

P/2022/00302
Received 09/03/2022

FLOOD RISK ASSESSMENT & SURFACE WATER DRAINAGE STRATEGY

HIGH STREET, ROCESTER

ON BEHALF OF SEP PROPERTIES LIMITED



Pegasus Group

Birmingham | Bracknell | Bristol | Cambridge | Cirencester | Dublin | East Midlands | Leeds | Liverpool | London | Manchester | Newcastle | Peterborough

DESIGN **ENVIRONMENT** **PLANNING** **ECONOMICS** **HERITAGE**

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1. INTRODUCTION

Background

- 1.1 Pegasus Planning Group Ltd has been appointed by SEP Properties Limited (herein referred to as "the Applicant") to undertake a Flood Risk Statement (FRS) for a proposed commercial development off High Street, Rocester.
- 1.2 This assessment considers the risks of all types of flooding to the site including tidal, fluvial, surface, historic, groundwater, sewer and artificial sources.

National and Local Policies

- 1.3 The National Planning Policy Framework (NPPF) states that a site-specific Flood Risk Assessment (FRA) will be required for proposals:
- a) that are greater than 1 hectare in area within Flood Zone 1;
 - b) for all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3;
 - c) in an area within Flood Zone 1 which has critical drainage problems; and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.
 - d) in an area within Flood Zone 1 identified in a Strategic Flood Risk Assessment as being at increased flood risk in the future.
 - e) in an area in Flood Zone 1 that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.
- 1.4 The site is located in Flood Zone 1 with a small area in Flood zone 2 and is under 1.0ha, therefore, a full FRA is required.
- 1.5 As of April 2015, the legislation for dealing with FRAs changed, with additional emphasis put on the use of Sustainable Drainage Systems (SuDS) within drainage schemes for new developments.

- 1.6 In February 2016, the Environment Agency (EA) introduced new guidance relating to climate change allowance, which has increased the percentage rate of change applied to the 1 in 100 year event scenario.
- 1.7 As such, any new application will require a surface water drainage scheme submitted to accompany all planning applications and will be required to demonstrate the use of SuDS within the design and should be in line with the requirements as set out within the National Planning Policy Framework Technical Guidance (NPPFTG).
- 1.8 A Level 2 Strategic Flood Risk Assessment (SFRA) for the East Staffordshire Borough Council (the Council) considers the detailed nature of the flood hazard by taking into account the presence of flood risk management measures and has been undertaken with a principle purpose to facilitate application of the Exception Test. The key objectives of the study are to:
- Review the Flood Zones presented in the Level 1 SFRA, in particular the Functional Floodplain (Flood Zone 3b);
 - Review flood defence infrastructure, including its present condition, maintenance and upgrading, consequences of overtopping or failure and the response to climate change;
 - Model flood risk across the Flood Zones, including the identification of rapid inundation zones, risk to people behind defences and the effect of increased runoff from developments on flood risk; and
 - Analyse site specific flood risk.

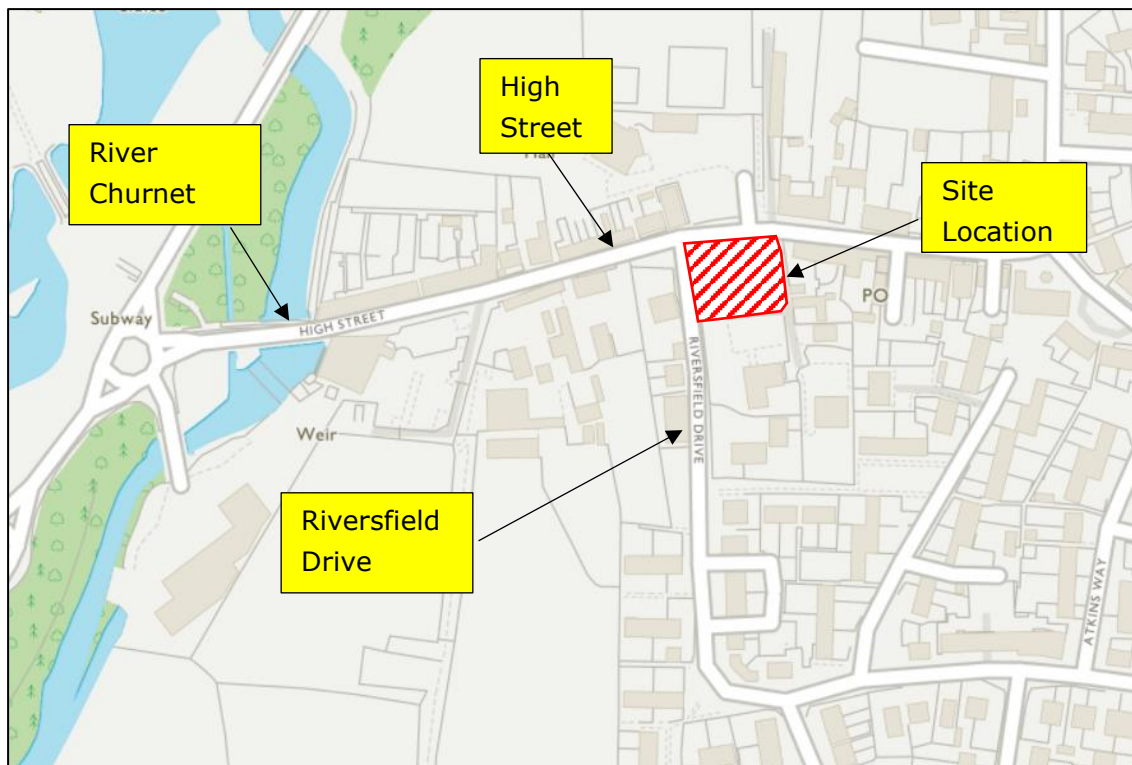
In addition guidance notes are provided for the execution of the Exception Test, the preparation of FRAs, Emergency Planning Measures and Dealing with Surface Water Drainage.

2. EXISTING SITE AND HYDROLOGY

Site Location & Existing Conditions

- 2.1 The site area is approximately 0.1Ha in size and is currently a greenfield site. The site comprises of existing trees / vegetation.
- 2.2 The site is bounded to the north by High Street, to the west by Riversfield Drive and existing residential dwellings and gardens on all other boundaries.
- 2.3 Approximate site co-ordinates are E: 410804; N: 339309, with nearest post code ST14 5JU.
- 2.4 The Environment Agency flood map shows majority of the site to be within Flood Zone 1 (<1:1000 year probability of flooding) whilst western portion of the site is indicated to be within Flood Zone 2 (1 in 1000 - 1 in 100 year probability of flooding).
- 2.5 A copy of the EA flood map can be found at Section 5 of this report.

Figure 2.1 – Site Location



- 2.6 A site specific topographical survey has been undertaken which indicates the site to be relatively flat, with a slight fall from east to west, from a high point of 87.22m

AOD in the north east corner of the site to a low point of 86.90m AOD in the west side of the site.

Existing Drainage and Hydrology

- 2.7 There are two main rivers in the vicinity of the site. River Churnet located approximately 150m west of the site and River Dove located approximately 550m east of the site.
- 2.8 The site is currently greenfield, therefore it is permeable and allows surface water run-off to drain naturally to ground.
- 2.9 Geological data held by the British Geological Survey (BGS) indicates that the bedrock geology underlying the site is Mercia Mudstone Group "Mudstone".
- 2.10 The Soilscape soils data shows the site as "Slightly acid loamy soils freely draining".

3. PROPOSED DEVELOPMENT

- 3.1 The proposed development is for a new convenience foodstore (Use Class E) with associated parking facilities, plant, landscaping and new access road.
- 3.2 The existing site area is undeveloped, therefore the majority of the site is permeable. The nature of the proposed development will consist of rooves and hard standing areas, therefore increasing the impermeable area of the site.
- 3.3 The site will be accessed from Riversfield Drive that bounds western part of the site. It is proposed that the main access will be private.
- 3.4 A copy of the proposed site layout can be found at **Appendix A**.

