

FRA & SuDS Strategy Report

FRA20242.1



The PES

**Rear of 69 Sandy Lane/Lowther Court,
Prestwich,
Manchester,
M25 9PS**

5-03-2025

Prepared for:

Contents

1	Executive Summary	3
2	Introduction	4
3	Site Conditions and Planning Policy	5
4	Flooding	16
5	Sustainable Drainage Systems Strategy	23
6	Management and Maintenance	28
7	Conclusions	31

Figures

Figure 1 - Site Location Plan for the Existing & Proposed Development at rear of 69 Sandy Lane / Lowther Court, Prestwich, Manchester, M25 9PS

Figure 2 - Existing & Proposed Block Plans for the Development at rear of Sandy Lane/Lowther Court, Prestwich

Figure 3 - Proposed Ground, First & Roof Plans for the Development at rear of Sandy Lane/Lowther Court, Prestwich

Figure 4 - Proposed North, South, East & West Elevations for the Development at Sandy Lane/Lowther Court, Prestwich

Figure 5 - Proposed Sections A-A & B-B, for the Development at Sandy Lane/Lowther Court, Prestwich

Figure 6 - Proposed Front & Rear Perspectives and Visualisations for the Development at Sandy Lane/Lowther Court, Prestwich

Figure 7 - BGS Bedrock Geology 1 in 50,000

Figure 8 - BGS Superficial Geology 1 in 50,000

Figure 9 - magic.defra.gov.uk - Source Protection Zones merged (England)

Figure 10 - EA Flood Map for Planning

Figure 11 - Flood Risk from Rivers or the sea - Yearly chance of flooding

Figure 12 - Flood Risk from Rivers or the sea - Yearly chance of flooding between 2036 and 2069

Figure 13 - Flood Risk from Surface Water – Yearly chance of flooding

Figure 14 - Flood Risk from Surface Water – Yearly chance of flooding between 2040 and 2060

Figure 15 - Bury MBC's Local Flood Risk Management Strategy April 2018 Figure 6 – Surface Water Flooding

Figure 16 - Bury MBC's Local Flood Risk Management Strategy April 2018 Figure 7 - Groundwater Flooding

Figure 17 - SuDS Management Train (susdrain)

Tables

Table 1 - Table 1 from Planning Policy Guidance (Flood Risk and Coastal Change) 06 03 2014

Table 2 - Table 2 from Planning Policy Guidance (Flood Risk and Coastal Change) 06 03 2014

Table 3 - Table 3 from Planning Policy Guidance (Flood Risk and Coastal Change) 06 03 2014

Appendices

A Thames Water Correspondence

B Surface Water Drainage System Associated Hydraulic Calculations

C SuDS Strategy Drawing No FRA20242-DS-001

1. Executive Summary

The PES has been commissioned to produce a Flood Risk Assessment (FRA) & Sustainable Urban Drainage System (SuDS) Strategy Report in support of a planning application for the proposed redevelopment at the rear of 69 Sandy Lane / Lowther Court, Prestwich, Manchester, M25 9PS currently a tarmacked area housing the local domestic garages. The proposed redevelopment of the site entails the demolition of the existing garages and erection of two 2-bedroom 4-person dwellings.

This FRA and SuDS report has been prepared as a desk top study based on the architectural drawings supplied and gathered data available within the public domain. It summarises the SuDS design process for the proposed development and demonstrates that the development complies with planning policy on flood risk – National Planning Policy Framework (NPPF) and supports Planning Practice Guidance (PPG) as well as the local Bury Metropolitan Borough Council, Greater Manchester Council Policies and guidelines including associated SuDS requirements.

The design process began with a review and analysis of the proposed development and the existing site conditions with respect to surface water drainage and flood risk. This included a study of both the hydrology and hydrogeology of the site.

The proposed SuDS design strategy provides for the source control technique of permeable paving and rain water harvesting water butts for reuse of water. The surface water runoff will be discharged into the existing United Utilities combined sewer network within the proposed development site. Landscaped areas are provided for biodiversity and amenity value.

Associated hydraulic and attenuation calculations showing both pre and post development impermeable areas and a description of the proposed surface water management SuDS scheme for the site were prepared accordingly. A gravity surface water discharge has been sized and used to allow a practicable maintenance regime to be incorporated within the SuDS that allows a practicable maintenance regime to be incorporated and to allow for attenuation drain down times. A practicably maintained gravity discharge of 0.5 l/s is proposed for rainfall runoff for 1 in 100yr + cc and calculations provided show an attenuation of 11.4m³ is required. The 1 in 100yr + cc discharge rate is a reduction of approximately 98% from 1 in 100yr brownfield rates.

The SuDS provides a surface water management solution for the rainwater runoff for the site and reduces the runoff discharge that leaves the site. It shows that the proposed development does not result in an increase to the risk of flooding on or off site. Permeable pavement 450mm thick as Formpave / Aquaflow attenuation system or similar is provided on site for source control to collect and convey and treat storm / surface water prior to discharge into the existing combined sewer system. The first 5mm runoff is provided for within the permeable pavement SuDS. Landscaped gardens also provide for the first 5mm runoff and an element of bioretention and biodiversity. Evapotranspiration will occur in appropriate weather conditions.

Exceedance flows from the proposed roof will be directed to ground level where they will mirror the existing flow routes at the front and to ground within landscaped gardens at the rear.

This report provides a management and a maintenance regime statement for the SuDS surface water management of the new development.

2. Introduction

Brief

The PES has been commissioned to produce a Flood Risk Assessment (FRA) & Sustainable Urban Drainage System (SuDS) Strategy Report in support of a planning application for the proposed redevelopment at the rear of 69 Sandy Lane / Lowther Court, Prestwich, Manchester, M25 9PS currently a tarmacked area housing the local domestic garages. The proposed redevelopment of the site entails the demolition of the existing garages and erection of two 2-bedroom 4-person dwellings.

This desk study report is produced to identify an appropriate SuDS for the new residential development that mirrors the natural drainage pattern of the development site and restricts flows to greenfield runoff conditions if possible for the site. The SuDS will provide a surface water management solution to reduce the surface water run off that leaves the site and show that the proposed development will not result in an increase to the risk of flooding on or off site. Where required, it recommends mitigation to any potential flooding issues associated with the proposed development. The SuDS solution follows the requirements of the Environment Agency (EA), Bury Metropolitan Borough Council, Greater Manchester Council and United Utilities.

The SuDS solution is developed using information supplied by others. The PES in good faith has used it as deemed accurate, without guarantee but as best information available at the time of completion of the SuDS design and associated report.

The purpose of this report is to summarise the SuDS strategy design process for the proposed development and demonstrate that the development complies with national planning policy on flood risk as well as the local Bury Metropolitan Borough Council, Greater Manchester Council Policies, the and guidelines including associated SuDS requirements.

Report Structure

These works are discussed in the following sections. The structure of this report is summarised as follows:

- Section 3: Describes site conditions with respect to topography, hydrology, hydrogeology, drainage and potential design proposals as well as identifying National and local planning Policies and guidance;
- Section 4: Provides a commentary on how flood risk from a range of potential sources may or may not constrain development proposals and influence the SuDS solution;
- Section 5: Provides a surface water drainage statement;
- Section 6: Provides a management and a maintenance regime statement for the surface water drainage/ SuDS surface water management;
- Section 7: Presents a summary of the report and identifies the main conclusions that can be drawn.

3. Site Conditions and Planning Policy

Existing Conditions

There is an existing set of domestic garages on the relatively flat tarmacked area at the rear of 69 Sandy Lane / Lowther Court, Prestwich, Manchester, M25 9PS. The existing garages site is accessed directly off Sandy Lane and sits adjacent to Lowther Court. The proposed redevelopment site is located within a mixed commercial / mainly residential urban area.

There are no drainage ditches or watercourses on or nearby the development site.

The existing garages site and neighbourhood is serviced by a United Utilities combined sewer network. Exceedance flows discharge to the United Utilities combined sewer network via the surface water gully at the domestic garage site adjacent.

Proposed development

The proposed redevelopment of the site entails the demolition of the existing garages and erection of two 2-bedroom 4-person dwellings

Exceedance flows will continue to discharge onto the adjacent highways.

The site location for the proposed development at the rear of 69 Sandy Lane / Lowther Court, Prestwich is shown below in Figure 1.

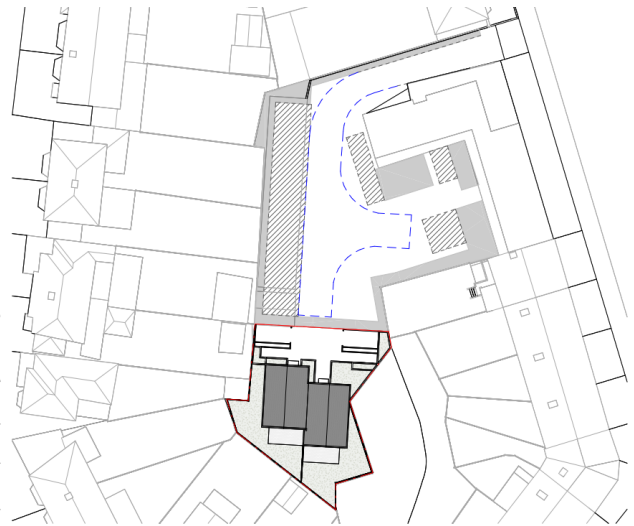


Figure 1 –Site Location Plan for the Existing & Proposed Development at rear of 69 Sandy Lane / Lowther Court, Prestwich, Manchester, M25 9PS

Existing & Proposed Block Plans, Proposed Ground, First & Roof Plans, Proposed North, South, East & West Elevations, Proposed Sections A-A & B-B and Proposed Front & Rear Perspectives and Visualisations for the redevelopment at land at the rear of Sandy Lane / Lowther Court, Prestwich are shown below in Figures 2, 3 4, 5 and 6 respectively.

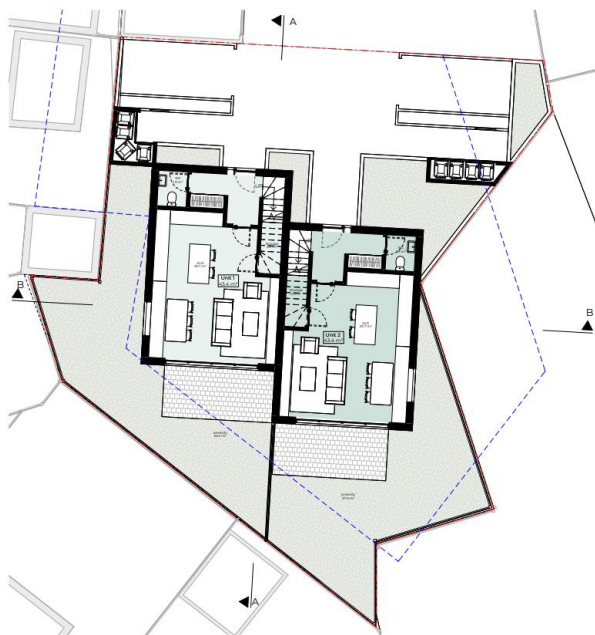


Existing Block Plan



Proposed Block Plan

Figure 2 – Existing & Proposed Block Plans for the Development at rear of Sandy Lane/Lowther Court, Prestwich



