

FLOOD RISK AND DRAINAGE
SOLUTIONS LTD

NPPF Flood Risk & SUDS Assessment

Land to the East of Harrow
Avenue, Bamford, Rochdale

Report No: 2023-037

Client: Mr J Smithies

Date: 17/07/2023

144 NEW LANE
OSWALDTWISTLE
HYNDBURN
LANCASHIRE
BB5 3QW
TEL: 07961477330
EMAIL: INFO@FLOODRISK-DRAINAGE.CO.UK



WWW.FLOODRISK-DRAINAGE.CO.UK

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Contract

This report describes work commissioned by Mr J Smithies dated 27th June 2023. Chris Vose BSc of Flood Risk and Drainage Solutions Ltd carried out the work.

Disclaimer

This document has been prepared solely as a Flood Risk Assessment for Mr J Smithies. Flood Risk and Drainage Solutions Ltd accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

Executive Summary

Flood Risk and Drainage Solutions Ltd have been appointed by Mr J Smithies to provide a Flood Risk & SUDS Assessment in support of the planning application for the erection of 4No residential properties located on land to the east of Harrow Avenue, Bamford, Rochdale, Lancashire.

The development site is shown to be located within Flood Zone 1 on the current Environment Agency Flood Map and therefore has a low risk of fluvial flooding.

From the initial assessment it is concluded that the primary source of flood risk will be from pluvial runoff/overland flow and surface water drainage.

The application site is located to the east of Harrow Avenue in Bamford, accessed via an existing road located to the north of No1 Harrow Avenue and currently the site comprises of undeveloped land.

The topographical survey provided shows that the site slopes from west (137.000m AOD) to east (134.300m AOD) with a topographical depression located along the south/east boundary considered to be a land drainage ditch.

The ditch falls to the east where it then meanders south flowing in the direction of the River Roch which is located approximately 220m south of the application site.

Development proposals comprise of the erection of 3No properties with associated access and car parking provisions.

Pluvial/Overland Flow Routes

In conclusion, the surface water overland flow routes which enter the site from Harrow Avenue (west) and Bury Road (north) are only present during the low-risk event i.e., 1 in 1000-year event. During the medium and high-risk events no flow routes are present.

Following development, the proposed properties would not be in the direct line of the flow routes, therefore there would be low risk of obstruction, allowing the flow routes to continue their original flow path before entering the ditch.

In order to mitigate against any pluvial flooding entering the properties, it is recommended that finished floor levels are elevated no less than 300mm above existing ground level, which is higher than the predicted pluvial flooding level during the low-risk event.

Surface Water & Foul Drainage

The existing site is not considered to be formally drained, surface water runoff infiltrates to a degree, before following topography east into the ditch, which ultimately conveys flows into the River Roach approximately 220m downstream of the site.

- Total Site Area = 0.192Ha

Infiltration Methods

A review of Soilscape Maps identifies that the underlying ground comprises of 'Slowly permeable seasonally wet acid loamy and clayey soils'. Borehole logs taken from the BGS online service for the nearest borehole log which is approximately 400m south east, shows that the underlying ground comprises of mud stone down to a considerable depth.

Taking the above into consideration the use of infiltration methods is not considered to be viable.

Discharge to Watercourse

The nearest watercourse to the application site is the ditch located at the south east of the site.

Due to the fact that infiltration methods have been found to be unsuitable, surface water flows from the proposed development should be directed to watercourse (ditch), which ultimately discharges into the River Roch, as per the existing situation.

Greenfield runoff rates have been calculated using the redline boundary of the site, which has a total area of 0.192 Hectares.

- $Q_{bar} = 1.6l/s$

Flows from the proposed development should not exceed existing runoff rates for the 1 in 2 year event i.e. $Q_{Bar} 1.6l/s$.

- Proposed discharge rate = $1.6l/s$

Indicative attenuation volumes have been calculated using the proposed impermeable area which accounts for 0.0758Ha, restricted to $1.6l/s$ during the 1 in 100 year + 50% climate change event.

- Indicative Attenuation Volumes 1 in 100 year + 50% climate change event = $48m^3 - 75m^3$.

The preliminary drainage strategy could comprise of storage provided by a mixture of permeable paving within the car parking areas and on/offline storage for the roof and access road contributing areas.

Flow to be restricted to no more than $1.6l/s$ by means of a vortex flow control chamber up to and including the 1 in 100 year + 50% climate change event.

Surface water to outfall into the existing ditch located at the south east of the site mimicking the existing situation.

Foul flows from the proposed development could connect into the public foul network which is expected to be located to the east within Harrow Avenue, following consent from United Utilities.

Flood Mitigation Measures

Due to the potential surface water flood risk during the low-risk probability event resulting in a potential depth of less than 300mm, it is recommended that finished floor levels are elevated to 300mm above existing ground levels.

- Proposed finished floor levels = 300mm above existing ground level

Contents

1.0	Introduction.....	6
1.1	Terms of Reference	6
1.2	Objectives.....	6
1.3	Data Sources.....	6
2.0	Planning Policy Context	7
2.1	Approach to the Assessment	7
2.2	National Planning Policy Framework (NPPF)	7
2.2.1	Site Specific Flood Risk Assessment Checklist.....	7
2.2.2	Sources of Flooding.....	10
2.2.3	Flood Zones	11
2.2.4	Vulnerability of Different Development Types.....	11
2.2.5	Climate Change.....	12
3.0	Details of the Site.....	13
3.1	Site Details.....	13
3.2	Site Description	13
3.3	Proposed Development Details	14
4.0	Historic Flooding.....	16
4.1	Bury, Rochdale and Oldham SFRA (2009)	16
4.2	Open Data.....	16
4.3	Internet Search.....	16
5.0	Initial Evaluation of Flood Risk	17
5.1	The Environment Agency Flood Map.....	17
5.2	Sources of Flooding.....	17
6.0	Quantitative Flood Risk Assessment.....	19
6.1	Pluvial / Overland Flow.....	19
6.1.1	General.....	19
6.1.2	Low Risk Event	20
6.1.3	Medium Risk Event.....	20
6.1.4	High Risk Event	20
6.1.5	Pluvial: Conclusion.....	20
6.2	Surface Water Runoff.....	21
6.2.1	General.....	21
6.2.2	Existing On-site Drainage Regime.....	21
6.2.1	Sewer Records.....	21
6.2.2	Surface Water Drainage Hierarchy	21

6.2.3	Sustainable Urban Drainage Systems (SUDS)	21
6.2.4	Greenfield Runoff Rates	23
6.2.5	Restricted Discharge Rates.....	23
6.2.6	Indicative Attenuation Volumes.....	23
6.2.7	Preliminary Drainage Strategy	23
6.3	Foul	24
7.0	Mitigation Measures	25
7.1	Finished Floor Levels	25
8.0	Conclusions & Recommendations	26

Figures

Figure 2.1: The Environment Agency Flood Map	11
Figure 3.1: Ditch Located at the South East of the Site	14
Figure 3.2: Development Proposals	15
Figure 4.1: Recorded Flood Outlines Trub Road.....	16
Figure 5.1: Environment Agency Surface Water Flood Map.....	18
Figure 6.1: Environment Agency Surface Water Flood Depth.....	19
Figure 6.2: Environment Agency Surface Water Flood Velocity.....	19

Tables

Table 1: Peak Rainfall Intensity Allowance ¹	12
Table 2: Development Location.....	13
Table 3: Possible Flooding Mechanisms	17
Table 4: SUDS Planner	22

Appendices

Appendix A: -	Development Proposals
Appendix B: -	Topographical Survey
Appendix C: -	Desk Top Ground Conditions
Appendix D: -	Greenfield Runoff Rates
Appendix E: -	Indicative Attenuation Volumes

1.0 Introduction

1.1 Terms of Reference

Flood Risk and Drainage Solutions Ltd have been appointed by Mr J Smithies to provide a Flood Risk & SUDS Assessment in support of the planning application for the erection of 4No residential properties located on land to the east of Harrow Avenue, Bamford, Rochdale, Lancashire.