4. DEVELOPMENT VULNERABILITY AND FLOOD ZONE CLASSIFICATION

National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG)

- 4.1 Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency, (EA) on all applications in flood risk zones. The EA will consider the effects of flood risk in accordance with the NPPF.
- 4.2 NPPF and PPG requires that, as part of the planning process:
- A 'site specific' Flood Risk Assessment will be undertaken for any site that has a flood risk potential.
 - Flood risk potential is minimised by applying a 'sequential approach' to locating 'vulnerable' land uses.
 - Sustainable drainage systems are used for surface water disposal where practical.
 - Flood risk is managed through the use of flood resilient and resistant techniques.
 - Residual risk is identified and safely managed.
- 4.3 Table 1 of Planning Practice Guidance, categorises flood zones into:
- Zone 1- Low probability (< 1 in 1000 years)
 - Zone 2- Medium probability (1 in 1000 - 1 in 100 years)
 - Zone 3a- High probability (> 1 in 100 years)
 - Zone 3b- The functional floodplain (>1 in 20 years)
- 4.4 The majority of the Site, approximately 84%, is located within Flood Zone 1 and the remainder of the Site amounting to just 165 sq.m in the north west corner of the Site, is within Flood Zone 2. Within Flood Zone 2, only 99 sq.m is proposed to be developed as car park and the remainder is to be retained as soft landscaping i.e. permeable land.
- 4.5 Table 2 of the PPG includes a matrix indicating the types of development that are acceptable in different Flood Zones (see Table 4.1 below). The proposed development is for a shop and ancillary development and as such is categorised as

a less vulnerable use Paragraph 066 Reference ID: 7-066-20140306 of the PPG confirms:

"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."

Table 4.1 – NPPF Guidance

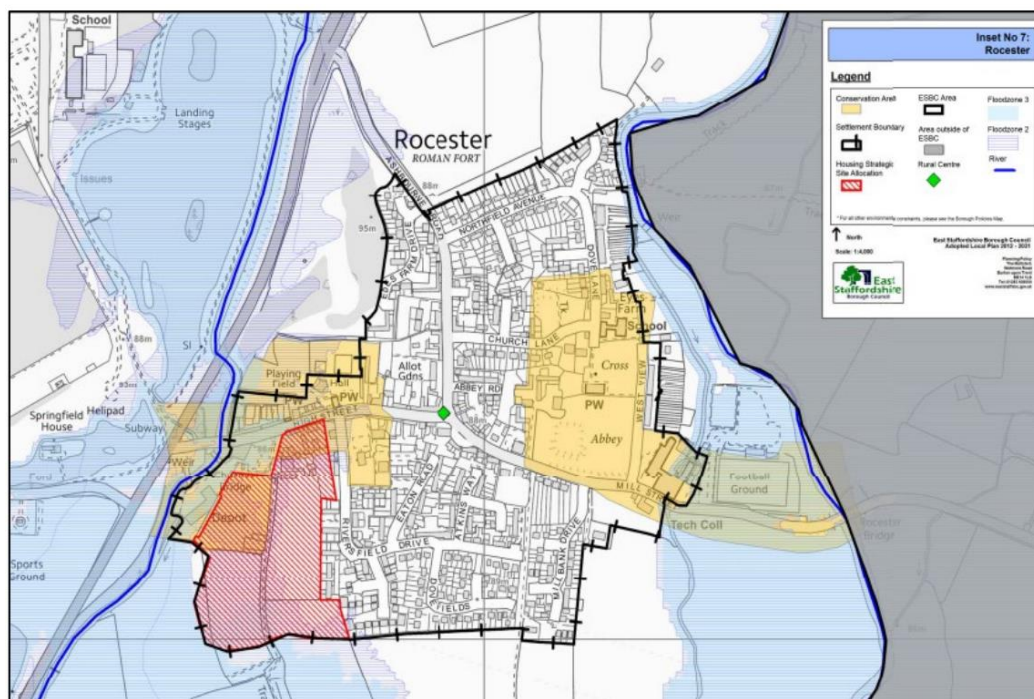
Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	✗	Exception Test Required	Exception Test Required	✓
Zone 3b	Exception Test Required	✗	✗	✗	✓

4.6 Whilst only a small proportion of the Site is located within Flood Zone 2 and the proposed development is appropriate within Flood Zone 2, because the Site is not allocated for development in the Local Plan and is not categorised as minor development, the sequential test must be applied. Following the guidance in the PPG, the sequential test is included in Section 5 of this report.

5. THE SEQUENTIAL TEST

- 5.1 As set out in Section 4, a sequential test is required by the NPPF and this was confirmed in the pre-application advice received. PPG provides guidance on the way in which this should be presented. The relevant guidance from the PPG is as follows.
- 5.2 In applying the sequential test to the Site, the extent of the catchment area has been confirmed with the applicant as being confined to Rocester only given the settlement-specific requirement for a convenience store within the village. Furthermore, with reference to the Local Plan Policies Map, the site search has been confined only to land within the settlement boundary in accordance with Policy SP 2 of the East Staffordshire Borough Local Plan (2015) which restricts development in principle outside of settlement boundaries. The Policies Map is included below for reference.
- 5.3 A review has been carried out of any suitable and available sites within the settlement boundary of Rocester that are within Flood Zone 1 and with a site area of at least 0.1 hectares.
- 5.4 The conclusion of this assessment is that there are no other sites within the settlement boundary within Flood Zone 1 that could accommodate the proposed development. The majority of the catchment area is in residential use with no land available or of a suitable size for the proposed development. However and for completeness, a number of sites have been assessed as follows.

Figure 5.1 – The Policy Map



- The strategic allocation for 90 houses at 'Land south of Rocester' (Policy SP4) has been discounted as the allocation does not include land for retail or commercial development. There appears to be a pending planning application that was submitted in August 2017 (P/2017/00667) and has not yet been determined (for reasons that are not clear). Moreover, approximately two-thirds of that site is within Flood Zone 2. As such, the site does not benefit from any planning consent and given that a planning permission for development in accordance with the site allocation is still pending after nearly 5 years, there is no certainty that the land will be developed at all. Importantly, if it is, the planning consent will not include land for the proposed development and is discounted as not suitable or available.
- The Car Sales Garage on Ashbourne Road is located within Flood Zone 1. As such, enquiries have been made by the applicant and the Co-op who confirmed that the Site was not available for development at a price at which was viable for the applicant and/or the proposed foodstore operator. As such, the site is discounted as not being available.
- Land around Mill Street and West View and to the south of the church has been discounted because it is in close proximity to the Grade II Listed

Church of St Michael and that land includes a scheduled monument according to the Historic England list of Listed Buildings (it was part of a Roman fort). The land is discounted as not being suitable.

- Land to the east and in proximity to the JCB Academy and Rocester FC ground has been discounted as it is outside of the settlement boundary and / or is within Flood Zones 2 and 3. It is discounted as not being suitable.
- Land to the north of Rocester (to the north of Northfield Drive and to the east of Ashbourne Road) has been discounted as it is outside of the settlement boundary according to the Local Plan where development is restricted. It is discounted as not being suitable.

5.5 Therefore, in summary it is considered the sequential test has been satisfied, taking into account the guidance within the PPG regarding the catchment of the proposed development, site specific requirements and any other land within Flood Zone 1 that is suitable or available.

6. SITE SPECIFIC FLOODING ISSUES AND EXISTING FLOOD RECORDS

6.1 Local Planning Authorities, (LPA) have a statutory obligation to consult the Environment Agency, (EA) on all applications in flood risk zones. The EA will consider the effects of flood risk in accordance with the NPPF.

National Planning Policy Framework (NPPF)

6.2 In accordance with the National Planning Policy Framework, this Flood Risk Assessment considers all sources of flooding including:

- a) Tidal Flooding – from sea;
- b) Fluvial Flooding – from rivers and streams;
- c) Pluvial Flooding – overland surface water flow and exceedance;
- d) Historic flooding – known historic flooding issues;
- e) Groundwater flooding – from elevated groundwater levels or springs;
- f) Flooding from sewers – exceedance flows from existing sewer systems; and
- g) Artificial sources – reservoirs, canals etc.

