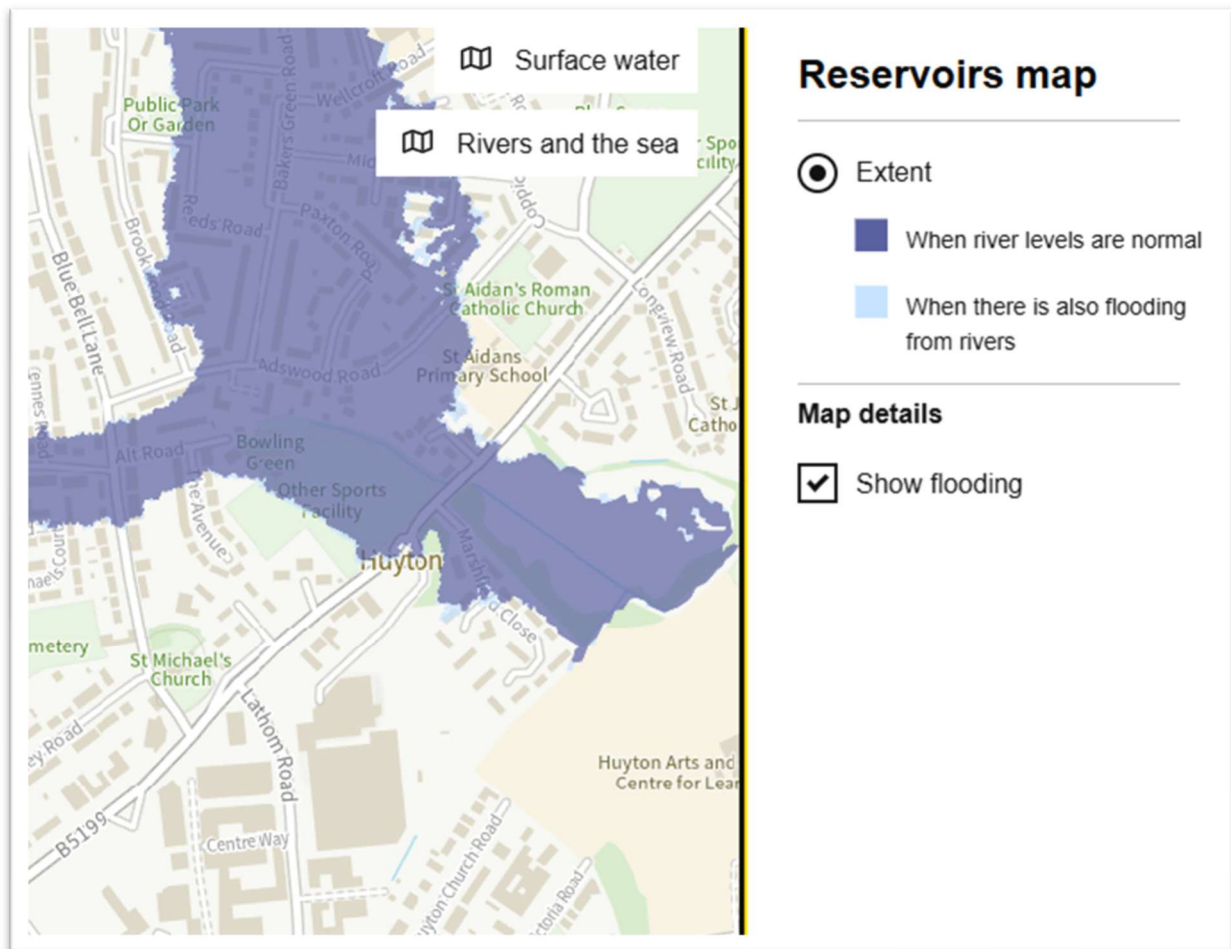


Figure 18:Extent of Flooding from Reservoirs (Source; EA Flood Warning Information Service)

3.2.3 Flood Risk from Groundwater

Within the Geo Report, groundwater testing was undertaken and it did not reach surface level. Please see an extract of the report relating to groundwater in Figure 19.

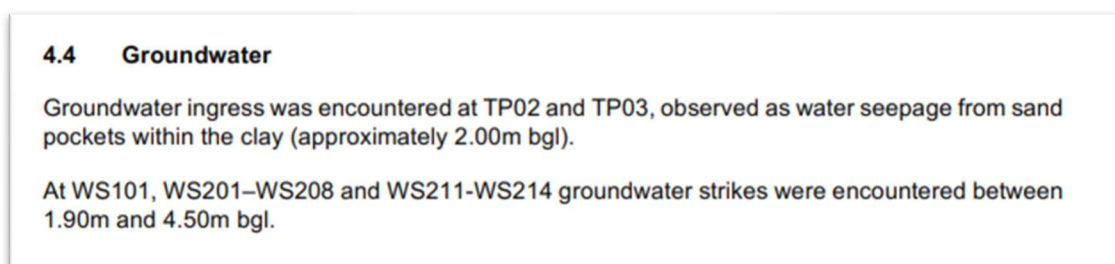


Figure 19: Geo Report

Furthermore, groundwater flooding is noted to be unlikely on the long-term flood risk checker for groundwater. Please see Figure 20.

Other flood risks

[More about groundwater and reservoirs](#)

Groundwater

Flooding from groundwater is unlikely in this area.

Figure 20: Risk of Groundwater Flooding to Site (Long Term Flood Risk Checker - EA)

3.2.4 Flood Risk from Sewers

According to the United Utilities (UU) sewer map, there are no public sewers crossing the site. Therefore, flooding risk from sewers is believed to be low for this site. Please see Figure 21 below:

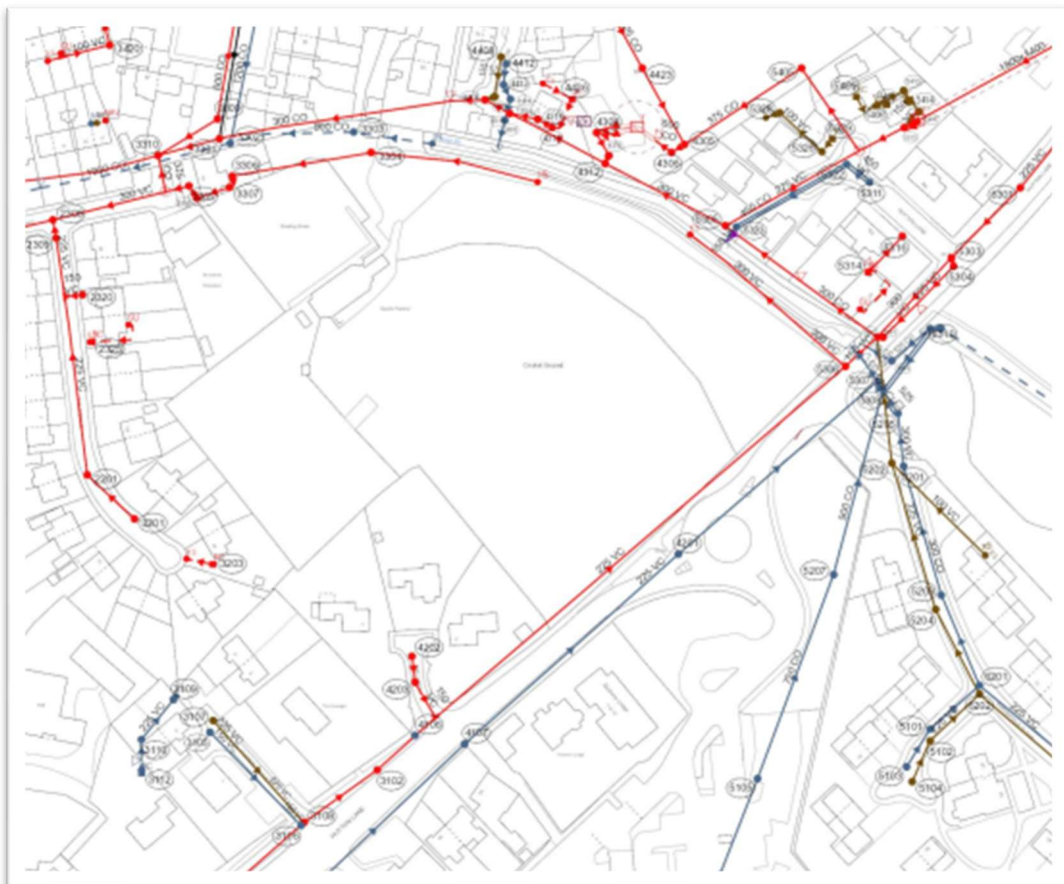


Figure 21: Sewer Map

3.3 Existing Surface Water Drainage Arrangements

The site is assumed to drain to the watercourse in the north.

According to the public sewer map, there are no public sewers crossing the site.

4. ASSESSMENT OF FLOOD RISK FOR PROPOSED DEVELOPMENT

4.1 Development Proposals

It is proposed to create 84 dwellings at the land to the north of Huyton Lane, Knowsley, L36 7SB, as shown on the indicative masterplan Figure 22. Please see Appendix F for the layout.

The development area is 2.216ha, the developable Area (development boundary excluding large areas of POS) is 1.741ha and the impermeable area has been assessed as 1.075ha (includes 10% urban creep on private areas). Please see Appendix G below:



4.3 Surface Water flooding

The site is at risk of surface water flooding up to and including the 1 in 100-year event. This flood extent increases in the 1 in 1000-year event. Please see Figure 14 and Figure 15.

We obtained the surface water flood depth to 20cm, 30cm, 60cm and 90cm for the site on the Long Term Flood Risk checker and put them over the site layout. As can be seen in Figure 17, plots 1-45 are at a low risk of surface water flooding up to 30cm depth. None of the dwelling are placed in areas at medium or high risk of surface water flooding.

Furthermore, at the recent completed pre application, the LLFA stated that the site is not at risk of surface water flooding. Therefore, it is considered the site is at low risk of surface water flooding according to the LLFA.

4.4 NPPF Vulnerability

The development will be classed as 'More Vulnerable' under the NPPF vulnerability classification (Table 3). The flood risk vulnerability and flood zone compatibility are displayed in Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (Source NPPF Technical Guide). As noted in Section 3.2, the site is within a Flood Zone 1.

Table 2: Flood Risk Vulnerability Classification (Source: NPPF Technical Guide)

More Vulnerable (MV)
Hospitals, residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels
Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
Non-residential uses for health services, nurseries and educational establishments.
Landfill and sites used for waste management facilities for hazardous waste ⁶ .
Sites used for holiday or short let caravans and camping, subject to a specific warning and evacuation plan. ⁷

Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (Source NPPF Technical Guide)

Flood Zone	Definition	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
1	$T > 1,000$	✓	✓	✓	✓	✓
2	$100 < T_{fluv} < 1,000$ $200 < T_{tidal} < 1,000$	✓	✓	Exc. Test	✓	✓
3a	$T_{fluv} < 100$ $T_{tidal} < 200$	Exc. Test	✓	✗	Exc. Test	✓
3b (functional floodplain)	$T_{fluv} < 20$	Exc. Test	✓	✗	✗	✗

As the development is 'More Vulnerable' and it is in Flood Zone 1, as set out in section 3.2, according to Table 3: Flood Risk Vulnerability and Flood Zone Compatibility (Source NPPF Technical Guide), the sequential test is passed and there is no need for an exception test.

5. DRAINAGE STRATEGY

Please find below the Drainage Strategy, this is based on Ironside Farrar Drainage Strategy.

5.1 Existing Drainage Arrangements

5.1.1 Surface Water

It is assumed the existing drainage arrangements is that all the surface water from the existing buildings and hardstanding drain to the watercourse to the north.

5.2 Infiltration Rates

It is considered that infiltration is unlikely to be feasible as infiltration tests at the site failed. Therefore, it is recommended the site does not use infiltration.

5.3 Run-off

The discharge has been set at Q-bar greenfield runoff rate of 13.7l/s, using the developable area to calculate the greenfield rate (1.741ha). Please see appendix G for the impermeable areas and appendix H for the calculations for the greenfield rates.

5.4 Surface Water Drainage Strategy and SuDS

The drainage strategy is based on the tenants of the national standards for sustainable drainage systems.

These standards are intended for application in the design of surface water drainage systems for new infrastructure and development, whether on greenfield or brownfield sites. They are not designed to apply to retrofit SuDS designs, which often have different objectives and face broader constraints. However, the standards could serve as a starting point for retrofit design. It is important to acknowledge that constraints specific to retrofit projects may prevent the full application of the standards.

These standards only apply to the management of surface water runoff that is essentially uncontaminated and consists predominantly of rainwater. For some land uses, where there is a higher risk (for example, a large car park), the inclusion of proprietary measures as opposed, or in addition, to SuDS may be needed. However, where there is a risk of pollution, an Environmental Permit or Registration of an Exemption may be required from the Environment Agency.

There are 7 standards which are indicated below:

Standard 1: Runoff Destination;

Standard 2: Management of everyday rainfall;

Standard 3: Management of extreme rainfall;

Standard 4: Water Quality;

Standard 5: Amenity;

Standard 6: Biodiversity; and

Standard 7: Design of drainage for construction, operation, maintenance and structural integrity.

- **Standard 1: Runoff Destination**

In accordance with the Flood Risk and Coastal Change Planning Practice Guidance, where possible, preference should be given to multi-functional sustainable drainage systems, and to solutions that allow surface water to be discharged according to the following hierarchy of drainage options:

- 1. Rainwater Harvesting
- 2. Into the ground (infiltration);
- 3. To a watercourse;
- 4. To a surface water sewer, highway drain, or another drainage system; and
- 5. To a combined sewer.

Rainwater Harvesting is not required because this area of England is outside of a rain scarcity area. However, non-potable water should be used in gardens and landscaping, therefore, water butts have been installed to each dwelling, which means that rainwater can be reused for the gardens and outdoor irrigation. Furthermore, even though infiltration is not feasible on the site, there will be some infiltration through the filter drains and strips, a detention basin and the permeable pavements back into the ground.

As detailed in section 2.3, infiltration is not feasible.

There is an ordinary watercourse that runs along the sites northern border. It is proposed to discharge the sites surface water to the watercourse to the north of the site.

Conclusion: Infiltration is not feasible at this site; therefore, it is proposed to discharge the sites surface water to the watercourse to the north. All lower options on the hierarchy will be discounted.

- **Standard 2: Management of Everyday Rainfall (Interception)**

Given the impermeable nature of the site, interception for the first 5mm of rainfall will be achieved through storage in the SuDS features as absorption / evaporation. This can be achieved using a combination of source control SuDS (e.g. filter drains and permeable pavements) and regional control SuDS (detention basin).

Within the guidance it is stated that this can be achieved by comparing the size of the filter drains/strips, permeable paving and detention basin to the impermeable areas. If the SuDS systems have a higher area than the impermeable area, then this standard is achieved.

To confirm, the filter drains, detention basin and the permeable pavements are unlined, and will have engineered soil under them as proscribed in CIRIA guidance 753 and therefore can use the higher multipliers.

Please see Appendix H for the drainage strategy:

Table 4: Summary of Permeable and Impermeable Areas from Ironside Farrar Drainage Strategy.

2. Standard 2 (Management of Everyday Rainfall)

SuDS measure will be incorporated within development to assist with preventing runoff from the site for the first 5mm of rainfall of the majority of rainfall events.

2.a) Private Permeable Drives with underdrains to be provided with Engineered sub-base layer beneath the underdrain level to assist with first 5mm rainfall requirements.

Total Private Permeable Drive Area (highlighted) = 0.219 Ha

Total Private Permeable Drive Area with multiplication factor (x5) = 1.095 Ha

2.b) Private Filter Drains with no infiltration assumed, to provide a depth of stone below level of perforated pipe to assist with first 5mm rainfall requirements. To be treated as a permeable drive in terms of multiplication factor (no infiltration due to underlying ground).

Total Private Filter Drain Length = 83.6m; Filter Drain width 0.5m

Total Private Filter Drain Area = $41.8\text{m}^2 = 0.00418\text{ Ha}$

Total Private Filter Drain Area with multiplication factor (x5) = 0.021 Ha

2.c) Detention Basins to provide topsoil or SuDS soils to basin base that achieves infiltration rate of $1 \times 10^{-6}\text{m/s}$.

Total Detention Basin Base Area = 0.0259 Ha

Total Detention Basin Base Area with multiplication factor (x25) = 0.647 Ha

Total Area of SuDS provided (with multiplication factors) = 1.763 Ha

Total Impermeable Areas = 1.075 Ha

Development is considered to comply with Standard 2 of the National Standards for Sustainable Drainage Systems.

The area that drains the first 5mm of rainfall is 1.763ha (this includes for filter drains, detention basin and permeable paving with multiplication factors) and the impermeable area is 1.075ha, therefore, in accordance with the National Standards of SuDS Guidance, the site drainage will deal with the first 5mm of rainfall via SuDS storage.

• Standard 3: Management of Extreme Rainfall and Flooding

The drainage system is designed so that there is no on-site flooding in the 1 in 30-year event + 40% climate change.

The drainage system is designed so that there is no on-site flooding of any building, nor any off-site flooding for the 1 in 100-year event + 45% climate change plus 10% urban creep has been applied to all private impermeable areas (plots and drives).

The ground levels are to be designed such that overland flood routes in exceedance events do not result in adverse flood risk elsewhere (Appendix I).

Modelling of the surface water runoff to the design parameters was carried out using Causeway, an industry leading software which allows design and analysis of SuDS features. (Appendix H) The following conservative assumptions and design parameters have been set within the Hydraulic model:

- Rainfall intensity was obtained using the Flood Estimation Handbook (FEH), and increased by 45% plus 10% urban creep has been applied to all private impermeable areas (plots and drives);
- No runoff loss has been assumed in the modelling, therefore, all the design rainfall landing on the impermeable surfaces is expected to reach the filter drains/strips, permeable paving and detention basin on site;

- As per the conclusions in Section 3.3, the soil has been modelled with an infiltration rate of zero 0.0m/hr; and
- Please see Appendix H and Figure 23 for the drainage strategy.