The development site is shown to be located within Flood Zone 1 on the current Environment Agency Flood Map and therefore has a low risk of fluvial flooding.

It is usual for the Environment Agency to raise an objection to development applications within the floodplain, or Zones 2 and 3 of the flood map, until the issue of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is in excess of 1 Hectare until suitable consideration has been given to the management of surface water runoff.

1.2 Objectives

The objective of this assessment is to evaluate the following issues in regard to flood risk at the application site.

- Suitability of the proposed development in accordance with current planning policy.
- Identify the risk to both the proposed development and people from all forms of flooding.
- Provide a preliminary assessment of foul and surface water management.
- Increasing the risk of flooding elsewhere e.g. surface water flows and flood routing.
- Recommendation of appropriate measures to mitigate against flooding both within the proposed development, and neighbouring land and property.

1.3 Data Sources

This assessment is based on desk-top study of information from the following sources:

- National Planning Policy Framework (Updated 24th July 2018)
- Planning Practice Guidance at www.gov.uk (March 2014)
- Building Regulations Approved Document H
- Environment Agency Flood Mapping
- Rochdale Borough's Strategy for Flood Risk Assessment (2014)
- North West River Basin District – Flood Risk Management Plan 2015 – 2021 – Part B –
- Sub areas in the North West River Basin District (2016)
- Rochdale Adopted Core Strategy (October 2016)
- British Geological Society – Historic Borehole Logs
- Cranfield University's Soilscape Viewer
- CIRIA C697 The SUDS Manual
- Internet search
- Flood Map for Planning
- FLOW Causeway
- Long Term Flood Risk Maps
- www.data.gov.uk

2.0 Planning Policy Context

2.1 Approach to the Assessment

From the initial assessment it is concluded that the primary source of flood risk will be from pluvial runoff/overland flow and surface water drainage.

Consideration has also been given to the site flooding from secondary sources such as fluvial, canal, groundwater; artificial water bodies; infrastructure failure and ponding.

The requirements for flood risk assessments are generally as set out in the 'Technical Guidance to the National Planning Policy Framework', updated in February 2021; and in more detail from the Environment Agency's 'Standing Advice on Flood Risk' available from <https://www.gov.uk/government/publications/national-planning-policy-framework-3>.

2.2 National Planning Policy Framework (NPPF)

The information provided in the flood risk assessment should be credible and fit for purpose.

Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a Strategic Flood Risk Assessment for the area, and the interactive flood risk maps available on the Environment Agency's website.

A flood risk assessment should also be appropriate to the scale, nature and location of the development.

2.2.1 Site Specific Flood Risk Assessment Checklist

The following checklist has been extracted from Flood Risk & Coastal Change Section available from www.gov.uk, updated in February 2021.

1. Development site and location

Provide a description of the site you are proposing to develop, including, or making reference to, a location map which clearly indicates the development site.

- A. Where is the development site located? (e.g. postal address or national grid reference)
- B. What is the current use of the site? (e.g. undeveloped land, housing, shops, offices)
- C. Which Flood Zone (for river or sea flooding) is the site within? (i.e. Flood Zone 1, Flood Zone 2, Flood Zone 3).

Check the Flood Map for Planning (Rivers and Sea) and the Strategic Flood Risk Assessment for the area available from the local planning authority.

2. Development proposals

Provide a general summary of the development proposals, including, or making reference to, an existing block plan and a proposed block plan, where appropriate.

- A. What are the development proposal(s) for this site? Will this involve a change of use of the site and, if so, what will that change be?
- B. In terms of vulnerability to flooding, what is the vulnerability classification of the proposed development?
- C. What is the expected or estimated lifetime of the proposed development likely to be? (E.g. less than 20 years, 20-50 years, 50-100 years?).

NPPF Flood Risk & SUDS Assessment

Land to the East of Harrow Avenue, Bamford, Rochdale

Report No: 2023-037

3. Sequential test

For developments in flood zones 2 or 3 only.

(If the development site is wholly within flood zone 1, this section can be skipped - go to section 4).

Describe how the sequential test has been applied to the development (if required, and as set out in paragraphs 101-104 of the National Planning Policy Framework); and provide the evidence to demonstrate how the requirements of the test have been met.

See paragraph 033 of the NPPF guidance for further information. (It is recommended that the Developer or Agent contacts the LPA to confirm whether the sequential test should be applied and to ensure the appropriate level of information is provided).

- A. What other locations with a lower risk of flooding have you considered for the proposed development?
- B. If you have not considered any other locations, what are the reasons for this?
- C. Explain why you consider the development cannot reasonably be located within an area with the lowest probability of flooding (flood zone 1); and, if your chosen site is within flood zone 3, explain why you consider the development cannot reasonably be located in flood zone 2.
- D. As well as flood risk from rivers or the sea, have you taken account of the risk from any other sources of flooding in selecting the location for the development?

Exception test

Provide the evidence to support certain development proposals in flood zones 2 or 3 if, following application of the sequential test, it is appropriate to apply the exception test, as set out in paragraphs 102-104 of the National Planning Policy Framework.

It is advisable to contact the local planning authority to confirm whether the exception test needs to be applied and to ensure the appropriate level of information is provided.

- A. Would the proposed development provide wider sustainability benefits to the community? If so, could these benefits be considered to outweigh the flood risk to and from the proposed development?
- B. How can it be demonstrated that the proposed development will remain safe over its lifetime without increasing flood risk elsewhere?
- C. Will it be possible to for the development to reduce flood risk overall (e.g. through the provision of improved drainage)?

4. Climate Change

How is flood risk at the site likely to be affected by climate change? (The local planning authority's Strategic Flood Risk Assessment should have taken this into account). Further advice on how to take account of the impacts of climate change in flood risk assessments is available from the Environment Agency.

5. Site specific flood risk

Describe the risk of flooding to and from the proposed development over its expected lifetime, including appropriate allowances for the impacts of climate change. It would be helpful to include any evidence, such as maps and level surveys of the site, flood datasets (e.g. flood levels, depths and/or velocities) and any other relevant data, which can be acquired through consultation with the Environment Agency, the lead local flood authority for the area, or any other relevant flood risk management authority. Alternatively, you may consider undertaking or commissioning your own assessment of flood risk, using methods such as computer flood modelling.

- A. What is/ are the main source(s) of flood risk to the site? (E.g. tidal/sea, fluvial or rivers, surface water, groundwater, other?). You should consider the flood mapping available from the Environment Agency, the Strategic Flood Risk Assessment for the area, historic flooding records and any other relevant and available information.

- B. What is the probability of the site flooding, taking account of the maps of flood risk available from the Environment Agency, the local planning authority's Strategic Flood Risk Assessment and any further flood risk information?
- C. Are you aware of any other sources of flooding that may affect the site?
- D. What is the expected depth and level for the design flood? See paragraph 055 of the NPPF guidance for information on what is meant by a "design flood". If possible, flood levels should be presented in metres above Ordnance Datum (i.e., the height above average sea level).
- E. Are properties expected to flood internally in the design flood and to what depth? Internal flood depths should be provided in metres.
- F. How will the development be made safe from flooding and the impacts of climate change, for its lifetime? Further information can be found in paragraphs 054 and 059 (including on the use of flood resilience and resistance measures) of the NPPF guidance.
- G. How will you ensure that the development and any measures to protect the site from flooding will not cause any increase in flood risk off-site and elsewhere? Have you taken into account the impacts of climate change, over the expected lifetime of the development? (e.g. providing compensatory flood storage which has been agreed with the Environment Agency).
- H. Are there any opportunities offered by the development to reduce the causes and impacts of flooding?