Tidal Flooding

6.3 The Environment Agency website provides basic flood mapping data as a general guide to whether a site is at risk of flooding from various sources including rivers and seas for Flood Zoning classification.

6.4 This mapping (Figure 5.1) indicates that majority of the site is located within Flood Zone 1 an area with a low probability of flooding occurring (<1:1000 yr). However, western portion of the site is indicated to be in Flood Zone 2 an area with medium probability of flooding occurring (1 in 1000 - 1 in 100 years).

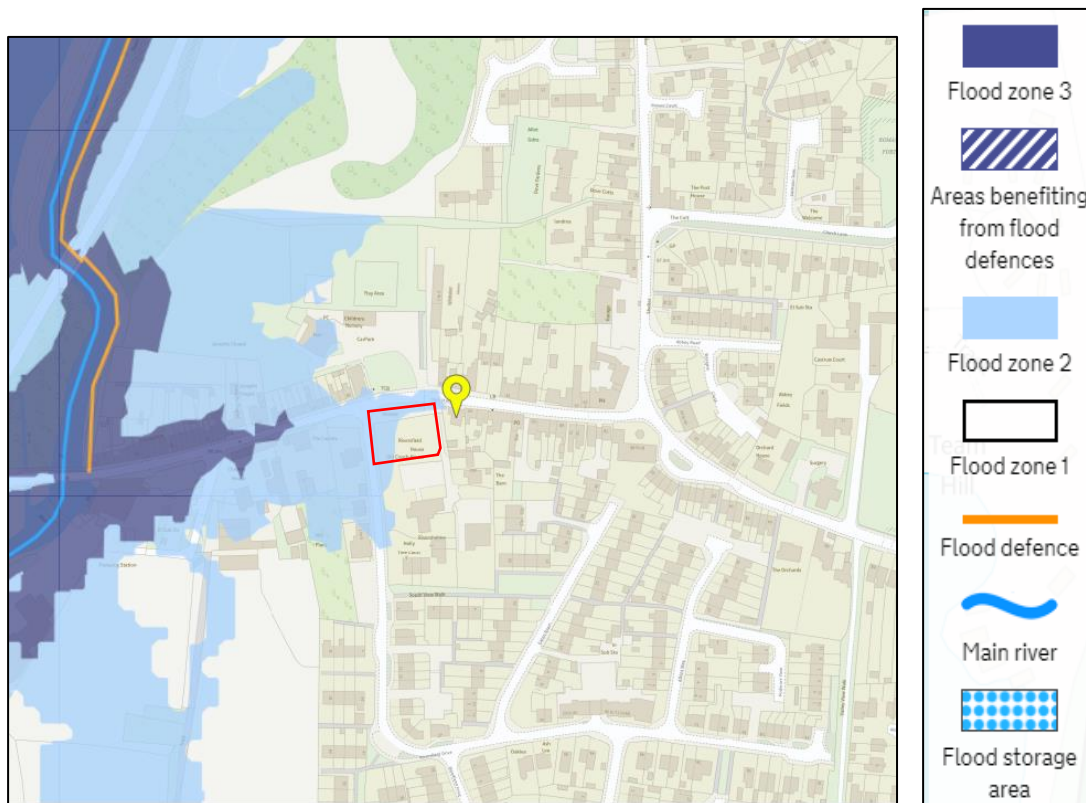
6.5 Given the site's elevation (<86m AOD) and its inland location, it is unlikely that tidal flooding could have an extent that could pose a risk to the site. Therefore, tidal flooding is considered to be **Very Low**.

Fluvial Flooding

6.6 There are two main rivers in the vicinity of the site. River Churnet located 150m to the east and River Dove located 550m to the west of the site.

- 6.7 According to the EA Historic Map, there are no records of flooding at the site. However, there are records of fluvial flooding in proximity of the site from the River Churnet. The East Staffordshire Strategic Flood Risk Assessment states that in 2012 Rocester was impacted by main river flooding.
- 6.8 The East Staffordshire SFRA states that for approximately 600m beside the village of Rocester, the channel has privately maintained, 1 in 100 year standard, raised flood defences along its left bank.
- 6.9 Given the above, and the location of the building to the east of the development, Fluvial Flood risk to the site is considered to be **Low**.

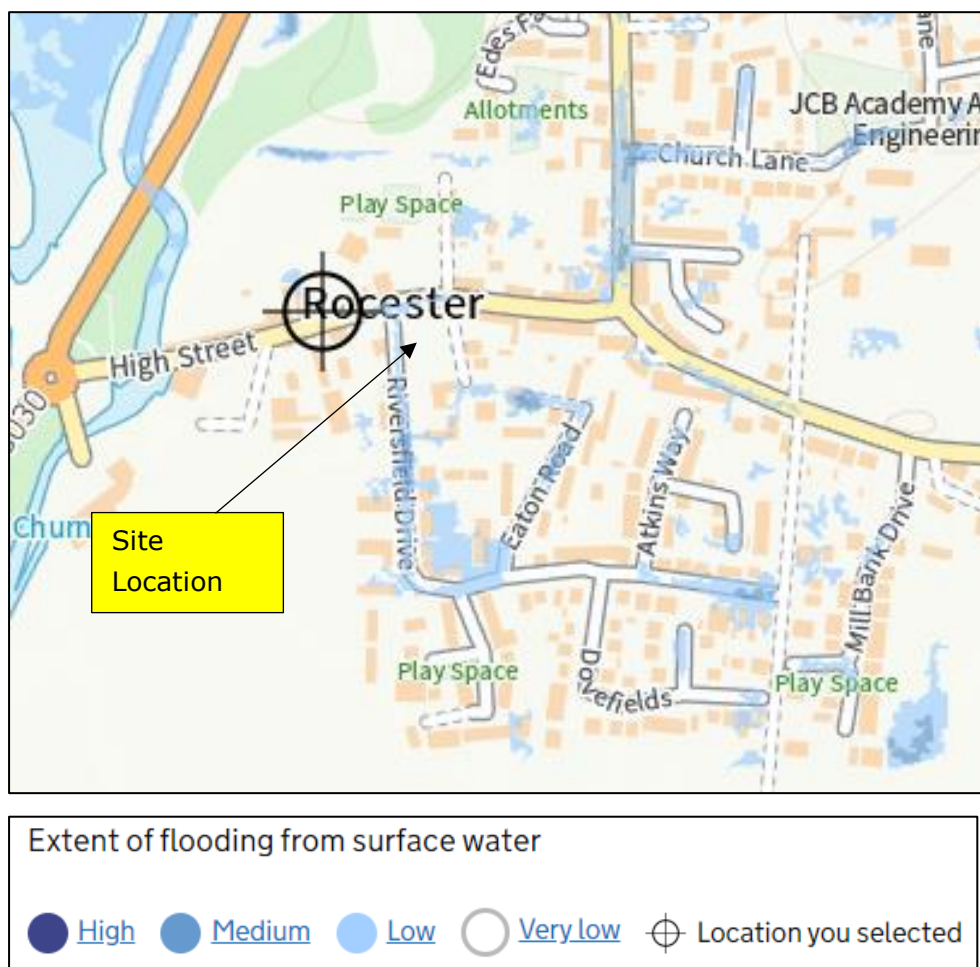
Figure 6.1 – Environment Agency Tidal / Fluvial Flooding Map



Pluvial Flooding

- 6.10 The Surface Water (Pluvial) Flood Map (Figure 5.2) indicates that the site is at a very low risk from surface water flooding. There are some areas of low risk indicated outside the site boundary within High Street and Riversfield Drive.

Figure 6.2 – Environment Agency Surface Flooding Map



6.11 Therefore, the development is considered to be at **Very Low** risk of flooding from surface water flows.

Historic Flooding

6.12 The East Staffordshire Councils Strategic Flood Risk Assessment notes flooding that occurred in the spring 1947 as a result of heavy rainfall and rapid snow thaw. However, much of the flooding in recent years is attributable to the blinding or blocking of grills or culverts or the overloading of the drainage systems. This was especially notable in the summer of 1999 and the autumn of 2000 in Burton upon Trent, Uttoxeter and many of the surrounding villages.