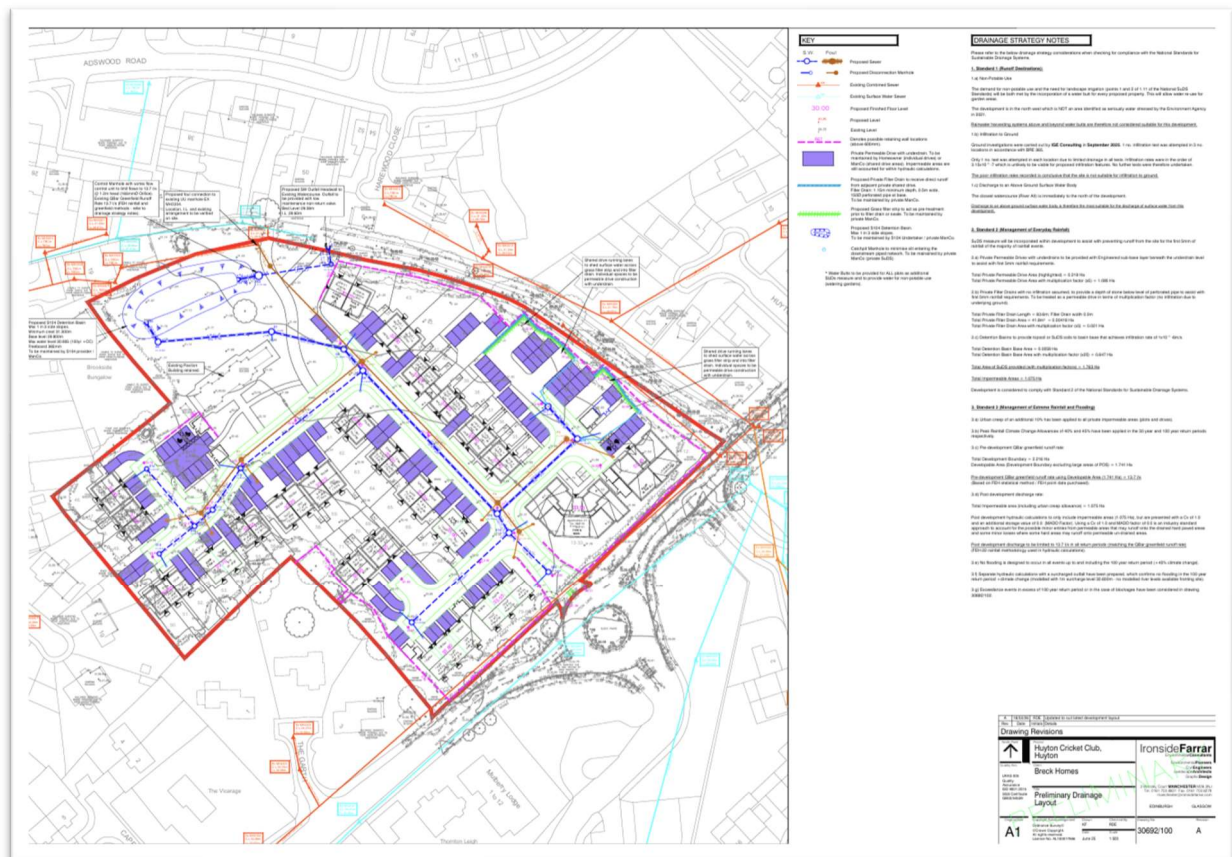


Figure 23: Drainage Strategy Design

• Standard 4: Water Quality

Adequate amount of SuDS required to be implemented on the site to achieve a suitable management train to achieve water quality improvements.

Accordingly, the permeable paving, filter drains/strips and detention basin provides sufficient water quality improvements to meet the minimum targets. Additional source control measures will provide further enhanced treatment over and above minimum requirements. Please see the Simple Pollution Index, which indicates that the proposed SuDS is sufficient (Appendix J).

• Standard 5: Amenity

A walking path will be placed around the basin so that it can be used for amenity value.

Standard 6: Biodiversity

The detention basin will be seeded with flowers and water compatible plants, please see the landscape drawings with the types of plants in it.

Standard 7: Design of Drainage for Construction, Operation, Maintenance & Structural Integrity

Structures which manage surface water runoff require little maintenance, however, a regular maintenance schedule e.g., after heavy rainfall, should be established by the site owners to reduce the risk of blockage within the drainage system and ensure the design remains in good working order. It is intended that the drainage system, and detention basin will be offered for adoption by a management

company, UU or a NAV. Filter drains and strips will be maintained by a management company. The permeable pavements and Water Butts will be maintained by the individual households. Please find a proposed strategy for maintenance below:

5.5 Maintenance Plan

Table 5: Operation and Maintenance Requirements for Filter Strips/Drains

TABLE 15.1 Operation and maintenance requirements for filter strips			
	Maintenance schedule	Required action	Typical frequency
Regular maintenance		Remove litter and debris	Monthly (or as required)
		Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
		Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
		Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (eg oils)	Monthly (at start, then half yearly)
		Check flow spreader and filter strip surface for even gradients	Monthly (at start, then half yearly)
		Inspect gravel flow spreader upstream of filter strip for clogging	Monthly (at start, then half yearly)
		Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then half yearly)
	Occasional maintenance	Reseed areas of poor vegetation growth; alter plant types to better suit conditions, if required	As required or if bare soil is exposed over > 10% of the filter strip area.
Remedial actions		Repair erosion or other damage by re-turfing or reseeded	As required
		Relevel uneven surfaces and reinstate design levels	As required
		Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
		Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
		Remove and dispose of oils or petrol residues using safe standard practices	As required

Table 6: Operation and Maintenance Requirements for Pervious Pavements

TABLE 20.15 Operation and maintenance requirements for pervious pavements

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

Table 7: Operation and Maintenance Requirements for Detention Basins

TABLE 22.1 Operation and maintenance requirements for detention basins

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

5.5.1 Pre App Consultation

A pre application was undertaken and the LLFA kindly responded, please see below their comments and our comments in bold underneath:

The proposed drainage strategy appears that have not allocated source control SuDS features at the property level as well as spaces for blue and green corridors. A Sustainable Drainage Design (SuDS) aims to minimise the impacts from a proposed development on water quantity and quality and maximise amenity and biodiversity. In designing an appropriate set of SuDS techniques for a development site, the LLFA will be expecting surface water runoff to be managed close to source (Source control/ property level control), only conveying downstream what cannot be managed at source. Therefore, the drainage design shall be required to include source control/property level control (e.g. permeable pavement and rain garden), green and open conveying systems / green corridors (e.g. green swale and ditch) and regional control (e.g. attenuation basin) features. The development of drainage design should therefore be planned as early as possible before the setting the property/other spaces layout in close collaboration with the landscape and biodiversity team. This becomes more important in this case where the surface water runoff is proposed to connect to a culverted watercourse, implying that there is no much flexibility on adopted discharge rate.

Following the comments from the LLFA in the pre app, please find the amended drainage strategy which now includes permeable pavements for the individual houses, the private drives are drained into a swale in the north of the development and a raingarden in the south. The main car park to the east of the site is drained to a grass filter drain and then a traditional filter drain. This means that the private driveways, parking spaces are drained to source control SuDS which will provide attenuation and water quality benefits.

An explanation of existing drainage system/mechanism and flow paths on the site and that how the site is currently affected by off-site surface water runoff shall be required.

The existing site drains towards the watercourse in the north east.

As can be seen the drainage strategy similarly drains to the north east and will discharge into the watercourse. The dwellings and buildings have been raised a minimum of 150mm above the road levels. Therefore if there is surface water flooding which should only happen in above the 1 in 100 year event plus climate change the surface water will flood down the roads and then into the car park and finally into the watercourse.

Evidence and justification (e.g. infiltration tests and groundwater levels) shall be required to demonstrate that in choosing drainage features for post development, the surface water drainage discharge hierarchy has appropriately been followed.

As indicated in section 2.3 infiltration is not feasible at the site, as the infiltration rate is between 2.72×10^{-7} and 9.45×10^{-9} m/s. Therefore, traditional infiltration SuDS cannot be used. Therefore, it is proposed that raingardens, permeable pavements and swales and raingardens have been used.

Then storage will be held at the car park and storage underneath it. The reason for this is the watercourse is very shallow and a attenuation basin will not be feasible because of the inverts.

The maximum discharge rate from the development site would be expected to be restricted to QBAR greenfield runoff rate. Volume of attenuation storage required on site for the 1% (1in100) plus climate change storm.

Please see the calculations in Appendix H which indicate that the site has been restricted to Qbar greenfield rates and has storage up to and including the 1 in 100 year event plus climate change.

Where the proposals are connecting to an existing drainage system/watercourse, it is likely that the authorities responsible for maintaining those systems/watercourse will have their own design requirements. These requirements will need to be reviewed and agreed as part of any surface water drainage scheme.

Agreed, at due course a land drainage consent will be sought.

Detailed Drainage Scheme Plan showing the layout of the proposed drainage network, post development impermeable area, the location of the storage within the proposed development and how these relate to the submitted calculations, including any chamber, pipe numbers, direction of flow, invert and cover levels, gradients diameters and dimensions. The methods of flow control must be detailed as should non-conventional elements such as pond and permeable paving.

Please see Appendix H for the drainage strategy.

Sufficient information on the correct number of treatment stages in the surface water management train will also be required, for further information see the CIRIA SuDS Manual (C753).

Please see the simple index pollution from CIRIA 753 indicating that the water quality is acceptable (Appendix J)

The mechanism for securing long-term maintenance will need to be considered and agreed between the applicant and the Local Planning Authority. This may involve discussions with those adopting and/or maintaining the proposed systems, which could include the Highway Authority, Planning Authority, Parish Councils, Water Companies and private management companies.

Please see section 5.5 but can this be conditioned as this will need to be undertaken at detailed design.

Evidence that exceedance flows and runoff in excess of design criteria shall be considered - calculations and plans shall be provided to show where above ground flooding might occur and where this would pool and flow.

Please see Appendix I for the overland flow routes.

6. SUMMARY & CONCLUSIONS

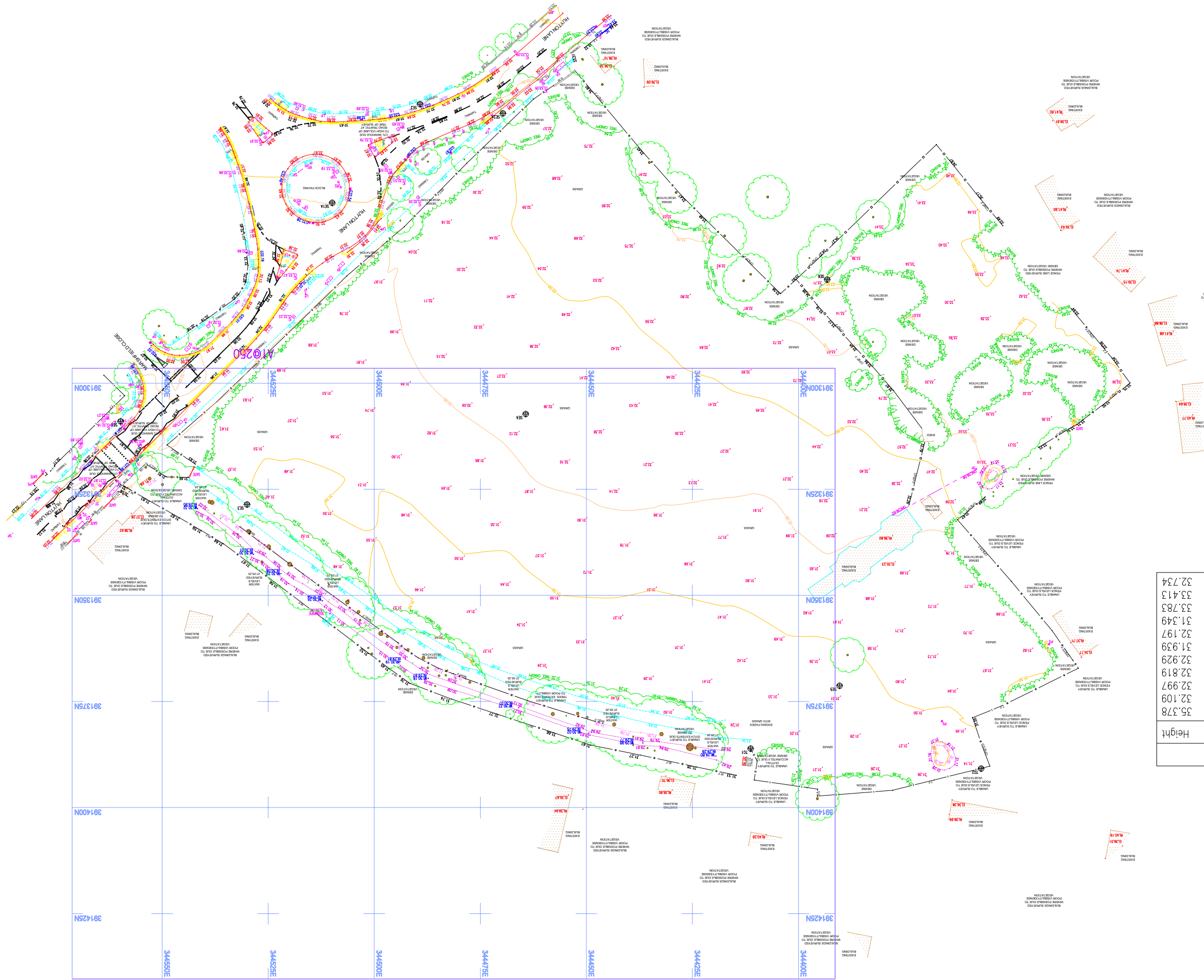
A summary of the main conclusions for the FRA is presented below:

- Development proposals are for a development of 84 dwellings at the land to the north of Huyton Lane, Knowsley, L36 7SB;
- The development site is 2.216ha, the developable Area (development boundary excluding large areas of POS) is 1.741ha and the impermeable area has been assessed as 1.075ha (includes 10% urban creep on private areas);
- The northern area of the site is within Flood Zones 2 and 3 (medium to high fluvial flood risk) and the rest of the site is in Flood Zone 1 (low risk) on the national Flood Risk Map for Planning. However, the Local Hydraulic Model indicates that the site is within Flood Zone 1. The Local Hydraulic model is more accurate; therefore, the site is within Flood Zone 1;
- The reason for the disparity between the models is that the local model includes the culvert and the national model, due to its coarseness, does not include the culvert;
- On the Flood Maps for Planning Rivers and Seas Flood Risk Maps (defended and undefended), the site is flood free, and therefore, in a Flood Zone 1;
- The EA Surface Water Flood Risk maps indicate that the site is at flood risk from surface water. The EA recommended that enquiries should be made with the LLFA as the LLFA are the statutory consultee for surface water. The LLFA state there is no surface water flooding on the site;
- None of the dwellings are placed in areas at medium or high risk of surface water flooding. According to the pre application, the LLFA believes that the site is not at risk of surface water flooding. Therefore, according to the LLFA, the risk of surface water is low;
- The site is at risk of reservoir flooding; however, this is very rare;
- The site is at low risk of groundwater, sewer and infrastructure flooding;
- It appears infiltration will not be feasible on this site due to the glacial till ground on site and failed infiltration testing;
- All dwellings will have water butts for water harvesting and reuse;
- The site will be required to have attenuation up to and including the 1 in 100-year event plus climate change of 45% plus urban creep for the surface water;
- Ironside Farrar have been commissioned to undertake the drainage strategy, the site will discharge into the watercourse to the north of the site at a Q-bar greenfield runoff rate of 13.7l/s. Attenuation will be held in permeable paving, filter drains, filter strips and a detention basin;
- The Simple Pollution Index indicates that the proposed SuDS is sufficient; and
- The detention basin will have a path around it for amenity and be seeded with flowers for biodiversity.

7. REFERENCES

Author	Date	Title/Description
Department for Communities and Local Government	Dec 2024	Technical Guidance to the National Planning Policy Framework
Ministry of Housing, Communities and Local Government.	Dec 2024	National Planning Policy Framework

Appendix A: Topographical Survey



SURVEY STATIONS			
Name	Eastings	Northings	Height
CC4	335667.156	382169.068	35.378
SE1	34508.986	391308.986	32.109
SE1A	34509.924	391257.479	32.997
SE2	34489.224	391234.221	32.819
SE2A	34469.671	391236.420	32.929
SE3	344530.000	391328.585	31.939
SE4	34464.312	391307.267	32.197
SE5	344390.309	391371.301	31.349
SE6	344393.230	391275.555	33.783
TG1	34411.294	391386.114	33.413
TG2	344356.959	391390.834	32.734

Appendix B: Ground Testing Report

All foundation excavations should be inspected by a suitably qualified engineer to prove that the founding strata is suitable and uniform along the length of the foundation, and capable of taking the anticipated structural loadings.

6.4 Chemical Attack on Buried Concrete

Chemical tests (see Appendix 3) show low levels of water soluble sulphates and near neutral conditions. Based on these conditions, it is recommended that for foundations the Design Sulphate Class for the site, as defined in BRE Special Digest 1⁽²⁰⁰⁵⁾, be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1. The recommendations of BRE Special Digest 1 should be followed for concrete foundations and ground bearing floor slabs.

6.5 Pavement Design

The ground investigation identified the soil type at subgrade level to typically be Clay, with a plasticity index range of 18% to 24%. Based on the recommendations for design CBR values provided in Interim advice note 73/06, Revision 1⁽²⁰⁰⁹⁾, the estimated CBR value for this soil type would be 3% to 4%.

Results of the in-situ DCP testing carried out at the site indicated CBR values at likely subgrade level to range between 6.16% and 18.29%, with an average value of 9.85%. Full results are presented in Appendix 4.

A conservative design CBR value of 1% should be adopted in areas where Made Ground is encountered at subgrade level.

Once formation level for the new road pavements has been achieved, proof rolling should be carried out using a heavy roller and any soft areas that are revealed should be excavated and a greater depth of subbase provided.

Exposed subgrades are likely to deteriorate rapidly on exposure to wet weather and should be shaped to shed water. Subbase should be placed as soon as possible to minimise the exposure of subgrade to adverse weather conditions.

6.6 Soakaways

Falling head test were carried out in the installed windowless sample boreholes. The natural ground shows variability across the site for deep soakaways.

Better permeability rates were encountered in WS202 (2.72E-07), WS203 (2.78E-07), WS206 (3.37E-08), WS208 (2.78E-07), WS209 (1.42E-08) and WS210 (2.84E-08) with the poorest rate encountered as 9.45E-09 in WS204.

6.7 Suitability of Excavated Materials

Acceptability criteria and testing, and methods of compaction/placement will depend on the type of contract and specification used for the construction of the proposed development and it is recommended that earthworks specifications are reviewed by a suitably qualified engineer, once these have been prepared by the relevant parties.

Appendix C: EA Flood Levels

Flood risk assessment data



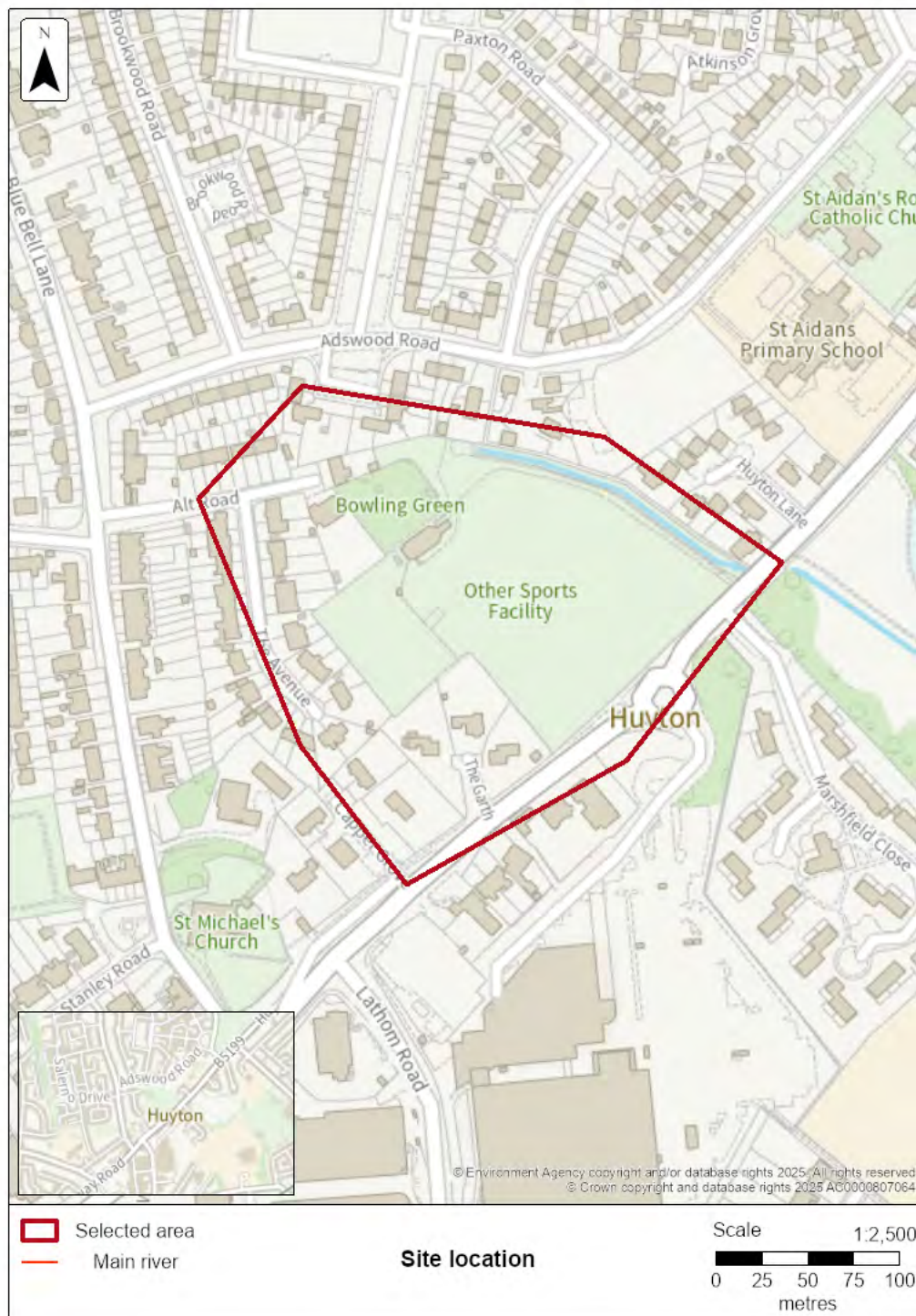
Location of site: 344406 / 391304 (shown as easting and northing coordinates)

Document created on: 19 June 2025

This information was previously known as a product 4.