6. Surface water management*

Describe the existing and proposed surface water management arrangements at the site using sustainable drainage systems wherever appropriate, to ensure there is no increase in flood risk to others off-site.

- A. What are the existing surface water drainage arrangements for the site?
- B. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?
- C. What are the proposals for managing and discharging surface water from the site, including any measures for restricting discharge rates? For major developments (e.g. of ten or more homes or major commercial developments), and for all developments in areas at risk of flooding, sustainable drainage systems should be used, unless demonstrated to be inappropriate.
- D. How will you prevent run-off from the completed development causing an impact elsewhere?
- E. Where applicable, what are the plans for the ongoing operation and/or maintenance of the surface water drainage systems?

7. Occupants and users of the development

Provide a summary of the numbers of future occupants and users of the new development; the likely future pattern of occupancy and use; and proposed measures for protecting more vulnerable people from flooding.

- A. Will the development proposals increase the overall number of occupants and/or people using the building or land, compared with the current use? If this is the case, by approximately how many will the number(s) increase?
- B. Will the proposals change the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? If this is the case, describe the extent of the change.
- C. Where appropriate, are you able to demonstrate how the occupants and users that may be more vulnerable to the impact of flooding (e.g., residents who will sleep in the building; people with health or mobility issues; etc.,) will be located primarily in the parts of the building and site that are at lowest risk of flooding? If not, are there any overriding reasons why this approach is not being followed?

8. Residual risk

Describe any residual risks that remain after the flood risk management and mitigation measures are implemented, and to explain how these risks can be managed to keep the users of the development safe over its lifetime.

- A. What flood related risks will remain after the flood risk management and mitigation measures have been implemented?
- B. How, and by whom, will these risks be managed over the lifetime of the development? (e.g., putting in place flood warning and evacuation plans).

9. Flood risk assessment credentials

Provide details of the author and date of the flood risk assessment.

- A. Who has undertaken the flood risk assessment?
- B. When was the flood risk assessment completed?

Other considerations

* Managing surface water

The site-specific flood risk assessment will need to show how surface water runoff generated by the developed site will be managed. In some cases, it may be advisable to detail the surface water management for the proposed development in a separate drainage strategy or plan. You may like to discuss this approach with the lead local flood authority.

Surface water drainage elements of major planning applications (e.g., of ten or more homes) are reviewed by the lead local flood authority for the area. As a result, there may be specific issues or local policies, for example the Local Flood Risk Management Strategy or Surface Water Management Plan, that will need to be considered when assessing and managing surface water matters.

It is advisable to contact the appropriate lead local flood authority prior to completing the surface water drainage section of the flood risk assessment, to ensure that the relevant matters are covered in sufficient detail.

Proximity to Main Rivers

If the development of the site involves any activity within specified distances of main rivers, a flood risk activity permit may be required in addition to planning permission.

For non-tidal main rivers, a flood risk activity permit may be required if the development of the site is within 8 metres of a river, flood defence structure or culvert.

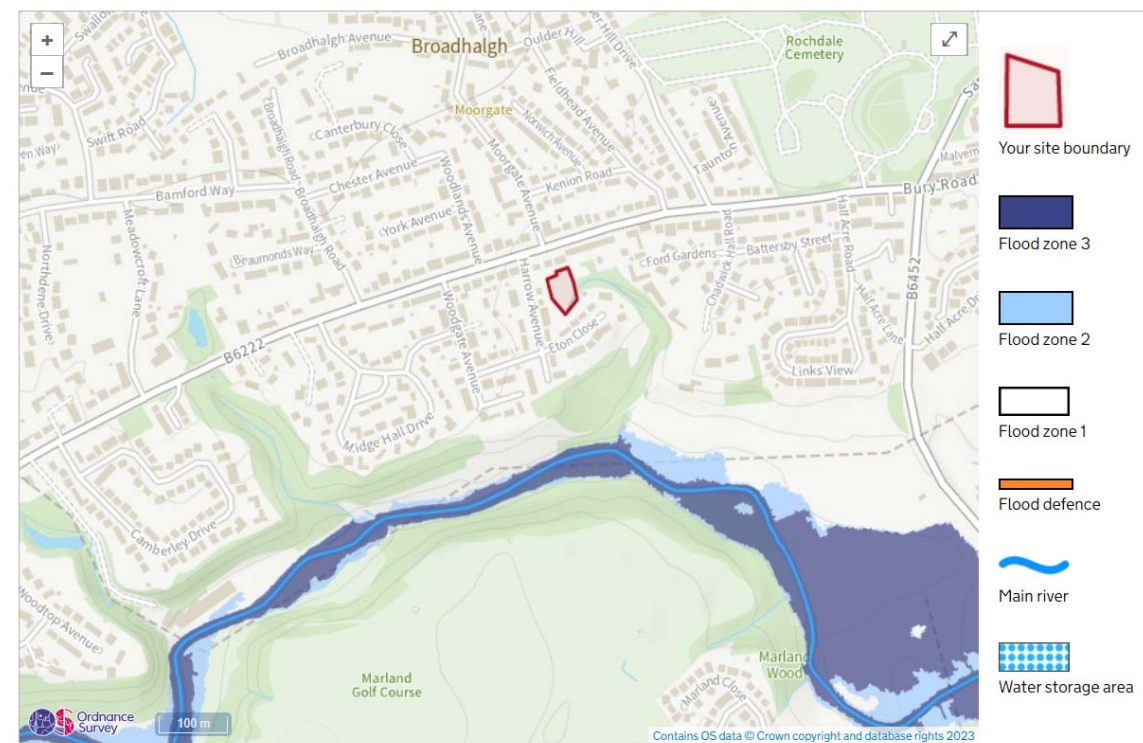
For tidal main rivers, a flood risk activity permit may be required if the development of the site is within 16 metres of a river, flood defence structure or culvert.

Details on obtaining a Flood Risk Activity Permit are available from the Environment Agency.

2.2.2 Sources of Flooding

- **Rivers (fluvial):** Flooding occurs when flow within river channels exceeds capacity; and the type of flood event experienced e.g. flash flooding; depends upon the characteristics of the river catchment.
- **The Sea (tidal):** Flooding at low lying coastline and tidal estuaries is caused by storm surges and high tides; with overtopping and breach failure of sea defences possible during extreme storm events.
- **Pluvial (surface flooding or overland flows):** Heavy rainfall, which is unable to soak away via infiltration or enter drainage systems can flow overland, resulting in localised flooding. Topography generally influences the direction and depth of flooding caused by this mechanism.
- **Groundwater:** Caused when ground water levels rise to the surface; and is most likely to occur in low lying areas underlain by aquifers.
- **Sewers and drains:** Generally occurs in more urban areas; where sewers and drains are overwhelmed by heavy rainfall or blocked pipes and gullies.
- **Artificial Sources (reservoirs, canals, lakes and ponds):** Reservoir and canal flooding may occur as a result of capacity exceedance or structural failure.