6.13 In 2012 there were a large number of incidents from various sources, where Rocester (address: New Highway) was affected by main river flooding.

- 6.14 It should be noted from the recorded events above that the site has not been historically affected by flooding.
- 6.15 It is therefore considered that historic flooding at this site is **Very Low**.

Groundwater Flooding

- 6.16 The underlying strata, as derived from the BGS data indicates that the site has superficial drift deposits composed of River Terrace Deposits (sand and gravel) and bedrock deposits recorded as the Mercia Mudstone Group – Mudstone.
- 6.17 The East Staffordshire states that Rocester and land south of Rocester have significant risk of groundwater flooding. There are areas along the line of the main rivers where the susceptibility is high (greater than 75%). River floodplains are made up of loamy and clayey floodplain soils with naturally high groundwater, along with freely draining soils.
- 6.18 There are no known reports of flooding at this site occurring from groundwater.
- 6.19 It is therefore considered flooding from this source is **Low**.

Flooding from Sewers

Flooding from Adopted Sewers

- 6.20 The East Staffordshire SFRA notes that there are relatively few occurrences of surface sewer water flooding within the borough and all are located outside the Flood Zone boundaries. Occurrences are located in the villages of Rough Hay, Anslow, Tutbury, Denstone and Mayfield, in addition to the suburb of Stapenhill in Burton upon Trent.
- 6.21 There are no records of sewer flooding occurring at the site. However, no specific addresses are shown within the SFRA.

Flooding from Private Drainage

- 6.22 Due to the topography of the surrounding area any flood water from private drainage of the sites surrounding would be intercepted by existing highways network.

6.23 Therefore, the development is considered to be at low risk of flooding from failure of private drainage.

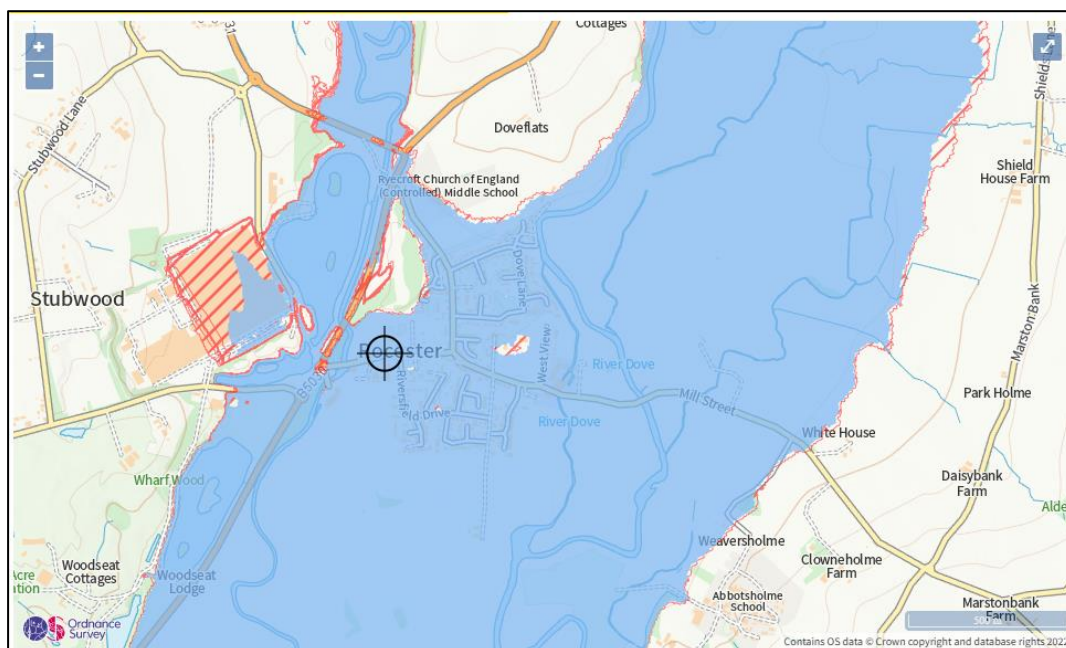
6.24 The risk of sewer flooding to the site is therefore considered to be **Low**.

Flooding from Artificial Sources

6.25 The EA map shows that the site falls within the catchment area of Carsington Water Reservoir and would be impacted in a case of a hazard. Carsington Water Reservoir is operated by Severn Trent Water. It should be noted that the operation of reservoirs is strictly managed, and reservoir flooding is extremely unlikely to happen.

6.26 Therefore, the development is considered to be at **Low** risk of flooding from reservoirs, canals and artificial sources.

Figure 6.3 – Environment Agency Reservoir Flooding Map



Post Development Residual Flood Risk Summary

6.27 The risk of flooding is summarised in Table 5.1:

Table 6.1 – Flood Risk to the site from all sources

Flood Source	Flood Risk	Mitigation/Comments
Tidal	Very Low	<ul style="list-style-type: none"> Given the site's inland location and elevation, tidal flooding to the site is very low.
Fluvial	Low	<ul style="list-style-type: none"> Building located entirely within Flood Zone 1.
Pluvial	Very Low	<ul style="list-style-type: none"> The EA flood maps show the site to have a very low probability of flooding from surface water.
Historic	Very Low	<ul style="list-style-type: none"> The site has not been historically affected by flooding. No mitigation measures are required.
Groundwater	Low	<ul style="list-style-type: none"> The site is underlain by Bedrock geology of Mudstone.
Sewers	Low	<ul style="list-style-type: none"> No historic records of sewer flooding occurring at the site. No mitigation measures are required.
Artificial	Low	<ul style="list-style-type: none"> Reservoir hazards very unlikely to occur.

Access & Egress

6.28 The site is not subject to any form of severe flooding, therefore in the event of an extreme event occurrence, access and egress to/from the site can be easily achieved to higher parts of the site as necessary.

7. PROPOSED DRAINAGE STRATEGY

Proposed Impermeable Areas

- 7.1 The entirety of the site is a greenfield site and is currently 100% permeable. The proposed development will increase the impermeable area by approximately 82.5% due to the introduction of proposed building associated with the parking areas / access road.

Surface Water Management

- 7.2 The SuDS hierarchy demands that surface water run off should be disposed of as high up the following list as practically possible:

- Into the ground (infiltration) and re-use, or then;
- To a surface water body, or then;
- To a surface water sewer, highway drain or another drainage system, or then;
- To a combined sewer.

- 7.3 In order to determine the most suitable method of surface water disposal from the site the options listed above have been considered as follows:

Infiltration rates

- 7.4 Based on the BGS records, the underlying substrata of the site is Mudstone, therefore infiltration is not deemed feasible on site and as such, cellular storage is deemed suitable for use and therefore will be the main source of surface water attenuation for the drainage strategy.

- 7.5 It should be noted that infiltration testing should be carried out to confirm that infiltration is not feasible.

SuDS selection process

- 7.6 Various methods of SuDS (Sustainable Drainage Systems) usage should be considered, but different methods have constraints attached to them that may not be suitable for this development. Therefore, an assessment of the suitability of different SuDS techniques have been made, which is summarised in the Table

below. Guidance from 'The SuDS manual' C753 has been used to form the basis of this assessment.