Customer reference number: UJTU4AFAYPD

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

We recommend that you work with a flood risk consultant to get your flood risk assessment.

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Information that's unavailable

This document **does not** contain:

- past floods
- flood defences and attributes

We do not have past flooding data for this location.

Please note that:

- flooding may have occurred that we do not have records for
- flooding can come from a range of different sources
- we can only supply flood risk data relating to flooding from rivers or the sea

You can contact your Lead Local Flood Authority or Internal Drainage Board to see if they have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

We aren't able to display flood defence locations and attributes as there are no formal flood defences in the area of interest.

Surface water and other sources of flooding

When using the surface water map on the [check your long term flood risk service](#) the following considerations apply:

- surface water extents are suitable for use in planning
- surface water climate change scenarios may help to inform risk assessments, but the available data fall short of what is required to assess planned development
- surface water depth information should not be used for planning purposes

To find out about other factors that might affect the flood risk of this location, you should also check:

- [reservoir flood risk](#)
- groundwater flood risk - you could use the [British Geological Survey groundwater flooding data](#), [groundwater: current status and flood risk](#) and the guide on [mining and groundwater constraints for development](#) - further information may be available from the lead local flood authority (LLFA)
- your local planning authority's SFRA, which includes future flood risk

Your Lead Local Flood Authority is Knowsley District.

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: Upper Alt 2013

Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial

Date: 1 July 2013

This model contains the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occurring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

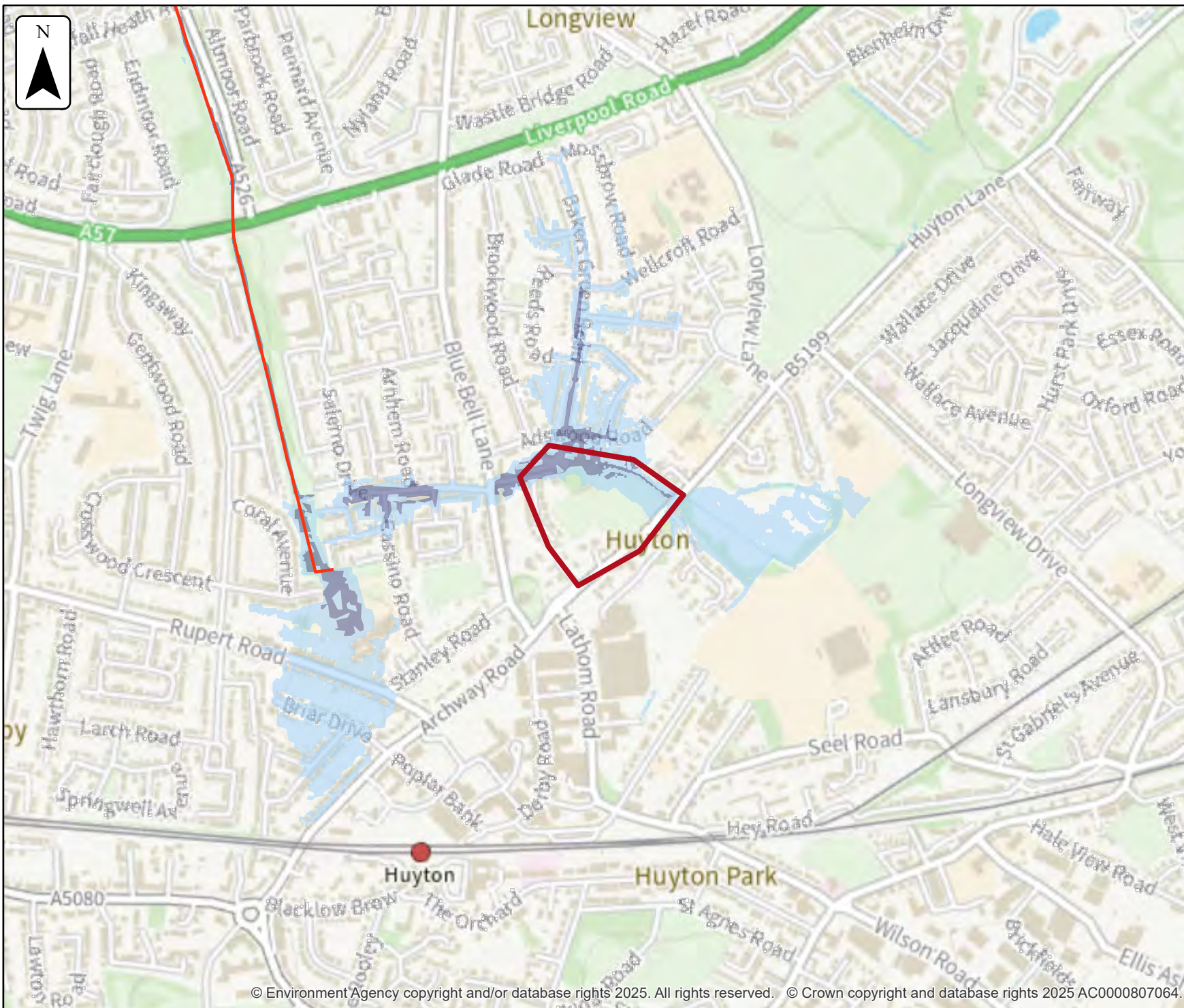
- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change



Flood map for planning

Location (easting/northing)
344406/391304

Scale
1:10,000

Created
19 Jun 2025

-  Selected area
-  Main river
-  Flood Zone 3
-  Flood Zone 2

0 100 200 300 400 500
metres

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

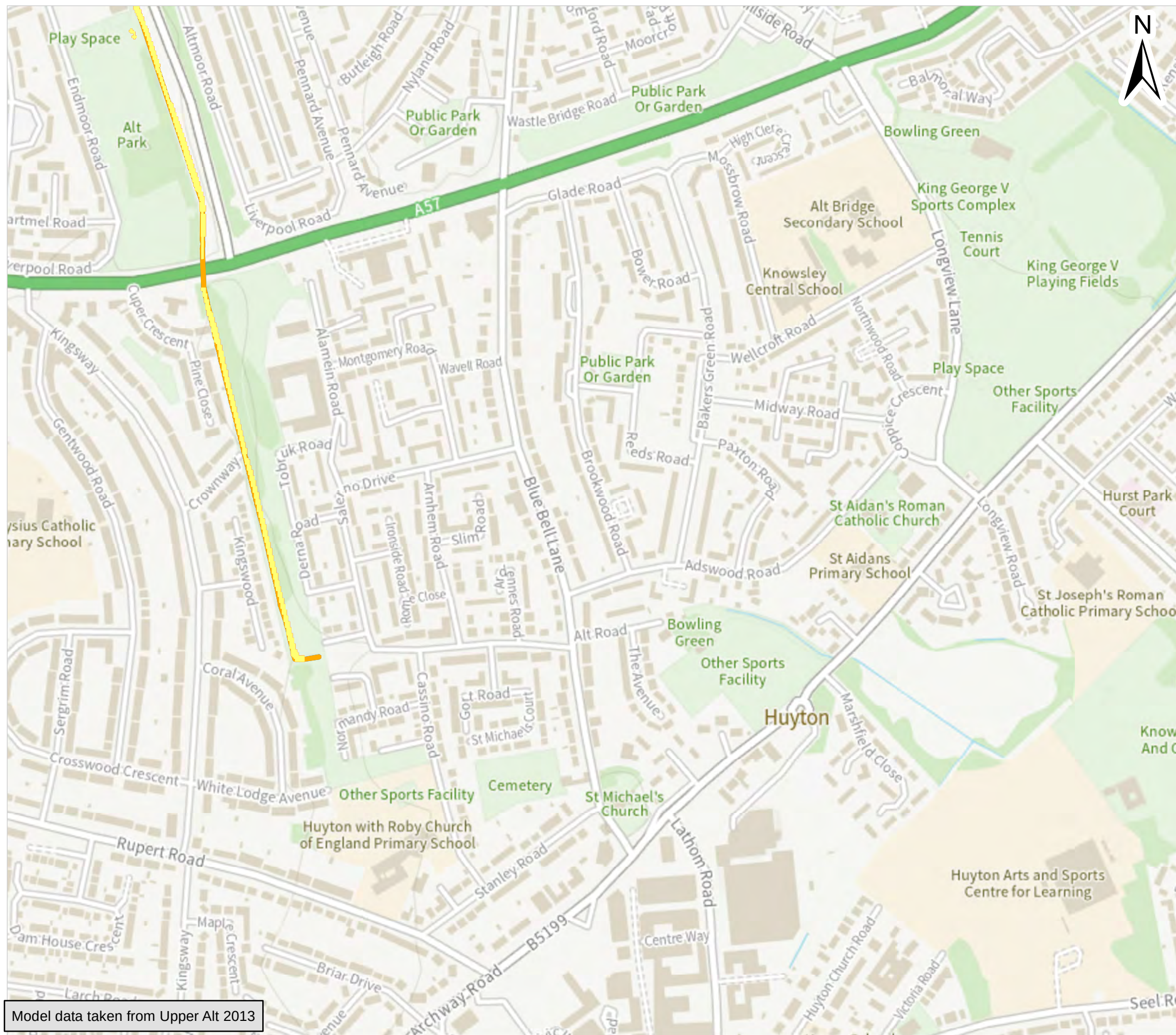
The climate change data included in the models may not include the latest [flood risk assessment climate change allowances](#). Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

Modelled scenarios

The following scenarios are included:

- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled fluvial: risk of flooding from rivers where flood defences have been removed, including estimated impact of climate change



**Modelled Flood Outlines:
Huyton, L36 7XH**

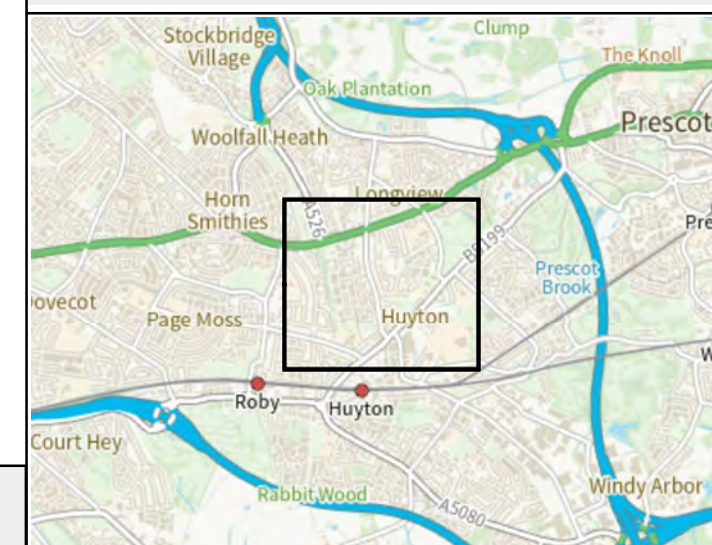
**Location (easting/northing)
344406/391304**

**Model name:
Upper Alt 2023**

Created 20/06/2025

Key

- 0.1% Annual Exceedance Probability Defended Scenario
- 1%+Climate Change (+70%) Annual Exceedance Probability Undefended Scenario
- 0.1% Annual Exceedance Probability Undefended Scenario
- 1%+Climate Change (+70%) Annual Exceedance Probability Defended Scenario



Node Point ID	Model Flood Group ID (D = Defended, UD = Undefended, CC = Climate Change)	Annual Exceedance Probability (AEP %)	Water Level (mAOD)	Flow (m ³ /s ⁻¹)
RALT07_3589	UAlt2013_D	20	28	0.45
RALT07_3589	UAlt2013_D	0.1	28.3	1.24
RALT07_3589	UAlt2013_D	2	28.07	0.62
RALT07_3589	UAlt2013_U	2	28.07	0.62
RALT07_3589	UAlt2013_U	20	28	0.45
RALT07_3589	UAlt2013_U	3.33	28.04	0.56
RALT07_3589	UAlt2013_D	1	28.11	0.71
RALT07_3589	UAlt2013_D	3.33	28.04	0.56
RALT07_3589	UAlt2013_U	1	28.11	0.71
RALT07_3589	UAlt2013_D_20%CC	1	28.16	0.86
RALT07_3589	UAlt2013_U	0.1	28.3	1.24
RALT07_3589	UAlt2013_U_70%CC	1	28.29	1.21
RALT07_3589	UAlt2013_U_35%CC	1	28.2	0.96
RALT07_3589	UAlt2013_U_30%CC	1	28.19	0.93
RALT07_3589	UAlt2013_D_70%CC	1	28.29	1.21
RALT07_3589	UAlt2013_D_35%CC	1	28.2	0.96
RALT07_3589	UAlt2013_D_30%CC	1	28.19	0.93
RALT07_3559	UAlt2013_U	20	27.97	0.45
RALT07_3559	UAlt2013_D	20	27.97	0.45
RALT07_3559	UAlt2013_U	2	28.04	0.62
RALT07_3559	UAlt2013_U	0.1	28.28	1.24
RALT07_3559	UAlt2013_U	3.33	28.01	0.56
RALT07_3559	UAlt2013_D	2	28.04	0.62
RALT07_3559	UAlt2013_D_20%CC	1	28.13	0.86
RALT07_3559	UAlt2013_D	3.33	28.01	0.56
RALT07_3559	UAlt2013_D	1	28.08	0.71
RALT07_3559	UAlt2013_D	0.1	28.28	1.24
RALT07_3559	UAlt2013_U	1	28.08	0.71
RALT07_3559	UAlt2013_U_70%CC	1	28.27	1.21
RALT07_3559	UAlt2013_U_35%CC	1	28.18	0.96
RALT07_3559	UAlt2013_U_30%CC	1	28.16	0.93
RALT07_3559	UAlt2013_D_70%CC	1	28.27	1.21
RALT07_3559	UAlt2013_D_35%CC	1	28.18	0.96
RALT07_3559	UAlt2013_D_30%CC	1	28.16	0.93
RALT07_3454	UAlt2013_U	3.33	27.88	0.56
RALT07_3454	UAlt2013_D	20	27.83	0.45
RALT07_3454	UAlt2013_D	1	27.95	0.71
RALT07_3454	UAlt2013_U	1	27.95	0.71
RALT07_3454	UAlt2013_D	2	27.91	0.62

RALT07_3454	UAlt2013_U	2	27.91	0.62
RALT07_3454	UAlt2013_D	3.33	27.88	0.56
RALT07_3454	UAlt2013_D	0.1	28.15	1.24
RALT07_3454	UAlt2013_U	20	27.83	0.45
RALT07_3454	UAlt2013_U	0.1	28.15	1.24
RALT07_3454	UAlt2013_D_20%CC	1	28.01	0.86
RALT07_3454	UAlt2013_U_70%CC	1	28.14	1.21
RALT07_3454	UAlt2013_U_35%CC	1	28.05	0.96
RALT07_3454	UAlt2013_U_30%CC	1	28.04	0.93
RALT07_3454	UAlt2013_D_70%CC	1	28.14	1.21
RALT07_3454	UAlt2013_D_35%CC	1	28.05	0.96
RALT07_3454	UAlt2013_D_30%CC	1	28.04	0.93
RALT07_3352	UAlt2013_U	2	27.78	0.62
RALT07_3352	UAlt2013_D	20	27.71	0.45
RALT07_3352	UAlt2013_U	20	27.71	0.45
RALT07_3352	UAlt2013_D	3.33	27.76	0.56
RALT07_3352	UAlt2013_U	1	27.83	0.71
RALT07_3352	UAlt2013_D	1	27.83	0.71
RALT07_3352	UAlt2013_D	2	27.78	0.62
RALT07_3352	UAlt2013_D	0.1	28.02	1.24
RALT07_3352	UAlt2013_U	0.1	28.02	1.24
RALT07_3352	UAlt2013_D_20%CC	1	27.88	0.86
RALT07_3352	UAlt2013_U	3.33	27.76	0.56
RALT07_3352	UAlt2013_U_70%CC	1	28.01	1.21
RALT07_3352	UAlt2013_U_35%CC	1	27.92	0.96
RALT07_3352	UAlt2013_U_30%CC	1	27.91	0.93
RALT07_3352	UAlt2013_D_70%CC	1	28.01	1.21
RALT07_3352	UAlt2013_D_35%CC	1	27.92	0.96
RALT07_3352	UAlt2013_D_30%CC	1	27.91	0.93
RALT07_3312	UAlt2013_D	3.33	27.71	0.56
RALT07_3312	UAlt2013_U	2	27.74	0.62
RALT07_3312	UAlt2013_U	1	27.78	0.71
RALT07_3312	UAlt2013_D	20	27.66	0.45
RALT07_3312	UAlt2013_U	0.1	27.96	1.24
RALT07_3312	UAlt2013_D	0.1	27.96	1.24
RALT07_3312	UAlt2013_D	2	27.74	0.62
RALT07_3312	UAlt2013_D	1	27.78	0.71
RALT07_3312	UAlt2013_U	20	27.66	0.45
RALT07_3312	UAlt2013_D_20%CC	1	27.83	0.86
RALT07_3312	UAlt2013_U	3.33	27.71	0.56
RALT07_3312	UAlt2013_U_70%CC	1	27.95	1.21
RALT07_3312	UAlt2013_U_35%CC	1	27.87	0.96
RALT07_3312	UAlt2013_U_30%CC	1	27.86	0.93
RALT07_3312	UAlt2013_D_70%CC	1	27.95	1.21
RALT07_3312	UAlt2013_D_35%CC	1	27.87	0.96
RALT07_3312	UAlt2013_D_30%CC	1	27.86	0.93
RALT07_3272n	UAlt2013_D_20%CC	1	27.77	0.86
RALT07_3272n	UAlt2013_U	3.33	27.65	0.56

RALT07_3272n	UAlt2013_D	3.33	27.65	0.56
RALT07_3272n	UAlt2013_U	20	27.6	0.45
RALT07_3272n	UAlt2013_U	1	27.72	0.71
RALT07_3272n	UAlt2013_D	2	27.68	0.62
RALT07_3272n	UAlt2013_D	0.1	27.9	1.24
RALT07_3272n	UAlt2013_D	1	27.72	0.71
RALT07_3272n	UAlt2013_U	0.1	27.9	1.24
RALT07_3272n	UAlt2013_D	20	27.6	0.45
RALT07_3272n	UAlt2013_U	2	27.68	0.62
RALT07_3272n	UAlt2013_U_70%CC	1	27.89	1.21
RALT07_3272n	UAlt2013_U_35%CC	1	27.81	0.96
RALT07_3272n	UAlt2013_U_30%CC	1	27.8	0.93
RALT07_3272n	UAlt2013_D_70%CC	1	27.89	1.21
RALT07_3272n	UAlt2013_D_35%CC	1	27.81	0.96
RALT07_3272n	UAlt2013_D_30%CC	1	27.8	0.93
RALT07_3271o	UAlt2013_D	3.33	27.65	0.56
RALT07_3271o	UAlt2013_D_20%CC	1	27.77	0.86
RALT07_3271o	UAlt2013_D	0.1	27.9	1.24
RALT07_3271o	UAlt2013_U	0.1	27.9	1.24
RALT07_3271o	UAlt2013_D	1	27.72	0.71
RALT07_3271o	UAlt2013_D	2	27.68	0.62
RALT07_3271o	UAlt2013_D	20	27.6	0.45
RALT07_3271o	UAlt2013_U	20	27.6	0.45
RALT07_3271o	UAlt2013_U	2	27.68	0.62
RALT07_3271o	UAlt2013_U	1	27.72	0.71
RALT07_3271o	UAlt2013_U	3.33	27.65	0.56
RALT07_3271o	UAlt2013_D_70%CC	1	27.89	1.21
RALT07_3271o	UAlt2013_U_70%CC	1	27.89	1.21
RALT07_3271o	UAlt2013_U_35%CC	1	27.81	0.96
RALT07_3271o	UAlt2013_U_30%CC	1	27.8	0.93
RALT07_3271o	UAlt2013_D_35%CC	1	27.81	0.96
RALT07_3271o	UAlt2013_D_30%CC	1	27.8	0.93
RALT07_3216	UAlt2013_U	20	27.52	0.45
RALT07_3216	UAlt2013_U	0.1	27.81	1.24
RALT07_3216	UAlt2013_D	3.33	27.57	0.56
RALT07_3216	UAlt2013_D	2	27.59	0.62
RALT07_3216	UAlt2013_D	0.1	27.81	1.24
RALT07_3216	UAlt2013_D_20%CC	1	27.69	0.86
RALT07_3216	UAlt2013_U	2	27.59	0.62
RALT07_3216	UAlt2013_D	20	27.52	0.45
RALT07_3216	UAlt2013_U	1	27.63	0.71
RALT07_3216	UAlt2013_U	3.33	27.57	0.56
RALT07_3216	UAlt2013_D	1	27.63	0.71
RALT07_3216	UAlt2013_D_70%CC	1	27.81	1.21
RALT07_3216	UAlt2013_D_35%CC	1	27.72	0.96
RALT07_3216	UAlt2013_D_30%CC	1	27.71	0.93
RALT07_3216	UAlt2013_U_70%CC	1	27.81	1.21
RALT07_3216	UAlt2013_U_35%CC	1	27.72	0.96

RALT07_3216	UAlt2013_U_30%CC	1	27.71	0.93
RALT07_3163	UAlt2013_D	20	27.41	0.45
RALT07_3163	UAlt2013_U	20	27.41	0.45
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RALT07_3163	UAlt2013_D	3.33	27.46	0.56
RALT07_3163	UAlt2013_D	1	27.53	0.71
RALT07_3163	UAlt2013_U	0.1	27.72	1.24
RALT07_3163	UAlt2013_D	2	27.49	0.62
RALT07_3163	UAlt2013_U	2	27.49	0.62
RALT07_3163	UAlt2013_U	1	27.53	0.71
RALT07_3163	UAlt2013_D_20%CC	1	27.59	0.86
RALT07_3163	UAlt2013_U	3.33	27.46	0.56
RALT07_3163	UAlt2013_D_70%CC	1	27.71	1.21
RALT07_3163	UAlt2013_D_35%CC	1	27.63	0.96
RALT07_3163	UAlt2013_D_30%CC	1	27.61	0.93
RALT07_3163	UAlt2013_U_70%CC	1	27.71	1.21
RALT07_3163	UAlt2013_U_35%CC	1	27.63	0.96
RALT07_3163	UAlt2013_U_30%CC	1	27.61	0.93
RALT07_3117	UAlt2013_D	0.1	27.55	1.64
RALT07_3117	UAlt2013_U	0.1	27.55	1.64
RALT07_3117	UAlt2013_U	1	27.38	0.94
RALT07_3117	UAlt2013_D	2	27.34	0.82
RALT07_3117	UAlt2013_U	2	27.34	0.82
RALT07_3117	UAlt2013_D_20%CC	1	27.43	1.13
RALT07_3117	UAlt2013_D	1	27.38	0.94
RALT07_3117	UAlt2013_U	20	27.27	0.59
RALT07_3117	UAlt2013_D	20	27.27	0.59
RALT07_3117	UAlt2013_D	3.33	27.32	0.74
RALT07_3117	UAlt2013_U	3.33	27.32	0.74
RALT07_3117	UAlt2013_U_70%CC	1	27.54	1.61
RALT07_3117	UAlt2013_D_70%CC	1	27.54	1.61
RALT07_3117	UAlt2013_D_35%CC	1	27.47	1.28
RALT07_3117	UAlt2013_D_30%CC	1	27.46	1.23
RALT07_3117	UAlt2013_U_35%CC	1	27.47	1.28
RALT07_3117	UAlt2013_U_30%CC	1	27.46	1.23
RALT07_3071	UAlt2013_D	1	27.23	0.94
RALT07_3071	UAlt2013_U	20	27.15	0.59
RALT07_3071	UAlt2013_D	0.1	27.34	1.64
RALT07_3071	UAlt2013_D	20	27.15	0.59
RALT07_3071	UAlt2013_D_20%CC	1	27.26	1.13
RALT07_3071	UAlt2013_D	2	27.2	0.82
RALT07_3071	UAlt2013_U	2	27.2	0.82
RALT07_3071	UAlt2013_U	1	27.23	0.94
RALT07_3071	UAlt2013_U	0.1	27.34	1.64
RALT07_3071	UAlt2013_U	3.33	27.18	0.74
RALT07_3071	UAlt2013_D	3.33	27.18	0.74
RALT07_3071	UAlt2013_U_70%CC	1	27.34	1.61
RALT07_3071	UAlt2013_U_35%CC	1	27.28	1.28

RALT07_3071	UAlt2013_U_30%CC	1	27.28	1.23
RALT07_3071	UAlt2013_D_70%CC	1	27.34	1.61
RALT07_3071	UAlt2013_D_35%CC	1	27.28	1.28
RALT07_3071	UAlt2013_D_30%CC	1	27.28	1.23
RALT07_3037n	UAlt2013_U	0.1	27.19	1.64
RALT07_3037n	UAlt2013_D	20	26.97	0.59
RALT07_3037n	UAlt2013_U	20	26.97	0.59
RALT07_3037n	UAlt2013_D	1	27.06	0.94
RALT07_3037n	UAlt2013_U	3.33	27.01	0.74
RALT07_3037n	UAlt2013_D	3.33	27.01	0.74
RALT07_3037n	UAlt2013_D	2	27.03	0.82
RALT07_3037n	UAlt2013_U	2	27.03	0.82
RALT07_3037n	UAlt2013_D_20%CC	1	27.1	1.13
RALT07_3037n	UAlt2013_U	1	27.06	0.94
RALT07_3037n	UAlt2013_D	0.1	27.19	1.64
RALT07_3037n	UAlt2013_U_70%CC	1	27.18	1.61
RALT07_3037n	UAlt2013_U_35%CC	1	27.12	1.28
RALT07_3037n	UAlt2013_U_30%CC	1	27.11	1.23
RALT07_3037n	UAlt2013_D_70%CC	1	27.18	1.61
RALT07_3037n	UAlt2013_D_35%CC	1	27.12	1.28
RALT07_3037n	UAlt2013_D_30%CC	1	27.11	1.23
RALT07_2996o	UAlt2013_D_20%CC	1	26.94	1.13
RALT07_2996o	UAlt2013_U	0.1	27.01	1.64
RALT07_2996o	UAlt2013_U	1	26.9	0.94
RALT07_2996o	UAlt2013_D	2	26.88	0.82
RALT07_2996o	UAlt2013_U	3.33	26.86	0.74
RALT07_2996o	UAlt2013_U	20	26.82	0.59
RALT07_2996o	UAlt2013_U	2	26.88	0.82
RALT07_2996o	UAlt2013_D	1	26.9	0.94
RALT07_2996o	UAlt2013_D	20	26.82	0.59
RALT07_2996o	UAlt2013_D	3.33	26.86	0.74
RALT07_2996o	UAlt2013_D	0.1	27.01	1.64
RALT07_2996o	UAlt2013_U_70%CC	1	27.01	1.61
RALT07_2996o	UAlt2013_U_35%CC	1	26.96	1.28
RALT07_2996o	UAlt2013_U_30%CC	1	26.95	1.23
RALT07_2996o	UAlt2013_D_70%CC	1	27.01	1.61
RALT07_2996o	UAlt2013_D_35%CC	1	26.96	1.28
RALT07_2996o	UAlt2013_D_30%CC	1	26.95	1.23

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

Your Lead Local Flood Authority is Knowsley District.

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

[Find out more about flood risk activity permits](#)

Help and advice

Contact the Cumbria and Lancashire Environment Agency team at inforequests.cmblnc@environment-agency.gov.uk for:

- [more information about getting a product 5, 6, 7 or 8](#)
- general help and advice about the site you're requesting data for

Appendix D: EA Communications

FW: FOLLOW UP TO RESPONSE- Request for information - Ref: EIR2025/14592RI

From CMBLNC Info Requests <Inforequests.cmblnc@environment-agency.gov.uk>

Date Tue 24/06/2025 14:06

To Charles Townsend <charles@townsendwaterengineering.co.uk>

Cc eir2025/14592/con1@ea.ecase.co.uk <eir2025/14592/con1@ea.ecase.co.uk>

External (inforequests.cmblnc@environment-agency.gov.uk)

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Hello Charles,

Regarding your enquiry below, the teams confirm that matters relating to surface water flooding are not within the remit of the Environment Agency; they advise that you direct this particular enquiry to the Lead Local Flood Authority.

Kind regards,
Rosie

Rosie Irlam
Customer and Engagement Officer
Cumbria and Lancashire

From: Charles Townsend <charles@townsendwaterengineering.co.uk>

Sent: 20 June 2025 16:50

To: CMBLNC Info Requests <Inforequests.cmblnc@environment-agency.gov.uk>

Subject: Re: RESPONSE- Request for information - Ref: EIR2025/14592RI

Hi Rosie,

Thank you for Stirling efforts in turning this around so quickly. It is brilliant.

Is it possible that I can discuss this with planning liaison as this is a highly unusual reply. I am likely to place the finished floor levels at the surface water 1 in 100 year event plus climate change depth and add 600mm. However as the flooding is not fluvial flooding it is surface water flooding I will not be undertaking compensatory storage.

Does that sound reasonable?

Kind regards
Charles

Charles Townsend BSc (Hons) CIWEM CSci
Townsend Water Engineering
charles@townsendwaterengineering.co.uk
Tel: 07786912617
Landline (better reception) 01244 294890

From: Cumbria and Lancashire Enquiries <inforequests.cmlnc@environment-agency.gov.uk>
Sent: 20 June 2025 16:08
To: Charles Townsend <charles@townsendwaterengineering.co.uk>
Subject: RESPONSE- Request for information - Ref: EIR2025/14592RI

Hi Charles,

I am writing in response to your request for information, received 19 June 2025, regarding Request for Flood risk assessment data (product 4). Customer request reference UJTU4AFAYPD.

We respond to requests for information under the Freedom of Information Act 2000 (FOI) and Environmental Information Regulations 2004 (EIR).

Upper Alt model 2013

Our detailed local modelling shows that there is currently no risk of flooding from the River Alt to the site of interest. Please find attached a product 4 for the River Alt showing the most extreme flood outlines that we have modelled so you can see the risk from the River Alt. In-channel modelled measurements have been provided as part of the Product 4.

New National Modelling

The site has placed in Flood Zones 3 and 2 because of direct rainfall modelling on the site (part of National Modelling undertaken). This direct rainfall method was applied to the surface water mapping and outputs linked to watercourses have been copied into the Flood Map for Planning. You will be able to see that the surface water mapped extents and the Flood Zones match in this area.

We don't have specific water level information associated with the National Modelling that we are able to provide yet, it is estimated that we will receive these in December 2025.

You may wish to download the surface water mapping via [Risk of Flooding from Surface Water](#). You have the opportunity to download the extent of surface water flooding (rofsw_4band) and some depth data. The depth data labels are slightly misleading e.g rofsw_4band_0_3 depth actually means depth of flooding = 30cm and the likelihood of that depth occurring, rofsw_4band_0_6 means depth of flooding = 60cm and the likelihood of that depth occurring.

These are specific depth categories and the chance of flooding to that depth in the category.

We are unable to provide Product 4 information for New National Modelling/Direct rainfall modelling at this time.

Where we cannot provide flood levels or depths and these are needed to inform a Flood Risk Assessment (FRA) to support a planning application, you will need to interpret the data we provide to determine indicative flood levels and depths. The approach you take to do this should be presented in your FRA and we will review it if we are a statutory consultee on the planning application. We may also review it if you submit a draft FRA to us through our chargeable planning advice service. You can submit a request for chargeable planning advice to our Sustainable Places team at clplanning@environment-agency.gov.uk

Other information

- The Environment Agency holds no records of flooding for the site of interest. Please be aware, however, that this does not necessarily mean that flooding has not occurred here in the past as our records are not comprehensive.*

- *For all queries relating to flooding from surface water, ordinary watercourses and groundwater flooding, please contact the Lead Local Flood Authority, Knowsley Council.*
- *Surface Water Maps can be viewed online at <https://flood-map-for-planning.service.gov.uk/>*

Please refer to the [Open Government Licence](#) which explains the permitted use of this information.

Rights of appeal

If you are not satisfied with our decision, you can contact us within two calendar months to ask for the decision to be reviewed. We will then conduct an internal review of our response to your request and give you our decision in writing within 40 working days.

If you are not satisfied with the outcome of the internal review, you can then make an appeal to the Information Commissioner Office, the statutory regulator for EIR and FOI. The address is: Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire. SK9 5AF.

Tel: 0303 123 1113 (local rate) or 01625 545 745 (national rate) | Fax: 01625 524 510 Email: casework@ico.org.uk | Website: www.ico.org.uk

Yours sincerely,

Rosie Irlam

CLA Area Customers and Engagement Team

Your feedback is important to us - please visit Environment Agency FOI Customer Satisfaction Survey

Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

Appendix E: LLFA Communications

FW: Pre Application - Former Huyton Cricket Club , Huyton Lane, Huyton ref 25/00016/PREAPP [LICH-DMS.FID794054]

From Andy Garnett <AG@breck.co.uk>

Date Sat 14/06/2025 06:49

To David Stoddart <d.stoddart@primetp.co.uk>; Alistair Henderson <alistair@tree-solutions.co.uk>; Charles Townsend <charles@townsendwaterengineering.co.uk>; Mike Potts <mike.potts@envirosolution.co.uk>; 'Rob Henderson' <rob.henderson@jda-architects.com>; 'Karen O'Reilly' <karen.oreilly@jda-architects.com>; Ysobella Cox <ysobella@ues.org.uk>; Roy Gibbs <roy@ues.org.uk>

Cc Harry Russell <harry.russell@lichfields.uk>; James Fairhurst <jf@breck.co.uk>; Kirstie Oakey <kirstie.oakey@lichfields.uk>; Dan King <dk@breck.co.uk>

 8 attachments (5 MB)

2500016PREAPP REV1.docx; Huyton Lane - Proposed Site Layout - Rev E.pdf; Huyton Lane - Proposed Site Layout - Rev E.dwg; image001.jpg; image002.jpg; image003.jpg; image004.png; image005.jpg;

External (ag@breck.co.uk)

[Report This Email](#) [FAQ](#) [GoDaddy Advanced Email Security](#), Powered by INKY

All

Interesting feedback here from the pre app formal doc attached.

A few extracts of note for the main reports;

Design @'Rob Henderson' All layout concerns already addressed.

- *The elevations should as stated in the draft heritage statement take cues from the pavilion and the arts and crafts revival style present in St Micheal's conservation area.*
- *The elevations would benefit from a more bespoke design with additional detail e.g. stone cills, decorative brickwork (e.g arched brickwork pattern) above windows.*
- *Use of bay/projecting windows should be considered to add detail/ depth to the elevations.*
- *Eaves detailing should be considered .*
- *Buff brick is not prominent in the area and would be unacceptable.. Red / Brown brick would be preferred.*
- *Rendered properties should be sited near to pavilion with brick properties located adjacent to Huyton Lane*

Noise / AQA @Mike Potts note we now no longer propose a padel court. The building will be refurbished for use by potential community use i.e. meeting hall etc.

Control of Noise – Noise assessment is required to ensure a scheme for the protection of the dwellings from noise from the use of the pavilion and the padel courts, is to be submitted prior to approval.

Air Quality Assessment – An air quality assessment may be required as the proposed development would exceed the stage 1 criteria (more than 10 residential units) and stage 2 criteria (more than 500 AADT for light duty vehicles) as stated in the document, Land-Use Planning & Development Control: Planning for Air Quality. [air-quality-planning-guidance.pdf](#). If you consider an AQ assessment is not required, then justification must be provided. If the development was to go ahead, we would look to place the following conditions on the development:

Trees

No real issue [@Alistair Henderson](#) as we have now removed all trees to the N East and put in communal spaces.

FRA / Flood [@Charles Townsend](#) LLFA no objection in principle, which is good.

Having considered the submitted information and reference to the publicly available databases, the LLFA has no objection in principle to the proposed development of the site as it is currently located in Flood Risk Zone 1 and low surface water flood risk. Despite the acceptance of the proposed development for the site, the proposed drainage strategy is not satisfactory and any future planning application for site should consider the following key points in developing the site drainage strategy:

- The proposed drainage strategy appears that have not allocated source control SuDS features at the property level as well as spaces for blue and green corridors. A Sustainable Drainage Design (SuDS) aims to minimise the impacts from a proposed development on water quantity and quality and maximise amenity and biodiversity. In designing an appropriate set of SuDS techniques for a development site, the LLFA will be expecting surface water runoff to be managed close to source (Source control / property level control), only conveying downstream what cannot be managed at source. Therefore, the drainage design shall be required to include source control/ property level control (e.g. permeable pavement and rain garden), green and open conveying systems / green corridors (e.g. green swale and ditch) and regional control (e.g. attenuation basin) features. The development of drainage design should therefore be planned as early as possible before the setting the property/other spaces layout in close collaboration with the landscape and biodiversity team. This becomes more important in this case where the surface water runoff is proposed to connect to a culverted watercourse, implying that there is no much flexibility on adopted discharge rate.

- An explanation of existing drainage system/mechanism and flow paths on the site and that how the site is currently affected by off-site surface water runoff shall be required.

- Evidence and justification (e.g. infiltration tests and groundwater levels) shall be required to demonstrate that in choosing drainage features for post development, the surface water drainage discharge hierarchy has appropriately been followed.

- The maximum discharge rate from the development site would be expected to be restricted to QBAR greenfield runoff rate. Volume of attenuation storage required on site for the 1% (1in100) plus climate change storm.

- Where the proposals are connecting to an existing drainage system/watercourse, it is likely that the authorities responsible for maintaining those systems/watercourse will have their own design requirements. These requirements will need to be reviewed and agreed as part of any surface water drainage scheme.

- Detailed Drainage Scheme Plan showing the layout of the proposed drainage network, post development impermeable area, the location of the storage within the proposed development and how these relate to the submitted calculations, including any chamber, pipe numbers, direction of flow, invert and cover levels, gradients diameters and dimensions. The methods of flow control must be detailed as should non-conventional elements such as pond and permeable paving.

- Sufficient information on the correct number of treatment stages in the surface water management train will also be required, for further information see the CIRIA SuDS Manual (C753).

- The mechanism for securing long-term maintenance will need to be considered and agreed between the applicant and the Local Planning Authority. This may involve discussions with those adopting and/or maintaining the proposed systems, which could include the Highway Authority, Planning Authority, Parish Councils, Water

Companies and private management companies.

- Evidence that exceedance flows and runoff in excess of design criteria shall be considered - calculations and plans shall be provided to show where above ground flooding might occur and where this would pool and flow.

- An assessment of groundwater levels and its fluctuations shall be required.

- A Phase II geo-environmental assessment to identify the site physical characteristics, likely existing contamination and potential remediation strategy shall be required.

- A management and maintenance plan for the proposed drainage system, arrangements for adoption and means of access for inspection and maintenance purposes shall be considered.

Highways @David Stoddart

Not much here other than below. My view is the parking court he speaks of is fine. Do we need details of the private access to the rear of 50 Adswood Dr?

Small parking courts, such as that for 46, 47 and 48 are not supported, as they are poorly overlooked and tend to attract anti-social behaviour.

The removal of dwelling access from the initial section of the site road is welcomed to avoid potential conflicts with vehicles entering the site.

The access way serving Plots 75-83 is labelled as a parking court, although its layout is more akin to a shared surface road. If this is intended for adoption, it would need to have a 2m service strip introduced. Kerb radii would need to be increased to 6m if the intention is for refuse collection vehicles to enter, in order to avoid overrunning. Similarly for the car park serving the apartments.

Highways question whether the intention is to provide vehicular access to number 50 Adswood Road via the 4m wide pedestrian link. If so, further detailed design would be required at the application stage to enable careful consideration.

Servicing arrangements including the location of bin storage and cycle storage areas for the apartment element of the scheme should be clearly identified.

TRO – the site is located close to the town centre and all residential roads within walking distance are subject to residents' parking zones, this development will also need to be covered by such a TRO.

Highways would require a Road Safety Audit to be conducted of the proposed access arrangements as a fourth arm of the existing roundabout. The entry radii at 10m could permit relatively high speeds of traffic from the south western approach on Huyton Lane into the site, which would be hazardous to pedestrians crossing the access. The existing street trees, although currently immature will increase in size and this could cause an impairment to visibility of vehicles approaching from this direction. The estate will be subject to a 20mph speed limit and the layout will need to ensure that this speed is adhered to. On straight alignments greater than 60m, traffic calming features will be required.

All can we keep pressing ahead with all reports and drawings etc to hit the end of June deadline?

To reaffirm the final layout pre planning is attached.

AG



**Andy
Garnett**
Managing Director

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20 Sceptre Court

Bamber Bridge
Preston
PR5 6AW

From: Harry Russell <harry.russell@lichfields.uk>

Sent: 13 June 2025 12:52

To: Andy Garnett <AG@breck.co.uk>; James Fairhurst <jf@breck.co.uk>

Cc: Kirstie Oakey <Kirstie.Oakey@lichfields.uk>

Subject: FW: Pre Application - Former Huyton Cricket Club , Huyton Lane, Huyton ref 25/00016/PREAPP [LICH-DMS.FID794054]

Hi Andy

We have received the written feedback to the pre-app request, please see attached. From an initial scan it looks like the response repeats a lot of what we have already received from Mark and various consultees. There's no mention of any other contributions in this response, we suggest that we stay quiet on this point for the time being.

The response states that the listed building consent application should be supported by a schedule of works, existing and proposed elevations/floor plans/ sections as applicable, details of all materials and a structural survey.

Please note the comments from highways on the internal highways layout and general comments on layout and design (with regards to elevation treatment etc.).

@James Fairhurst - I don't think we have missed anything off the validation requirements but grateful if you could check against your tracker. When we were on site we took a few pictures of the pavilion. We will review these and let you know if we they will suffice for the photomontages.

We note the feedback received from residents so far. A lot of it seems to be as expected, and we note the comments on the padel courts. With regards to habitat/wildlife comments we will see what the PEA says and base the submission of its findings.

Please let me know if you have any queries. I am on leave this afternoon and Monday but look forward to catching up on my return.

Kind regards

Harry

Harry Russell
Planner

BA (Hons) MSc MRTPI

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From: Quinn, Mark <mark.quinn@knowsley.gov.uk>

Sent: 13 June 2025 12:20

To: Harry Russell <harry.russell@lichfields.uk>; Kirstie Oakey <Kirstie.Oakey@lichfields.uk>

Subject: Pre Application - Former Huyton Cricket Club , Huyton Lane, Huyton ref 25/00016/PREAPP

CAUTION: This email originated from an external source.

Hi Harry/ Kirstie.

Please find the LPA's response to this application.

Regards

Mark Quinn
Principal Planner
Planning

Telephone: 0151 443 2223

Knowsley Council, Huyton Library, Civic Way, Huyton, Knowsley, L36 9FB



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Appendix F: Site Layout



Housetype	m²	Ft²	Total No.	Total m²	Total Ft²
Type B - 2B3P Bungalow (NDSS)	61	657	2	122	1313
Type C - 2B3P House Type (NDSS & M4(2))	74	797	8	592	6372
Type D - 2B4P Aspect House Type (NDSS)	81	872	1	81	872
Type E - 2B3P House Type (NDSS & M4(3))	101	1087	4	404	4349
Type F - 3B4P House Type (NDSS)	86	926	15	1290	13885
Type G - 3b4P U/P House Type (NDSS)	90	969	1	90	969
Type J - 4b6P House Type (NDSS & M4(2))	114	1227	8	912	9817
Type M - 2b3P Apartments (NDSS)	61	657	12	732	7879
Type N1 - 1b2p Apartment (NDSS)	50	538	6	300	3229
Type N2 - 2b3p Apartment (NDSS)	61	657	6	366	3940
Type N3 - 2b3p Apartment (NDSS)	50	538	6	300	3229
Type N4 - 2b3p Apartment (NDSS)	61	657	3	183	1970
Type P1 - 1b2p Maisonettes (M42)	50	538	6	300	3229
Type P2 - 1b2p Maisonettes (NDSS)	57	614	6	342	3681
TOTAL			84	6014	64734

	Site Area		Density		Footage			
	Ha	Ac	Un/Ha	Un/Ac	m²/Ha	m²/Ac	Ft²/Ha	Ft²/Ac
Gross	2.21	5.46	38.01	15.38	2721.27	1101.26	29291.45	11853.85
Nett	1.84	4.55	45.65	18.47	3268.48	1322.71	3268.48	14237.50

HOUSE TYPE KEY:

- TYPE B 2B3P BUNGALOW 61**
- TYPE C 2B3P HOUSE TYPE 74**
- TYPE E 2B3P HOUSE TYPE 101**
- TYPE F 3B4P HOUSE TYPE 86**
- TYPE G 3B4P FLYOVER HOUSE TYPE 90**
- TYPE J 4B6P HOUSE TYPE 114**
- TYPE P1 1B2P 50 (GF)
TYPE P2 2B3P 57 (FF)**
- TYPE M1 2B3P 61 (GF)
TYPE M2 2B3P 61 (FF)**
- TYPE N1 1B2P 50
TYPE N2 2B3P 61
TYPE N3 1B2P 50
TYPE N4 2B3P 61**

INDICATES CIRCULATION SPACE

0 5 10 15 20 25
SCALE BAR

- SOCIAL RENT**
- SHARED OWNERSHIP**
- RENT TO BUY**

REV	DATE	DRAWN	DESCRIPTION
K	FEB 24	SHW	SUDS AREA UPDATED
J	FEB 24	SHW	PLANNERS COMMENTS ENDSORED
H	DEC 23	SHW	FOOTPATHS & PARKING BAY DIMENSIONS ADDED
G	DEC 23	SHW	UPDATED INCORPORATING COMMENTS
F	JUNE 22	SHW	PLANNERS & HIGHWAYS COMMENTS ENDSORED
E	JUNE 22	SHW	PLOTS 42-43 SWAPPED WITH PLOTS 63 & 64
D	JUNE 22	SHW	PLOTS 42-43 MOVED OUT OF FLOOD RISK AREA
C	MAY 23	SHW	PLANNERS COMMENTS ENDSORED
B	MAY 23	SHW	REAR GARDEN AREAS UPDATED FOR PLOTS 01-45
A	MAY 23	SHW	PLOTS 62-64 & 82-84 UPDATED

TITLE:				
PROPOSED SITE LAYOUT				
 Breck Homes 20 Sceptre Court Bamber Bridge Preston PR5 5AW Tel: 01524 587 000 Email: hello@breck.co.uk www.breck.co.uk/homes				
PROJECT: HUYTON LANE, KNOWSLEY				
DATE: MARCH 25	SCALE: 1:500 @ A1	JOB REF: -	DRAWING NUMBER: P01 Huyton Lane / Proposed Site Layout - Option A	REV: K

Appendix G: Impermeable Area

Pipe No.	Pipe Length (m)	Road Area (Ha)	House & Drive (Ha)	House & Drive + 10% (Ha)	Total Area (Ha)	Hatch
1.000	15.509	0.018	0.041	0.045	0.063	
2.000	25.780	0.024	0.034	0.037	0.061	
1.001	8.382					
1.002	17.381	0.025			0.025	
1.003	54.076	0.044	0.096	0.106	0.150	
3.000	15.029	0.015	0.114	0.125	0.140	
3.001	37.914	0.043	0.078	0.086	0.129	
4.000	45.905	0.057	0.065	0.072	0.129	
5.000	19.187	0.025	0.027	0.030	0.055	
4.001	7.764	0.018	0.049	0.054	0.072	
3.002	67.905	0.057			0.057	
1.004	9.955	0.023	0.137	0.151	0.174	
1.005	25.723					
1.006	33.392		0.018	0.020	0.020	
1.007	5.435					
1.008	5.179					
1.009	25.403					
1.010	5.217					
TOTALS		0.349	0.659	0.726	1.075	

- NOTES
- 10% Urban creep allowance has been applied to plot and drive areas.
 - Hydraulic Calculations include all permeable drives as impermeable areas within model, to account for possible future changes to surfacing type or poor maintenance.
 - Filter drains shown are not considered to provide large attenuation volumes, therefore these have been excluded from the Hydraulic calculations. To be considered further at detailed design stage, once the level of SuDS provision has been agreed.

North Point

Quality Ass.

UKAS 005

Quality Assurance

ISO 9001:2015

SGS Certificate

GB02/54539

Project

Huyton Cricket Club

Client

Breck Homes

Title

Preliminary Impermeable Areas Plan

Original Scale

A1

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Drawn

NE

Date

Feb28

Checked By

RDE

Scale

1:500

IronsideFarrar

Environmental Planners

Civil Engineers

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3 Worsley Court

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EDINBURGH

GLASGOW

Drawing No.

30692/101

Revision

Appendix H: Ironside Farrar Drainage Strategy and Calculations

KEY

- S.W. Foul
- Proposed Sewer
- Proposed Disconnection Manhole
- Existing Combined Sewer
- Existing Surface Water Sewer
- Proposed Finished Floor Level
- Proposed Level
- Existing Level
- Denotes possible retaining wall locations (above 600mm).
- Private Permeable Drive with underdrain. To be maintained by Homeowner (individual drives) or ManCo (shared drive areas). Impermeable areas are still accounted for within hydraulic calculations.
- Proposed Private Filter Drain to receive direct runoff from adjacent private shared drive. Filter Drain: 1.15m minimum depth, 0.5m wide, 1500 perforated pipe at base. To be maintained by private ManCo.
- Proposed Grass filter strip to act as pre-treatment prior to filter drain or swale. To be maintained by private ManCo.
- Proposed S104 Detention Basin. Max 1 in 3 side slopes. To be maintained by S104 Undertaker / private ManCo.
- Catchpit Manhole to minimise silt entering the downstream piped network. To be maintained by private ManCo (private SuDS).

* Water Butts to be provided for ALL plots as additional SuDS measure and to provide water for non-potable use (watering gardens).

DRAINAGE STRATEGY NOTES

Please refer to the below drainage strategy considerations when checking for compliance with the National Standards for Sustainable Drainage Systems.

1. Standard 1 (Runoff Destinations):

1.a) Non-Potable Use

The demand for non-potable use and the need for landscape irrigation (points 1 and 2 of 1.11 of the National SuDS Standards) will be both met by the incorporation of a water butt for every proposed property. This will allow water re-use for garden areas.

The development is in the north west which is NOT an area identified as seriously water stressed by the Environment Agency in 2021.

Rainwater harvesting systems above and beyond water butts are therefore not considered suitable for this development.

1.b) Infiltration to Ground

Ground investigations were carried out by IGE Consulting in September 2025. 1 no. infiltration test was attempted in 3 no. locations in accordance with BRE 365.

Only 1 no. test was attempted in each location due to limited drainage in all tests. Infiltration rates were in the order of 3.15×10^{-7} which is unlikely to be viable for proposed infiltration features. No further tests were therefore undertaken.

The poor infiltration rates recorded is conclusive that the site is not suitable for infiltration to ground.

1.c) Discharge to an Above Ground Surface Water Body

The closest watercourse (River Alt) is immediately to the north of the development.

Discharge to an above ground surface water body is therefore the most suitable for the discharge of surface water from this development.

2. Standard 2 (Management of Everyday Rainfall)

SuDS measure will be incorporated within development to assist with preventing runoff from the site for the first 5mm of rainfall of the majority of rainfall events.

2.a) Private Permeable Drives with underdrains to be provided with Engineered sub-base layer beneath the underdrain level to assist with first 5mm rainfall requirements.

Total Private Permeable Drive Area (highlighted) = 0.219 Ha
Total Private Permeable Drive Area with multiplication factor (x5) = 1.095 Ha

2.b) Private Filter Drains with no infiltration assumed, to provide a depth of stone below level of perforated pipe to assist with first 5mm rainfall requirements. To be treated as a permeable drive in terms of multiplication factor (no infiltration due to underlying ground).

Total Private Filter Drain Length = 83.6m; Filter Drain width 0.5m
Total Private Filter Drain Area = 41.8m² = 0.00418 Ha
Total Private Filter Drain Area with multiplication factor (x5) = 0.021 Ha

2.c) Detention Basins to provide topsoil or SuDS soils to basin base that achieves infiltration rate of 1×10^{-6} m/s.

Total Detention Basin Base Area = 0.0259 Ha
Total Detention Basin Base Area with multiplication factor (x25) = 0.647 Ha

Total Area of SuDS provided (with multiplication factors) = 1.763 Ha

Total Impermeable Areas = 1.075 Ha

Development is considered to comply with Standard 2 of the National Standards for Sustainable Drainage Systems.

3. Standard 3 (Management of Extreme Rainfall and Flooding)

3.a) Urban creep of an additional 10% has been applied to all private impermeable areas (plots and drives).

3.b) Peak Rainfall Climate Change Allowances of 40% and 45% have been applied in the 30 year and 100 year return periods respectively.

3.c) Pre-development QBar greenfield runoff rate:

Total Development Boundary = 2.216 Ha
Developable Area (Development Boundary excluding large areas of POS) = 1.741 Ha

Pre-development QBar greenfield runoff rate using Developable Area (1.741 Ha) = 13.7 l/s
(Based on FEH statistical method / FEH point data purchased).

3.d) Post development discharge rate:

Total Impermeable area (including urban creep allowance) = 1.075 Ha

Post development hydraulic calculations to only include impermeable areas (1.075 Ha), but are presented with a Cv of 1.0 and an additional storage value of 0.0 (MADD Factor). Using a Cv of 1.0 and MADD factor of 0.0 is an industry standard approach to account for the possible minor entries from permeable areas that may runoff onto the drained hard paved areas and some minor losses where some hard areas may runoff onto permeable un-drained areas.

Post development discharge to be limited to 13.7 l/s in all return periods (matching the QBar greenfield runoff rate) (FEH-22 rainfall methodology used in hydraulic calculations).

3.e) No flooding is designed to occur in all events up to and including the 100 year return period (+45% climate change).

3.f) Separate hydraulic calculations with a surcharged outfall have been prepared, which confirms no flooding in the 100 year return period + climate change (modelled with 1m surcharge level 30.600m - no modelled river levels available fronting site).

3.g) Exceedance events in excess of 100 year return period or in the case of blockages have been considered in drawing 30692/102.

A	18/02/26	RDE	Updated to suit latest development layout.
Rev	Date	Initials	Details

Drawing Revisions

North Arrow	Project: Huyton Cricket Club, Huyton	IronsidesFarrar Environmental Planners Civil Engineers Landscape Architects Graphic Design	
Quality Ass.	Client: Breck Homes		
UKAS 005 Quality Assurance ISO 9001:2015 SCS Certificate GB02/54539	Title: Preliminary Drainage Layout	3 Worsley Court, MANCHESTER M28 3NU Tel: 0161 703 8801 Fax: 0161 703 8279 manchester@ironsidesfarrar.com	
Original Size	Copyright, Act/plan/development Ordinance Survey® © Crown Copyright. All rights reserved. Licence No. AL100017966.	Drawn: KF Date: June 25	Checked By: RDE Scale: 1:500
A1		Drawing No.: 30692/100	Revision: A

**Design Settings**

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.650
CV	1.000	Preferred Cover Depth (m)	1.350
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	100.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
13	0.063	4.00	33.650	1200	344358.787	391280.071	1.944	31.706
14	0.061	4.00	33.700	1200	344354.378	391309.476	1.925	31.775
12	0.000		33.470	1500	344370.933	391289.715	1.942	31.528
11	0.025	4.00	33.400	1500	344377.193	391295.290	2.052	31.348
10	0.150	4.00	33.200	1500	344386.909	391309.702	2.069	31.131
17	0.140	4.00	32.920	1800	344493.284	391331.026	2.462	30.458
16	0.129	4.00	33.050	1800	344503.354	391319.868	2.630	30.420
19	0.129	4.00	33.650	1500	344446.092	391256.121	2.125	31.525
20	0.055	4.00	32.650	1500	344493.345	391273.816	1.755	30.895
18	0.072	4.00	33.150	1800	344479.740	391287.347	2.522	30.628
15	0.057	4.00	33.400	1800	344475.673	391293.960	3.075	30.325
9	0.174	4.00	32.600	1800	344429.168	391343.441	2.445	30.155
8	0.000		32.500	1800	344422.587	391350.912	2.370	30.130
7	0.020	4.00	31.650	1800	344397.582	391356.949	1.584	30.066
6	0.000		31.500	1800	344358.351	391353.394	1.532	29.968
5	0.000		31.300		344354.609	391359.424	1.461	29.839
4	0.000	4.00	31.300		344386.768	391375.174	1.500	29.800
3	0.000		31.300	2400	344393.128	391376.363	1.520	29.780
2	0.000		31.300	1200	344418.220	391380.326	1.669	29.631
1			31.250		344417.406	391385.479	1.650	29.600

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	13	12	15.509	0.600	31.706	31.603	0.103	150.0	225	4.24	55.2
2.000	14	12	25.779	0.600	31.775	31.603	0.172	150.0	225	4.40	55.2
1.001	12	11	8.383	0.600	31.528	31.423	0.105	80.0	300	4.48	55.2
1.002	11	10	17.381	0.600	31.348	31.131	0.217	80.0	375	4.63	55.2
1.003	10	9	54.075	0.600	31.131	30.380	0.751	72.0	375	5.05	55.0
3.000	17	16	15.030	0.600	30.458	30.420	0.038	400.0	600	4.21	55.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.065	42.3	12.6	1.719	1.642	0.063	0.0	84	0.931
2.000	1.065	42.3	12.2	1.700	1.642	0.061	0.0	82	0.922
1.001	1.759	124.3	24.7	1.642	1.677	0.124	0.0	91	1.383
1.002	2.027	223.9	29.7	1.677	1.694	0.149	0.0	92	1.426
1.003	2.137	236.0	59.4	1.694	1.845	0.299	0.0	128	1.792
3.000	1.211	342.4	27.9	1.862	2.030	0.140	0.0	115	0.742

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.001	16	15	37.914	0.600	30.420	30.325	0.095	400.0	600	4.73	55.2
4.000	19	18	45.905	0.600	31.525	30.703	0.822	55.8	300	4.36	55.2
5.000	20	18	19.188	0.600	30.895	30.703	0.192	100.0	300	4.20	55.2
4.001	18	15	7.764	0.600	30.628	30.550	0.078	100.0	375	4.43	55.2
3.002	15	9	67.905	0.600	30.325	30.155	0.170	400.0	600	5.66	52.0
1.004	9	8	9.956	0.600	30.155	30.130	0.025	400.0	600	5.80	51.3
1.005	8	7	25.723	0.600	30.130	30.066	0.064	400.0	600	6.15	49.8
1.006	7	6	39.392	0.600	30.066	29.968	0.098	400.0	600	6.70	47.7
1.007	6	5	7.097	0.600	29.968	29.950	0.018	400.0	600	6.79	47.3
6.000	4	3	6.470	0.600	29.800	29.780	0.020	323.5	600	4.08	55.2
1.009	3	2	25.403	0.600	29.780	29.631	0.149	170.0	225	4.50	55.2
1.010	2	1	5.217	0.600	29.631	29.600	0.031	170.0	225	4.59	55.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.001	1.211	342.4	53.7	2.030	2.475	0.269	0.0	159	0.892
4.000	2.108	149.0	25.7	1.825	2.147	0.129	0.0	84	1.593
5.000	1.572	111.1	11.0	1.455	2.147	0.055	0.0	63	1.009
4.001	1.812	200.1	51.1	2.147	2.475	0.256	0.0	129	1.523
3.002	1.211	342.4	109.4	2.475	1.845	0.582	0.0	232	1.082
1.004	1.211	342.4	195.7	1.845	1.770	1.055	0.0	325	1.250
1.005	1.211	342.4	189.8	1.770	0.984	1.055	0.0	320	1.241
1.006	1.211	342.4	185.4	0.984	0.932	1.075	0.0	315	1.234
1.007	1.211	342.4	183.9	0.932	0.750	1.075	0.0	313	1.232
6.000	1.348	381.2	0.0	0.900	0.920	0.000	0.0	0	0.000
1.009	1.000	39.7	0.0	1.295	1.444	0.000	0.0	0	0.000
1.010	1.000	39.7	0.0	1.444	1.425	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.509	150.0	225	Circular_Default Sewer Type	33.650	31.706	1.719	33.470	31.603	1.642
2.000	25.779	150.0	225	Circular_Default Sewer Type	33.700	31.775	1.700	33.470	31.603	1.642
1.001	8.383	80.0	300	Circular_Default Sewer Type	33.470	31.528	1.642	33.400	31.423	1.677
1.002	17.381	80.0	375	Circular_Default Sewer Type	33.400	31.348	1.677	33.200	31.131	1.694
1.003	54.075	72.0	375	Circular_Default Sewer Type	33.200	31.131	1.694	32.600	30.380	1.845
3.000	15.030	400.0	600	Circular_Default Sewer Type	32.920	30.458	1.862	33.050	30.420	2.030
3.001	37.914	400.0	600	Circular_Default Sewer Type	33.050	30.420	2.030	33.400	30.325	2.475
4.000	45.905	55.8	300	Circular_Default Sewer Type	33.650	31.525	1.825	33.150	30.703	2.147

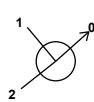
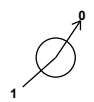
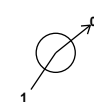
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	13	1200	Manhole	Adoptable	12	1500	Manhole	Adoptable
2.000	14	1200	Manhole	Adoptable	12	1500	Manhole	Adoptable
1.001	12	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
1.002	11	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable
1.003	10	1500	Manhole	Adoptable	9	1800	Manhole	Adoptable
3.000	17	1800	Manhole	Adoptable	16	1800	Manhole	Adoptable
3.001	16	1800	Manhole	Adoptable	15	1800	Manhole	Adoptable
4.000	19	1500	Manhole	Adoptable	18	1800	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	19.188	100.0	300	Circular_Default Sewer Type	32.650	30.895	1.455	33.150	30.703	2.147
4.001	7.764	100.0	375	Circular_Default Sewer Type	33.150	30.628	2.147	33.400	30.550	2.475
3.002	67.905	400.0	600	Circular_Default Sewer Type	33.400	30.325	2.475	32.600	30.155	1.845
1.004	9.956	400.0	600	Circular_Default Sewer Type	32.600	30.155	1.845	32.500	30.130	1.770
1.005	25.723	400.0	600	Circular_Default Sewer Type	32.500	30.130	1.770	31.650	30.066	0.984
1.006	39.392	400.0	600	Circular_Default Sewer Type	31.650	30.066	0.984	31.500	29.968	0.932
1.007	7.097	400.0	600	Circular_Default Sewer Type	31.500	29.968	0.932	31.300	29.950	0.750
6.000	6.470	323.5	600	Circular_Default Sewer Type	31.300	29.800	0.900	31.300	29.780	0.920
1.009	25.403	170.0	225	Circular_Default Sewer Type	31.300	29.780	1.295	31.300	29.631	1.444
1.010	5.217	170.0	225	Circular_Default Sewer Type	31.300	29.631	1.444	31.250	29.600	1.425

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	20	1500	Manhole	Adoptable	18	1800	Manhole	Adoptable
4.001	18	1800	Manhole	Adoptable	15	1800	Manhole	Adoptable
3.002	15	1800	Manhole	Adoptable	9	1800	Manhole	Adoptable
1.004	9	1800	Manhole	Adoptable	8	1800	Manhole	Adoptable
1.005	8	1800	Manhole	Adoptable	7	1800	Manhole	Adoptable
1.006	7	1800	Manhole	Adoptable	6	1800	Manhole	Adoptable
1.007	6	1800	Manhole	Adoptable	5		Junction	
6.000	4		Junction		3	2400	Manhole	Adoptable
1.009	3	2400	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.010	2	1200	Manhole	Adoptable	1		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
13	344358.787	391280.071	33.650	1.944	1200					
						0	1.000	31.706	225	
14	344354.378	391309.476	33.700	1.925	1200					
						0	2.000	31.775	225	
12	344370.933	391289.715	33.470	1.942	1500		1	2.000	31.603	225
						2	1.000	31.603	225	
						0	1.001	31.528	300	
11	344377.193	391295.290	33.400	2.052	1500		1	1.001	31.423	300
						0	1.002	31.348	375	
10	344386.909	391309.702	33.200	2.069	1500		1	1.002	31.131	375
						0	1.003	31.131	375	
17	344493.284	391331.026	32.920	2.462	1800					
						0	3.000	30.458	600	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
16	344503.354	391319.868	33.050	2.630	1800	1 0	1	3.000	30.420	600
							0	3.001	30.420	600
19	344446.092	391256.121	33.650	2.125	1500	0				
							0	4.000	31.525	300
20	344493.345	391273.816	32.650	1.755	1500	0				
							0	5.000	30.895	300
18	344479.740	391287.347	33.150	2.522	1800	0 1 2 1	1	5.000	30.703	300
							2	4.000	30.703	300
							0	4.001	30.628	375
15	344475.673	391293.960	33.400	3.075	1800	0 2 1 1	1	4.001	30.550	375
							2	3.001	30.325	600
							0	3.002	30.325	600
9	344429.168	391343.441	32.600	2.445	1800	0 1 2 1	1	3.002	30.155	600
							2	1.003	30.380	375
							0	1.004	30.155	600
8	344422.587	391350.912	32.500	2.370	1800	0 1	1	1.004	30.130	600
							0	1.005	30.130	600
7	344397.582	391356.949	31.650	1.584	1800	0 1	1	1.005	30.066	600
							0	1.006	30.066	600
6	344358.351	391353.394	31.500	1.532	1800	0 1	1	1.006	29.968	600
							0	1.007	29.968	600
5	344354.609	391359.424	31.300	1.461		1	1	1.007	29.950	600
4	344386.768	391375.174	31.300	1.500		0				
							0	6.000	29.800	600
3	344393.128	391376.363	31.300	1.520	2400	1 0	1	6.000	29.780	600
							0	1.009	29.780	225
2	344418.220	391380.326	31.300	1.669	1200	0 1	1	1.009	29.631	225
							0	1.010	29.631	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	344417.406	391385.479	31.250	1.650		1	1.010	29.600	225

Simulation Settings

Rainfall Methodology	FEH-22	Drain Down Time (mins)	240	30 year (l/s)	23.3
Rainfall Events	Singular	Additional Storage (m³/ha)	0.0	100 year (l/s)	28.6
Summer CV	1.000	Starting Level (m)		Check Discharge Volume	✓
Winter CV	1.000	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	450
Analysis Speed	Detailed	1 year (l/s)	11.9		
Skip Steady State	✓	2 year (l/s)	12.8		

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	40	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.70
Greenfield Method	FEH	Growth Factor 100 year	2.08
Positively Drained Area (ha)	1.741	Betterment (%)	0
SAAR (mm)	871	QMed	12.8
Host	1	QBar	13.7
BFIHost	0.351	Q 1 year (l/s)	11.9
Region	10	Q 2 year (l/s)	12.8
QBar/QMed conversion factor	1.075	Q 30 year (l/s)	23.3
Growth Factor 1 year	0.87	Q 100 year (l/s)	28.6
Growth Factor 2 year	0.93		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.741	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.49	PR	0.512
CWI	124.678	Runoff Volume (m³)	450

Node 1 Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		
Applies to All storms					

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	1.000	245	1.000	490	1.000	735	1.000	980	1.000	1225	1.000
5	1.000	250	1.000	495	1.000	740	1.000	985	1.000	1230	1.000
10	1.000	255	1.000	500	1.000	745	1.000	990	1.000	1235	1.000
15	1.000	260	1.000	505	1.000	750	1.000	995	1.000	1240	1.000
20	1.000	265	1.000	510	1.000	755	1.000	1000	1.000	1245	1.000
25	1.000	270	1.000	515	1.000	760	1.000	1005	1.000	1250	1.000
30	1.000	275	1.000	520	1.000	765	1.000	1010	1.000	1255	1.000
35	1.000	280	1.000	525	1.000	770	1.000	1015	1.000	1260	1.000
40	1.000	285	1.000	530	1.000	775	1.000	1020	1.000	1265	1.000
45	1.000	290	1.000	535	1.000	780	1.000	1025	1.000	1270	1.000
50	1.000	295	1.000	540	1.000	785	1.000	1030	1.000	1275	1.000
55	1.000	300	1.000	545	1.000	790	1.000	1035	1.000	1280	1.000
60	1.000	305	1.000	550	1.000	795	1.000	1040	1.000	1285	1.000
65	1.000	310	1.000	555	1.000	800	1.000	1045	1.000	1290	1.000
70	1.000	315	1.000	560	1.000	805	1.000	1050	1.000	1295	1.000
75	1.000	320	1.000	565	1.000	810	1.000	1055	1.000	1300	1.000
80	1.000	325	1.000	570	1.000	815	1.000	1060	1.000	1305	1.000
85	1.000	330	1.000	575	1.000	820	1.000	1065	1.000	1310	1.000
90	1.000	335	1.000	580	1.000	825	1.000	1070	1.000	1315	1.000
95	1.000	340	1.000	585	1.000	830	1.000	1075	1.000	1320	1.000
100	1.000	345	1.000	590	1.000	835	1.000	1080	1.000	1325	1.000
105	1.000	350	1.000	595	1.000	840	1.000	1085	1.000	1330	1.000
110	1.000	355	1.000	600	1.000	845	1.000	1090	1.000	1335	1.000
115	1.000	360	1.000	605	1.000	850	1.000	1095	1.000	1340	1.000
120	1.000	365	1.000	610	1.000	855	1.000	1100	1.000	1345	1.000
125	1.000	370	1.000	615	1.000	860	1.000	1105	1.000	1350	1.000
130	1.000	375	1.000	620	1.000	865	1.000	1110	1.000	1355	1.000
135	1.000	380	1.000	625	1.000	870	1.000	1115	1.000	1360	1.000
140	1.000	385	1.000	630	1.000	875	1.000	1120	1.000	1365	1.000
145	1.000	390	1.000	635	1.000	880	1.000	1125	1.000	1370	1.000
150	1.000	395	1.000	640	1.000	885	1.000	1130	1.000	1375	1.000
155	1.000	400	1.000	645	1.000	890	1.000	1135	1.000	1380	1.000
160	1.000	405	1.000	650	1.000	895	1.000	1140	1.000	1385	1.000
165	1.000	410	1.000	655	1.000	900	1.000	1145	1.000	1390	1.000
170	1.000	415	1.000	660	1.000	905	1.000	1150	1.000	1395	1.000
175	1.000	420	1.000	665	1.000	910	1.000	1155	1.000	1400	1.000
180	1.000	425	1.000	670	1.000	915	1.000	1160	1.000	1405	1.000
185	1.000	430	1.000	675	1.000	920	1.000	1165	1.000	1410	1.000
190	1.000	435	1.000	680	1.000	925	1.000	1170	1.000	1415	1.000
195	1.000	440	1.000	685	1.000	930	1.000	1175	1.000	1420	1.000
200	1.000	445	1.000	690	1.000	935	1.000	1180	1.000	1425	1.000
205	1.000	450	1.000	695	1.000	940	1.000	1185	1.000	1430	1.000
210	1.000	455	1.000	700	1.000	945	1.000	1190	1.000	1435	1.000
215	1.000	460	1.000	705	1.000	950	1.000	1195	1.000	1440	1.000
220	1.000	465	1.000	710	1.000	955	1.000	1200	1.000		
225	1.000	470	1.000	715	1.000	960	1.000	1205	1.000		
230	1.000	475	1.000	720	1.000	965	1.000	1210	1.000		
235	1.000	480	1.000	725	1.000	970	1.000	1215	1.000		
240	1.000	485	1.000	730	1.000	975	1.000	1220	1.000		

Node 3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	29.780	Product Number	CTL-SHE-0165-1370-1200-1370
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.7	Min Node Diameter (mm)	1500

Node 4 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	39.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	29.800	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.030

Inlets

5

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	259.0	259.0	1.500	736.2	749.8

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	31.779	0.073	9.0	0.0828	0.0000	OK
15 minute summer	14	10	31.846	0.071	8.7	0.0799	0.0000	OK
15 minute summer	12	10	31.611	0.083	17.7	0.1464	0.0000	OK
15 minute summer	11	10	31.427	0.079	21.2	0.1397	0.0000	OK
15 minute summer	10	10	31.239	0.108	42.5	0.1908	0.0000	OK
2160 minute summer	17	2160	30.630	0.172	1.4	0.4366	0.0000	OK
2160 minute summer	16	2160	30.630	0.210	2.7	0.5333	0.0000	OK
15 minute summer	19	10	31.597	0.072	18.3	0.1267	0.0000	OK
15 minute summer	20	10	30.950	0.055	7.8	0.0972	0.0000	OK
15 minute summer	18	10	30.748	0.120	36.2	0.3062	0.0000	OK
2160 minute summer	15	2160	30.630	0.305	5.8	0.7751	0.0000	OK
2160 minute summer	9	2160	30.630	0.475	10.4	1.2078	0.0000	OK
2160 minute summer	8	2160	30.630	0.500	9.9	1.2714	0.0000	OK
2160 minute summer	7	2160	30.630	0.564	9.9	1.4343	0.0000	OK
2160 minute summer	6	2160	30.630	0.662	9.4	1.6837	0.0000	SURCHARGED
2160 minute summer	5	2160	30.630	0.791	9.1	0.0000	0.0000	OK
2160 minute summer	4	2160	30.630	0.830	4.6	0.0000	0.0000	SURCHARGED
2160 minute summer	3	2160	30.630	0.850	0.6	3.8434	0.0000	SURCHARGED
2160 minute summer	2	2160	30.600	0.969	0.6	1.0960	0.0000	SURCHARGED
15 minute summer	1	1	30.600	1.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	9.0	0.830	0.213	0.1683	
15 minute summer	14	2.000	12	8.7	0.831	0.204	0.2686	
15 minute summer	12	1.001	11	17.6	1.187	0.142	0.1246	
15 minute summer	11	1.002	10	21.2	0.990	0.095	0.3743	
15 minute summer	10	1.003	9	41.1	1.607	0.174	1.3864	
2160 minute summer	17	3.000	16	1.4	0.238	0.004	1.1570	
2160 minute summer	16	3.001	15	2.7	0.279	0.008	4.3821	
15 minute summer	19	4.000	18	18.2	1.432	0.122	0.5834	
15 minute summer	20	5.000	18	7.8	0.901	0.070	0.1659	
15 minute summer	18	4.001	15	36.1	1.289	0.181	0.2178	
2160 minute summer	15	3.002	9	5.8	0.323	0.017	12.9927	
2160 minute summer	9	1.004	8	9.9	0.463	0.029	2.4384	
2160 minute summer	8	1.005	7	9.7	0.433	0.028	6.7588	
2160 minute summer	7	1.006	6	9.4	0.342	0.027	10.9595	
2160 minute summer	6	1.007	5	9.1	0.381	0.026	1.9991	
2160 minute summer	5	Flow through Pond	4	4.6	0.017	0.000	314.5011	
2160 minute summer	4	6.000	3	0.6	0.126	0.002	1.8225	
2160 minute summer	3	1.009	2	0.6	0.173	0.016	1.0103	
2160 minute summer	2	1.010	1	0.6	0.016	0.016	0.2075	13.5

**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.74%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	31.793	0.087	12.3	0.0984	0.0000	OK
15 minute summer	14	10	31.859	0.084	11.9	0.0947	0.0000	OK
15 minute summer	12	10	31.627	0.099	24.2	0.1743	0.0000	OK
15 minute summer	11	10	31.442	0.094	29.1	0.1664	0.0000	OK
15 minute summer	10	10	31.260	0.129	58.4	0.2276	0.0000	OK
2160 minute winter	17	1800	30.646	0.188	1.1	0.4782	0.0000	OK
2160 minute winter	16	1800	30.646	0.226	2.1	0.5752	0.0000	OK
15 minute summer	19	10	31.610	0.085	25.2	0.1496	0.0000	OK
15 minute summer	20	10	30.959	0.064	10.7	0.1130	0.0000	OK
15 minute summer	18	10	30.772	0.144	49.8	0.3670	0.0000	OK
2160 minute winter	15	1800	30.646	0.321	4.5	0.8181	0.0000	OK
2160 minute winter	9	1800	30.646	0.491	8.3	1.2497	0.0000	OK
2160 minute winter	8	1800	30.646	0.516	7.9	1.3133	0.0000	OK
2160 minute winter	7	1800	30.646	0.580	7.9	1.4762	0.0000	OK
2160 minute winter	6	1800	30.646	0.678	7.5	1.7258	0.0000	SURCHARGED
2160 minute winter	5	1800	30.646	0.807	7.2	0.0000	0.0000	OK
2160 minute winter	4	1800	30.646	0.846	3.7	0.0000	0.0000	SURCHARGED
2160 minute winter	3	1800	30.646	0.866	1.5	3.9183	0.0000	SURCHARGED
2160 minute winter	2	1800	30.600	0.969	1.5	1.0960	0.0000	SURCHARGED
15 minute summer	1	1	30.600	1.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	12.3	0.901	0.291	0.2118	
15 minute summer	14	2.000	12	11.9	0.905	0.280	0.3383	
15 minute summer	12	1.001	11	24.2	1.287	0.194	0.1575	
15 minute summer	11	1.002	10	29.1	1.073	0.130	0.4788	
15 minute summer	10	1.003	9	57.3	1.726	0.243	1.8933	
2160 minute winter	17	3.000	16	1.1	0.223	0.003	1.2956	
2160 minute winter	16	3.001	15	2.1	0.261	0.006	4.7531	
15 minute summer	19	4.000	18	25.1	1.567	0.169	0.7358	
15 minute summer	20	5.000	18	10.7	0.948	0.096	0.2228	
15 minute summer	18	4.001	15	49.8	1.397	0.249	0.2769	
2160 minute winter	15	3.002	9	4.5	0.298	0.013	13.6000	
2160 minute winter	9	1.004	8	7.9	0.459	0.023	2.5125	
2160 minute winter	8	1.005	7	7.7	0.431	0.022	6.9038	
2160 minute winter	7	1.006	6	7.5	0.375	0.022	11.0419	
2160 minute winter	6	1.007	5	7.2	0.395	0.021	1.9991	
2160 minute winter	5	Flow through Pond	4	3.7	0.027	0.000	323.1377	
2160 minute winter	4	6.000	3	1.5	0.094	0.004	1.8225	
2160 minute winter	3	1.009	2	1.5	0.037	0.037	1.0103	
2160 minute winter	2	1.010	1	1.5	0.037	0.037	0.2075	61.9

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	31.892	0.186	38.5	0.2100	0.0000	OK
15 minute summer	14	10	31.950	0.175	37.3	0.1975	0.0000	OK
15 minute summer	12	10	31.726	0.198	75.7	0.3496	0.0000	OK
15 minute summer	11	11	31.597	0.249	91.0	0.4392	0.0000	OK
15 minute summer	10	11	31.552	0.421	183.4	0.7440	0.0000	SURCHARGED
15 minute summer	17	11	31.445	0.987	85.6	2.5117	0.0000	SURCHARGED
15 minute summer	16	11	31.425	1.005	192.9	2.5567	0.0000	SURCHARGED
15 minute summer	19	11	31.680	0.155	78.9	0.2743	0.0000	OK
15 minute summer	20	11	31.498	0.603	54.7	1.0649	0.0000	SURCHARGED
15 minute summer	18	11	31.493	0.865	153.3	2.2026	0.0000	SURCHARGED
15 minute summer	15	11	31.431	1.106	297.1	2.8145	0.0000	SURCHARGED
15 minute summer	9	11	31.256	1.101	532.3	2.8018	0.0000	SURCHARGED
15 minute summer	8	11	31.106	0.976	530.9	2.4838	0.0000	SURCHARGED
1440 minute summer	7	900	30.910	0.844	33.9	2.1468	0.0000	SURCHARGED
1440 minute summer	6	900	30.909	0.941	33.8	2.3957	0.0000	SURCHARGED
1440 minute summer	5	900	30.909	1.070	33.8	0.0000	0.0000	OK
1440 minute summer	4	900	30.909	1.109	22.0	0.0000	0.0000	SURCHARGED
1440 minute summer	3	900	30.909	1.129	13.5	5.1085	0.0000	SURCHARGED
1440 minute summer	2	900	30.605	0.974	13.5	1.1018	0.0000	SURCHARGED
15 minute summer	1	1	30.600	1.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	38.5	1.161	0.909	0.5132	
15 minute summer	14	2.000	12	37.2	1.171	0.879	0.8189	
15 minute summer	12	1.001	11	75.7	1.689	0.609	0.3753	
15 minute summer	11	1.002	10	91.7	1.315	0.410	1.6320	
15 minute summer	10	1.003	9	171.4	1.760	0.726	5.9643	
15 minute summer	17	3.000	16	114.0	0.565	0.333	4.2336	
15 minute summer	16	3.001	15	168.1	0.701	0.491	10.6795	
15 minute summer	19	4.000	18	78.9	1.753	0.530	2.4606	
15 minute summer	20	5.000	18	32.7	0.928	0.294	1.3512	
15 minute summer	18	4.001	15	136.3	1.653	0.681	0.8563	
15 minute summer	15	3.002	9	301.6	1.071	0.881	19.1273	
15 minute summer	9	1.004	8	530.9	1.885	1.550	2.8044	
15 minute summer	8	1.005	7	528.4	1.876	1.543	7.2456	
1440 minute summer	7	1.006	6	33.8	0.427	0.099	11.0958	
1440 minute summer	6	1.007	5	33.8	0.492	0.099	1.9991	
1440 minute summer	5	Flow through Pond	4	22.0	0.039	0.002	471.5868	
1440 minute summer	4	6.000	3	13.5	0.246	0.035	1.8225	
1440 minute summer	3	1.009	2	13.5	0.339	0.339	1.0103	
1440 minute summer	2	1.010	1	13.5	0.339	0.339	0.2075	489.7

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	11	32.593	0.887	49.4	1.0032	0.0000	SURCHARGED
15 minute summer	14	11	32.641	0.866	47.8	0.9795	0.0000	SURCHARGED
15 minute summer	12	11	32.477	0.949	89.9	1.6776	0.0000	SURCHARGED
15 minute summer	11	11	32.410	1.062	107.2	1.8772	0.0000	SURCHARGED
15 minute summer	10	11	32.355	1.224	224.7	2.1628	0.0000	SURCHARGED
15 minute summer	17	11	32.114	1.656	109.7	4.2137	0.0000	SURCHARGED
15 minute summer	16	11	32.098	1.678	209.1	4.2700	0.0000	SURCHARGED
15 minute summer	19	11	32.491	0.966	101.1	1.7064	0.0000	SURCHARGED
15 minute summer	20	11	32.206	1.311	55.3	2.3162	0.0000	SURCHARGED
15 minute summer	18	11	32.185	1.557	166.0	3.9631	0.0000	SURCHARGED
15 minute summer	15	11	32.077	1.752	376.2	4.4578	0.0000	SURCHARGED
15 minute summer	9	11	31.819	1.664	672.5	4.2353	0.0000	SURCHARGED
15 minute summer	8	11	31.579	1.449	670.9	3.6887	0.0000	SURCHARGED
15 minute summer	7	11	31.191	1.125	682.6	2.8624	0.0000	SURCHARGED
1440 minute summer	6	930	31.131	1.163	44.8	2.9599	0.0000	SURCHARGED
1440 minute summer	5	930	31.131	1.292	44.7	0.0000	0.0000	OK
1440 minute summer	4	930	31.131	1.331	29.0	0.0000	0.0000	FLOOD RISK
1440 minute summer	3	930	31.131	1.351	13.9	6.1121	0.0000	FLOOD RISK
960 minute winter	2	570	30.605	0.974	13.6	1.1019	0.0000	SURCHARGED
15 minute summer	1	1	30.600	1.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	46.4	1.195	1.097	0.6168	
15 minute summer	14	2.000	12	43.5	1.195	1.027	1.0253	
15 minute summer	12	1.001	11	87.7	1.732	0.705	0.5903	
15 minute summer	11	1.002	10	117.6	1.234	0.525	1.9171	
15 minute summer	10	1.003	9	181.9	1.753	0.771	5.9643	
15 minute summer	17	3.000	16	108.0	0.561	0.315	4.2336	
15 minute summer	16	3.001	15	177.7	0.704	0.519	10.6795	
15 minute summer	19	4.000	18	95.3	1.763	0.640	3.2326	
15 minute summer	20	5.000	18	37.4	0.931	0.337	1.3512	
15 minute summer	18	4.001	15	162.7	1.771	0.813	0.8563	
15 minute summer	15	3.002	9	377.6	1.341	1.103	19.1273	
15 minute summer	9	1.004	8	670.9	2.382	1.959	2.8044	
15 minute summer	8	1.005	7	669.7	2.378	1.956	7.2456	
15 minute summer	7	1.006	6	682.3	2.423	1.992	11.0958	
1440 minute summer	6	1.007	5	44.7	0.511	0.130	1.9991	
1440 minute summer	5	Flow through Pond	4	29.0	0.037	0.002	613.8183	
1440 minute summer	4	6.000	3	13.9	0.200	0.036	1.8225	
1440 minute summer	3	1.009	2	13.6	0.343	0.343	1.0103	
960 minute winter	2	1.010	1	13.6	0.343	0.343	0.2075	569.4

**Design Settings**

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.650
CV	1.000	Preferred Cover Depth (m)	1.350
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	100.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)	Invert Level (m)
13	0.063	4.00	33.650	1200	344358.787	391280.071	1.944	31.706
14	0.061	4.00	33.700	1200	344354.378	391309.476	1.925	31.775
12	0.000		33.470	1500	344370.933	391289.715	1.942	31.528
11	0.025	4.00	33.400	1500	344377.193	391295.290	2.052	31.348
10	0.150	4.00	33.200	1500	344386.909	391309.702	2.069	31.131
17	0.140	4.00	32.920	1800	344493.284	391331.026	2.462	30.458
16	0.129	4.00	33.050	1800	344503.354	391319.868	2.630	30.420
19	0.129	4.00	33.650	1500	344446.092	391256.121	2.125	31.525
20	0.055	4.00	32.650	1500	344493.345	391273.816	1.755	30.895
18	0.072	4.00	33.150	1800	344479.740	391287.347	2.522	30.628
15	0.057	4.00	33.400	1800	344475.673	391293.960	3.075	30.325
9	0.174	4.00	32.600	1800	344429.168	391343.441	2.445	30.155
8	0.000		32.500	1800	344422.587	391350.912	2.370	30.130
7	0.020	4.00	31.650	1800	344397.582	391356.949	1.584	30.066
6	0.000		31.500	1800	344358.351	391353.394	1.532	29.968
5	0.000		31.300		344354.609	391359.424	1.461	29.839
4	0.000	4.00	31.300		344386.768	391375.174	1.500	29.800
3	0.000		31.300	2400	344393.128	391376.363	1.520	29.780
2	0.000		31.300	1200	344418.220	391380.326	1.669	29.631
1			31.250		344417.406	391385.479	1.650	29.600

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	13	12	15.509	0.600	31.706	31.603	0.103	150.0	225	4.24	55.2
2.000	14	12	25.779	0.600	31.775	31.603	0.172	150.0	225	4.40	55.2
1.001	12	11	8.383	0.600	31.528	31.423	0.105	80.0	300	4.48	55.2
1.002	11	10	17.381	0.600	31.348	31.131	0.217	80.0	375	4.63	55.2
1.003	10	9	54.075	0.600	31.131	30.380	0.751	72.0	375	5.05	55.0
3.000	17	16	15.030	0.600	30.458	30.420	0.038	400.0	600	4.21	55.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.065	42.3	12.6	1.719	1.642	0.063	0.0	84	0.931
2.000	1.065	42.3	12.2	1.700	1.642	0.061	0.0	82	0.922
1.001	1.759	124.3	24.7	1.642	1.677	0.124	0.0	91	1.383
1.002	2.027	223.9	29.7	1.677	1.694	0.149	0.0	92	1.426
1.003	2.137	236.0	59.4	1.694	1.845	0.299	0.0	128	1.792
3.000	1.211	342.4	27.9	1.862	2.030	0.140	0.0	115	0.742

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.001	16	15	37.914	0.600	30.420	30.325	0.095	400.0	600	4.73	55.2
4.000	19	18	45.905	0.600	31.525	30.703	0.822	55.8	300	4.36	55.2
5.000	20	18	19.188	0.600	30.895	30.703	0.192	100.0	300	4.20	55.2
4.001	18	15	7.764	0.600	30.628	30.550	0.078	100.0	375	4.43	55.2
3.002	15	9	67.905	0.600	30.325	30.155	0.170	400.0	600	5.66	52.0
1.004	9	8	9.956	0.600	30.155	30.130	0.025	400.0	600	5.80	51.3
1.005	8	7	25.723	0.600	30.130	30.066	0.064	400.0	600	6.15	49.8
1.006	7	6	39.392	0.600	30.066	29.968	0.098	400.0	600	6.70	47.7
1.007	6	5	7.097	0.600	29.968	29.950	0.018	400.0	600	6.79	47.3
6.000	4	3	6.470	0.600	29.800	29.780	0.020	323.5	600	4.08	55.2
1.009	3	2	25.403	0.600	29.780	29.631	0.149	170.0	225	4.50	55.2
1.010	2	1	5.217	0.600	29.631	29.600	0.031	170.0	225	4.59	55.2

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.001	1.211	342.4	53.7	2.030	2.475	0.269	0.0	159	0.892
4.000	2.108	149.0	25.7	1.825	2.147	0.129	0.0	84	1.593
5.000	1.572	111.1	11.0	1.455	2.147	0.055	0.0	63	1.009
4.001	1.812	200.1	51.1	2.147	2.475	0.256	0.0	129	1.523
3.002	1.211	342.4	109.4	2.475	1.845	0.582	0.0	232	1.082
1.004	1.211	342.4	195.7	1.845	1.770	1.055	0.0	325	1.250
1.005	1.211	342.4	189.8	1.770	0.984	1.055	0.0	320	1.241
1.006	1.211	342.4	185.4	0.984	0.932	1.075	0.0	315	1.234
1.007	1.211	342.4	183.9	0.932	0.750	1.075	0.0	313	1.232
6.000	1.348	381.2	0.0	0.900	0.920	0.000	0.0	0	0.000
1.009	1.000	39.7	0.0	1.295	1.444	0.000	0.0	0	0.000
1.010	1.000	39.7	0.0	1.444	1.425	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.509	150.0	225	Circular_Default Sewer Type	33.650	31.706	1.719	33.470	31.603	1.642
2.000	25.779	150.0	225	Circular_Default Sewer Type	33.700	31.775	1.700	33.470	31.603	1.642
1.001	8.383	80.0	300	Circular_Default Sewer Type	33.470	31.528	1.642	33.400	31.423	1.677
1.002	17.381	80.0	375	Circular_Default Sewer Type	33.400	31.348	1.677	33.200	31.131	1.694
1.003	54.075	72.0	375	Circular_Default Sewer Type	33.200	31.131	1.694	32.600	30.380	1.845
3.000	15.030	400.0	600	Circular_Default Sewer Type	32.920	30.458	1.862	33.050	30.420	2.030
3.001	37.914	400.0	600	Circular_Default Sewer Type	33.050	30.420	2.030	33.400	30.325	2.475
4.000	45.905	55.8	300	Circular_Default Sewer Type	33.650	31.525	1.825	33.150	30.703	2.147

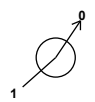
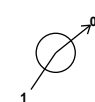
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	13	1200	Manhole	Adoptable	12	1500	Manhole	Adoptable
2.000	14	1200	Manhole	Adoptable	12	1500	Manhole	Adoptable
1.001	12	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable
1.002	11	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable
1.003	10	1500	Manhole	Adoptable	9	1800	Manhole	Adoptable
3.000	17	1800	Manhole	Adoptable	16	1800	Manhole	Adoptable
3.001	16	1800	Manhole	Adoptable	15	1800	Manhole	Adoptable
4.000	19	1500	Manhole	Adoptable	18	1800	Manhole	Adoptable

Pipeline Schedule

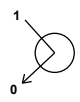
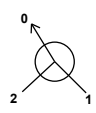
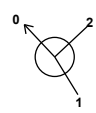
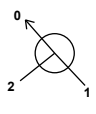
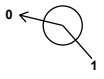
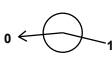
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	19.188	100.0	300	Circular_Default Sewer Type	32.650	30.895	1.455	33.150	30.703	2.147
4.001	7.764	100.0	375	Circular_Default Sewer Type	33.150	30.628	2.147	33.400	30.550	2.475
3.002	67.905	400.0	600	Circular_Default Sewer Type	33.400	30.325	2.475	32.600	30.155	1.845
1.004	9.956	400.0	600	Circular_Default Sewer Type	32.600	30.155	1.845	32.500	30.130	1.770
1.005	25.723	400.0	600	Circular_Default Sewer Type	32.500	30.130	1.770	31.650	30.066	0.984
1.006	39.392	400.0	600	Circular_Default Sewer Type	31.650	30.066	0.984	31.500	29.968	0.932
1.007	7.097	400.0	600	Circular_Default Sewer Type	31.500	29.968	0.932	31.300	29.950	0.750
6.000	6.470	323.5	600	Circular_Default Sewer Type	31.300	29.800	0.900	31.300	29.780	0.920
1.009	25.403	170.0	225	Circular_Default Sewer Type	31.300	29.780	1.295	31.300	29.631	1.444
1.010	5.217	170.0	225	Circular_Default Sewer Type	31.300	29.631	1.444	31.250	29.600	1.425

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	20	1500	Manhole	Adoptable	18	1800	Manhole	Adoptable
4.001	18	1800	Manhole	Adoptable	15	1800	Manhole	Adoptable
3.002	15	1800	Manhole	Adoptable	9	1800	Manhole	Adoptable
1.004	9	1800	Manhole	Adoptable	8	1800	Manhole	Adoptable
1.005	8	1800	Manhole	Adoptable	7	1800	Manhole	Adoptable
1.006	7	1800	Manhole	Adoptable	6	1800	Manhole	Adoptable
1.007	6	1800	Manhole	Adoptable	5		Junction	
6.000	4		Junction		3	2400	Manhole	Adoptable
1.009	3	2400	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.010	2	1200	Manhole	Adoptable	1		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
13	344358.787	391280.071	33.650	1.944	1200					
						0	1.000	31.706	225	
14	344354.378	391309.476	33.700	1.925	1200					
						0	2.000	31.775	225	
12	344370.933	391289.715	33.470	1.942	1500		1	2.000	31.603	225
						2	1.000	31.603	225	
						0	1.001	31.528	300	
11	344377.193	391295.290	33.400	2.052	1500		1	1.001	31.423	300
						0	1.002	31.348	375	
10	344386.909	391309.702	33.200	2.069	1500		1	1.002	31.131	375
						0	1.003	31.131	375	
17	344493.284	391331.026	32.920	2.462	1800					
						0	3.000	30.458	600	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
16	344503.354	391319.868	33.050	2.630	1800		1 3.000	30.420	600
							0 3.001	30.420	600
19	344446.092	391256.121	33.650	2.125	1500				
							0 4.000	31.525	300
20	344493.345	391273.816	32.650	1.755	1500				
							0 5.000	30.895	300
18	344479.740	391287.347	33.150	2.522	1800		1 5.000	30.703	300
							2 4.000	30.703	300
							0 4.001	30.628	375
15	344475.673	391293.960	33.400	3.075	1800		1 4.001	30.550	375
							2 3.001	30.325	600
							0 3.002	30.325	600
9	344429.168	391343.441	32.600	2.445	1800		1 3.002	30.155	600
							2 1.003	30.380	375
							0 1.004	30.155	600
8	344422.587	391350.912	32.500	2.370	1800		1 1.004	30.130	600
							0 1.005	30.130	600
7	344397.582	391356.949	31.650	1.584	1800		1 1.005	30.066	600
							0 1.006	30.066	600
6	344358.351	391353.394	31.500	1.532	1800		1 1.006	29.968	600
							0 1.007	29.968	600
5	344354.609	391359.424	31.300	1.461			1 1.007	29.950	600
4	344386.768	391375.174	31.300	1.500					
							0 6.000	29.800	600
3	344393.128	391376.363	31.300	1.520	2400		1 6.000	29.780	600
							0 1.009	29.780	225
2	344418.220	391380.326	31.300	1.669	1200		1 1.009	29.631	225
							0 1.010	29.631	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	344417.406	391385.479	31.250	1.650		1	1.010	29.600	225

Simulation Settings

Rainfall Methodology	FEH-22	Drain Down Time (mins)	240	30 year (l/s)	23.3
Rainfall Events	Singular	Additional Storage (m³/ha)	0.0	100 year (l/s)	28.6
Summer CV	1.000	Starting Level (m)		Check Discharge Volume	✓
Winter CV	1.000	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	450
Analysis Speed	Detailed	1 year (l/s)	11.9		
Skip Steady State	✓	2 year (l/s)	12.8		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	40	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.70
Greenfield Method	FEH	Growth Factor 100 year	2.08
Positively Drained Area (ha)	1.741	Betterment (%)	0
SAAR (mm)	871	QMed	12.8
Host	1	QBar	13.7
BFIHost	0.351	Q 1 year (l/s)	11.9
Region	10	Q 2 year (l/s)	12.8
QBar/QMed conversion factor	1.075	Q 30 year (l/s)	23.3
Growth Factor 1 year	0.87	Q 100 year (l/s)	28.6
Growth Factor 2 year	0.93		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	1.741	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.49	PR	0.512
CWI	124.678	Runoff Volume (m³)	450

Node 3 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	29.780	Product Number	CTL-SHE-0165-1370-1200-1370
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	13.7	Min Node Diameter (mm)	1500

Node 4 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	39.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	29.800	Main Channel Slope (1:X)	1000.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.030

Inlets
5

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	259.0	259.0	1.500	736.2	749.8

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	31.779	0.073	9.0	0.0828	0.0000	OK
15 minute summer	14	10	31.846	0.071	8.7	0.0799	0.0000	OK
15 minute summer	12	10	31.611	0.083	17.7	0.1464	0.0000	OK
15 minute summer	11	10	31.427	0.079	21.2	0.1397	0.0000	OK
15 minute summer	10	10	31.239	0.108	42.5	0.1908	0.0000	OK
15 minute summer	17	10	30.567	0.109	19.9	0.2777	0.0000	OK
15 minute summer	16	10	30.553	0.133	38.0	0.3376	0.0000	OK
15 minute summer	19	10	31.597	0.072	18.3	0.1267	0.0000	OK
15 minute summer	20	10	30.950	0.055	7.8	0.0972	0.0000	OK
15 minute summer	18	10	30.748	0.120	36.2	0.3062	0.0000	OK
15 minute summer	15	11	30.515	0.190	81.8	0.4829	0.0000	OK
15 minute summer	9	11	30.462	0.307	140.4	0.7813	0.0000	OK
15 minute summer	8	11	30.417	0.287	137.2	0.7314	0.0000	OK
15 minute summer	7	12	30.341	0.275	137.9	0.7002	0.0000	OK
15 minute summer	6	12	30.227	0.259	136.5	0.6591	0.0000	OK
240 minute summer	5	160	30.112	0.273	44.9	0.0000	0.0000	OK
240 minute summer	4	160	30.112	0.312	28.7	0.0000	0.0000	OK
240 minute summer	3	160	30.112	0.332	13.3	1.5010	0.0000	SURCHARGED
240 minute summer	2	160	29.724	0.093	13.2	0.1054	0.0000	OK
240 minute summer	1	160	29.688	0.088	13.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	9.0	0.830	0.213	0.1683	
15 minute summer	14	2.000	12	8.7	0.831	0.204	0.2686	
15 minute summer	12	1.001	11	17.6	1.187	0.142	0.1246	
15 minute summer	11	1.002	10	21.2	0.990	0.095	0.3743	
15 minute summer	10	1.003	9	41.1	1.607	0.174	1.3864	
15 minute summer	17	3.000	16	19.7	0.492	0.058	0.6093	
15 minute summer	16	3.001	15	37.6	0.633	0.110	2.2785	
15 minute summer	19	4.000	18	18.2	1.432	0.122	0.5834	
15 minute summer	20	5.000	18	7.8	0.901	0.070	0.1659	
15 minute summer	18	4.001	15	36.1	1.289	0.181	0.2178	
15 minute summer	15	3.002	9	78.0	0.722	0.228	7.5181	
15 minute summer	9	1.004	8	137.2	0.988	0.401	1.3857	
15 minute summer	8	1.005	7	135.6	1.047	0.396	3.3300	
15 minute summer	7	1.006	6	136.5	1.127	0.399	4.7743	
15 minute summer	6	1.007	5	137.3	1.246	0.401	0.7820	
240 minute summer	5	Flow through Pond	4	28.7	0.058	0.002	89.5033	
240 minute summer	4	6.000	3	13.3	0.294	0.035	0.9958	
240 minute summer	3	1.009	2	13.2	0.861	0.333	0.3911	
240 minute summer	2	1.010	1	13.2	0.884	0.333	0.0782	165.4

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.75%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	31.793	0.087	12.3	0.0984	0.0000	OK
15 minute summer	14	10	31.859	0.084	11.9	0.0947	0.0000	OK
15 minute summer	12	10	31.627	0.099	24.2	0.1743	0.0000	OK
15 minute summer	11	10	31.442	0.094	29.1	0.1664	0.0000	OK
15 minute summer	10	10	31.260	0.129	58.4	0.2276	0.0000	OK
15 minute summer	17	10	30.593	0.135	27.3	0.3427	0.0000	OK
15 minute summer	16	10	30.581	0.161	52.1	0.4099	0.0000	OK
15 minute summer	19	10	31.610	0.085	25.2	0.1496	0.0000	OK
15 minute summer	20	10	30.959	0.064	10.7	0.1130	0.0000	OK
15 minute summer	18	10	30.772	0.144	49.8	0.3670	0.0000	OK
15 minute summer	15	11	30.560	0.235	111.9	0.5973	0.0000	OK
15 minute summer	9	11	30.526	0.371	191.6	0.9435	0.0000	OK
15 minute summer	8	11	30.477	0.347	184.4	0.8837	0.0000	OK
15 minute summer	7	11	30.396	0.330	186.6	0.8404	0.0000	OK
15 minute summer	6	12	30.271	0.303	182.5	0.7720	0.0000	OK
240 minute summer	5	164	30.182	0.343	55.9	0.0000	0.0000	OK
240 minute summer	4	164	30.182	0.382	35.1	0.0000	0.0000	OK
240 minute summer	3	164	30.182	0.402	13.9	1.8202	0.0000	SURCHARGED
240 minute summer	2	164	29.725	0.094	13.6	0.1068	0.0000	OK
240 minute summer	1	164	29.690	0.090	13.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	12.3	0.901	0.291	0.2118	
15 minute summer	14	2.000	12	11.9	0.905	0.280	0.3383	
15 minute summer	12	1.001	11	24.2	1.287	0.194	0.1575	
15 minute summer	11	1.002	10	29.1	1.073	0.130	0.4788	
15 minute summer	10	1.003	9	57.3	1.726	0.243	1.8933	
15 minute summer	17	3.000	16	26.9	0.513	0.079	0.8112	
15 minute summer	16	3.001	15	51.0	0.673	0.149	3.0453	
15 minute summer	19	4.000	18	25.1	1.567	0.169	0.7358	
15 minute summer	20	5.000	18	10.7	0.948	0.096	0.2228	
15 minute summer	18	4.001	15	49.8	1.397	0.249	0.2769	
15 minute summer	15	3.002	9	102.7	0.750	0.300	9.6721	
15 minute summer	9	1.004	8	184.4	1.060	0.538	1.7511	
15 minute summer	8	1.005	7	183.4	1.119	0.536	4.2172	
15 minute summer	7	1.006	6	182.5	1.219	0.533	5.9013	
15 minute summer	6	1.007	5	184.8	1.368	0.540	0.9591	
240 minute summer	5	Flow through Pond	4	35.1	0.058	0.003	115.1240	
240 minute summer	4	6.000	3	13.9	0.320	0.036	1.2630	
240 minute summer	3	1.009	2	13.6	0.866	0.342	0.3983	
240 minute summer	2	1.010	1	13.6	0.890	0.342	0.0796	203.8

**Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.72%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	31.892	0.186	38.5	0.2100	0.0000	OK
15 minute summer	14	10	31.950	0.175	37.3	0.1975	0.0000	OK
15 minute summer	12	10	31.726	0.198	75.7	0.3496	0.0000	OK
15 minute summer	11	11	31.597	0.249	91.0	0.4392	0.0000	OK
15 minute summer	10	11	31.552	0.421	183.4	0.7440	0.0000	SURCHARGED
15 minute summer	17	11	31.445	0.987	85.6	2.5117	0.0000	SURCHARGED
15 minute summer	16	11	31.425	1.005	192.9	2.5567	0.0000	SURCHARGED
15 minute summer	19	11	31.680	0.155	78.9	0.2743	0.0000	OK
15 minute summer	20	11	31.498	0.603	54.7	1.0649	0.0000	SURCHARGED
15 minute summer	18	11	31.493	0.865	153.3	2.2026	0.0000	SURCHARGED
15 minute summer	15	11	31.431	1.106	297.1	2.8145	0.0000	SURCHARGED
15 minute summer	9	11	31.256	1.101	532.3	2.8018	0.0000	SURCHARGED
15 minute summer	8	11	31.106	0.976	530.9	2.4838	0.0000	SURCHARGED
15 minute summer	7	11	30.864	0.798	538.5	2.0319	0.0000	SURCHARGED
240 minute winter	6	232	30.719	0.751	90.7	1.9109	0.0000	SURCHARGED
240 minute winter	5	232	30.719	0.880	88.0	0.0000	0.0000	OK
240 minute winter	4	232	30.719	0.919	51.3	0.0000	0.0000	SURCHARGED
240 minute winter	3	232	30.719	0.939	14.7	4.2474	0.0000	SURCHARGED
2160 minute winter	2	1440	29.726	0.095	13.6	0.1071	0.0000	OK
2160 minute winter	1	1440	29.690	0.090	13.6	0.0000	0.0000	OK

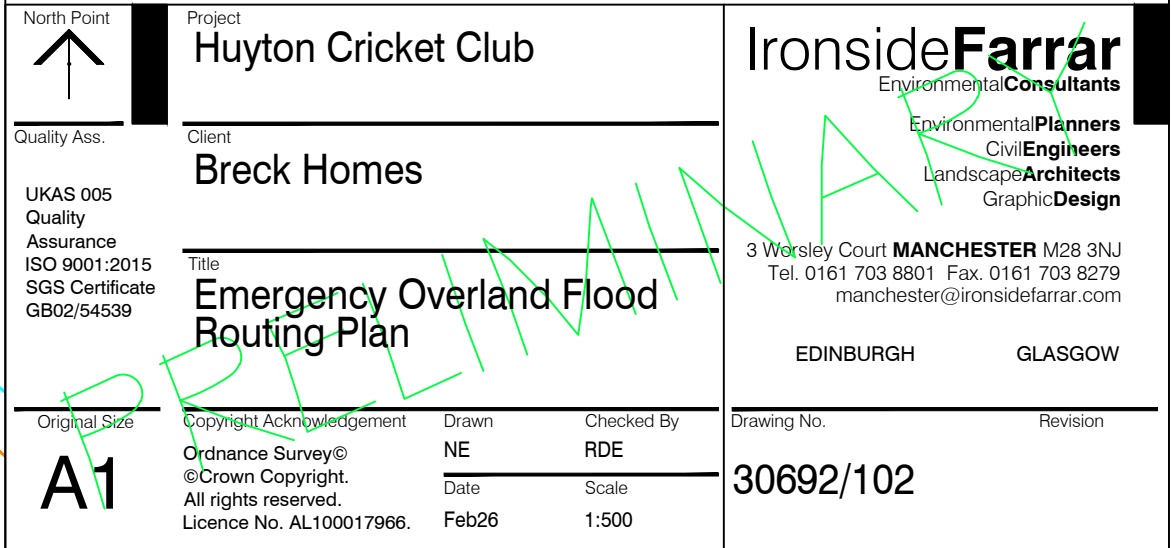
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	38.5	1.161	0.909	0.5132	
15 minute summer	14	2.000	12	37.2	1.171	0.879	0.8189	
15 minute summer	12	1.001	11	75.7	1.689	0.609	0.3753	
15 minute summer	11	1.002	10	91.7	1.315	0.410	1.6320	
15 minute summer	10	1.003	9	171.4	1.760	0.726	5.9643	
15 minute summer	17	3.000	16	114.0	0.565	0.333	4.2336	
15 minute summer	16	3.001	15	168.1	0.701	0.491	10.6795	
15 minute summer	19	4.000	18	78.9	1.753	0.530	2.4606	
15 minute summer	20	5.000	18	32.7	0.928	0.294	1.3512	
15 minute summer	18	4.001	15	136.3	1.653	0.681	0.8563	
15 minute summer	15	3.002	9	301.6	1.071	0.881	19.1273	
15 minute summer	9	1.004	8	530.9	1.885	1.550	2.8044	
15 minute summer	8	1.005	7	528.4	1.876	1.543	7.2456	
15 minute summer	7	1.006	6	535.3	1.901	1.563	10.9673	
240 minute winter	6	1.007	5	88.0	0.971	0.257	1.9991	
240 minute winter	5	Flow through Pond	4	51.3	0.082	0.004	361.9363	
240 minute winter	4	6.000	3	14.7	0.348	0.038	1.8225	
240 minute winter	3	1.009	2	13.6	0.867	0.343	0.3996	
2160 minute winter	2	1.010	1	13.6	0.891	0.343	0.0799	976.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	11	32.593	0.887	49.4	1.0032	0.0000	SURCHARGED
15 minute summer	14	11	32.641	0.866	47.8	0.9795	0.0000	SURCHARGED
15 minute summer	12	11	32.477	0.949	89.9	1.6776	0.0000	SURCHARGED
15 minute summer	11	11	32.410	1.062	107.2	1.8772	0.0000	SURCHARGED
15 minute summer	10	11	32.355	1.224	224.7	2.1628	0.0000	SURCHARGED
15 minute summer	17	11	32.114	1.656	109.7	4.2137	0.0000	SURCHARGED
15 minute summer	16	11	32.098	1.678	209.1	4.2700	0.0000	SURCHARGED
15 minute summer	19	11	32.491	0.966	101.1	1.7064	0.0000	SURCHARGED
15 minute summer	20	11	32.206	1.311	55.3	2.3162	0.0000	SURCHARGED
15 minute summer	18	11	32.185	1.557	166.0	3.9631	0.0000	SURCHARGED
15 minute summer	15	11	32.077	1.752	376.2	4.4578	0.0000	SURCHARGED
15 minute summer	9	11	31.819	1.664	672.5	4.2353	0.0000	SURCHARGED
15 minute summer	8	11	31.579	1.449	670.9	3.6887	0.0000	SURCHARGED
15 minute summer	7	11	31.191	1.125	682.6	2.8624	0.0000	SURCHARGED
240 minute winter	6	236	30.934	0.966	108.7	2.4597	0.0000	SURCHARGED
240 minute winter	5	236	30.935	1.096	106.3	0.0000	0.0000	OK
240 minute winter	4	236	30.935	1.135	60.5	0.0000	0.0000	SURCHARGED
240 minute winter	3	236	30.935	1.155	14.7	5.2230	0.0000	SURCHARGED
15 minute summer	2	236	29.726	0.095	13.6	0.1071	0.0000	OK
15 minute summer	1	236	29.690	0.090	13.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	1.000	12	46.4	1.195	1.097	0.6168	
15 minute summer	14	2.000	12	43.5	1.195	1.027	1.0253	
15 minute summer	12	1.001	11	87.7	1.732	0.705	0.5903	
15 minute summer	11	1.002	10	117.6	1.234	0.525	1.9171	
15 minute summer	10	1.003	9	181.9	1.753	0.771	5.9643	
15 minute summer	17	3.000	16	108.0	0.561	0.315	4.2336	
15 minute summer	16	3.001	15	177.7	0.704	0.519	10.6795	
15 minute summer	19	4.000	18	95.3	1.763	0.640	3.2326	
15 minute summer	20	5.000	18	37.4	0.931	0.337	1.3512	
15 minute summer	18	4.001	15	162.7	1.771	0.813	0.8563	
15 minute summer	15	3.002	9	377.6	1.341	1.103	19.1273	
15 minute summer	9	1.004	8	670.9	2.382	1.959	2.8044	
15 minute summer	8	1.005	7	669.7	2.378	1.956	7.2456	
15 minute summer	7	1.006	6	682.3	2.423	1.992	11.0958	
240 minute winter	6	1.007	5	106.3	0.938	0.310	1.9991	
240 minute winter	5	Flow through Pond	4	60.5	0.097	0.005	486.9940	
240 minute winter	4	6.000	3	14.7	0.414	0.039	1.8225	
240 minute winter	3	1.009	2	13.6	0.867	0.343	0.3996	
15 minute summer	2	1.010	1	13.6	0.891	0.343	0.0799	195.9

Appendix I: Flood Routing



Appendix J: Simple Pollution Index Approach

SIMPLE INDEX APPROACH: TOOL



HRW does not take any direct or indirect damage claim, loss, cost, expense or liability however arising out of the use or impossibility to use the tool, even when HRW has been informed of the possibility of the same. The user hereby releases HRW from and against any damage claim, loss, expense or liability resulting from any action taken against HRW that is related in any way to the use of the tool or any reliance made in respect of the output of such use by any person whatsoever. HRW does not guarantee that the tool's functions meet the requirements of any person, nor that the tool is free from errors.

- The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).
- The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.
- The process that is automated in this tool is described in the SuDS Manual, Chapter 26 (Section 26.7)
- Relevant design examples are included in the SuDS Manual Appendix C.
- Each of the steps below are part of the process set out in the flowchart on Sheet 3.
- Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.
- Interception should be delivered for all upstream impermeable areas as part of the strategy for water quantity and quality control for the site. This is required in order to deliver both of the water quality criteria set out in Chapter 4 of the SuDS Manual

DROP DOWN LIST RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

Runoff Area Land Use Description		Hazard Level	Pollution Hazard Indices			DESIGN CONDITIONS	
			Suspended	Metals	Hydrocarbons	1	2
Select land use type from the drop down list (or 'Other' if none applicable) →							
Individual driveway		Low	0.5	0.4	0.4		
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row							
Landuse Pollution Hazard Index		Low	0.5	0.4	0.4		

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component

If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design)

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generally described by the suggested components, then 'Proprietary treatment system' or 'User defined index' should be selected and a description of the component and agreed user defined indices should be entered in the row below the drop down lists

SuDS Component Description		Pollution Mitigation Indices			DESIGN CONDITIONS		
		Suspended Solids	Metals	Hydrocarbons	1	2	3
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list					SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B		
Permeable pavement (where the pavement is not designed as an infiltration component)		0.7	0.6	0.7			
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list							
Seals		0.5	0.6	0.6	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B		
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list							
None		0	0	0			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:					Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome) then the outcome is fixed at <= 0.95. In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land uses, where this assumption is accepted. This outcome would meet more detailed verification.		
Aggregated Surface Water Pollution Mitigation Index		0.95	0.9	>0.95			

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification)

Is the runoff now discharged to an infiltration component?

Yes? [Go to Step 2B](#)
No? [Go to Step 2C](#)

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design)

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generally described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Pollution Mitigation Indices			DESIGN CONDITIONS
		Total Suspended	Metals	Hydrocarbons	
Select type of groundwater protection from the drop down list					1
None					2
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined index' and enter a description of the protection and agreed user defined indices in this row:					3
Groundwater Protection Pollution Mitigation Index		0	0	0	

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

		Combined Pollution Mitigation Indices		
		Total Suspended	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area		0.95	0.9	>0.95

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification)

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (in over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices

Sufficiency of Pollution Mitigation Indices				1
Total Suspended	Metals	Hydrocarbons		
Sufficient	Sufficient	Sufficient	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies.	

Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but interception requires separate evaluation.