Figure 2.1: The Environment Agency Flood Map



Source: www.gov.uk

2.2.3 Flood Zones

- **Flood Zone 1:** Low probability (less than 1 in 1000 year (<0.1% AEP) annual probability of river or sea flooding in any year).
- **Flood Zone 2:** Medium probability (between 1 in 100 year (1.0% AEP) and 1 in 1000 year (0.1% AEP) annual probability of river flooding; or between 1 in 200 year (0.2% AEP) and 1 in 1000 year (0.1% AEP) annual probability of sea flooding in any year).
- **Flood Zone 3a:** High probability (1 in 100 year (1.0% AEP) or greater annual probability of river flooding in any year or 1 in 200 year (0.5% AEP) or greater annual probability of sea flooding in any year).
- **Flood Zone 3b:** This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5% AEP), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

2.2.4 Vulnerability of Different Development Types

- **Essential Infrastructure:** Transport infrastructure (railways and motorways etc...); utility infrastructure (primary sub-stations, water treatment facilities; power stations; and wind turbines).
- **Water Compatible Development:** Flood control infrastructure; water and sewage infrastructure; navigation facilities.
- **Highly Vulnerable:** Emergency services; basement dwellings; mobile home parks; industrial or other facilities requiring hazardous substance consent.
- **More Vulnerable:** Hospitals; residential dwellings; educational facilities; landfill sites caravan and camping sites.
- **Less Vulnerable:** Commercial premises; emergency services not required during a flood; agricultural land.

NPPF Flood Risk & SUDS Assessment

Land to the East of Harrow Avenue, Bamford, Rochdale

Report No: 2023-037

2.2.5 Climate Change

The NPPF requires the application of climate change over the lifetime of a development. As of 27th May 2022, the guidance is as follows.

Table 1: Peak Rainfall Intensity Allowance ¹

Applied Across All of England	2050's	2070's
Upper End	40%	50%
Central	25%	35%

Due to the development having a proposed life span in excess of 50 years, 50% should be applied to rainfall intensity when developing the drainage strategy, to account for climate change over the lifetime of the development,

3.0 Details of the Site

3.1 Site Details

Table 2: Development Location

Site Name:	Harrow Avenue, Bamford
Purpose of Development:	Residential
Existing Land Use:	Undeveloped Vegetated Area
OS NGR:	SD8751112827
Country:	England
County:	Greater Manchester
Local Planning Authority:	Rochdale Borough Council
Lead Local Flood Authority	Rochdale Borough Council
Internal Drainage Board:	Not Applicable
Other Authority (e.g. British Waterways/ Harbour Authority)	Not Applicable

Location Plan:



Source: Cube Architecture

3.2 Site Description

The application site is located to the east of Harrow Avenue in Bamford, accessed via an existing road located to the north of No1 Harrow Avenue and currently the site comprises of undeveloped land.

NPPF Flood Risk & SUDS Assessment

Land to the East of Harrow Avenue, Bamford, Rochdale

Report No: 2023-037

The topographical survey provided shows that the site slopes from west (137.000m AOD) to east (134.300m AOD) with a topographical depression located along the south/east boundary considered to be a land drainage ditch.

The ditch falls to the east where it then meanders south flowing in the direction of the River Roch which is located approximately 220m south of the application site.

Figure 3.1: Ditch Located at the South East of the Site



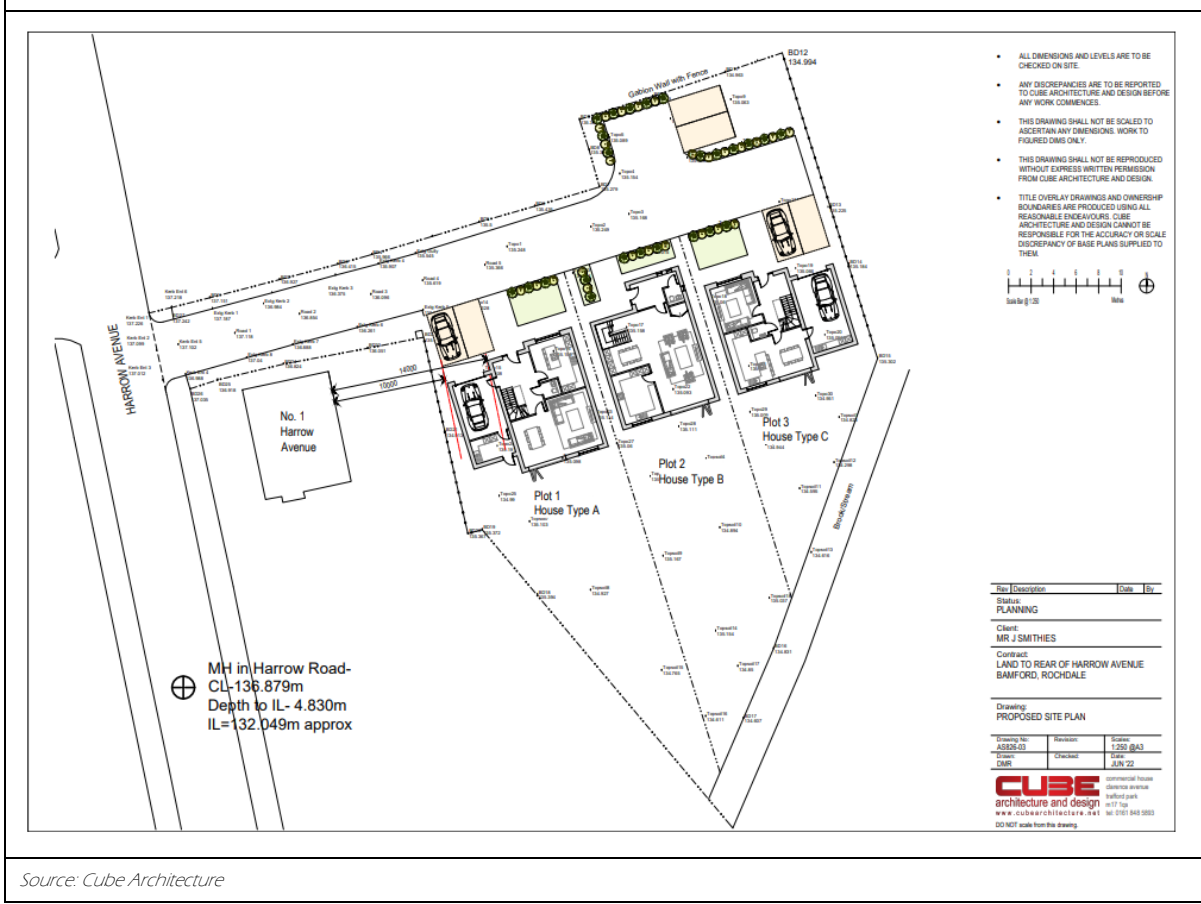
Source: FRDS

As is shown within the figure above, the ditch is not wet year round and therefore engineering judgement would suggest that is not considered to be directing flows from a spring or as a result of shallow groundwater.

3.3 Proposed Development Details

Development proposals comprise of the erection of 3No properties with associated access and car parking provisions.