Table 7.1 – Assessment of SuDS Suitability

SuDS Technique	Potentially suitable for this development	Justification
Rainwater Harvesting	No	Not suitable for commercial development.
Green Roofs	No	Unsuitable for a commercial development with pitched roofs.
Infiltration Systems (Soakaways, etc.)	No	Soakaways are not considered feasible.
Filter Drains	No	Infiltration is not considered feasible.
Swales	No	Not feasible due to land take.
Bioretention Systems	Yes	Planters could be located below the building downpipes.
Trees	No	Unfeasible due to large root structures presenting a risk to the foundations
Underground storage	Yes	It is considered feasible, Cellular Storage can be placed within the parking area.
Detention basins & ponds	No	Not considered due to land take.
Wetlands	No	Due to the nature of the site, this is not considered feasible

Permeable Paving	Yes	It is considered that permeable paving is considered in private car parking and driveway areas.
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Surface Water Drainage Strategy

- 7.7 The surface water drainage design has considered the use of SuDS appropriate to the development and suitable solutions discussed in the previous section.
- 7.8 All surface water runoff will be collected by a traditional gravity fed drainage systems for the proposed building and tarmacked highway. Discharge is assumed to be into a storm water sewer located within Riversfield Drive located west of the site.
- 7.9 The overall proposed built impermeable area catchment has increased by approximately 82.5% (0.086 Ha increase).
- 7.10 Greenfield run off rate for the development has been calculated using the IH124 method via Micro Drainage. Rates have been calculated at 50ha and then factored down to the site area of 0.1ha, resulting in a restricted discharge rate of approximately 0.5 l/s. Hydrobrake flow control devices have small orifices for low discharge rates and due to the risk of blockage a discharge rate of 2.0 l/s has been used within the source control calculations.
- 7.11 The surface water source control calculations for the proposed building and associated parking, show that the site will not flood in the 1 in 100 year return period, plus 40% climate change event.
- 7.12 The source control calculations are included in **Appendix B** and the proposed drainage strategy layout can be found at **Appendix C**.
- 7.13 All below ground drainage will be HDPE material and non-jointed pipes, all manhole covers will be heavy duty type D400 to BS EN 124.

Water Quality

- 7.14 The SuDS Manual (CIRIA C753) states that the design of surface water drainage should consider minimising contaminants in surface water runoff discharged from the site. The level of treatment required depends on the proposed land use, according to the pollution hazard indices.
- 7.15 To ensure that adequate treatment is provided, the SuDS mitigation indices for the development must be equal to, or exceed, the pollution hazard indices. A stormwater filtration unit has been proposed close to the drainage outfall to provide water quality treatment. However, other drainage components could be used for the proposed development, and this should be confirmed at the detailed design stage.
- 7.16 Table 6.2 shows the water quality mitigation indices that the stormwater filtration unit and permeable paving provides suitable treatment for surface water runoff, which confirms that the proposed development provides adequate water quality treatment.

Table 7.2 – Water Quality Indices (as per C753 The SuDS Manual)

		Pollution Hazard Level	Total suspended solids	Metals	Hydrocarbons
Land Use	Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
	Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Drainage Component	Permeable pavement		0.7	0.6	0.7
	Proprietary treatment systems (details to be confirmed by manufacturer)		0.8	0.8	0.8
Mitigation Indices	Indices \geq Pollution Hazard		Yes	Yes	Yes

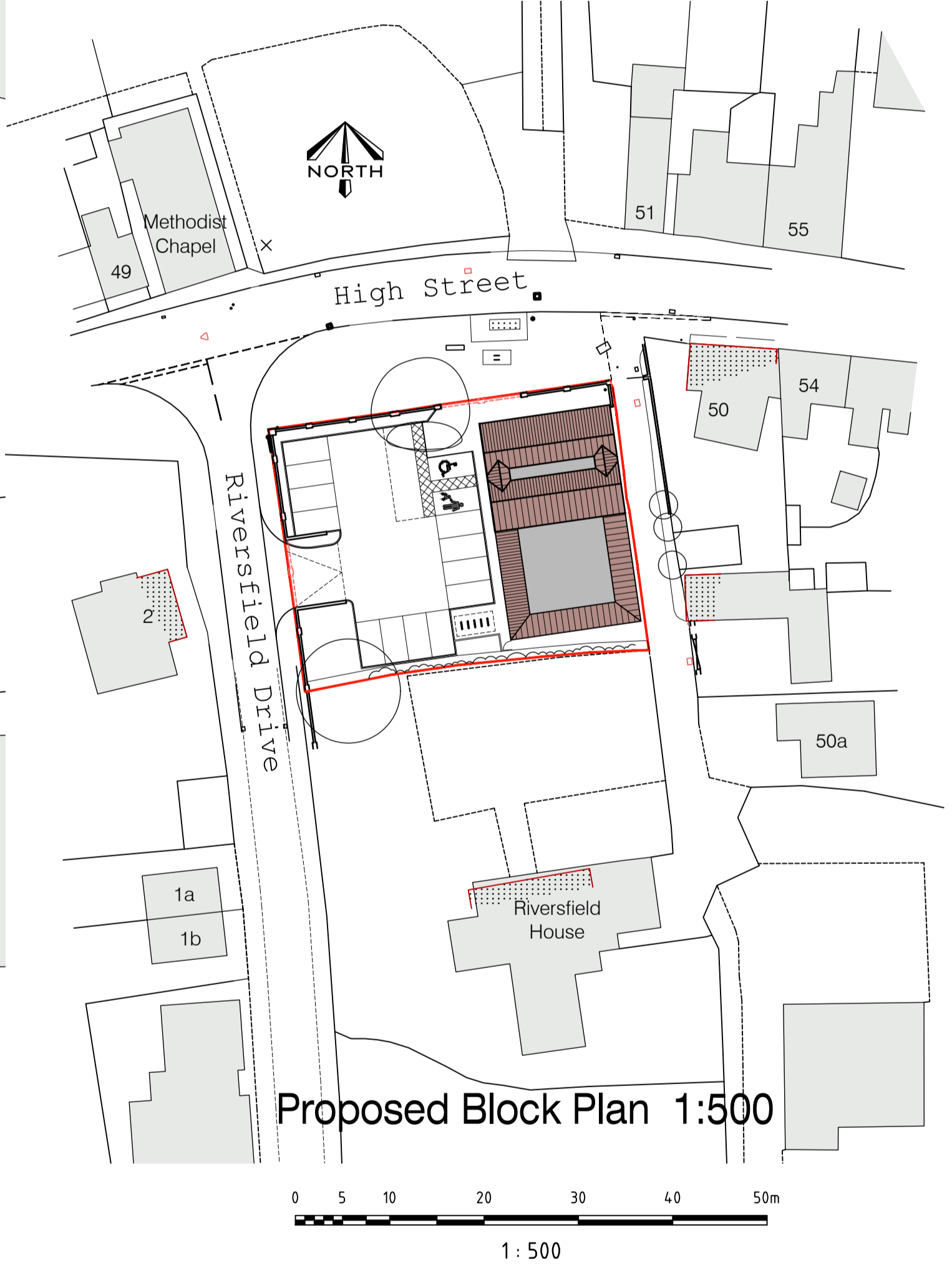
8. SUMMARY

- 8.1 The site is greenfield, comprised of grassed areas, trees and other vegetation and it is proposed to develop the site for a convenience foodstore with associated access and parking.
- 8.2 A sequential assessment has been undertaken as a small part of the Site is within Flood Zone 2 and the NPPF requires an assessment to be undertaken. Guidance within the PPG has framed the assessment which concluded that there are no other suitable or available sites within the catchment for the proposed development.
- 8.3 Infiltration is not been deemed feasible due to the soil substrata being Mudstone, therefore geocellular storage will be used as the main form of attenuation on site. Infiltration testing should be carried out to confirm this approach.
- 8.4 The drainage network has been designed to accommodate flows for the 1 in 100 year event scenario, allowing for up to 40% climatic change without flooding occurring.
- 8.5 A full maintenance regime has been provided within **Appendix D** of this report in the form of an operation and maintenance manual (O&M).
- 8.6 The proposal is considered to accord with the requirements of the National Planning Policy Framework (NPPF) with residual risk to the site fully mitigated, and as such considered low risk.