Proposed Ground Floor



Proposed First Floor



Proposed Roof

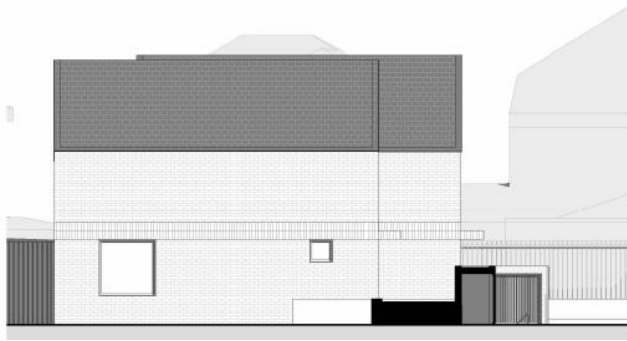
Figure 3 - Proposed Ground, First & Roof Plans for the Development at rear of Sandy Lane/Lowther Court, Prestwich



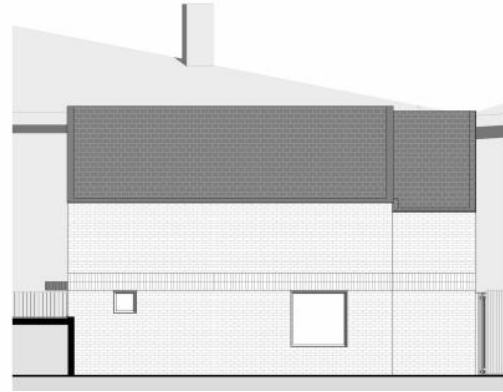
Proposed North Elevation



Proposed South Elevation



Proposed East Elevation



Proposed West Elevation

Figure 4 – Proposed North, South, East & West Elevations for the Development at Sandy Lane/Lowther Court, Prestwich



Section AA



Section BB

Figure 5 - Proposed Sections A-A & B-B for the Development at Sandy Lane/Lowther Court, Prestwich



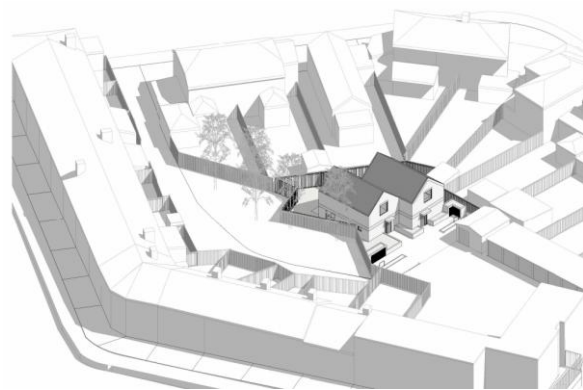
Proposed Front Perspective



Proposed Rear Perspective



Front Visualisation



Rear Visualisation

Figure 6 - Proposed Front & Rear Perspectives and Visualisations for the Development at Sandy Lane/Lowther Court, Prestwich

Critical Drainage Area

A definition for Critical Drainage Areas (CDAs) is "A discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure."

Within the Bury, Rochdale and Oldham Councils Strategic Flood Risk Assessment (SFRA) Screening for CDAs was undertaken using data from the following sources:

- Local authority incident records
- Discussions with Local Authority Drainage Engineers
- The National Surface Water Map
- United Utilities DG5 register

The table below identifies CDAs within the Bury MBC area that have been defined from the surface water flooding information available at the time.

Local Authority	Area	Description	Take forward as CDA?
Bury	Ramsbottom	National Areas Susceptible to Surface Water Flooding map shows a risk of property flooding Known issues on Dick Field Clough and stream to south with surface water flowing along roads and through development areas Development planned for this area Known issues with sewer capacity	Yes – known issues and national Areas Susceptible to Surface Water Flooding map suggest significant risk Sewer system is at capacity which may suggest that surface water flooding happens frequently.
Bury	Radcliffe	National Areas Susceptible to Surface Water Flooding map shows a risk of property flooding Known issues on Water Street and Pilkington Way Known issues with sewer capacity Development planned for this area	Yes – known issues and national Areas Susceptible to Surface Water Flooding maps suggest significant risk Sewer system is at capacity which may suggest that surface water flooding happens frequently.

Figure x – Bury, Rochdale and Oldham Councils Strategic Flood Risk Assessment Table 5-1: Screening for Critical Drainage Areas

The application site is not located within a designated CDA.

Existing Surface Water / Thames Water Sewers

United Utilities Sewer Asset data shows that there is an existing combined sewer network within the garages site at the rear of Sandy Lane / Lowther Court and adjacent to the site that serves the existing neighbourhood. There is an existing gulley at the site that captures surface water runoff at the site. The existing site drains to the adjacent United Utilities network.

United Utilities sewer asset data is provided within Appendix A.

Topography.

The access lane falls into the site and is at 84.46mAOD as it opens into the garage area. The tarmacked area generally falls from the edges into the site to a low point that is just lower than 84.02mAOD at the central gulley location. The proposed development site is a reasonably flat one with an existing level of approximately 84.55mAOD.

Hydrology

The application site lies within the EA's North West River Basin District. The River Irwell lies approximately 800m to the west in Drinkwater Park.

There are no watercourses or drainage ditches in the close proximity of the development site.

Exceedance flows at the existing site fall to the United Utilities combined sewer system that serves it.

Hydrogeology

The British Geological Survey site describes the site bedrock geology as Pennine Upper Coal Measures Formation - Mudstone, siltstone and sandstone. A sedimentary bedrock formed during the Carboniferous period. A sedimentary deposit formed during the Quaternary period. Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with coal seams, but no mudstones containing marine fossils are present. The bedrock at the Lowther Court site identified by the British Geological Survey site is shown in Figure 7 below.

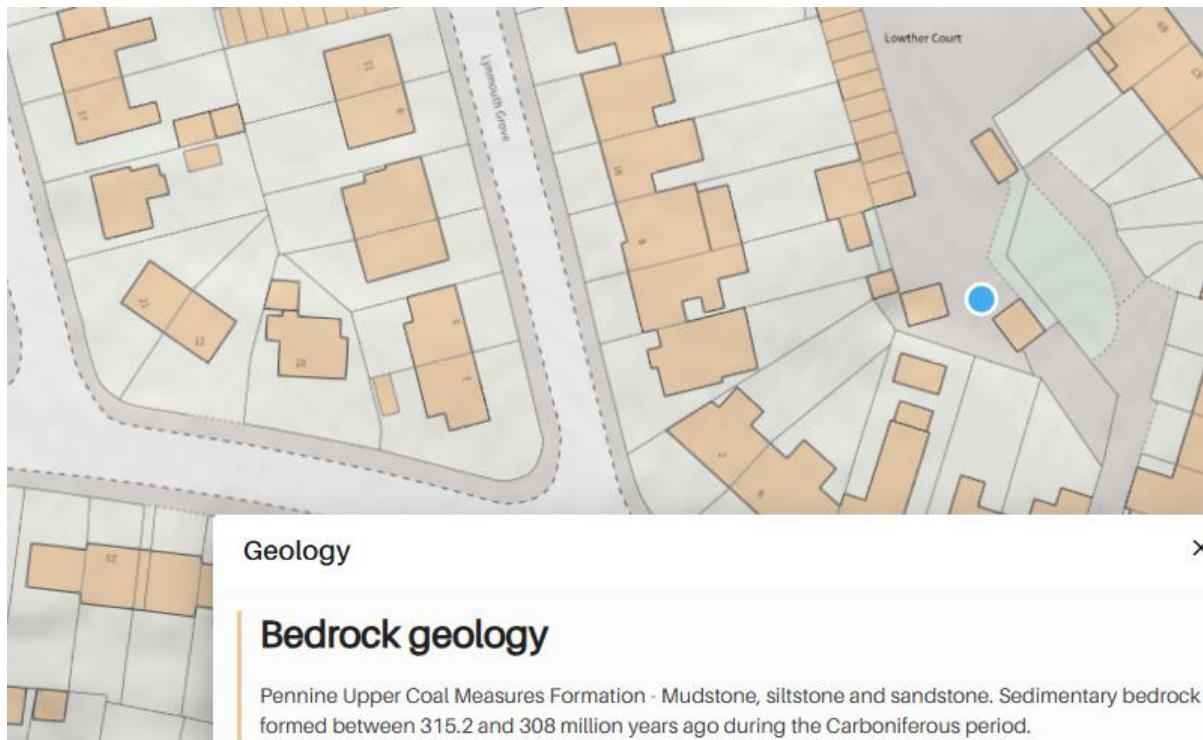


Figure 7 - BGS Bedrock Geology 1 in 50,000 (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2019]. Base mapping is provided by ESRI).

The British Geological Survey site indicates that superficial deposits at the site is Hummocky (moundy) Glacial Deposits, Devensian - Sand and gravel that overlays the Pennine Upper Coal Measures Formation. Superficial deposits at the application site identified by the British Geological Survey site are shown in Figure 8 below.

There are no records of historical trial holes and boreholes at the application site. A ground investigation was undertaken in the wider neighbourhood relating to an "unusual groundwater seepage" issue. The ground was a mix of sand, clayey sand and gravels.

Given the potential of impermeable ground or a shallow perched groundwater at the proposed development site it is concluded that a source control infiltration / soak away system is not appropriate for this development site. The existence / availability of a United Utilities combined sewer local to the site that serves it adds support to this conclusion.

The SuDS strategy for the proposed development will be discussed further in sections below.

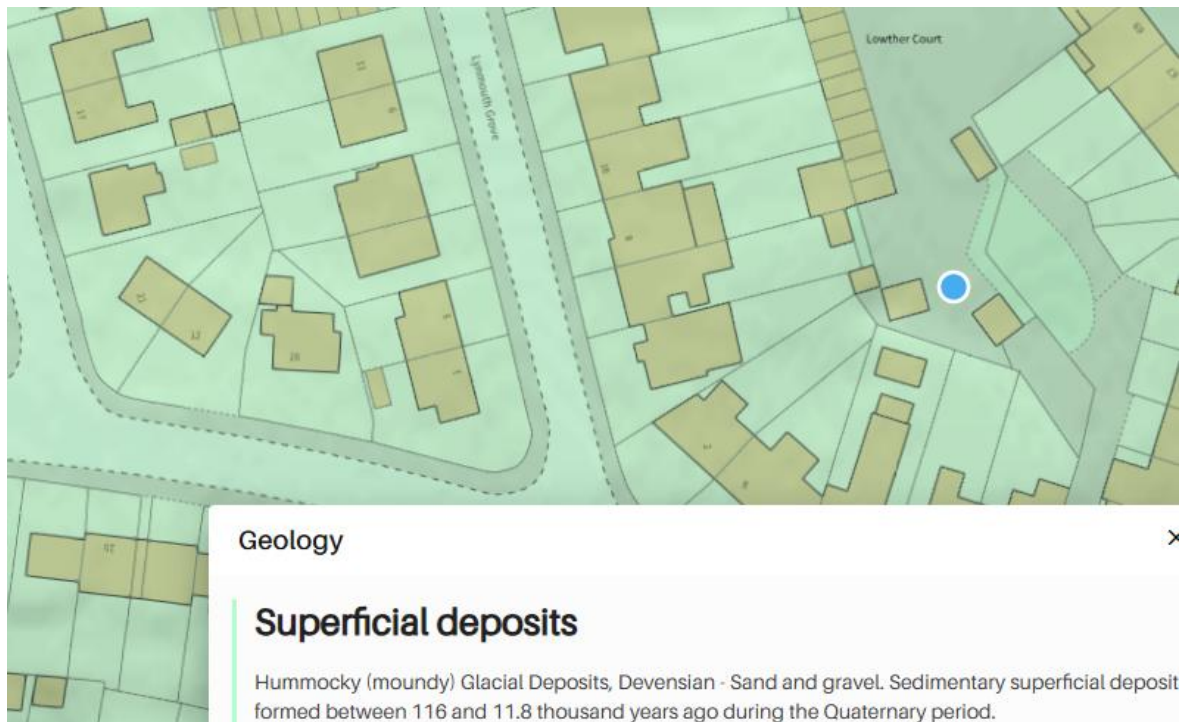
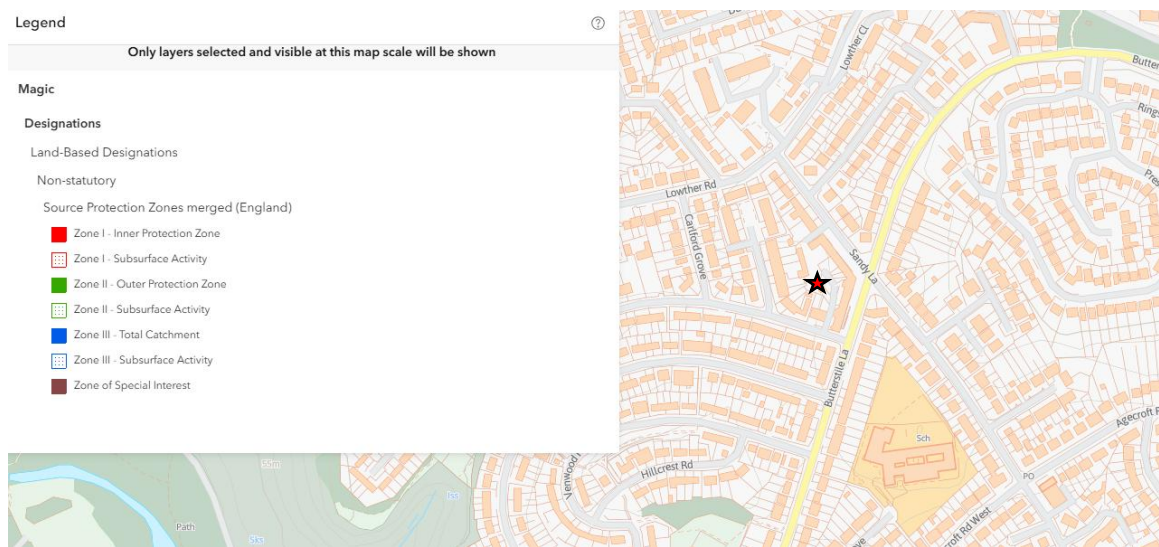