Figure 3.2: Development Proposals



Source: Cube Architecture

4.0 Historic Flooding

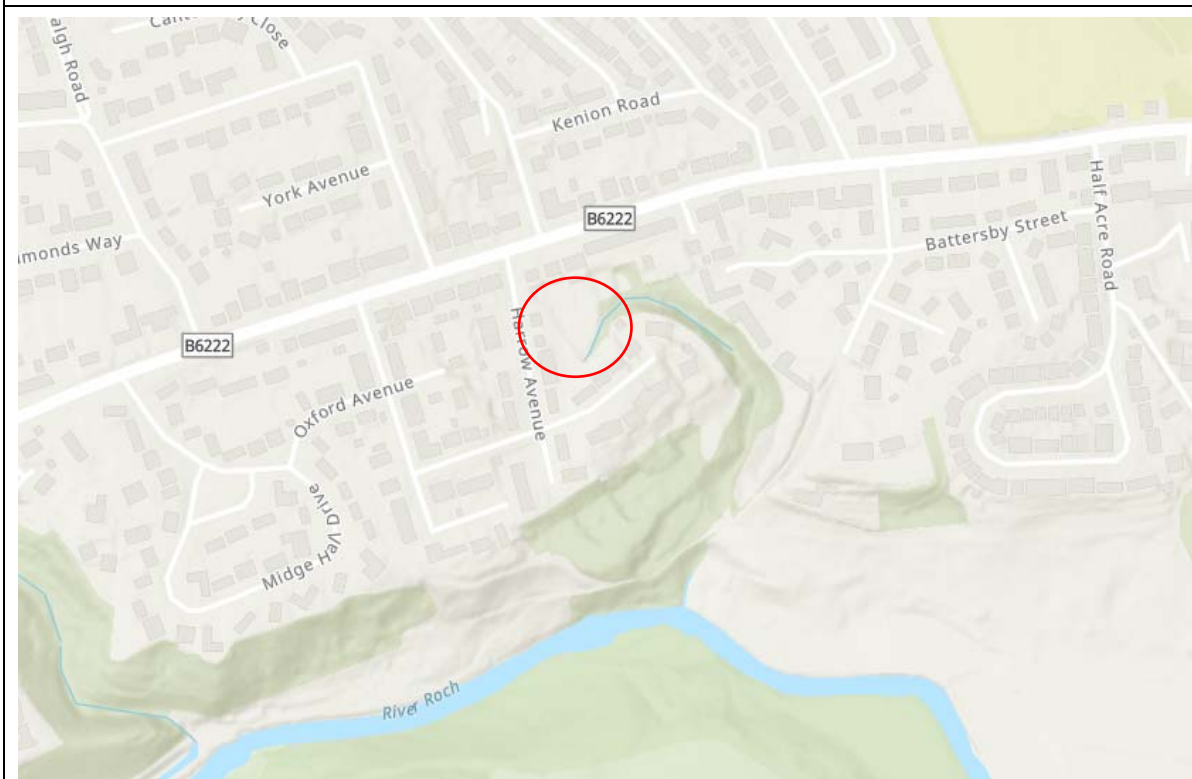
4.1 Bury, Rochdale and Oldham SFRA (2009)

The SFRA document does not indicate any history of flooding within the Bamford area.

4.2 Open Data

The Recorded Flood Outlines and Historic Flood Maps, from the DEFRA Spatial Data Platform, presents no indication of recorded flood incidents within proximity to the application site.

Figure 4.1: Recorded Flood Outlines Trub Road



Source: Open Data

4.3 Internet Search

An internet search of flooding in Bamford area has been undertaken and no reports were found.

5.0 Initial Evaluation of Flood Risk

5.1 The Environment Agency Flood Map

The Environment Agency Flood Map illustrated within Figure 2.1, confirms that proposed development site is located within Flood Zone 1.

The definition for each of the flood zones highlighted above is provided for reference within Section 2.2.3 of this report.

5.2 Sources of Flooding

Table 3: Possible Flooding Mechanisms		
Source/Pathway	Significant?	Comment/Reason
Fluvial	No	Site located within Flood Zone 1
Canal	No	Not Applicable
Tidal/Coastal	No	Not Applicable
Reservoir	No	EA Map shows that the site is not located within the area affected by reservoir flooding.
Surface Water Drainage	Yes	The site will require a new positive drainage strategy serving the development.
Groundwater	No	The site does have a ditch on-site, however the ditch is dry until a heavy rainfall event.
Pluvial Flooding	Yes	The site is located within an area identified to have a low surface water flood risk.
Blockage	No	Potential for blockage if the depression is obstructed.
Infrastructure failure	No	Not Applicable
Rainfall Ponding	No	No excess areas of ponding identified

From the initial assessment it is concluded that the primary source of flood risk will be from pluvial flooding/overland flow and surface water drainage, which require further investigation.

Blockage

Due to the ditch being located within the redline boundary, there is always a risk of blockage from either natural causes or as a result of people.

It is noted that the development proposals position of the properties to the north of the site with the garden areas located to the south of the site. In the event that the depression was to become obstructed flows would flow around the blockage and back into the original route of flow.

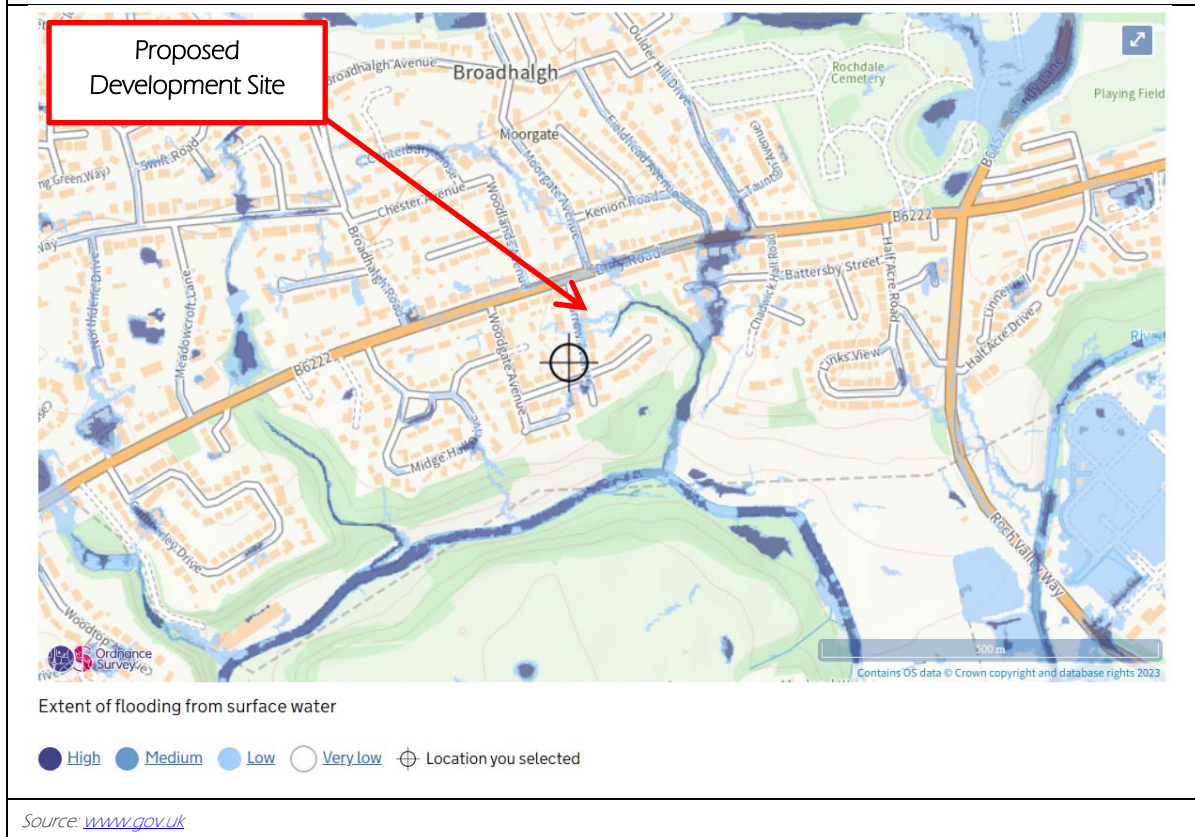
Surface Water Flooding / Overland Flow

The Environment Agency's Surface Water Flood Map identifies that the redline boundary of the proposed development is considered to have a low risk, showing flow routes from the west and north.

The ditch is considered to have a high risk of pluvial flooding; however, this seems to be confined within the banks of the depression.

- **Low risk** means that this area has a chance of flooding of between 0.1% and 1% each year. 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.
- **High risk** means that this area has a chance of flooding of greater than 3.3% each year. 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.

Figure 5.1: Environment Agency Surface Water Flood Map



Due to the risk of surface water flooding being considered high within the ditch, flooding from this mechanism requires further evaluation.

6.0 Quantitative Flood Risk Assessment

6.1 Pluvial / Overland Flow

6.1.1 General

A review of the Environment Agency's Surface Water Flood Map has been undertaken to determine the depth and velocity of the surface water flow route associated with the proposed development site.

Figure 6.1: Environment Agency Surface Water Flood Depth

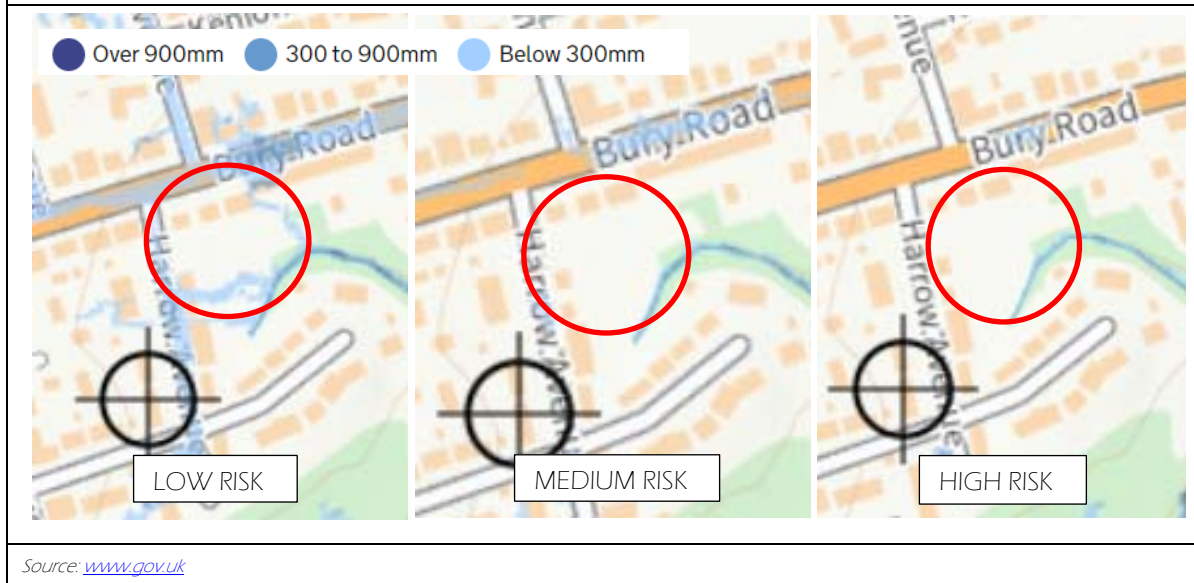
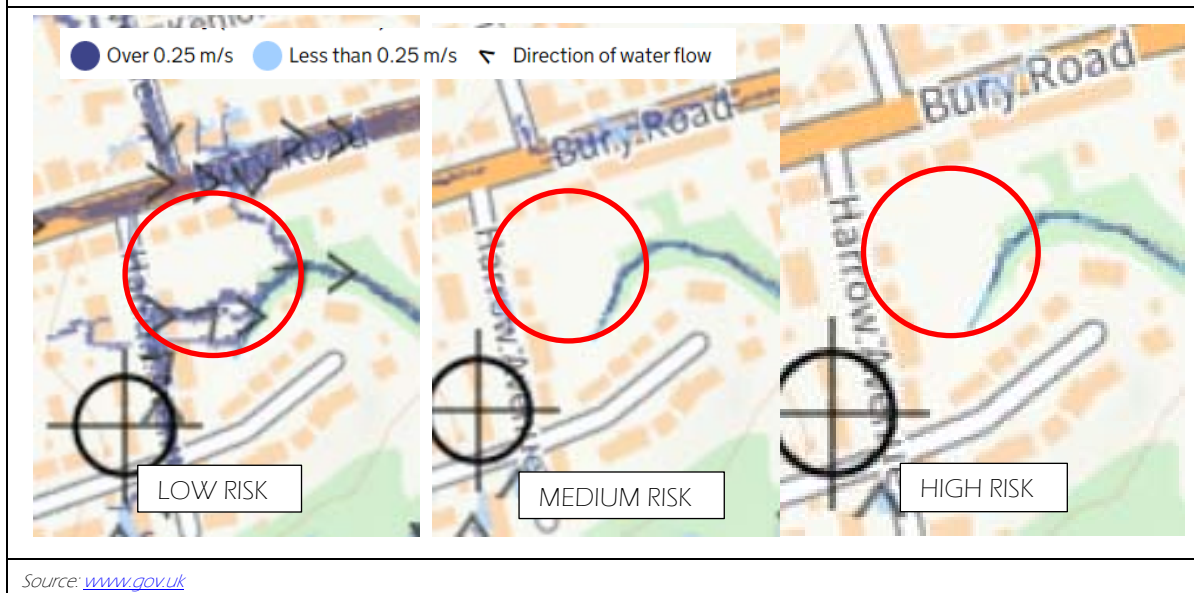


Figure 6.2: Environment Agency Surface Water Flood Velocity



Evaluation has been undertaken to determine flood depths and velocities within the curtilage of the redline boundary of the proposed development, this is shown overleaf for a range of events.

6.1.2 Low Risk Event

A review of the EA Surface Water Flood Map during the low-risk event shows that flow routes emanating from the west (Harrow Ave) and the north (Bury Road) flow through the site before entering the ditch located at the south east of the site.

During the low-risk event (1:1000 year) the depths and velocities at the site are identified below:

- Depth = Less than 300mm
- Velocity = Over 0.25m/s
- The depth of water within the ditch is considered to be between 300mm and 900mm.

6.1.3 Medium Risk Event

During the medium risk event (1:100 year) the surface water flow routes are no longer present, the depths and velocities are identified below:

- Depth = N/A
- Velocity = N/A
- The depth of water within the ditch is considered to be between 300mm and 900mm.

6.1.4 High Risk Event

During the high-risk event (1:30 year) the surface water flow routes are no longer present, the depths and velocities are identified below:

- Depth = N/A
- Velocity = N/A
- The depth of water within the ditch is considered to be between 300mm and 900mm.

6.1.5 Pluvial: Conclusion

In conclusion, the surface water overland flow routes which enter the site from Harrow Avenue (west) and Bury Road (north) are only present during the low-risk event i.e., 1 in 1000-year event. During the medium and high-risk events no flow routes are present.

Following development, the proposed properties would not be in the direct line of the flow routes, therefore there would be low risk of obstruction, allowing the flow routes to continue their original flow path before entering the ditch.

In order to mitigate against any pluvial flooding entering the properties, it is recommended that finished floor levels are elevated no less than 300mm above existing ground level, which is higher than the predicted pluvial flooding level during the low-risk event.

6.2 Surface Water Runoff

6.2.1 General

The application site comprises of undeveloped grassed/vegetated plot with ditch located along the south/east of the site.

6.2.2 Existing On-site Drainage Regime

The existing site is not considered to be formally drained, surface water runoff infiltrates to a degree, before following topography east into the ditch, which ultimately conveys flows into the River Roach approximately 220m downstream of the site.

- Total Site Area = 0.192Ha

6.2.1 Sewer Records

At the time of writing sewer records were not available, however engineering judgment suggests that the public sewer network is located to the west within Harrow Avenue.

6.2.2 Surface Water Drainage Hierarchy

The hierarchy for disposal of surface water from new developments is outlined within the Building Regulations Approved Document H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse
- Discharge to public surface water sewer
- Discharge to public combined sewer

Infiltration

A review of Soilscape Maps identifies that the underlying ground comprises of 'Slowly permeable seasonally wet acid loamy and clayey soils'.

Borehole logs taken from the BGS online service for the nearest borehole log which is approximately 400m south east, shows that the underlying ground comprises of mud stone down to a considerable depth.

Taking the above into consideration the use of soakaway methods is not considered to be viable.

*Desktop ground conditions provided within the appendices.

Watercourse

The nearest watercourse to the application site is the ditch located at the south east of the site.

Due to the fact that infiltration methods have been found to be unsuitable, surface water flows from the proposed development should be directed to watercourse (ditch), which ultimately discharges into the River Roch, as per the existing situation.

6.2.3 Sustainable Urban Drainage Systems (SUDS)

SUDS act to reduce the impact of surface water runoff from the development by limiting runoff volumes and rates from leaving the site.

Undertaking an assessment using the SUDS Planner a number of different methods could be used within the development. A summary of the results is tabulated overleaf:

NPPF Flood Risk & SUDS Assessment

Land to the East of Harrow Avenue, Bamford, Rochdale

Report No: 2023-037

Table 4: SUDS Planner

SUDS Criteria	Rank 1	Rank 2	Rank 3
Hydrological	Green Roof	Permeable Paving	On/offline Storage
Land Use	Infiltration Trench/Soakaway	Bioretention Area	On/offline Storage
Site Features	Green Roof	Permeable Paving	Filtration Techniques
Community & Environment	Bioretention Area	Infiltration Trench/Soakaway	Stormwater Wetlands
Economics & Maintenance	Wet Ponds	Grassed Swales	Dry Detention
Total	Green Roof	Permeable Paving	On/offline Storage

1. Source Control

The inclusion of source control in SUDS schemes is one of the more important principles of SUDS design, and source control components should be upstream of any pond, wetland or other SUDS component.

Source control can help provide interception storage which can handle and treat some of the more frequent but smaller, polluting events (at least 5mm).

Most source control components will be located within the private properties or highway areas. Their purpose is to manage rainfall close to where it falls, not allowing it to become a problem elsewhere.

The main types of source control include:

- Green roofs
- Rainwater harvesting
- Permeable paving
- Other permeable surfaces

Source control methods look to maximize permeability within a site to promote attenuation, treatment and infiltration, thereby reducing the need for off-site conveyance.

a) Green Roofs

Green roof solutions generally comprise of a multi-layered system that covers the roof of a building with vegetation cover, and/or landscaping over a drainage layer, designed to intercept and retain rainfall.

The incorporation of green roofs is to be decided by the architect/developers during the final design stage and is largely dependent on the final building design.

The likelihood of green roofs being utilised is considered to be low due to the increase in structural cost of the development.

b) Rainwater Harvesting

Rainwater harvesting provides a source of non-potable water, for purposes such as car washing; and landscaped area irrigation etc... and can be used for some industrial processes to reduce consumption of water from conventional supplies.

This SUDS solution, like green roof technology, is also designed to provide interception storage i.e. acts to reduce the volume of surface water leaving the proposed development; thereby helping to alleviate the current pressures on the receiving watercourse.

Rainwater harvesting can be installed at relatively low costs dependant on the chosen structure providing that the development site has scope.

c) Permeable Paving

Pervious surfaces can be either porous or permeable. The important distinction between the two is:

Porous surfacing is a surface that infiltrates water across the entire surface. Permeable surfacing is formed of material that is itself impervious to water but, by virtue of voids formed through the surface, allows infiltration through the pattern of voids.

Pervious surfaces provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into underlying layers.

The water can be temporarily stored before infiltration to the ground, reused, or discharged to a watercourse or other drainage system. Surfaces with an aggregate sub-base can provide good water quality treatment.

2. On/offline Storage

This is a traditional form of surface water attenuation and may be provided via online or offline structures such as oversized pipes; or shallow attenuation structures such as geo-cellular crate systems e.g. Hydro-International's Stormcell System or similar. These structures may be easily placed within either hardstanding or landscaped areas to provide ease of access for maintenance purposes.

6.2.4 Greenfield Runoff Rates

Greenfield runoff rates have been calculated using the redline boundary of the site, which has a total area of 0.192 Hectares.

- $Q_{bar} = 1.6l/s$

*Greenfield Runoff Calculations provided as an appendix.

6.2.5 Restricted Discharge Rates

Flows from the proposed development should not exceed existing runoff rates for the 1 in 2 year event i.e. $Q_{Bar} 1.6l/s$.

- Proposed discharge rate = $1.6l/s$

6.2.6 Indicative Attenuation Volumes

Indicative attenuation volumes have been calculated using the proposed impermeable area which accounts for 0.0758Ha, restricted to $1.6l/s$ during the 1 in 100 year + 50% climate change event.

- Indicative Attenuation Volumes 1 in 100 year + 50% climate change event = $48m^3 - 75m^3$.

6.2.7 Preliminary Drainage Strategy

The preliminary drainage strategy could comprise of storage provided by a mixture of permeable paving within the car parking areas and on/offline storage for the roof and access road contributing areas.

Flow to be restricted to no more than $1.6l/s$ by means of a vortex flow control chamber up to and including the 1 in 100 year + 50% climate change event.

Surface water to outfall into the existing ditch located at the south east of the site mimicking the existing situation.

6.3 Foul

Foul flows from the proposed development could connect into the public foul network which is expected to be located to the east within Harrow Avenue, following consent from United Utilities.

7.0 Mitigation Measures

7.1 Finished Floor Levels

Due to the potential surface water flood risk during the low-risk probability event resulting in a potential depth of less than 300mm, it is recommended that finished floor levels are elevated to 300mm above existing ground levels.

- Proposed finished floor levels = 300mm above existing ground level

8.0 Conclusions & Recommendations

Pluvial/Overland Flow Routes

In conclusion, the surface water overland flow routes which enter the site from Harrow Avenue (west) and Bury Road (north) are only present during the low-risk event i.e., 1 in 1000-year event. During the medium and high-risk events no flow routes are present.

Following development, the proposed properties would not be in the direct line of the flow routes, therefore there would be low risk of obstruction, allowing the flow routes to continue their original flow path before entering the ditch.

In order to mitigate against any pluvial flooding entering the properties, it is recommended that finished floor levels are elevated no less than 300mm above existing ground level, which is higher than the predicted pluvial flooding level during the low-risk event.

Surface Water & Foul Drainage

The existing site is not considered to be formally drained, surface water runoff infiltrates to a degree, before following topography east into the ditch, which ultimately conveys flows into the River Roach approximately 220m downstream of the site.

- Total Site Area = 0.192Ha

Infiltration Methods

A review of Soilscape Maps identifies that the underlying ground comprises of 'Slowly permeable seasonally wet acid loamy and clayey soils'. Borehole logs taken from the BGS online service for the nearest borehole log which is approximately 400m south east, shows that the underlying ground comprises of mud stone down to a considerable depth.

Taking the above into consideration the use of infiltration methods is not considered to be viable.

Discharge to Watercourse

The nearest watercourse to the application site is the ditch located at the south east of the site.

Due to the fact that infiltration methods have been found to be unsuitable, surface water flows from the proposed development should be directed to watercourse (ditch), which ultimately discharges into the River Roch, as per the existing situation.

Greenfield runoff rates have been calculated using the redline boundary of the site, which has a total area of 0.192 Hectares.

- $Q_{bar} = 1.6l/s$

Flows from the proposed development should not exceed existing runoff rates for the 1 in 2 year event i.e. $Q_{Bar} 1.6l/s$.

- Proposed discharge rate = 1.6l/s

Indicative attenuation volumes have been calculated using the proposed impermeable area which accounts for 0.0758Ha, restricted to 1.6l/s during the 1 in 100 year + 50% climate change event.

- Indicative Attenuation Volumes 1 in 100 year + 50% climate change event = $48m^3 - 75m^3$.

The preliminary drainage strategy could comprise of storage provided by a mixture of permeable paving within the car parking areas and on/offline storage for the roof and access road contributing areas.

NPPF Flood Risk & SUDS Assessment

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Report No: 2023-037

Flow to be restricted to no more than 1.6l/s by means of a vortex flow control chamber up to and including the 1 in 100 year + 50% climate change event.

Surface water to outfall into the existing ditch located at the south east of the site mimicking the existing situation.

Foul flows from the proposed development could connect into the public foul network which is expected to be located to the east within Harrow Avenue, following consent from United Utilities.

Flood Mitigation Measures

Due to the potential surface water flood risk during the low-risk probability event resulting in a potential depth of less than 300mm, it is recommended that finished floor levels are elevated to 300mm above existing ground levels.

- Proposed finished floor levels = 300mm above existing ground level

APPENDICES

Appendix A: - Development Proposals



- ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE.
- ANY DISCREPANCIES ARE TO BE REPORTED TO CUBE ARCHITECTURE AND DESIGN BEFORE ANY WORK COMMENCES.
- THIS DRAWING SHALL NOT BE SCALED TO ASCERTAIN ANY DIMENSIONS. WORK TO FIGURED DIMS ONLY.
- THIS DRAWING SHALL NOT BE REPRODUCED WITHOUT EXPRESS WRITTEN PERMISSION FROM CUBE ARCHITECTURE AND DESIGN.
- TITLE OVERLAY DRAWINGS AND OWNERSHIP BOUNDARIES ARE PRODUCED USING ALL REASONABLE ENDEAVOURS. CUBE ARCHITECTURE AND DESIGN CANNOT BE RESPONSIBLE FOR THE ACCURACY OR SCALE DISCREPANCY OF BASE PLANS SUPPLIED TO THEM.



Rev	Description	Date	By
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Status:
PLANNING

Client:
MR J SMITHIES

Contract:
LAND TO REAR OF HARROW AVENUE
BAMFORD, ROCHDALE

Drawing:
PROPOSED SITE PLAN

Drawing No: AS826-03	Revision:	Scales: 1:250 @A3
Drawn: DMR	Checked:	Date: JUN '22

Appendix B: - Topographical Survey

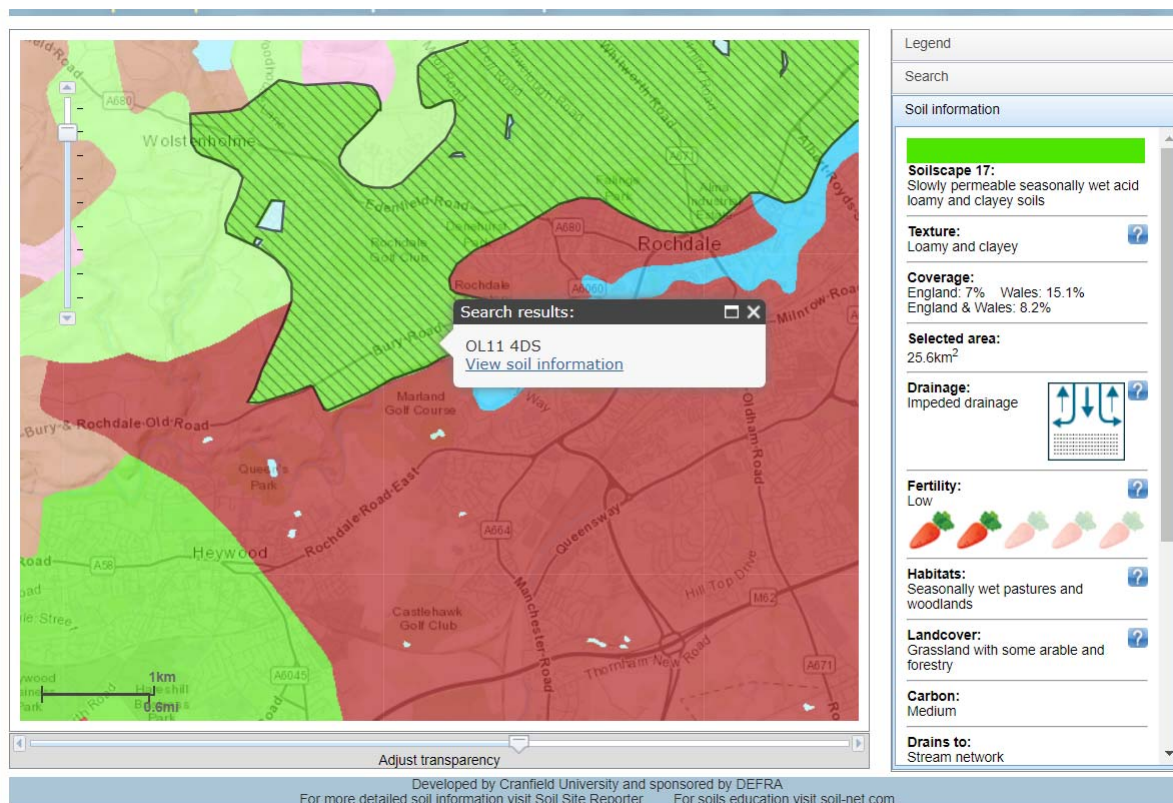


- ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE.
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Rev	Description	Date	By
Status: PLANNING			
Client: MR J SMITHIES			
Contract: LAND TO REAR OF HARROW AVENUE BAMFORD, ROCHDALE			
Drawing: PROPOSED SITE PLAN			
Drawing No: AS826-03	Revision:	Scales: 1:250 @A3	
Drawn: DMR	Checked:	Date: JUN '22	

Appendix C: - Desk Top Ground Conditions





SD 81 SE / 229

HOLST & CO. LTD.

SITE INVESTIGATION DEPT.

PARKSIDE LANE

LEEDS LS115SX.

87840 12566

Contract No. F1393/W2929

Location ROCH MILLS

Client County Borough of Rochdale

Borehole No. 35.

Ground Level

Date 25.2.70

BOREHOLE LOG

STRATA	Legend	Depth below Ground Level	Thickness of Strata	Type of Sample	c lb/sq. ft.	φ deg.	m.c. %	γ lb/cu. ft.	N
Top soil		0'0"	0'9"	1'6"					
Firm brown sandy stony clay	1/1	3'9"	3'0"	4'3"	1070	0	19.5	126	
Weathered black mudstone		5'0"	1'3"	8'6"	800	29	10.6	140	
Hard black mudstone		11'9"	6'9"	11'3"					90 63 for 6"

Water Struck at 5'9"

Maximum Observed Water Level

Undisturbed Sample ☐
Disturbed Sample ☐
Water Sample ☐
Penetration Test ☐

c = Cohesion
φ = Angle of Internal Friction
m.c. = Moisture Content
γ = Bulk Density
N = Standard Penetration Value

Water levels are subject to seasonal or tidal variation and should not be taken as constant

Appendix D: - Greenfield Runoff Rates

Calculated by:	Christian vose
Site name:	Harrow Ave
Site location:	Rochdale

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C153 (Ciria, 2016) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.61159° N
Longitude:	2.1899° W
Reference:	3024379653
Date:	Jul 17 2023 12:57

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):

0.192

Methodology

Q _{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	1121	1121
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{BAR} (l/s):	1.61	1.61
1 in 1 year (l/s):	1.4	1.4
1 in 30 years (l/s):	2.73	2.73
1 in 100 year (l/s):	3.34	3.34
1 in 200 years (l/s):	3.81	3.81

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix E: - Indicative Attenuation Volumes

Storage Estimate

Return Period (years)

100

OK

Climate Change (%)

50

Cancel

Impermeable Area (ha)

0.076

Update

Peak Discharge (l/s)

1.600

Infiltration Coefficient (m/hr)
(leave blank if no infiltration)

Calc

Required Storage (m³)

Calc

from

48

to

75

With infiltration (m³)

from

to