Appendix A – Proposed Site Layout



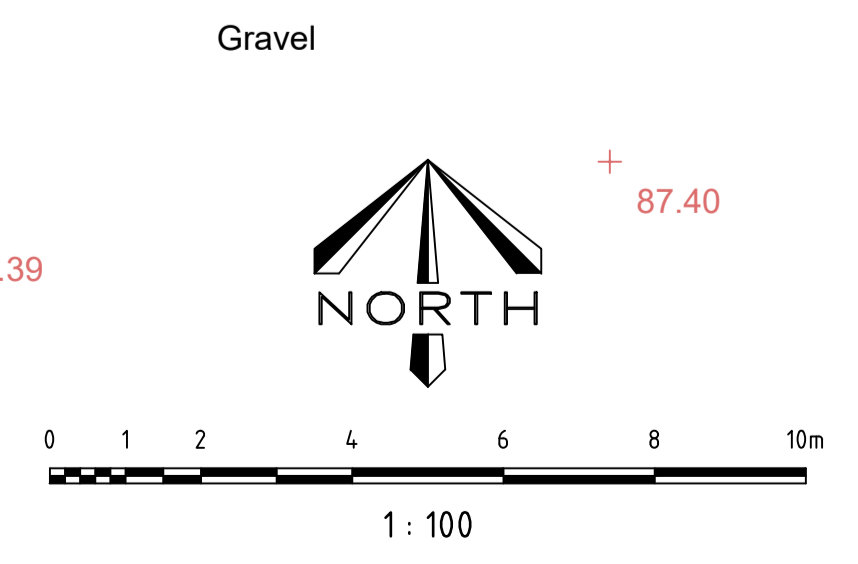
- EXTERNAL MATERIALS/FINISHES:**
- PROPOSED LANDSCAPING/PLANTING - Details TBA
 - EXISTING LANDSCAPING/PLANTING TO BE RETAINED
 - INDICATIVE NEW PLANTING - Details TBA
 - NEW SLIP RESISTANT CONC PAVING TO FOOTPATHS (Permeable paving around Ex tree root protection area)
 - BLOCK PAVING TO PARKING SPACES
 - TARMAC ACCESS ROADS/CAR PARK
- Thermoplastic white lining to Car Park Spaces
- APPROX. SITE AREA - 1,024sqm (0.25Acre)
- SITE REFERENCE POINTS TO DEVELOPMENT BOUNDARY
- PROPOSED PARKING - 14 SPACES (INC. 1 X DIS)
- PROPOSED NEW CO-OP RETAIL STORE:
PROPOSED FFL: +87.20
- Total Approx. GF GIA - 293sqm (3,154sqft)
Total Approx. FF GIA - 141sqm (1,518sqft)
Total Approx. GF & FF GIA - 434sqm (4,672sqft)



Planning Drawing

Rev A	28.02.22	Approx. eastern boundary line updated - TBC on site.	DB
rev.	date		drawn/chk d
Gould Singleton Architects Earls Way, Halesowen, West Midlands, B63 3HR <small>Tel: 0121 550 0359 Fax: 0121 550 0068 e-mail: info@goald-singleton.co.uk</small>			
number	drawn	checked	date
21-1875/10a	DB	GSA	Feb 2022
		Scales	
		1:100@A1	
		Land off High Street	
		Rocester	
		Uttoxeter	
		ST14 5JU	
		Proposed Site Plan	

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Appendix B – Source Control Calculations

Unit 5, The Priory
London Road
Sutton Coldfield B75 5SH



Date 08/02/2022 11:07
File

Designed by Marija.Raicevic
Checked by

Innovyze Source Control 2020.1.3

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	807	Region Number	Region 4

Results l/s


QBAR Rural	259.4
QBAR Urban	259.4
Q100 years	666.7
Q1 year	215.3
Q2 years	232.5
Q5 years	319.1
Q10 years	386.6
Q20 years	461.1
Q25 years	487.2
Q30 years	508.3
Q50 years	571.3
Q100 years	666.7
Q200 years	783.5
Q250 years	822.4
Q1000 years	1079.2

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 141 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	86.627	0.627	0.0	1.9	1.9	14.7	O K
30 min Summer	86.711	0.711	0.0	1.9	1.9	19.1	O K
60 min Summer	86.777	0.777	0.0	1.9	1.9	22.5	Flood Risk
120 min Summer	86.798	0.798	0.0	1.9	1.9	23.6	Flood Risk
180 min Summer	86.788	0.788	0.0	1.9	1.9	23.1	Flood Risk
240 min Summer	86.772	0.772	0.0	1.9	1.9	22.2	Flood Risk
360 min Summer	86.740	0.740	0.0	1.9	1.9	20.6	O K
480 min Summer	86.708	0.708	0.0	1.9	1.9	18.9	O K
600 min Summer	86.676	0.676	0.0	1.9	1.9	17.2	O K
720 min Summer	86.644	0.644	0.0	1.9	1.9	15.6	O K
960 min Summer	86.577	0.577	0.0	1.9	1.9	12.2	O K
1440 min Summer	86.268	0.268	0.0	1.9	1.9	6.1	O K
2160 min Summer	86.092	0.092	0.0	1.9	1.9	2.1	O K
2880 min Summer	86.026	0.026	0.0	1.7	1.7	0.6	O K
4320 min Summer	86.000	0.000	0.0	1.3	1.3	0.0	O K
5760 min Summer	86.000	0.000	0.0	1.0	1.0	0.0	O K
7200 min Summer	86.000	0.000	0.0	0.8	0.8	0.0	O K
8640 min Summer	86.000	0.000	0.0	0.7	0.7	0.0	O K
10080 min Summer	86.000	0.000	0.0	0.6	0.6	0.0	O K
15 min Winter	86.667	0.667	0.0	1.9	1.9	16.7	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	125.130	0.0	16.3	18
30 min Summer	83.961	0.0	22.1	32
60 min Summer	53.779	0.0	28.4	62
120 min Summer	33.273	0.0	35.4	110
180 min Summer	24.762	0.0	39.7	140
240 min Summer	19.940	0.0	42.7	174
360 min Summer	14.641	0.0	47.0	242
480 min Summer	11.758	0.0	50.5	312
600 min Summer	9.910	0.0	53.2	380
720 min Summer	8.613	0.0	55.4	448
960 min Summer	6.897	0.0	59.2	578
1440 min Summer	5.034	0.0	64.7	796
2160 min Summer	3.666	0.0	70.6	1128
2880 min Summer	2.923	0.0	74.9	1472
4320 min Summer	2.121	0.0	81.2	0
5760 min Summer	1.688	0.0	85.7	0
7200 min Summer	1.412	0.0	89.3	0
8640 min Summer	1.221	0.0	92.3	0
10080 min Summer	1.081	0.0	94.9	0
15 min Winter	125.130	0.0	18.3	18

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Unit 5, The Priory London Road Sutton Coldfield B75 5SH	P21-0850 Rocester Source Control Calcs	
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Innovyze	Source Control 2020.1.3	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
30 min Winter	86.764	0.764	0.0	1.9	1.9	21.8	Flood Risk
60 min Winter	86.845	0.845	0.0	1.9	1.9	26.1	Flood Risk
120 min Winter	86.881	0.881	0.0	2.0	2.0	28.0	Flood Risk
180 min Winter	86.867	0.867	0.0	1.9	1.9	27.2	Flood Risk
240 min Winter	86.845	0.845	0.0	1.9	1.9	26.0	Flood Risk
360 min Winter	86.797	0.797	0.0	1.9	1.9	23.5	Flood Risk
480 min Winter	86.747	0.747	0.0	1.9	1.9	20.9	O K
600 min Winter	86.697	0.697	0.0	1.9	1.9	18.3	O K
720 min Winter	86.647	0.647	0.0	1.9	1.9	15.7	O K
960 min Winter	86.428	0.428	0.0	1.9	1.9	9.8	O K
1440 min Winter	86.128	0.128	0.0	1.9	1.9	2.9	O K
2160 min Winter	86.009	0.009	0.0	1.6	1.6	0.2	O K
2880 min Winter	86.000	0.000	0.0	1.3	1.3	0.0	O K
4320 min Winter	86.000	0.000	0.0	0.9	0.9	0.0	O K
5760 min Winter	86.000	0.000	0.0	0.7	0.7	0.0	O K
7200 min Winter	86.000	0.000	0.0	0.6	0.6	0.0	O K
8640 min Winter	86.000	0.000	0.0	0.5	0.5	0.0	O K
10080 min Winter	86.000	0.000	0.0	0.5	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	83.961	0.0	24.8	32
60 min Winter	53.779	0.0	32.1	60
120 min Winter	33.273	0.0	39.8	116
180 min Winter	24.762	0.0	44.6	148
240 min Winter	19.940	0.0	47.9	186
360 min Winter	14.641	0.0	52.9	262
480 min Winter	11.758	0.0	56.6	338
600 min Winter	9.910	0.0	59.6	410
720 min Winter	8.613	0.0	62.3	484
960 min Winter	6.897	0.0	66.5	606
1440 min Winter	5.034	0.0	72.7	806
2160 min Winter	3.666	0.0	79.3	1104
2880 min Winter	2.923	0.0	84.1	0
4320 min Winter	2.121	0.0	91.2	0
5760 min Winter	1.688	0.0	96.4	0
7200 min Winter	1.412	0.0	100.4	0
8640 min Winter	1.221	0.0	103.8	0
10080 min Winter	1.081	0.0	106.8	0