Figure 8 - BGS Superficial Geology 1 in 50,000 (Source: British Geological Society Website (Contains British Geological Survey materials © URKI [2019]. Base mapping is provided by ESRI).

Groundwater

The application site is not located within a groundwater source protection zone as can be seen in Figure 9 below.



★ Location of the development.

Figure 9 - magic.defra.gov.uk - Source Protection Zones merged (England)

Flood Zone

The application site is within a Flood Zone 1 area as shown in Figure 10 below.

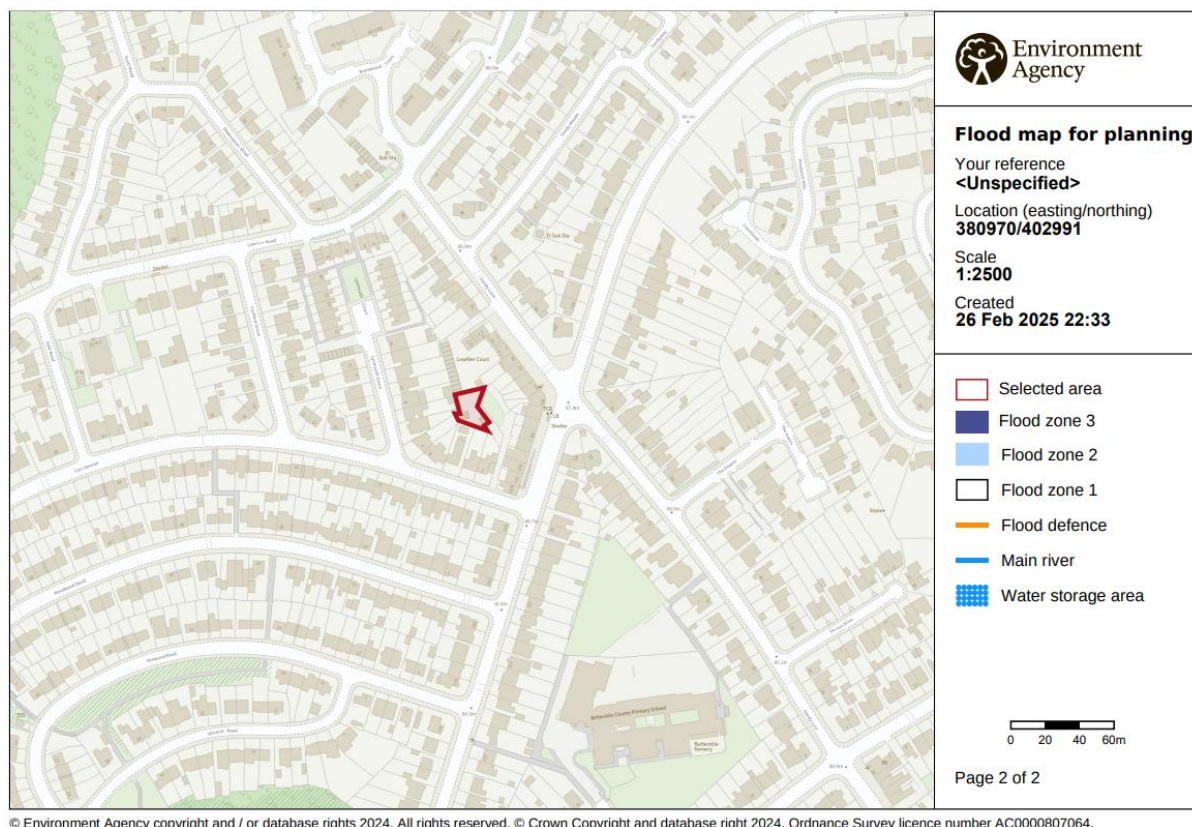


Figure 10 - EA Flood Map for Planning

Planning Policy

The National Planning Policy Framework (NPPF) currently sets out the Government's planning policies for England and defines Flood Zones, Flood Risk vulnerability classification and their compatibility in the tables below.

Table 1: Flood Zones

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's [Flood Map for Planning \(Rivers and Sea\)](#), available on the Environment Agency's web site, as indicated in the table below.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)

Flood Zone	Definition
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Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)
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Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

Table 1 – Table 1 from Planning Policy Guidance (Flood Risk and Coastal Change) 06 03 2014

Table 2: Flood risk vulnerability classification

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More vulnerable • 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. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable • Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.

- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 1 – Table 2 from Planning Policy Guidance (Flood Risk and Coastal Change) 06 03 2014

The proposed development classification at the application site is more vulnerable.

Table 3: Flood risk vulnerability and flood zone ‘compatibility’

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
 × Development should not be permitted.

Table 2 – Table 3 from Planning Policy Guidance (Flood Risk and Coastal Change) 06 03 2014

More vulnerable developments are acceptable within a Flood Zone 1.

References

This FRA & SuDS Strategy takes into account and makes reference to the NPPF and the National Planning Practice Guidance (NPPG) as well as the local policies and guidance provided within the Association of Greater Manchester Authorities Assessment of planning applications: Flood risk: Greater

Manchester (GM) Strategic Flood Risk Assessment (SFRA) Level 1 & 2; GM Flood Risk Management Framework 2019; GM Surface Water Management Plan Stage 1 (2012) & 2 (2013); Bury, Oldham and Rochdale SFRA Level 1 Vols 1 & 2 and Level 2 Vol 3 2009; Bury Preliminary Flood Risk Assessment (PFRA) 2011 & 2017; Bury Local Flood Risk Management Strategy 2014, 2015 & 2018;

It also makes reference to consultations with the Environment Agency and United Utilities as well as CIRIA753 The SuDS Manual and Government Non-statutory technical standards for sustainable – practice guidance and the design, maintenance and operation of SuDS.

4. Flooding

Introduction

There are a wide range of potential mechanisms which can cause flooding. Each potential source of flooding is discussed individually below.

Tidal or River Flooding

The EA website / database states that the application site currently has a Very low yearly chance of flooding and a Very low yearly chance of flooding between 2036 to 2069. The flood risk rating of Very low means that each year this area has a chance of flooding of less than 0.1%.

The yearly chance of flooding at the site from Rivers and sea is shown in the EA flood map for planning below in Figures 11 - Flood Risk from Surface Water - Yearly chance of flooding and Figures 12 - Flood Risk from Rivers and Sea - Yearly chance of flooding between 2036 and 2069.

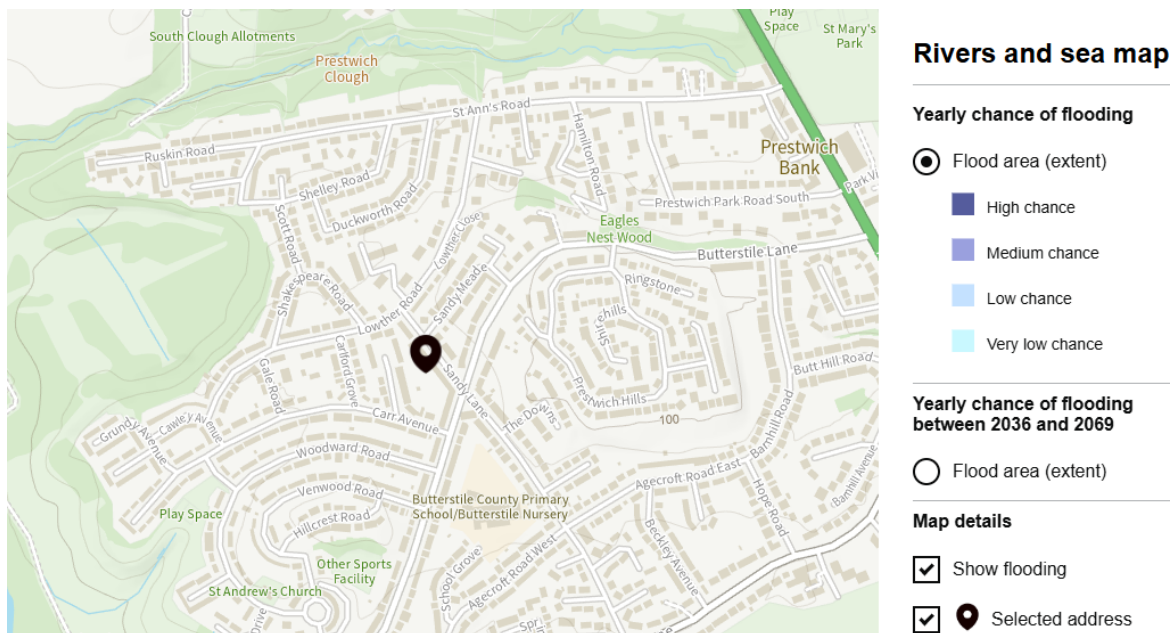


Figure 11 - Flood Risk from Rivers or the sea - Yearly chance of flooding

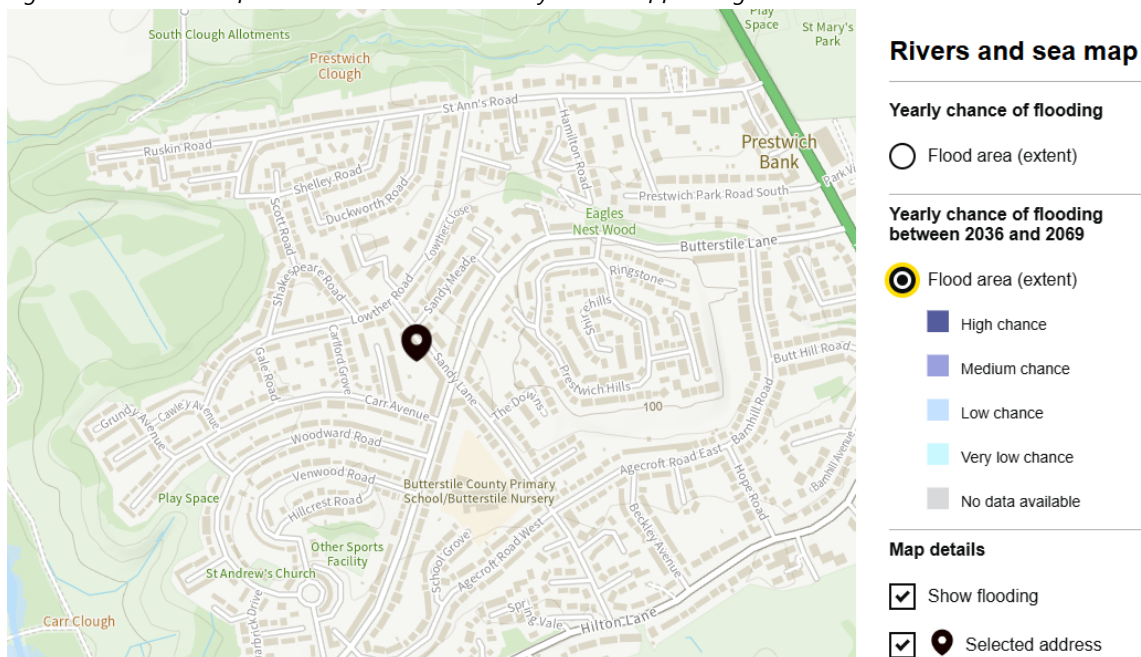


Figure 12 - Flood Risk from Rivers or the sea - Yearly chance of flooding between 2036 and 2069

There is no historical record of fluvial flooding at the site.

Surface Water Flooding

Surface water flooding can occur during high intensity rainfall events as sheet run off from fields or hard paved areas. the EA state that surface water flooding is sometimes known as flash flooding. It happens when rainwater cannot drain away through normal drainage systems. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

The EA website / database states that the application site currently has a medium yearly chance of flooding increasing to a high yearly chance of flooding between 2040 and 2060.

The flood risk rating of medium means that each year this area has a chance of flooding of between 1% and 3.3%.

The flood risk rating of high means that each year this area has a chance of flooding of more than 3.3%.

The yearly chance of flooding at the site from surface water is shown in the EA flood maps for planning shown below in Figure 13 - Flood Risk from Surface Water - Yearly chance of flooding and Figure 14 - Flood Risk from Surface Water - Yearly chance of flooding between 2040 and 2060.

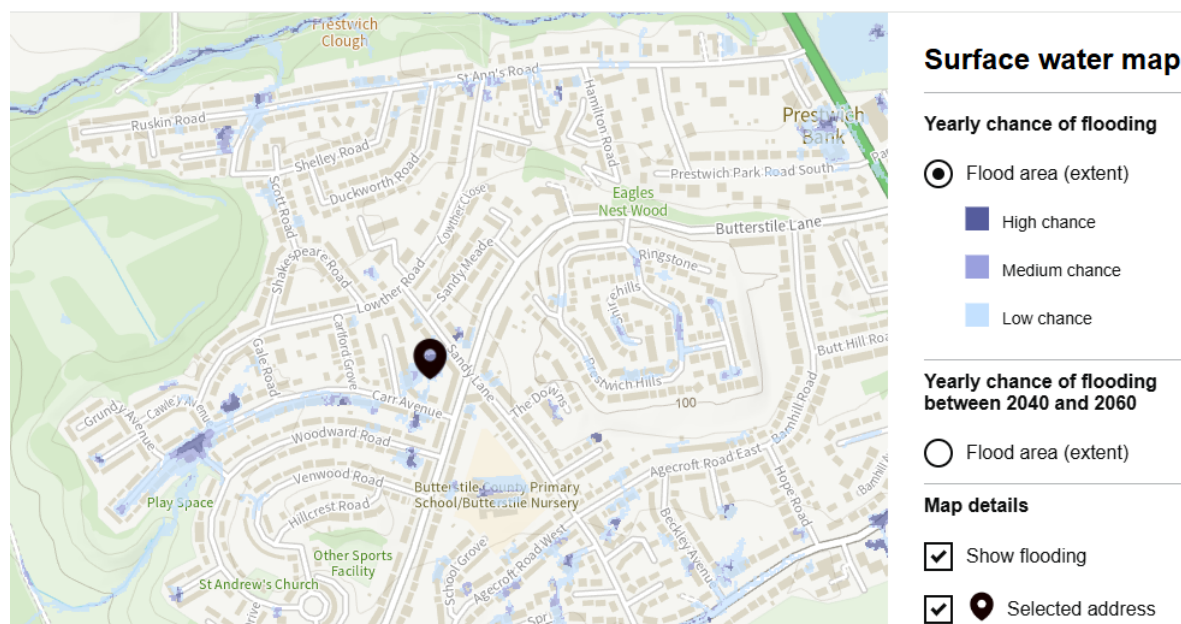


Figure 13 - Flood Risk from Surface Water – Yearly chance of flooding

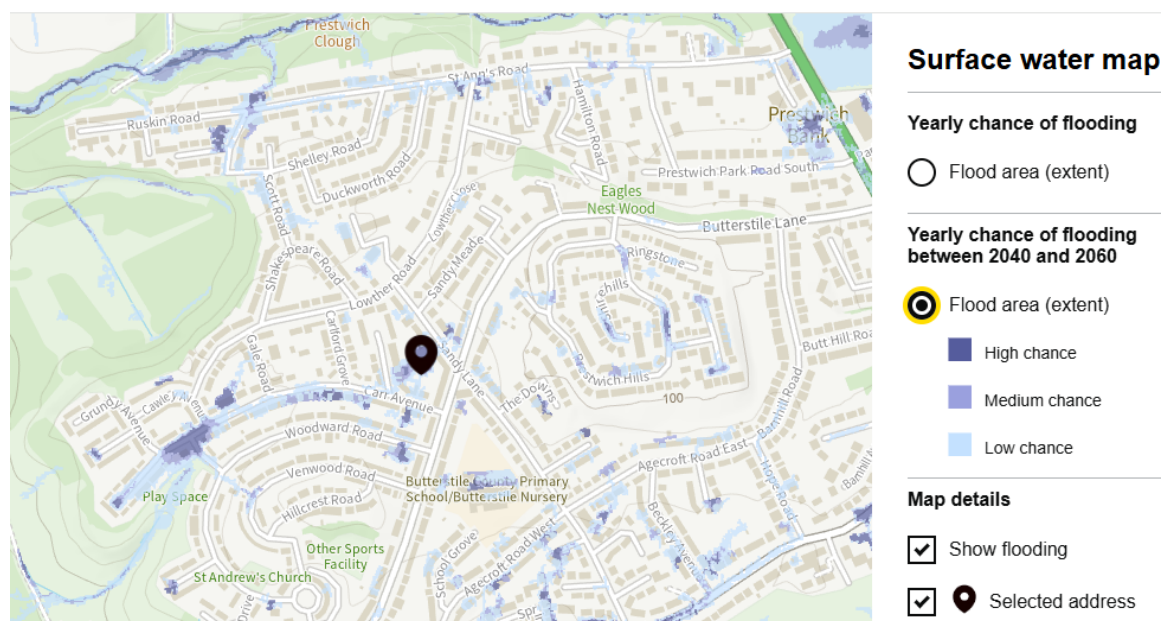


Figure 14 - Flood Risk from Surface Water – Yearly chance of flooding between 2040 and 2060

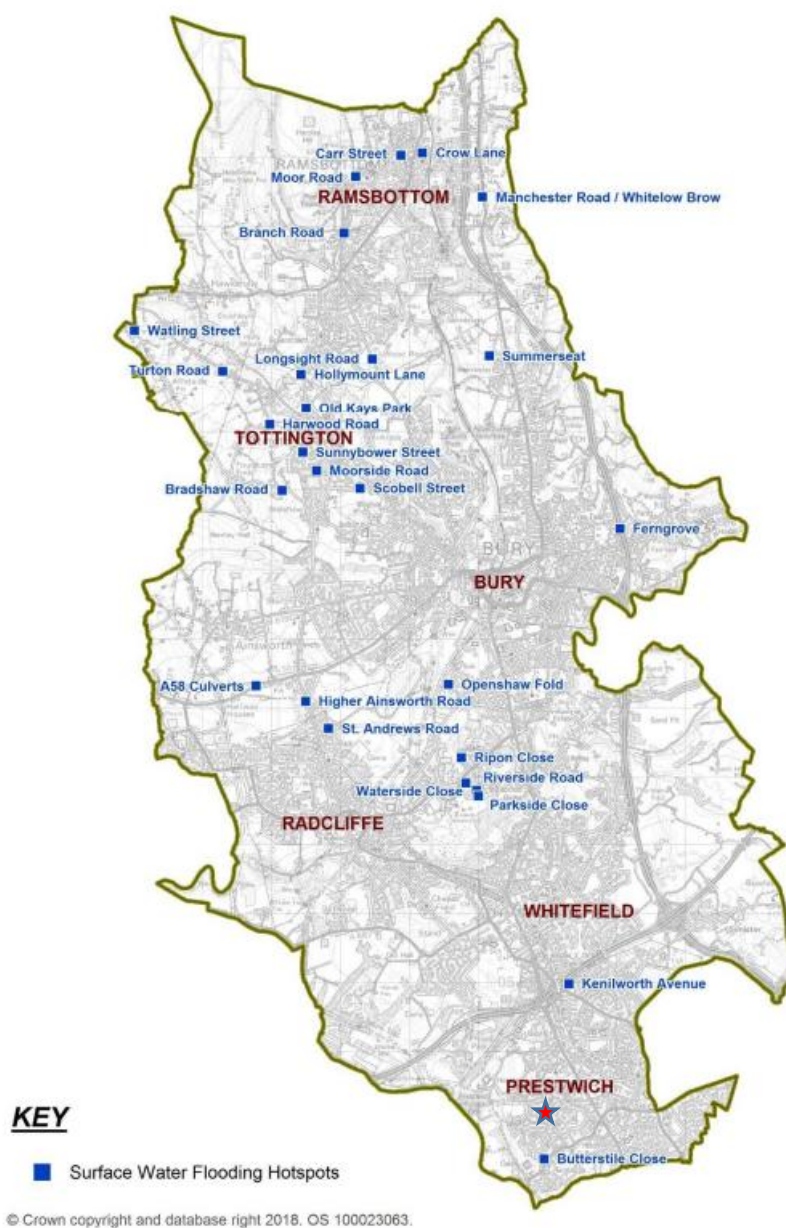
There is no historical record of surface water flooding at the site.

The EA website states that there is a medium chance of flooding to a height of 20cm at the site currently and in the longer term of between 2040 and 2060. For flood depths to raise to 30cm there is a low chance now and between 2040 and 2060 and a very low chance of flood waters reaching 60cm at the site.

At 20-30cm, flood water can get into some homes and buildings. Mitigation to provide for the risk of surface water at the rear of Lowther Court development should be provided. To prevent flooding threshold levels and finished floor levels should be raised to a height of 30cm + 20cm freeboard above existing ground levels at the site. Damp proofing in accordance with Building Regulations should be applied to the development. Airbricks should be self-closing.

The application site is not within or near a surface water flooding hotspot as shown below in Figure 15 – Bury MBC's Local Flood Risk Management Strategy April 2018 Figure 6 – Surface Water Flooding.

Figure 6 – Surface Water Flooding



★ Location of the development.

Figure 15 – Bury MBC's Local Flood Risk Management Strategy April 2018 Figure 6 – Surface Water Flooding

Groundwater Flooding

The Bury MBC's Local Flood Risk Management Strategy April 2018 states that groundwater flooding occurs when the water held underground rises to a level where it breaks the surface in areas away from usual channels and drainage pathways. It is generally as a result of exceptional extended periods of heavy rain, but can also occur as a result of reduced abstraction, underground leaks or the displacement of underground flows. Once groundwater flooding has occurred and particularly in soils that are impermeable, the water can be in situ for a lengthy period of time.

Local understanding of groundwater flooding is limited and often groundwater is not identified as a distinct event. The Environment Agency's national dataset, 'Areas Susceptible to Groundwater Flooding (ASStGWF)', provides a limited basis for assessing flood risk from groundwater.

Bury lies over an aquifer with geology consisting predominately of sands and gravels which have high permeability. However, there are areas of clay which have low permeability. There are relatively few reported incidents of groundwater flooding in Bury.

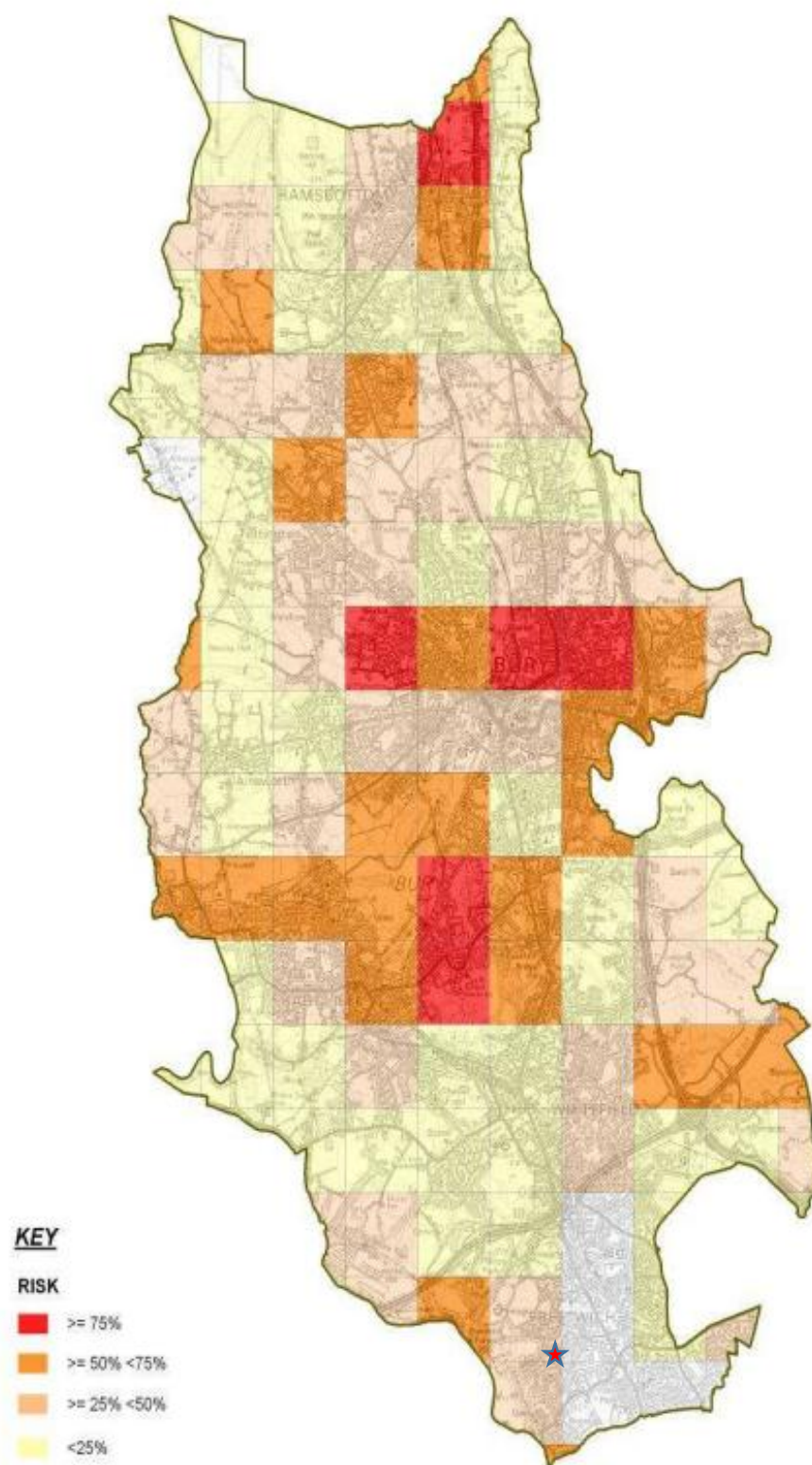
The Bury MBC's Local Flood Risk Management Strategy April 2018 Figure 7 - Groundwater Flooding in Figure 16 below shows that the application site is in an area that has $\geq 25\%$, 50% of groundwater flooding.

It is considered that groundwater flooding at the application site is a low to medium risk.

The application site has no recorded groundwater flooding.

The EA website states for the application site that "Flooding from groundwater is unlikely in this area."

Figure 7 – Groundwater Flooding



© Crown copyright and database right 2013. Ordnance Survey 100023063.

Source: Bury Council, 2016

★ Location of the development.

Figure 16 – Bury MBC's Local Flood Risk Management Strategy April 2018 Figure 7 - Groundwater Flooding

Flood Risk From Sewers

Waste water sewerage systems can fail and cause flooding due to blockages, a collapse, or damage to the pipe (for example, by tree roots growing through the pipework). Where the pipework is damaged, groundwater or surface water can enter and overwhelm the system. Flooding due to surface water can be caused by large quantities of rainfall entering and overloading the system during a storm.

United Utilities as the sewerage undertaker in this area is responsible for the maintenance and management of their sewers that could cause flooding at the application site.

United Utilities has a combined public sewerage network within the site and vicinity that services the development site for both foul sewage and surface water drainage. The United Utilities asset plan is shown in Appendix A. Public Sewers are defined as those for which the Company holds statutory responsibility under the Water Industry Act 1991.

United Utilities referencing for properties at risk of flooding from sewers include the following:

- A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.
- "Internal flooding" from public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.
- "At Risk" properties are those that the water company is required to include in the Regulatory Register that is presented annually to the Director General of Water Services. These are defined as properties that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Company's reporting procedure.
- Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the At Risk Register.
- Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Company.

It is expected that the sewers and water distribution networks in the vicinity of this site are well maintained as United Utilities is a highly professional company having planned operations and maintenance regimes for their sewerage, drainage and potable water main network systems.

It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Thames Water. United Utilities makes no comment upon this matter.

The risk of flooding from sewers is low.

Flood Risk from other Sources

In rare occasions, a development may be subject to flood risk from upstream features such as reservoirs, where there is a theoretical risk of failure. A reservoir is a large natural or artificial lake that is designed to collect and store water. The EA use predicted scenarios to understand the risk of flooding from reservoirs. An area is considered at risk if peoples' lives could be threatened by an uncontrolled release of water from a reservoir.

The EA website states that for the land to the rear of Sandy Lane / Lowther Court site "Flooding from reservoirs is unlikely in this area."

Historical Flooding

There are no records of historical flooding at the proposed development site.

Flood Risk Summary

Data from the Environment Agency's flood maps corresponds with that included within the local authority maps.

The application site has a medium risk of flooding with a high long term risk of surface water flooding between 2040-2060.

5. Sustainable Drainage Systems Strategy

Philosophy

Sustainable drainage has moved away from the traditional thinking of designing to manage flood risk and where runoff is regarded as a nuisance to a philosophy of surface water being a valuable resource that should be managed for maximum benefit.

Sustainable Drainage systems (SuDS) can contribute to sustainable development overall by improving the places and spaces where we live, work and play as well as balancing the different opportunities and challenges that influence urban design and the development of communities.

The SuDS philosophy is to replicate, as closely as possible the natural drainage from a site before development. SuDS mimic nature and manage rainfall close to where it falls. They can be designed to convey surface water, slow / attenuate runoff before it enters watercourses, provide areas to store water in natural contours and can be used to allow water to infiltrate into the ground or evaporate from the surface and transpired from vegetation.

The “four pillars” of SuDS design philosophy is to meet design objective where surface water runoff is managed for water quantity, water quality, amenity and biodiversity benefits.

Management Train

Adopting a holistic approach towards surface water drainage provides the benefits of combined water quality and quantity control, biodiversity as well as increased amenity value. This is accomplished by managing the increased flows and pollution from surface water runoff that can arise from development

A fundamental concept used in the management / development of SuDS is the management train or treatment train, illustrated in Figure 17 below

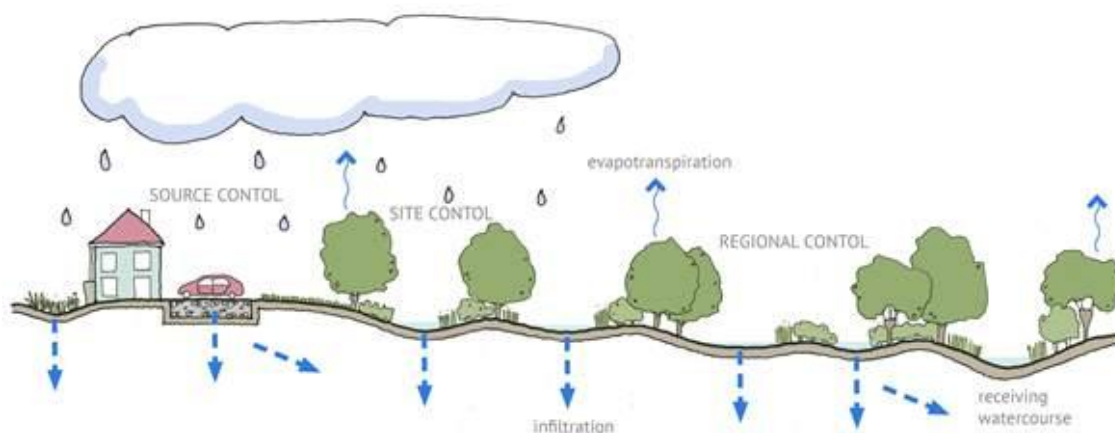


Figure 17 - SuDS Management Train (susdrain)

Just as in a natural catchment, drainage techniques can be used in series to change the flow and quality characteristics of the runoff in stages. The management train starts with prevention (prevent runoff by reducing impermeable areas), or good housekeeping measures for reducing pollution; and progresses through local source controls to larger downstream site and regional controls

They are regarded as a sequence of management practices, control structures and strategies designed to efficiently and sustainably drain surface water, while minimising pollution and managing the impact on water quality of local water bodies. Within the philosophy of the surface water management train each component adds to the performance of the whole drainage system.

Design Requirements

SuDS design proposals should consider the location of discharge as a hierarchy, Planning Practice Guidance states:

"Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system;
4. to a combined sewer."

SuDS design:

- o Manage runoff volumes and flow rates from hard surfaces, reducing the impact of urbanisation on flooding
- o Provide opportunities for using runoff where it falls
- o Protect or enhance water quality (reducing pollution from runoff)
- o Protect natural flow regimes in watercourses
- o Are sympathetic to the environment and the needs of the local community
- o Provide an attractive habitat for wildlife in urban watercourses
- o Provide opportunities for evapotranspiration from vegetation and surface water
- o Encourage natural groundwater/aquifer recharge (where appropriate)
- o Create better places to live, work and play.

Summary of typical SuDS Components:

Source Control

- Good house keeping
- Green Roofs
- Infiltration Basins
- Infiltration trenches
- Permeable pavements / Grasscrete
- Rainwater Harvesting
- Soakaways

Permeable Conveyance Systems

- Filter (or French) Drains
- Swales

Passive Treatment

- Bioretention / Vegetated areas
- Filter Strips
- Detention Basins
- Retention ponds
- Wetlands

Pipes and accessories. A series of conduits and their accessories normally laid underground that convey surface water to a suitable location for treatment and/or disposal. (Although sustainable, these techniques should be considered where other SUDS techniques are not practicable).

Site Considerations

As well as to ensure that the users of the site are not at risk, another key objective is to ensure that the development does not increase the potential of flooding elsewhere. This objective can be achieved by

designing a drainage / SuDS strategy for the development that will set the strict framework to be followed during the detailed drainage design.

Physical site conditions as described in Section 3 above are taken into account in order to develop a suitable SuDS Strategy for the proposed development. The SuDS strategy will be delivered in accordance with prevailing national and local planning policies guidance and design standards including CIRIA Reports etc.

Currently, the most significant directives influencing the design of the SuDS strategy are the Flood and Water Management Act 2010, the National Planning Policy Framework (NPPF) and relevant chapters of the Planning Practice Guidance (PPG); as well as the local policies including the Bury MBC Local Plan and guidance provided within the Association of Greater Manchester Authorities Assessment of planning applications: Flood risk: Greater Manchester (GM) Strategic Flood Risk Assessment (SFRA) Level 1 & 2; GM Flood Risk Management Framework 2019; GM Surface Water Management Plan Stage 1 (2012) & 2 (2013); Bury, Oldham and Rochdale SFRA Level 1 Vols 1 & 2 and Level 2 Vol 3 2009; Bury Preliminary Flood Risk Assessment (PFRA) 2011 & 2017; Bury Local Flood Risk Management Strategy 2014, 2015 & 2018;

It also makes reference to consultations with the Environment Agency and Thames Water as well as CIRIA753 The SuDS Manual and Government Non-statutory technical standards for sustainable – practice guidance and the design, maintenance and operation of SuDS.

This strategy sets the guidelines for future detailed design, but more importantly, it demonstrates that a sustainable drainage solution is deliverable at this site, complying with all relevant planning and legislative criteria.

Outline SuDS Strategy Design

The aim of the outline drainage / SuDS strategy is to mimic the existing drainage system for the site and to restrict discharge rates from the site to as close to greenfield rates as is practicable.

The existing rear of Sandy Lane / Lowther Court development site is a brownfield hard surfaced impermeable site that covers the whole of the site that sits on superficial deposit of Hummocky (moundy) Glacial Deposits, Devensian - Sand and gravel that overlays the impermeable Pennine Upper Coal Measures Formation. There are no recorded boreholes on the site. However, a ground investigation was undertaken in the wider neighbourhood relating to an “unusual groundwater seepage” issue. The ground was found to be a mix of sand, clayey sand and gravels.

Given the probability of impermeable ground or a shallow perched groundwater at the proposed development site it is concluded that a source control infiltration / soak away system is not appropriate for this development site.

There is no drainage ditch, ordinary watercourse or main river on or close to the application site.

United Utilities has provided a copy of their asset plans at and adjacent to the proposed rear of Sandy Lane / Lowther Court site. Their asset plans are provided in Appendix A. United Utilities state that their asset plan are not a fully comprehensive record of their assets within the area and private drainage is not shown on their plans nor level data for associated inspection chambers / manholes.

There is not a surface water sewer in the area available to accept a discharge from the proposed development site.

However, United Utilities asset drawing confirm the location of a combined sewer at the application site and adjacent to it. The existing site is drained via the United Utilities combined sewer network located within it. There are no reported flooding of properties in the area so it is therefore concluded that the United Utilities combined sewer has capacity for the existing surface water flow from the

existing site. The proposed SuDS Strategy is based on a discharge based greenfield rates rather than the existing unrestricted discharge from the site.

The existing level of the proposed development site sits at approximately 50cm higher than the low point of the site located at the existing surface water gulley within the tarmacked garage access / parking area. The proposed development site ground level is also to be raised to a minimum of 30cm + 20cm freeboard to provide mitigation for potential surface water flooding in the area.

Surface water runoff exceedance flows at the site fall to the low point gulley adjacent to the proposed development site and drains to the existing United Utilities combined sewer network on the site.

There are no historical records of flooding at the application site. The existing site is at medium to high risk of surface water flooding in the long term.

The main flood risk to the site is from potential surface water runoff from the proposed development site itself and possibly groundwater.

In addition to ensuring flood risk on site is not increased the SuDS design for the proposed development considers mitigation in order not to add to offsite flood risk. Surface water drainage flows from the application site will be to a flow based on greenfield runoff / a practicably controlled rate that allows for the associated attenuation half drain down rates.

It is proposed to drain the land to the rear Sandy Lane / Lowther Court redevelopment site via the United Utilities combined sewer drainage system located within it as existing.

It is the aim of this study to provide a SuDS strategy solution that is pragmatic in both its specification and maintenance in accordance with site constraints. A practicably maintainable flow control is used to determine a suitable surface water discharge from the proposed development layout. Hydraulic calculations were undertaken using FEH rainfall methodology to identify potential appropriate discharge rate and attenuation design options. The hydraulic calculation process was an iterative one to assess discharge with appropriate sized flow controls and attenuation drain down times.

The existing brownfield site has a total impermeable area of 340m². Hydraulic calculations established pre-development site unrestricted runoff rates for the brownfield site runoff of flows of 6.2 l/s for Q2, 11.2 l/s for Q30 and 15.1 l/s for Q100. These calculations are provided in Appendix B.

The proposed development site of 340m² was used to complete hydraulic calculations that established greenfield runoff flows for the site as Q2 of 0.2 l/s, Qbar of 0.2 l/s, Q30 of 0.4 l/s and Q100 of 0.5 l/s. These calculations are provided in Appendix C. the calculations are based on a site of 1ha and need to be adjusted to suit the actual area of the site. It is impracticable to restrict runoff rates from the proposed development to greenfield rates.

Runoff calculations were undertaken for the proposed development site of total area 340m² that now has an impermeable area of 210m². A total controlled discharge from the development site of 0.3 l/s for a Q2yr 0.4 l/s for Q30yr and 0.4 l/s for Q100yr plus 45% cc is calculated requiring an attenuation volume of 11.4m³. These calculations are also provided in Appendix B.

The 1 in 100yr + cc discharge rate is greater than greenfield Qbar runoff rate but a reduction of approximately 98% from 1 in 100yr brownfield critical discharge rates. The required attenuation is provided within permeable pavement and the associated flow control chamber and drainage network.

Surface water runoff from the grey pitched roofs will be collected and drain via ducting and rainwater down pipes to ground level and connect into the 450mm thick permeable pavement as Formpave / Aquaflow attenuation system or similar at the front of the buildings. The permeable pavement is connected to a Flow Control Chamber (FCC) that has a 15mm diameter orifice flow control located in it. The rear patios drainage is connected to the front permeable paving via a shallow drain. The FCC

is connected to the United Utilities combined sewer located within the development site. A rainwater harvesting water butt system is provided within the rear gardens of the proposed properties.

A plan of the SuDS strategy for the proposed development is provided in drawing FRA 20234-DS-001 in Appendix C.

Ground levels should allow for exceedance flows from roofs and ground level to be directed away from the development to the tarmacked car parking / garage area at the front with associated gulley mirroring the existing flow routes and site run off. Exceedance flows off the rear patios fall to the landscaped garden at the rear and drain to ground.

The proposed SuDS design strategy will provide the source control technique of permeable paving to collect and convey storm / surface water prior to discharge into the existing Thames Water combined sewer network that serves the existing site.

Landscaped gardens are provided on site for both source control for low rainfall events as well as opportunity for an element of bioretention, biodiversity and amenity value. They can also provide an opportunity for evapotranspiration and will also take the first 5mm of rainfall prior discharge to the ground and to the Thames Water combined sewer.

A rainwater harvesting water butt system is also included at the landscaped garden at the rear to accommodate an element of water reuse and stimulate biodiversity and amenity value for the communal areas and green roofs.

This strategy has been developed from a desk top study. Site surveys / investigations of the site drainage connections, network lines and levels should be undertaken to confirm the SuDS Strategy for detailed design.

6. Management and Maintenance

The onsite surface water management system is not eligible for adoption and will remain in the private ownership of the developer. A management company will be provided and will be responsible for the long-term maintenance of the onsite drainage system.

All drainage works are to be completed prior to occupation.

On Site SuDS

Surface water runoff from the grey pitched roofs will be collected and drain via ducting and rainwater down pipes to ground level and connect into the 450mm thick permeable pavement as Formpave / Aquaflow attenuation system or similar at the front of the buildings. The permeable pavement is connected to a Flow Control Chamber (FCC) that has a 15mm diameter orifice flow control located in it. The rear patios drainage is connected to the front permeable paving via a shallow drain. The FCC is connected to the United Utilities combined sewer located within the development site. A rainwater harvesting water butt system is provided within the rear gardens of the proposed properties.

A plan of the drainage strategy is provided in drawing FRA 20242-DS-001 in Appendix C.

Maintenance

The maintenance strategy and regime are to be in line with the CIRIA SuDS Design Guide and specific manufacturers recommendations. They should include

- inspections required to identify performance issues and plan appropriate maintenance needs
- operation and maintenance of the overall drainage system
- landscape management
- waste management associated with contaminated silt and other waste materials resulting from maintenance.

An Operations & Management Manual for the SuDS should be prepared and supplied to the site operator. It should provide the surface water management strategy and SuDS overall philosophy as well as the function and operation of each component. Manufacturers technical details and maintenance procedures and requirements should be included within the Manual.

General

Regular monthly good housekeeping management with inspections and cleansing should be employed at the whole of the site.

Regular inspection and cleansing of catchment, guttering, pipe inlets, channels, filters and inspection chambers to reduce the likelihood of contamination is required to suit the prevailing operations, usage and circumstances of the development site.

Inspections after extreme rainstorms are essential to ensure that there are no blockages.

Regular inspections & removal of litter, debris and sediment intrusion or other items that represent blockage risks.

Contaminated silts / sediments etc to be disposed of at appropriately licenced tip.

Regular weeding and maintenance should be carried out and more intently during months of growth.

Rainwater Harvesting

An Operations & Management Manual for the Rainwater Harvesting Butt technology to be specified at detail design should be prepared accordingly and supplied to the site operator.

Water Butts

Inspection routines are essential to maintain efficient performance of a rainwater harvesting / Water Butt system and they should be carried out at frequent and regular intervals. An initial inspection of the system should be undertaken following a significant storm and / or within 1 month of installation. Regular (quarterly) inspections to be undertaken over the lifetime as required.

- Regular: Inlet and outlet, should be inspected and cleared of any build up or debris.
- Keeping the water within a water butt clean should be a priority. Empty water butt completely to allow cleansing of the interior and remove the sludge, algae and grime that builds up on the sides and bottom of the container. There are various ecologically-sound products available to buy which are specifically made for cleaning the interior of water butts and enhancing the quality of the water. They contain non-toxic chemicals, so they are safe for children, wildlife and pets. These products liquids are usually very good at getting rid of smells in water butts and generally raising the quality of the water. Water purification tablets are an option.
- The exterior of a butt or rain barrel should receive a wipe over with an appropriate cleaning liquid on a regular basis to stop grime building.
- Occasional: Cleansing and reducing volumes of water for winter to prevent the risk of ice forming, expanding, and then cracking or splitting of the container.
- Remedial: Any vegetation which has encroached into drainage outlets should be removed immediately.
- Structure rehabilitation / repair. Remediate drainage system and structure as required.

Permeable paving maintenance

Inspection routines are essential to maintain efficient performance of permeable paving and they should be carried out at frequent and regular intervals. An initial inspection of the system should be undertaken within 3 months of installation. Occasional but regular inspections to be undertaken over the lifetime as required.

- Regular: The catch pit chamber and flow control for the permeable sub-base storage should be checked and emptied regularly to ensure there is no silting up of the system
- Vacuum and sweep permeable paving surface to remove litter, debris and contamination as circumstances require. Minimum: seasonally during Spring and at leaf fall in Autumn.
- Occasional: Management / removal and disposal of sediment intrusion.
- Removal of weeds and invasive plants as circumstance require.
- Washdown paving as required.
- Remedial: Infiltration surface reconditioning / rehabilitate surface. Sweep in and reapplication of 2-4mm clean gritstone. As Required
- Remediate areas of rutting and depressions - structure rehabilitation /repair.

As required Replace broken / damaged blocks.

7. Conclusions

The PES has been commissioned to produce a Flood Risk Assessment (FRA) & Sustainable Urban Drainage System (SuDS) Strategy Report in support of a planning application for the proposed redevelopment at the rear of 69 Sandy Lane / Lowther Court, Prestwich, Manchester, M25 9PS currently a tarmacked area housing the local domestic garages. The proposed redevelopment of the site entails the demolition of the existing garages and erection of two 2-bedroom 4-person dwellings.

This FRA and SuDS report has been prepared as a desk top study based on the architectural drawings supplied and gathered data available within the public domain. It summarises the SuDS design process for the proposed development and demonstrates that the development complies with planning policy on flood risk – National Planning Policy Framework (NPPF) and supports Planning Practice Guidance (PPG) as well as the local Bury Metropolitan Borough Council, Greater Manchester Council Policies and guidelines including associated SuDS requirements.

The design process began with a review and analysis of the proposed development and the existing site conditions with respect to surface water drainage and flood risk. This included a study of both the hydrology and hydrogeology of the site.

The proposed SuDS design strategy provides for the source control technique of permeable paving and rain water harvesting water butts for reuse of water. The surface water runoff will be discharged into the existing United Utilities combined sewer network within the proposed development site. Landscaped areas are provided for biodiversity and amenity value.

Associated hydraulic and attenuation calculations showing both pre and post development impermeable areas and a description of the proposed surface water management SuDS scheme for the site were prepared accordingly. A gravity surface water discharge has been sized and used to allow a practicable maintenance regime to be incorporated within the SuDS that allows a practicable maintenance regime to be incorporated and to allow for attenuation drain down times. A practicably maintained gravity discharge of 0.5 l/s is proposed for rainfall runoff for 1 in 100yr + cc and calculations provided show an attenuation of 11.4m³ is required. The 1 in 100yr + cc discharge rate is a reduction of approximately 98% from 1 in 100yr brownfield rates.

The SuDS provides a surface water management solution for the rainwater runoff for the site and reduces the runoff discharge that leaves the site. It shows that the proposed development does not result in an increase to the risk of flooding on or off site. Permeable pavement 450mm thick as Formpave / Aquaflo attenuation system or similar is provided on site for source control to collect and convey and treat storm / surface water prior to discharge into the existing combined sewer system. The first 5mm runoff is provided for within the permeable pavement SuDS. Landscaped gardens also provide for the first 5mm runoff and an element of bioretention and biodiversity. Evapotranspiration will occur in appropriate weather conditions.

Exceedance flows from the proposed roof will be directed to ground level where they will mirror the existing flow routes at the front and to ground within landscaped gardens at the rear.

This report provides a management and a maintenance regime statement for the SuDS surface water management of the new development.

Appendix A

Thames Water Correspondence

David Forward

1000 Mille
Great West Road, Brentford
London, United Kingdom
TW8 9DW

FAO:

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Your Ref: Lowther Court
Our Ref: UUPS-ORD-634996
Date: 27/02/2025

Dear Sirs

Location: FLAT 10 LOWTHER COURT SANDY LANE, PRESTWICH, MANCHESTER, M25 9PS

I acknowledge with thanks your request dated 25/02/2025 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad	R/Info	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
2303	81.78	CO	88.45	150			VC	41.0591	1 in 13	1108	103.02	FO	98.02	150			VC	38.5047	1 in 124
7005	88.88	CO	86.15	150			VC	83.83013	1 in 36	1903		CO	100			VC	36.77134	1 in 65	
7070		CO		150			VC	5.684121		7901	79.14	CO	77.19	300			VC	41.4367	1 in 166
0701	81.48	CO	79.14	225			VC	36.79674	1 in 10	1153	100.89	SW	97.53	450			CO	15.0323	
8200	82.87	CO	82.89	225			VC	29.27456	1 in 60	1512		CO	100			VC	12.92879		
8801	85.04	CO	83.44	225			VC	52.20153	1 in 113	1700	80.87	CO	78.76	225			VC	44.32949	1 in 19
8802	86.58	CO	85.14	225			VC	38.01316	1 in 20	1904		CO	100			VC	8.180412		
8803	90.75	CO	77.13	225			VC	32.97299	1 in 40	9004	84.4	CO	81.81	225			VC	58.69412	1 in 28
8811		CO		150			VC	7.401003		9001	80.18	CO	78.38	300			VC	34.9147	1 in 78
7003	79.53	CO	87.58	300			VC	50.28917	1 in 49	2101	102.56	FO	97.37	150			VC	28.79326	1 in 42
9912		CO		150			VC	6.84210		8900		CO	100			VC	10.36883		
7707		CO		225			VC	6.846746		6302	62.09	CO	60.39	300			VC	51.68134	1 in 62
9912	97.22	CO	95.96	150			VC	32.08818		9603	85.55	CO	84.01	225			VC	20.99975	1 in 60
7707	87.87	CO	83.12	225			VC	22.89088	1 in 3	8922		FO	100			VC	4.601539		
8801		CO		150			VC	63.96099	1 in 15	8903	84.37	CO	89.02	225			VC	65.40919	1 in 49
7707		CO		150			VC	7.470799		1107		CO	100			VC	11.29029		
1107	100.79	FO	98.47	150			VC	11.32379		8108		FO	150			VC	35.17625		
0203		CO	0	225			VC	38.14723	1 in 147	9005	80.4	CO	88.36	225			VC	39.41381	1 in 28
7103	81.13	SW	79.86	225			VC	5.05902		8109		CO	100			VC	5.878931		
9912		CO		225			VC	36.35457	1 in 12	8001	84.79	CO	83.34	225			VC	66.28725	1 in 71
0214		CO		100			VC	7.059879		2209		CO	100			PVC	12.36568		
2806		CO		100			VC	9.66682		9112		CO	150			VC	3.255086		
8101	77.05	SW	75.3	225			VC	11.16885		1007		CO	150			VC	8.272622		
7214		CO		100			VC	30.14863	1 in 25	0205	97.37	CO	96.41	150			VC	23.32811	1 in 83
2252		CO		450			GRP	7.485092		8919		CO	150			VC	6.656591		
1031	103.31	SW	96.85	450			GRP	8.246211		8902	83.07	CO	89.97	225			VC	35.73514	1 in 30
8105	77.05	CO	75.67	225			VC	31.32096	1 in 201	1211		CO	150			PVC	7.04		
9805	86.67	CO	86.3	225			VC	33.96055	1 in 17	8104	80.4	CO	79.225			VC	34.52819	1 in 12	
9907		CO		150			VC	29.14088	1 in 20	8908		CO	150			VC	5.461287		
1011		CO		150			VC	5.496229		9019		CO	150			VC	10.47371		
7908		CO		225			VC	4.491358		6301	62.03	SW	60.66	300			VC	64.88451	1 in 147
8800	91.92	CO	88.71	225			VC	63.69406		6103	77.83	CO	76.15	225			VC	5.879381	1 in 28
1011	103.02	SW	97.13	450			VC	41.03557	1 in 16	1809		CO	100			VC	9.271962		
2151	102.72	SW	96.72	450			VC	37.12147	1 in 101	9271	82.71	CO	89.94	300			VC	13.80147	1 in 57
0725		CO		100			VC	26.47674	1 in 38	1823		CO	100			VC	5.834867		
8103		CO	0	225			VC	3.430303		0102	95.84	CO	93.47	225			VC	10.81668	1 in 43
9902		CO		100			VC	22.76224		8106		FO	150			VC	12.54052		
9903		CO	0	225			VC	36.40055		1802	84.65	SW	83.03	225			VC	64.97522	1 in 16
2907		FO		100			VC	50.29917		8004	84.94	CO	83.58			VC	58.41233	1 in 13	
1301	82.54	SW	78.8	225			VC	4.70065		9917		CO	150			VC	29.29459		
1210		CO		100			VC	201.014	1 in 23	8915		CO	150			VC	10.47371		
7251		SW	0	150			VC	8.017283		0710		CO	150			VC	5.769832		
0010		CO		150			VC	85		1215		CO	100			VC	8.40378		
7106		CO		150			VC	16.8307		0702		CO	100			VC	12.8937		
0200	84.11	CO	82.37	150			VC	5.880162		0132		CO	150			VC	5.03765		
2251	86.21	SW	84.48	450			CO	210.2305		0719		SW	69.94	225			VC	0.5888073	
9816	96.67	CO	95.35	150			VC	13.15205	1 in 29	9086	74.25	SW	69.15	225			VC	87.13319	1 in 32
0010		CO		150			VC	8.986147		8900	74.25	FO	70.18	225			VC	87.24274	1 in 30
0014		CO		150			VC	69.65111		0124		CO	150			VC	24.42521		
1102	77.81	SW	76.43	225			VC	9.9602		8901	83.21	CO	91.37	225			VC	30	1 in 100
8102	103.02	FO	98.63	150			VC	16.07056	1 in 15	1213		CO	150			VC	11.32464		
8315		CO		150			VC	18.07779	1 in 120										
2159	103.02	SW	100.28	450			VC	8.430128											
7396	68.23	CO	66.34	150			VC	14.4222	1 in 120										
1703		CO		150			VC	27.55953	1 in 34										
9803	86.2	CO	83.36	225			VC	22.34586											
0103	84.27	CO	81.77	300			VC	7.136636											
0702		CO	0	225			VC	83.24062	1 in 94										
1714		CO		100			VC	19.73308	1 in 55										
9900	87.71	CO	85.63	225			VC	38.83298											
7201	79.39	CO	77.29	225			VC	7.209693											
0202	86.24	CO	86.64	150			VC	66.48313	1 in 22										
0117		CO		150			VC	82.55012	1 in 14										
1111	100.28	SW	97.64	450			PVC	14.71521											
2208	88.97	SW	86.17	225			VC	18.11077	1 in 5										
9802	85.83	CO	82.96	225			VC	14.71521											
8205		SW		225			VC	15.65077											
1214		CO		150			VC	17.56479											
8319		CO		150			VC	8.838116											
8807		CO		150			VC	15.14089											
0118		CO		150			VC	5.06035											
8108		CO		150			VC	57.58813											
8205		FO		150			VC	14.52412											
9901	83.02	CO	79.9	300			VC	12.41217											
0209		CO		100			VC	5.05902	1 in 51										
7290	68.59	CO	65.44	225			VC	6.25502											
0600	87.39	CO	85.54	150			VC	87.07889	1 in 13										
1717		CO		100			VC	23.8537	1 in 68										
1006		FO		100			VC	7.31776											
8806	82.51	CO	78.59	225			VC	10.0507	1 in 27										
9800	84.52	CO	82.51	225			VC	87.35725	1 in 27										
1007		CO		150			VC	104.6948	1 in 25										
1003	102.4	FO	96.67	150			VC	11.69666											
7004		CO		150			VC	25.00598											
7112		CO		150			VC	20.6502											
7000	83.53	SW	81.44	225			VC	8.176299											
1010		FO		150			VC	40.16217	1 in 23										
7307	73.4	CO	71.69	225			VC	9.69722											
1155	88.88	SW	87.3	225			VC	106.5692	1 in 49										
1154	99.69	SW	97.85	225			VC	7.81023	1 in 260										
7301	75.59	SW	73.69	150			VC	28.86174	1 in 180										
1002	101.47	CO	89.3	150			VC	14.56											
0201	85.19	CO	83.25	150			VC	22.4722	1 in 59										
7700	90.54	CO	87.07	225			VC	17.80449	1 in 32										
8																			

Appendix B

Surface Water Drainage System Associated Hydraulic Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
SITE	0.034	5.00	84.500	80.763	-12.579	1.350
OUT			84.500	82.072	-13.221	1.375

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	SITE	OUT	1.458	0.600	83.150	83.125	0.025	58.3	150	5.02	50.0

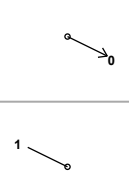
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.319	23.3	4.6	1.200	1.225	0.034	0.0	45	1.033

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	1.458	58.3	150	Circular	84.500	83.150	1.200	84.500	83.125	1.225

Link	US Node	Node Type	DS Node	Node Type
1.000	SITE	Junction	OUT	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
SITE	80.763	-12.579	84.500	1.350				
OUT	82.072	-13.221	84.500	1.375		1	1.000	83.125

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
Rainfall Events	Singular	Additional Storage (m ³ /ha)	0.0
FSR Region	England and Wales	Starting Level (m)	
M5-60 (mm)	17.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	2 year (l/s)	0.0
Summer CV	0.750	30 year (l/s)	0.0
Winter CV	1.000	100 year (l/s)	0.0
Analysis Speed	Detailed	Check Discharge Volume	x
Skip Steady State	x		

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.034	Betterment (%)	0
SAAR (mm)	959	QBar	0.0
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	10	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node FCC Online Orifice Control

Flap Valve	x	Invert Level (m)	8.843	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.015		

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SITE	10	83.203	0.053	6.2	0.0000	0.0000	OK
15 minute winter	OUT	10	83.178	0.053	6.2	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 winter	SITE	1.000	OUT	6.2	1.120	0.265	0.0080	2.9

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SITE	10	83.225	0.075	11.8	0.0000	0.0000	OK
15 minute winter	OUT	10	83.200	0.075	11.8	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 winter	SITE	1.000	OUT	11.8	1.328	0.504	0.0129	5.5

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SITE	10	83.238	0.088	15.2	0.0000	0.0000	OK
15 minute winter	OUT	10	83.213	0.088	15.1	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 winter	SITE	1.000	OUT	15.1	1.411	0.649	0.0156	7.0

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

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SITE	10	83.265	0.115	22.0	0.0000	0.0000	OK
15 minute winter	OUT	10	83.240	0.115	21.9	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 winter	SITE	1.000	OUT	21.9	1.508	0.939	0.0212	10.1

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SITE	0.021	5.00	84.500		80.945	-12.447	1.100
FCC			84.500	1200	80.149	-13.168	1.107
OUT			84.500		79.257	-13.817	1.114

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	SITE	FCC	1.074	0.600	83.400	83.393	0.007	150.0	100	5.03	50.0
1.001	FCC	OUT	1.103	0.600	83.393	83.386	0.007	150.0	100	5.06	50.0

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	0.625	4.9	2.8	1.000	1.007	0.021	0.0	54	0.647
1.001	0.625	4.9	2.8	1.007	1.014	0.021	0.0	54	0.647

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	1.074	150.0	100	Circular	84.500	83.400	1.000	84.500	83.393	1.007
1.001	1.103	150.0	100	Circular	84.500	83.393	1.007	84.500	83.386	1.014

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	SITE		Junction		FCC	1200	Manhole	Adoptable
1.001	FCC	1200	Manhole	Adoptable	OUT		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SITE	80.945	-12.447	84.500	1.100			0	1.000	83.400	100
FCC	80.149	-13.168	84.500	1.107	1200		1	1.000	83.393	100
							0	1.001	83.393	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
OUT	79.257	-13.817	84.500	1.114			1	1.001	83.386	100

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.2
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.3
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.4
Winter CV	1.000	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Detailed	Check Discharge Rate(s)	✓		

Storm Durations

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

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	FEH	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.034	Betterment (%)	0
SAAR (mm)	959	QMed	0.2
Host	28	QBar	0.2
BFIHost	0.558	Q 2 year (l/s)	0.2
Region	10	Q 30 year (l/s)	0.4
QBar/QMed conversion factor	1.075	Q 100 year (l/s)	0.5
Growth Factor 2 year	0.93		

Node FCC Online Orifice Control

Flap Valve	x	Invert Level (m)	83.393	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.015		

Node SITE Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	83.825
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	76.0	76.0	0.450	76.0	89.9	0.451	0.0	89.9

Results for 2 year Critical Storm Duration. Lowest mass balance: 93.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	SITE	92	83.869	0.469	1.2	1.0215	0.0000	SURCHARGED
120 minute winter	FCC	92	83.869	0.476	0.7	0.5386	0.0000	SURCHARGED
120 minute winter	OUT	92	83.403	0.017	0.3	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)
120 minute winter	SITE	1.000	FCC	0.7	0.316	0.148	0.0084	
120 minute winter	FCC	1.001	OUT	0.3	0.340	0.065	0.0010	3.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 93.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	SITE	116	84.025	0.625	2.7	4.5813	0.0000	SURCHARGED
120 minute winter	FCC	116	84.025	0.632	0.8	0.7152	0.0000	SURCHARGED
120 minute winter	OUT	118	83.405	0.019	0.4	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)
120 minute winter	SITE	1.000	FCC	0.8	0.363	0.158	0.0084	
120 minute winter	FCC	1.001	OUT	0.4	0.354	0.075	0.0011	6.8

Results for 100 year Critical Storm Duration. Lowest mass balance: 93.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	SITE	118	84.102	0.702	3.4	6.3373	0.0000	SURCHARGED
120 minute winter	FCC	118	84.102	0.709	0.7	0.8023	0.0000	SURCHARGED
120 minute winter	OUT	118	83.405	0.019	0.4	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)
120 minute winter	SITE	1.000	FCC	0.7	0.386	0.135	0.0084	
120 minute winter	FCC	1.001	OUT	0.4	0.360	0.079	0.0012	7.3

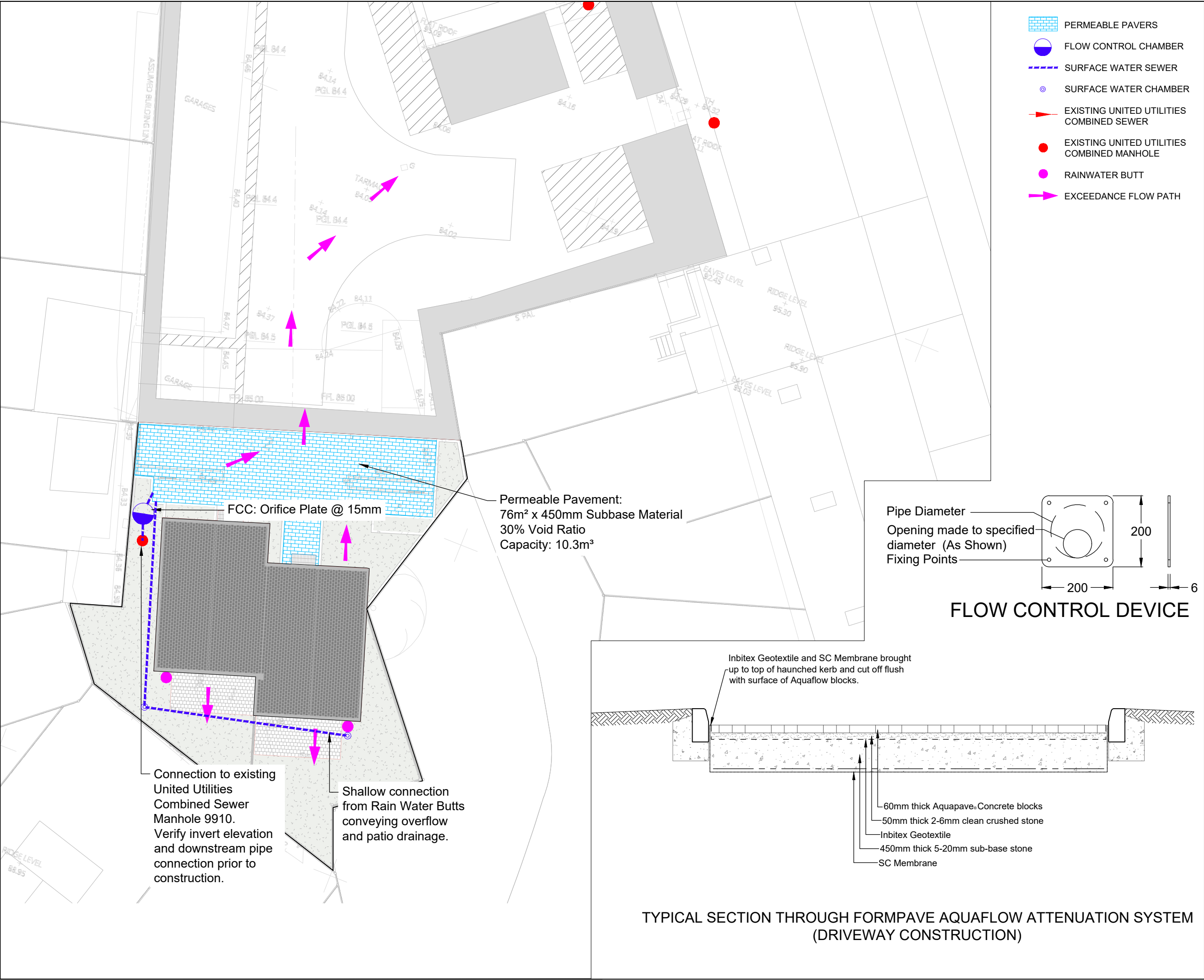
Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 93.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	SITE	232	84.324	0.924	2.9	10.2828	0.0000	FLOOD RISK
240 minute winter	FCC	232	84.324	0.931	0.5	1.0529	0.0000	FLOOD RISK
240 minute winter	OUT	232	83.407	0.021	0.4	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)
240 minute winter	SITE	1.000	FCC	0.5	0.363	0.103	0.0084	
240 minute winter	FCC	1.001	OUT	0.4	0.375	0.091	0.0013	10.7

Appendix C

Drainage Strategy Drawing No FRA20242-DS-001



Sources of Information

REV	DETAILS	DRW	CHKD	DATE
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The PES
THE Property, Energy & Sustainability Company

A: Holborn Tower, London, WC1V 6PL
T: 0207 231 0060 M: 07775 717 306
E: david@ThePES.co.uk | W: Home (thepes.co.uk)

Project	
Sandy Lane	
Drawing	
Drainage Strategy	
Date	03.03.2025
Scale	1:200
Drawn By	cca
Checked By	DF
Drawing No.	20242-DS-001
Rev.	-