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Unit 5, The Priory London Road Sutton Coldfield B75 5SH	P21-0850 Rocester Source Control Calcs	
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Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 87.050

Complex Structure

Cellular Storage

Invert Level (m) 86.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	24.0	24.0	0.600	0.0	34.0
0.500	24.0	34.0			

Porous Car Park


Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 10.0
 Membrane Percolation (mm/hr) 1000 Length (m) 17.4
 Max Percolation (l/s) 48.3 Slope (1:X) 1000.0
 Safety Factor 2.0 Depression Storage (mm) 5
 Porosity 0.30 Evaporation (mm/day) 3
 Invert Level (m) 86.570 Membrane Depth (m) 130

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SHE-0067-2000-1000-2000
 Design Head (m) 1.000
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Application Surface
 Sump Available Yes
 Diameter (mm) 67
 Invert Level (m) 85.920
 Minimum Outlet Pipe Diameter (mm) 100
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.296	1.9
Kick-Flo®	0.599	1.6
Mean Flow over Head Range	-	1.7

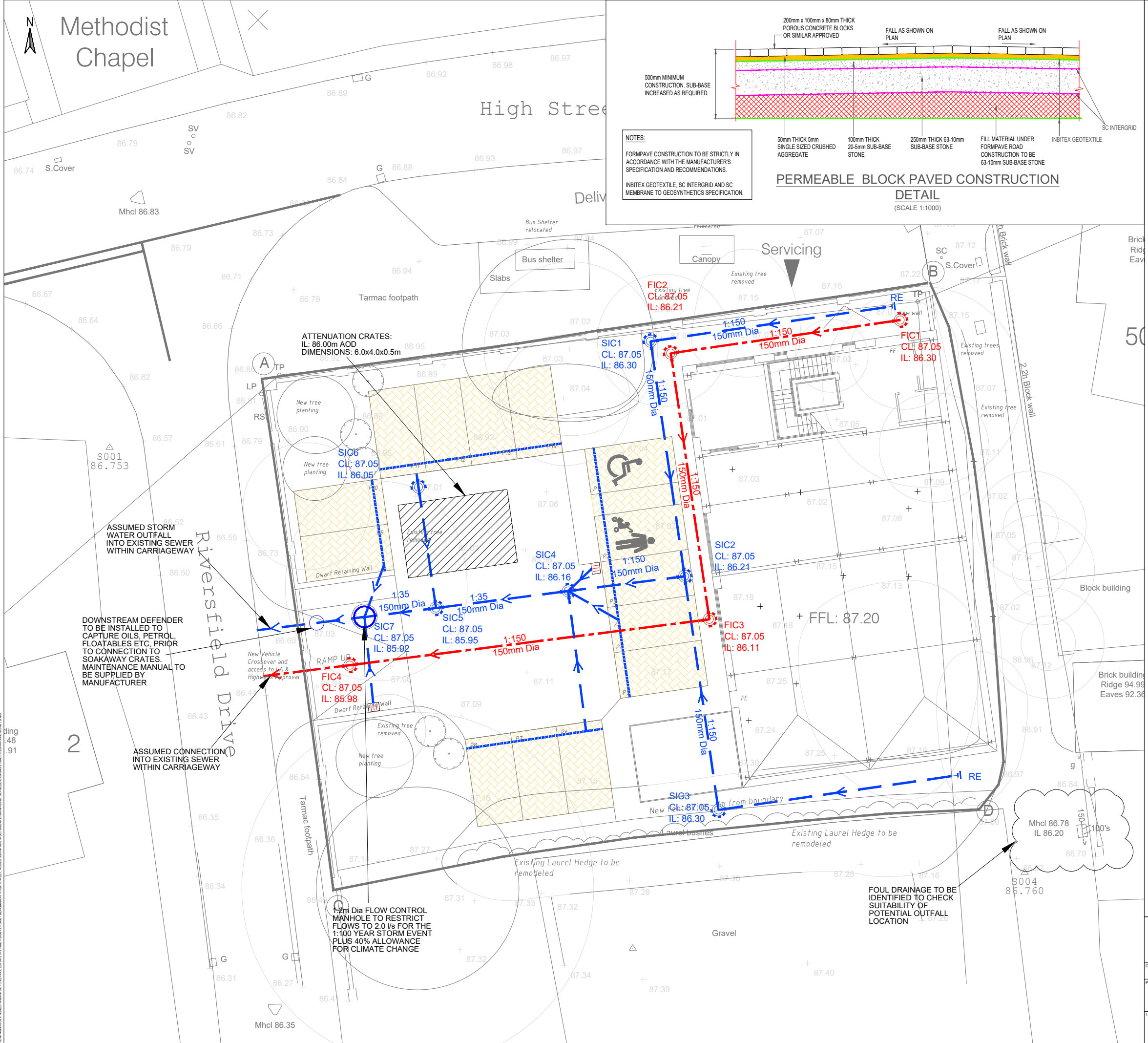
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Pegasus Group		Page 4
Unit 5, The Priory London Road Sutton Coldfield B75 5SH	P21-0850 Rocester Source Control Calcs	
Date 15/02/2022 10:51 File P21-0850_Source_Control...	Designed by MR Checked by LAJ	
Innovyze	Source Control 2020.1.3	

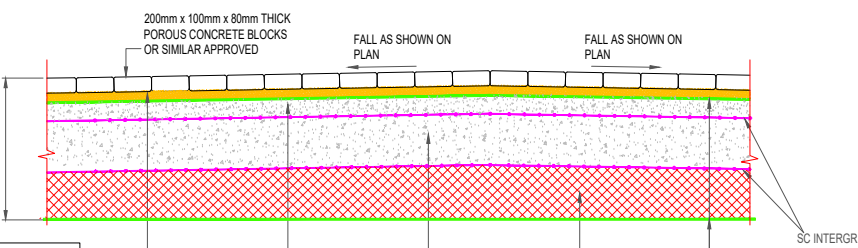
Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	1.200	2.2	3.000	3.3	7.000	4.9
0.200	1.9	1.400	2.3	3.500	3.5	7.500	5.1
0.300	1.9	1.600	2.5	4.000	3.8	8.000	5.2
0.400	1.9	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.8	2.000	2.7	5.000	4.2	9.000	5.5
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.7		

Appendix C – Proposed Drainage Strategy Layout



NOTES:
 FORMPAVE CONSTRUCTION TO BE STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATION AND RECOMMENDATIONS.
 INBITEX GEOTEXTILE, SC INTERGRID AND SC MEMBRANE TO GEOSYNTHETICS SPECIFICATION.



- NOTES:**
- DO NOT SCALE FROM THIS DRAWING
 - INFILTRATION TESTING TO BRE 365 TO BE CARRIED OUT AT APPROPRIATE PLACES ACROSS THE SITE TO DETERMINE THE FEASIBILITY OF THE USE OF SOAKAWAYS ON SITE. ALL FINDINGS TO BE REPORTED BACK TO THE ENGINEER
 - ALL PRIVATE DRAINAGE SHALL BE IN ACCORDANCE WITH BS8301 AND RELEVANT SECTIONS OF APPROVED DOCUMENT H OF THE BUILDING REGULATIONS
 - THE CONTRACTOR IS TO CHECK THE LEVEL OF EXISTING SEWERS BEING USED AS OUTFALLS OR CROSSING THE PROPOSED DRAINAGE RUNS PRIOR TO LAYING ANY PIPES. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.
 - ALL CONNECTIONS FOR DRAINAGE SHALL BE 100mm UNLESS NOTED OTHERWISE. ALL CONNECTIONS WHEN LAID SHALL BE PLUGGED, PROTECTED AS NECESSARY AND MARKED WITH A STAKE FOR FUTURE USE
 - FOR PRIVATE DRAINS WHERE COVER TO PIPES IS LESS THAN 900mm IN VEHICULAR AREAS OR 600mm IN OTHER AREAS TYPE Z BEDDING SHALL BE USED.
 - WHERE PIPES PASS THROUGH SCREEN WALLS, FOOTINGS OR RETAINING WALLS, LINTELS ARE TO BE PROVIDED OVER. UNDER BUILDINGS PIPES SHALL BE SURROUNDED WITH 150mm THICK GRANULAR MATERIAL. WHERE DRAINS PASS WITHIN 1.0m OF BUILDINGS THE WALL FOUNDATION SHALL BE TAKEN DOWN BELOW THE INVERT OF THE PIPE.
 - ALL GULLIES AND RAIN WATER DOWN PIPES CONNECTED DIRECTLY TO DRAINS ARE TO BE RODDABLE.
 - ALL DRAINAGE SHALL BE LAID UPSTREAM AND EACH RUN BETWEEN MANHOLES SHALL BE LAID COMPLETE PRIOR TO BACKFILLING. WHERE THIS IS NOT PRACTICABLE, TRIAL HOLES OR OTHER MEANS OF IDENTIFYING THE LINE AND LEVEL OF SERVICES SHALL BE CARRIED OUT PRIOR TO WORKS COMMENCING.
 - INTERNAL DRAINAGE TO BE LAID AT A MINIMUM GRADIENT OF 1 IN 40 IN ACCORDANCE WITH BS8301.

NOTE: ALL EXISTING ON SITE DRAINAGE TO BE EITHER REMOVED, SEALED OR GROUTED UP.
 NO EXISTING ON SITE DRAINAGE TO BE RE-USED AS PART OF NEW DEVELOPMENT.

NOTE: RECOMMENDATION FOR INCLUSION ON ALL PLOTS FOR RAINWATER BUTTS OR RAIN GARDEN PLANTERS TO BE INCORPORATED INTO PRIVATE DRAINAGE SYSTEMS.

NOTE: LOCATIONS OF SVP'S AND RWP'S TO BE CONFIRMED PRIOR TO ANY WORKS COMMENCING.

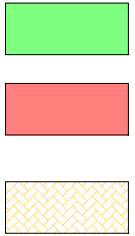
- KEY:**
- PRIVATE FOUL WATER DRAIN
 - PRIVATE FOUL WATER CHAMBER
 - STORM WATER DRAIN
 - STORM WATER CHAMBER
 - MANHOLE
 - PERMEABLE PAVING TO HAVE SUB-BASE GRADED AS SUCH TO FALL TOWARD NEW FILTER/TOE DRAIN. DRAIN TO CONNECT TO NEW SURFACE WATER SYSTEM AS SHOWN
 - ATTENUATION CRATES
 - PERMEABLE PAVING

First Floor, South Wing, Equinox North Great Park Road, Almondsbury, Bristol, BS32 4QL 01454 625045 www.pegasusgroup.co.uk Planning Design Environment Economics				REV	DATE	BY	DESCRIPTION	CHK	APD
CLIENT: GOULD SINGLETON ARCHITECTS		SCALE @ A1: 100	CHECKED: LAJ	APPROVED: LAJ					
PROJECT: LAND OFF HIGH STREET, ROCHESTER, UTTOXETER		DATE: 18.02.2022.	DESIGN-DRAWN: MR	DRAWING-STATUS: INFO					
TITLE: DRAINAGE STRATEGY		PROJECT CODE: P21-0850-PEG-XX-DR-C-001							

1:02500 PLAN AND SECTION. ALL DIMENSIONS TO FACE UNLESS OTHERWISE STATED. THIS DRAWING IS THE PROPERTY OF PEGASUS GROUP AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT THE WRITTEN PERMISSION OF PEGASUS GROUP.



KEY:



PERMEABLE AREA: 182.38m²

IMPERMEABLE AREA: 689.31m²

SUGGESTED AREAS FOR PERMEABLE PAVING

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CLIENT: GOULD SINGLETON ARCHITECTS

PROJECT: LAND OFF HIGH STREET, ROCESTER, UTTOXETER

TITLE: IMPERMEABLE AREAS PLAN

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REV	DATE	BY	DESCRIPTION	CHK	APP

SCALE @ A1: 100

DATE: 15.02.2022.

PROJECT CODE: P21-0850-PEG-XX-DR-C-002

CHECKED: LAJ

DESIGN DRAWN: MR

APPROVED: LAJ

DRAWING STATUS: INFO

Appendix D – Operation and Maintenance Manual

DRAINAGE OPERATION & MAINTENANCE MANUAL

HIGH STREET, ROCESTER

ON BEHALF OF SEP PROPERTIES LIMITED



Pegasus Group

Birmingham | Bracknell | Bristol | Cambridge | Cirencester | Dublin | East Midlands | Leeds | Liverpool | London | Manchester | Newcastle | Peterborough

DESIGN **ENVIRONMENT** **PLANNING** **ECONOMICS** **HERITAGE**

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2. PERMEABLE PAVING	2
3. PIPEWORK & MANHOLES	5

FIGURES & TABLES

TABLE 2.1:	PERMEABLE PAVING MAINTENANCE REQUIREMENTS
TABLE 3.1:	PIPEWORK AND MANHOLE MAINTENANCE REQUIREMENTS

APPENDICES

APPENDIX C	PROPOSED DRAINAGE STRATEGY
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1. INTRODUCTION

- 1.1 This report has been produced to accompany a Flood Risk Assessment for the proposed commercial development on land off High Street, Rocester.

Scope of the O&M Manual

- 1.2 This manual is intended to give an overview of the operation and maintenance for the range of SuDS features included with the drainage strategy and in relation to typical details only.
- 1.3 Where proprietary products are specified the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.
- 1.4 The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

2. PERMEABLE PAVING

- 2.1 The permeable pavements are located in the shared drives as shown on the drainage strategy which can be found at **Appendix C**.
- 2.2 The permeable pavements have/will be designed in accordance with CIRIA C753 and BS7533-13.
- 2.3 Permeable pavements contain proprietary products and as such where used the manufacture's recommendations should be followed.
- 2.4 The permeable pavements are intended to be water quality and attenuation storage features. These features are intended to be dry except during rainfall events. The permeable pavements may also be utilised as an infiltration area or soakaway for other areas of the development (where permissible).
- 2.5 The surface has been designed to be porous or to contain gaps where rain can flow through the upper construction layers into the voided stone which makes up the subbase. Where these features are intended to be used as infiltration devices or soakaways any capping also needs to be permeable to permit the flows to the formation.
- 2.6 Regular inspection and maintenance is important for the effective operation of the pervious pavement. Maintenance responsibility for the pavement and its surrounding area should be placed with the site's management company.
- 2.7 Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Table 2.1 – Permeable Paving Maintenance Requirements

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific

		observations of clogging or manufacturer's recommendations.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper	Every 10 to 15 years or as required (if

	substructure by remedial sweeping	infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three monthly, 48 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

3. PIPEWORK & MANHOLES

- 3.1 Pipes are the main conveyance across the site with the network as shown on drainage strategy found at **Appendix C**.
- 3.2 Pipes are proprietary products and the materials can vary across the site and as such where used the manufacture's recommendations should be followed. Regardless of the product used the pipes will be fully compliant with the drainage specification.
- 3.3 Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.
- 3.4 Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.
- 3.5 Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be draining correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with the management company employed by the developer for the site, unless the drainage is adopted as a lateral with the local Water Authority.
- 3.6 Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Table 3.1 – Pipework & Manholes Maintenance Requirements

Maintenance Schedule	Required Action	Typical Frequency
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required

	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required
	If continued poor performance jet and CCTV survey poorly performing runs.	As required
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required if above does not improve performance
Monitoring	Initial inspection should be provided as post construction CCTV survey.	Monthly for three months after installation
	Inspect for evidence of poor operation via water level in chambers and if	Three monthly, 48 hours after large storms in first six months

	required, take remedial action	
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually