APPENDIX 4.0 – PROPOSED MASTERPLAN

0 5 10 15 20 25

Metres (1:500)

N

Site Area: 0.43 Hectares

12 Unit Scheme:

6 x 3-Bedroom Semi-Detached Houses
(Plots 4-5, 7-8, 11-12 @ 95sqm / *1023 sqft*)

3 x 4-Bedroom Detached Houses
(Plots 1, 9-10 @ 117sqm / *1259 sqft*)

3 x 4-Bedroom Detached House
(Plots 2-3, 6 @ 120sqm / *1292 sqft*)

Rev:	Reason:	Date:

Client:
KENT COUNTY COUNCIL

Project:
LAND OFF LONGACRE ROAD,
PRIMARY SCHOOL, ASHFORD, KENT

Title:
PROPOSED SITE LAYOUT PLAN

Drawing:	Rev:	Scale:	Date:
DHA/11170/103	-	1:500	MAY 2017

dha urban design

Eclipse House, Eclipse Park. Sittingbourne Road
Maidstone, Kent. ME14 3EN

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e: info@dhaplanning.co.uk w: www.dhaplanning.co.uk

CAD Reference: 11170 - Application Drawings April 2017 - LS A3

APPENDIX 5.0 – SITE GEOLOGY AND INFILTRATION ASSESSMENT

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
GeoReports

Spencer Smith
DHA Planning
Eclipse House
Eclipse Park
Sittingbourne Road
Maidstone
Kent
ME14 3EN

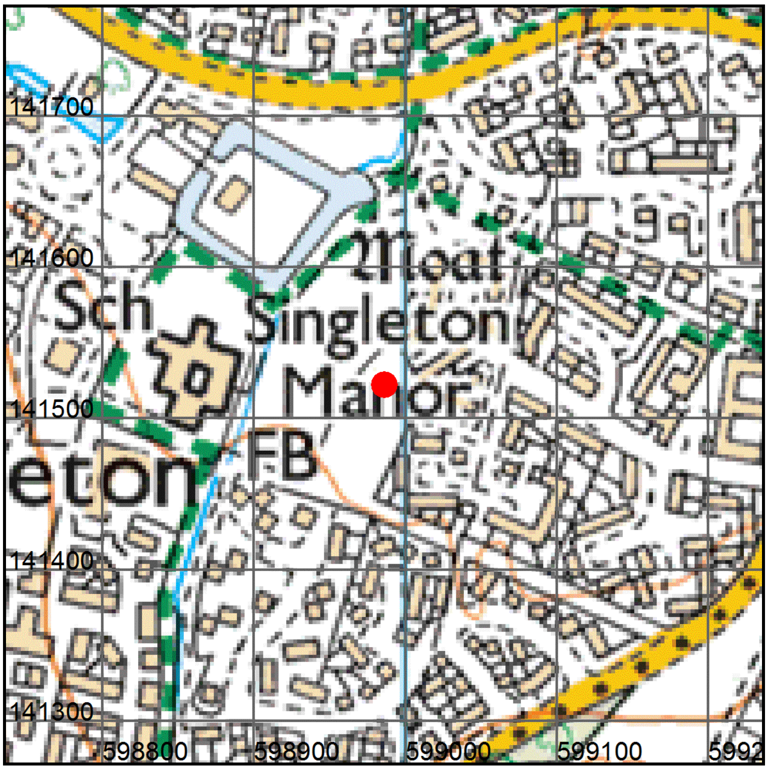
Infiltration SuDS GeoReport:

This report provides information on the suitability of the subsurface for the installation of infiltration sustainable drainage systems (SuDS). It provides information on the properties of the subsurface with respect to significant constraints, drainage, ground stability and groundwater quality protection.

Report Id: ***GR_215836/1***

Client reference: Great Chart - PO- 5533

Search location



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Scale: 1:5 000 (1cm = 50 m)

Contains Ordnance Survey data © Crown Copyright and database right 2017
OS Street View: Scale: 1:5 000 (1cm = 50 m)

Point centred at:
598986,141522

Search location indicated in red

Assessment for an infiltration sustainable drainage system

Introduction

Sustainable drainage systems (SuDS) are drainage solutions that manage the volume and quality of surface water close to where it falls as rain. They aim to reduce flow rates to rivers, increase local water storage capacity and reduce the transport of pollutants to the water environment. There are four main types of SuDS, which are often designed to be used in sequence. They comprise:

- **source control:** systems that control the rate of runoff
- **pre-treatment:** systems that remove sediments and pollutants
- **retention:** systems that delay the discharge of water by providing surface storage
- **infiltration:** systems that mimic natural recharge to the ground.

This report focuses on infiltration SuDS. It provides subsurface information on the properties of the ground with respect to drainage, ground stability and groundwater quality protection. It is intended principally for those involved in the preliminary assessment of the suitability of the ground for infiltration SuDS, and those involved in assessing proposals from others for sustainable drainage, but it may also be useful to help house-holders judge whether or not further professional advice should be sought. If in doubt, users should consult a suitably-qualified professional about the results in this report before making any decisions based upon it.

This GeoReport is structured in two parts:

- **Part 1. Summary data**.

  Comprises three maps that summarise the data contained within Part 2.

- **Part 2. Detailed data**.

  Comprises a further 24 maps in four thematic sections:

  - **Very significant constraints.** Maps highlight areas where infiltration may result in adverse impacts due to factors including: ground instability (soluble rocks, non-coal shallow mining and landslide hazards); persistent shallow groundwater, or the presence of made ground, which may represent a ground stability or contamination hazard.
  - **Drainage potential**. Maps indicate the drainage potential of the ground, by considering subsurface permeability, depth to groundwater and the presence of floodplain deposits.
  - **Ground stability**. Maps indicate the presence of hazards that have the potential to cause ground instability resulting in damage to some buildings and structures, if water is infiltrated to the ground.
  - **Groundwater protection**. Maps provide key indicators to help determine whether the groundwater may be susceptible to deterioration in quality as a result of infiltration.

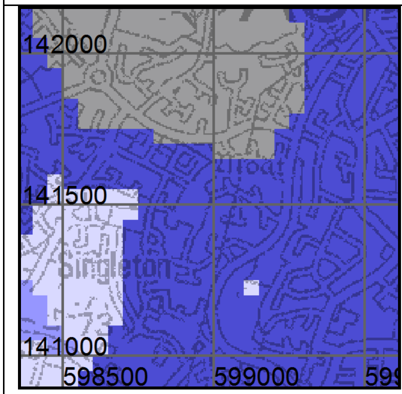
This report considers the suitability of the subsurface for the installation of infiltration SuDS, such as soakaways, infiltration basins or permeable pavements. It provides subsurface data to indicate whether, and which type of infiltration system may be appropriate. It does not state that infiltration SuDS are, or are not, appropriate as this is highly dependent on the design of the individual system. This report therefore describes the subsurface conditions at the site, allowing the reader to determine the suitability of the site for infiltration SuDS.

The map and text data in this report is similar to that provided in the '*Infiltration SuDS Map: Detailed'* national map product. For further information about the data, consult the '*User Guide for the Infiltration SuDS Map: Detailed'*, available from http://nora.nerc.ac.uk/16618/.

PART 1: SUMMARY DATA

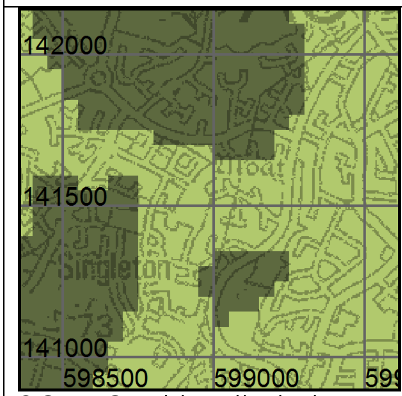
This section provides a summary of the data on the following pages.

In terms of the drainage potential, is the ground suitable for infiltration SuDS?



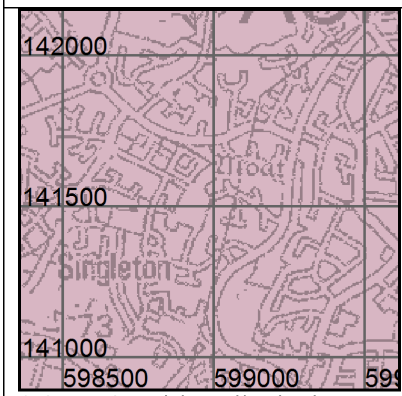
- Highly compatible for infiltration SuDS.
  The subsurface is likely to be suitable for free-draining infiltration SuDS.
- Probably compatible for infiltration SuDS.
  The subsurface is probably suitable although the design may be influenced by the ground conditions.
- Opportunities for bespoke infiltration SuDS.
  The subsurface is potentially suitable although the design will be influenced by the ground conditions.
- Very significant constraints are indicated.
  There is a very significant potential for one or more hazards associated with infiltration.

Is ground instability likely to be a problem?



- Increased infiltration is very unlikely to result in ground instability.
- Ground instability problems may be present or anticipated, but increased infiltration is unlikely to result in ground instability
- Ground instability problems are probably present. Increased infiltration may result in ground instability.
- There is a very significant potential for one or more geohazards associated with infiltration.

Is the groundwater susceptible to deterioration in quality?



- The groundwater is not expected to be especially vulnerable to contamination.
- The groundwater may be vulnerable to contamination.
- The groundwater is likely to be vulnerable to contaminants.
- Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

PART 2: DETAILED DATA

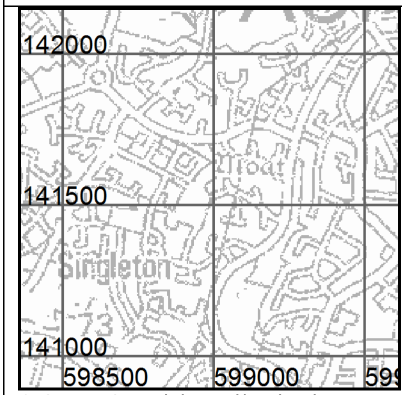
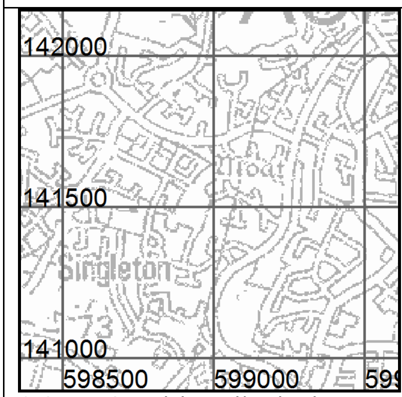
This section provides further information about the properties of the ground and will help assess the suitability of the ground for infiltration SuDS.

Section 1. Very significant constraints

Where maps are overlain by grey polygons, geological or hydrogeological hazards may exist that could be made worse by infiltration. The following hazards are considered:

- soluble rocks
- landslides
- shallow mining
- shallow groundwater
- made ground

For more information read 'Explanation of terms' at the end of this report.

Soluble rock hazard	
 	Very significant soluble rock hazard. Soluble rocks are present with a very significant possibility of localised subsidence that could be initiated or made worse by infiltration. The site investigation should consider whether the potential for or the consequences of subsidence as a result of infiltration are significant.
	Very significant soluble rock hazards are not present; however this hazard may still need to be considered. See Part 3.
Landslide hazard	
 	Very significant landslide hazard. Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail. The site investigation should consider whether the potential for or the consequences of landslide as a result of infiltration are significant.
	Very significant landslide hazards are not present; however this hazard may still need to be considered. See Part 3.

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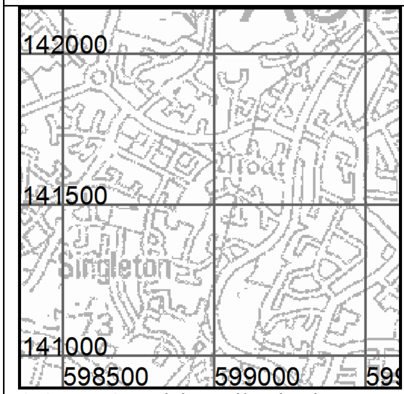
GeoReports

Shallow mining hazard

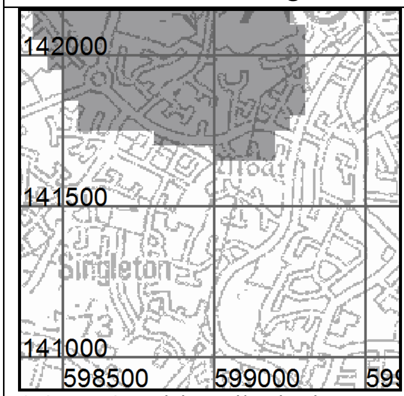


Very significant mining hazard.

Shallow mining is likely to be present with a very significant possibility of localised subsidence that could be initiated or made worse by increased infiltration. Also, infiltration may increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of subsidence and/or remobilisation of pollutants as a result of infiltration are significant.

Very significant mining hazards are not present; however this hazard may still need to be considered. See Part 3.

Persistent shallow groundwater

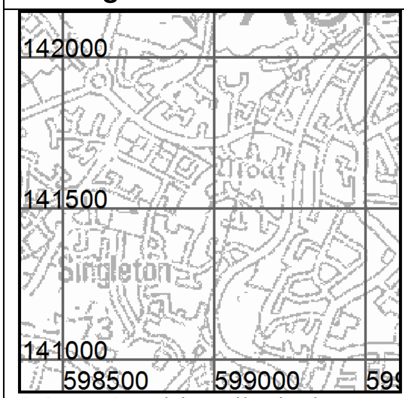


Very high likelihood of persistent or seasonally shallow groundwater.

Persistent or seasonally shallow groundwater is likely to be present. Infiltration may increase the likelihood of soakaway inundation, or groundwater emergence at the surface. The site investigation should consider whether the potential for or the consequences of groundwater level rise as a result of infiltration are significant.

See Part 2 for the likely depth to water table.

Made ground



Made ground present.

Made ground is present at the surface. Infiltration may affect ground stability or increase the possibility of remobilising pollutants. The site investigation should consider whether the potential for or consequences of ground instability and/or pollutant leaching as a result of infiltration are significant.

None recorded

Section 2. Drainage potential

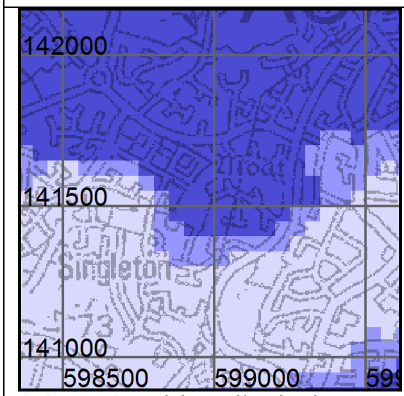
The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

- depth to water table
- permeability of the superficial deposits
- thickness of the superficial deposits
- permeability of the bedrock
- presence of floodplains

Superficial deposits are not present everywhere and therefore some areas of the *superficial deposit permeability* map may not be coloured. Where this is the case, the *bedrock permeability* map shows the likely permeability of the ground. Superficial deposits in some places are very thin and hence in these places you may wish to consider both the permeability of the superficial deposits and the permeability of the bedrock. The *superficial thickness* map will tell you whether the superficial deposits are thin (< 3 m thick) or thick (>3 m). Where they are over 3 m thick, the permeability of the bedrock may not be relevant.

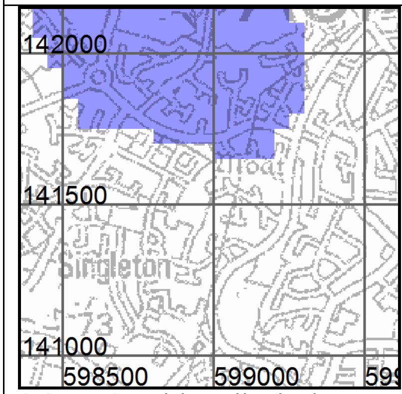
For more information read 'Explanation of terms' at the end of this report.

Depth to groundwater table



(lightest shade)	Groundwater is likely to be **more than 5 m** below the ground surface throughout the year.
(medium shade)	Groundwater is likely to be between **3 and 5 m** below the ground surface for at least part of the year.
(darkest shade)	Groundwater is likely to be **less than 3 m** below the ground surface for at least part of the year.

Superficial deposit permeability



Superficial deposits are likely to be **free-draining**.

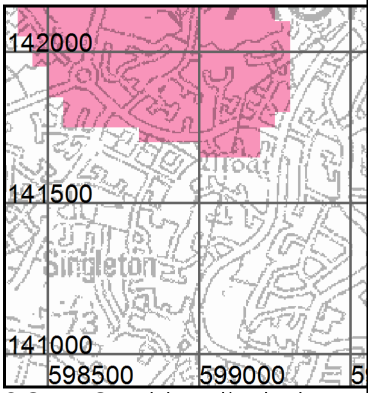
The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

Superficial deposits are likely to be **poorly draining**.

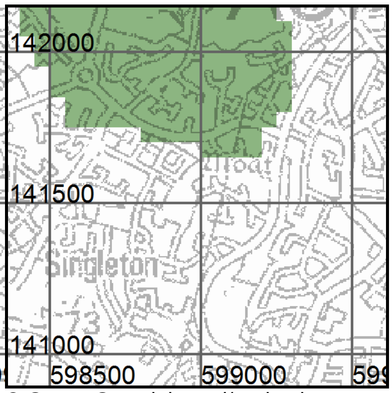
These maps show the permeability range that is summarised above.

- Very Low
- Low
- Moderate
- High
- Very High

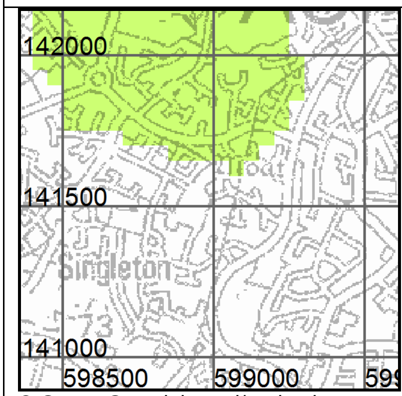
Minimum



Maximum



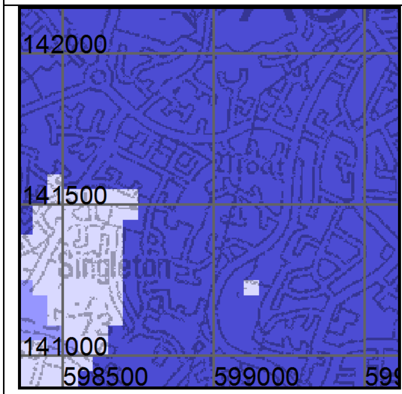
Superficial deposit thickness



The thickness of superficial deposits is **< 3 m** and hence the permeability of the ground may be dependent on both the superficial deposits (where present) and underlying bedrock (see below).

The thickness of superficial deposits is **> 3 m** and hence the permeability of the superficial deposits is likely to determine the permeability of the ground.

Bedrock permeability



Bedrock deposits are likely to be **free-draining**.

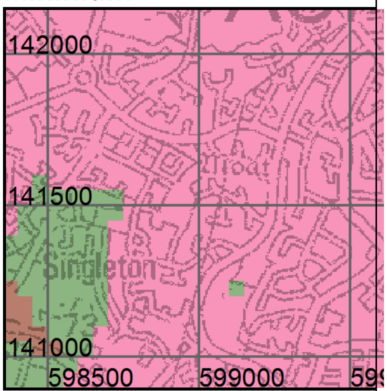
The bedrock permeability is **spatially variable**, but likely to permit moderate infiltration.

Bedrock deposits are likely to be **poorly draining**.

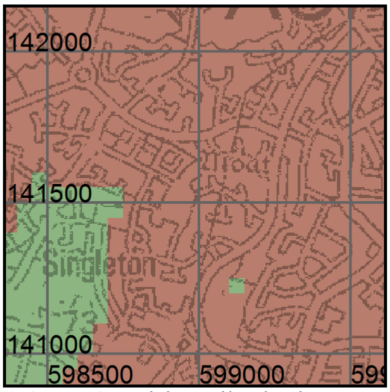
These maps show the permeability range that is summarised above.

Key
- Very Low
- Low
- Moderate
- High
- Very High

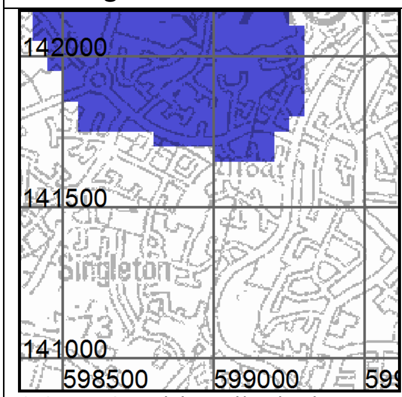
Minimum



Maximum



Geological indicators of flooding



Superficial floodplain deposits or low-lying coastal areas have been identified. Groundwater levels may rise in response to high river or tide levels, potentially causing inundation of subsurface infiltration SuDS.

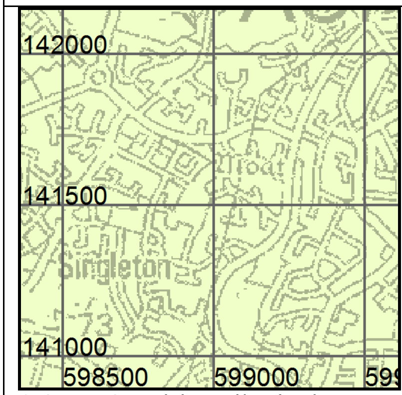
Section 3. Ground stability

The following pages contain maps that will help you assess whether infiltration may impact the stability of the ground. They consider hazards associated with:

- soluble rocks
- landslides
- shallow mining
- running sands
- swelling clays
- compressible ground, and
- collapsible ground

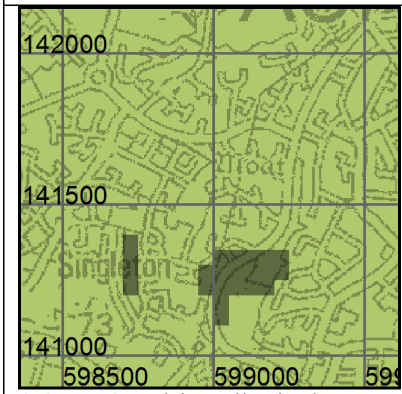
In the following maps, geohazards that are identified in green are unlikely to prevent infiltration SuDS from being installed, but they should be considered during design. For more information read ‘Explanation of terms’ at the end of this report.

Soluble rocks



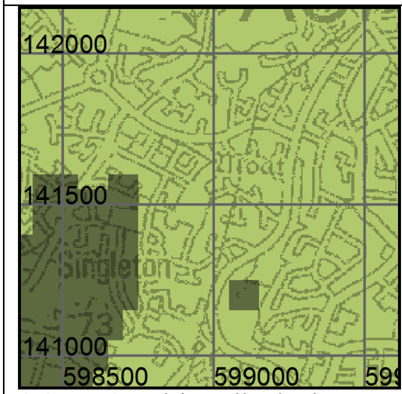
(pale yellow)	Increased infiltration is unlikely to result in subsidence.
(light green)	Increased infiltration is unlikely to cause localised subsidence, but potential impacts should be considered.
(dark green)	Increased infiltration may result in localised subsidence. The potential for or the consequences of subsidence associated with soluble rocks should be considered.
(grey)	Very significant possibility of localised subsidence that could be initiated or made worse by infiltration.

Landslides



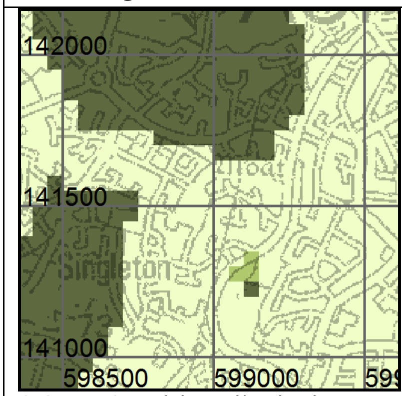
- Increased infiltration is unlikely to lead to slope instability.
- Slope instability problems may be present or anticipated, but increased infiltration is unlikely to cause instability
- Slope instability problems are probably present or have occurred in the past, and increased infiltration may result in slope instability.
- Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail.

Shallow mining



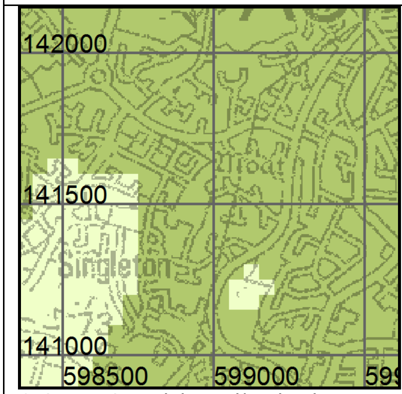
- Increased infiltration is unlikely to lead to subsidence.
- Shallow mining is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Shallow mining could be present with a significant possibility that localised subsidence could be initiated or made worse by increased infiltration.
- Shallow mining is likely to be present, with a very significant possibility that localised subsidence may be initiated or made worse by increased infiltration.

Running sand



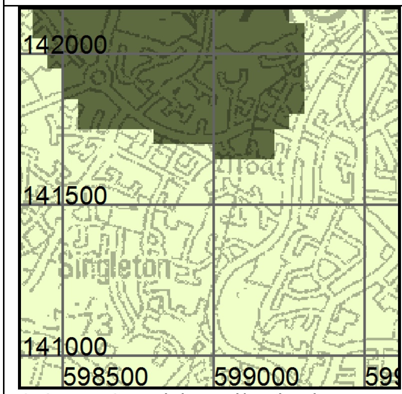
- Increased infiltration is unlikely to cause ground collapse associated with running sands.
- Running sand is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Significant possibility for running sand problems. Increased infiltration may result in a geohazard.

Swelling clays



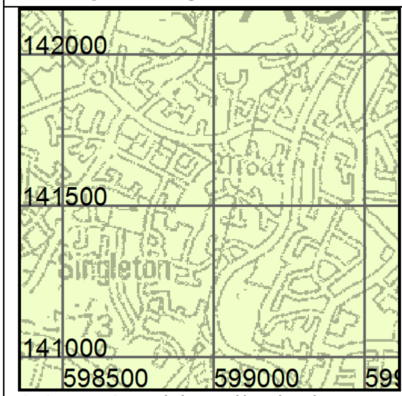
(pale yellow)	Increased infiltration is unlikely to cause shrink-swell ground movement.
(light green)	Ground is susceptible to shrink-swell ground movement. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
(dark green)	Ground is susceptible to shrink-swell ground movement. Increased infiltration may result in a geohazard.

Compressible ground



(pale yellow)	Increased infiltration is unlikely to lead to ground compression.
(dark green)	Compressibility and uneven settlement hazards are probably present. Increased infiltration may result in a geohazard.

Collapsible ground



(pale yellow)	Increased infiltration is unlikely to result in subsidence.
(light green)	Deposits with potential to collapse when loaded and saturated are possibly present in places. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
(dark green)	Deposits with potential to collapse when loaded and saturated are probably present in places. Increased infiltration may result in a geohazard.

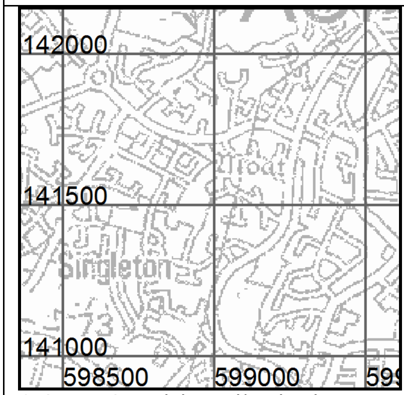
Section 4. Groundwater quality protection

The following pages contain maps showing some of the information required to ensure the protection of groundwater quality. Data presented includes:

- groundwater source protection zones (Environment Agency data)
- predominant flow mechanism
- made ground

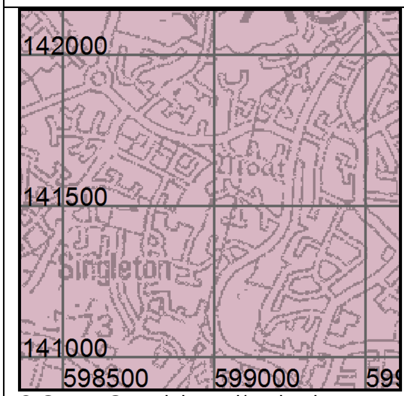
For more information read 'Explanation of terms' at the end of this report.

Groundwater source protection zones

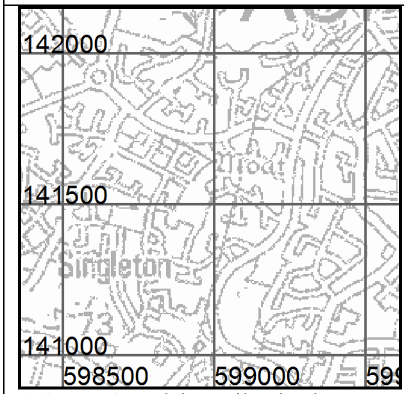


(white)	Groundwater is not within a source protection zone.
(brown)	Source protection zone IV
(blue)	Source protection zone III
(green)	Source protection zone II
(red)	Source protection zone I.

Predominant flow mechanism



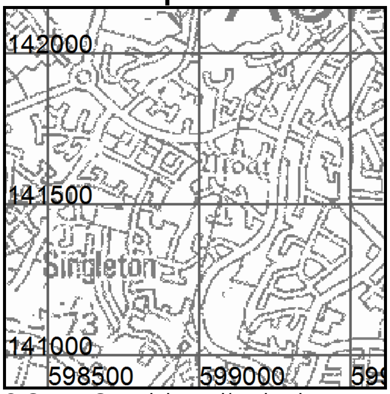
(light pink)	Water is likely to percolate through the unsaturated zone to the groundwater through either the pore space in granular media or through porespace and fractures; these processes have some potential for contaminant removal and breakdown.
(mauve)	Water is likely to percolate through the unsaturated zone to the groundwater through fractures, a process which has little potential for contaminant removal and breakdown.

Made ground	
 © Crown Copyright and/or database right 2017. All rights reserved. **Licence number 100021290 EUL**	Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

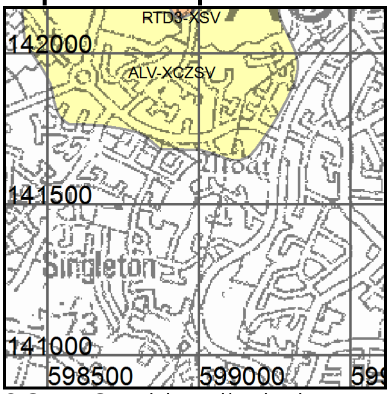
Section 5. Geological Maps

The following maps show the artificial, superficial and bedrock geology within the area of interest.

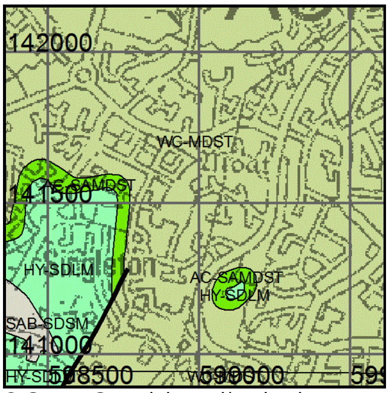
Artificial deposits



Superficial deposits



Bedrock



Fault

Coal, ironstone or mineral vein

Note: Faults and Coals, ironstone & mineral veins are shown for illustration and to aid interpretation of the map. Not all such features are shown and their absence on the map face does not necessarily mean that none are present

Key to Artificial deposits:
No deposits recorded by BGS in the search area

Key to Superficial deposits:

Map colour	Computer Code	Rock name	Rock type
	ALV-XCZSV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
	RTD3-XSV	RIVER TERRACE DEPOSITS, 3	SAND AND GRAVEL

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	AC-SAMDST	ATHERFIELD CLAY FORMATION	MUDSTONE, SANDY
	HY-SDLM	HYTHE FORMATION	SANDSTONE AND [SUBEQUAL/SUBORDINATE] LIMESTONE, INTERBEDDED
	SAB-SDSM	SANDGATE FORMATION	SANDSTONE, SILTSTONE AND MUDSTONE
	WC-MDST	WEALD CLAY FORMATION	MUDSTONE

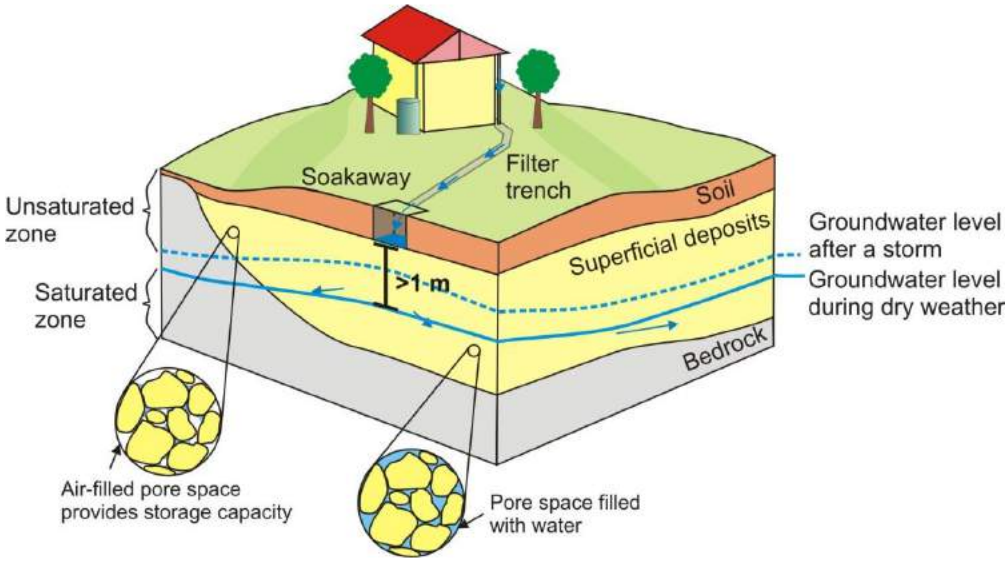
Limitations of this report:

- This report is concerned with the potential for infiltration-to-the-ground to be used as a SuDS technique at the site described. It only considers the subsurface beneath the search area and does NOT consider potential surface or subsurface impacts outside of that area.
- This report is NOT an alternative for an on-site investigation or soakaway test, which might reach a different conclusion.
- This report must NOT be used to justify disposal of foul waste or grey water.
- This report is based on and limited to an interpretation of the records held by the British Geological Survey (BGS) at the time the search is performed. The datasets used (with the exception of that showing depth to water table) are based on 1:50 000 digital geological maps and not site-specific data.
- Other more specific and detailed ground instability information for the site may be held by BGS, and an assessment of this could result in a modified assessment.
- To interpret the maps correctly, the report must be viewed and printed in colour.
- The search does NOT consider the suitability of sites with regard to:
    - previous land use,
    - potential for, or presence of contaminated land
    - presence of perched water tables
    - shallow mining hazards relating to coal mining. Searches of coal mining should be carried out via The Coal Authority Mine Reports Service: www.coalminingreports.co.uk.
    - made ground, where not recorded
    - proximity to landfill sites (searches for landfill sites or contaminated land should be carried out through consultation with local authorities/Environment Agency)
    - zones around private water supply boreholes that are susceptible to groundwater contamination.
- This report is supplied in accordance with the GeoReports Terms & Conditions available separately, and the copyright restrictions described at the end of this report

Explanation of terms

Depth to groundwater

In the shallow subsurface, the ground is commonly unsaturated with respect to water. Air fills the spaces within the soil and the underlying superficial deposits and bedrock. At some depth below the ground surface, there is a level below which these spaces are full of water. This level is known as the groundwater level, and the water below it is termed the groundwater. When water is infiltrated, the groundwater level may rise temporarily. To ensure that there is space in the unsaturated zone to accommodate this, there should be a minimum thickness of 1 m between the base of the infiltration system and the water table. An estimate of the *depth to groundwater* is therefore useful in determining whether the ground is suitable for infiltration.



Groundwater flooding

Groundwater flooding occurs when a rise in groundwater level results in very shallow groundwater or the emergence of groundwater at the surface. If infiltration systems are installed in areas that are susceptible to groundwater flooding, it is possible that the system could become inundated. The susceptibility map seeks to identify areas where the geological conditions and water tables indicate that groundwater level rise could occur under certain circumstances. A high susceptibility to groundwater flooding classification does not mean that groundwater flooding has ever occurred in the past, or will do so in the future as the susceptibility maps do not contain information on how often flooding may occur. The susceptibility maps are designed for planning; identifying areas where groundwater flooding might be an issue that needs to be taken into account.

Geological indicators of flooding

In floodplain deposits, groundwater level can be influenced by the water level in the adjacent river. Groundwater level may increase during periods of fluvial flood and therefore this should be taken into account when designing infiltration systems on such deposits. The *geological indicators of flooding* dataset shows where there is geological evidence (floodplain deposits) that flooding has occurred in the past.

For further information on flood-risk, the likely frequency of its recurrence in relation to any proposed development of the site, and the status of any flood prevention measures in place, you are advised to contact the local office of the Environment Agency (England and Wales) at www.environment-agency.gov.uk/ or the Scottish Environment Protection Agency (Scotland) at www.sepa.org.uk.

Artificial ground

Artificial ground comprises deposits and excavations that have been created or modified by human activity. It includes ground that is worked (quarries and road cuttings), infilled (back-filled quarries), landscaped (surface re-shaping), disturbed (near surface mineral workings) or classified as made ground (embankments and spoil heaps). The composition and properties of artificial ground are often unknown. In particular, the permeability and chemical composition of the artificial ground should be determined to ensure that the ground will drain and that any contaminants present will not be remobilised.

Superficial permeability

Superficial deposits are those geological deposits that were formed during the most recent period of geological time (as old as 2.6 million years before present). They generally comprise relatively thin deposits of gravel, sand, silt and clay and are present beneath the pedological soil in patches or larger spreads over much of Britain. The ease with which water can percolate through these deposits is controlled by their permeability and varies widely depending on their composition. Those deposits comprising clays and silts are less permeable and thus infiltration is likely to be slow, such that water may pool on the surface. In comparison, deposits comprising sands and gravels are more permeable allowing water to percolate freely.

Bedrock permeability

Bedrock forms the main mass of rock forming the Earth. It is present everywhere, commonly beneath superficial deposits. Where the superficial deposits are thin or absent, the ease with which water will percolate into the ground depends on the permeability of the bedrock.

Natural ground instability

Natural ground instability refers to the propensity for upward, lateral or downward movement of the ground that can be caused by a number of natural geological hazards (e.g. ground dissolution/compressible ground). Some movements associated with particular hazards may be gradual and of millimetre or centimetre scale, whilst others may be sudden and of metre or tens of metres scale. Significant natural ground instability has the potential to cause damage to buildings and structures, especially when the drainage characteristics of a site are altered. It should be noted, however, that many buildings, particularly more modern ones, are built to such a standard that they can remain unaffected in areas of significant ground movement.

Shrink-swell

A shrinking and swelling clay changes volume significantly according to how much water it contains. All clay deposits change volume as their water content varies, typically swelling in winter and shrinking in summer, but some do so to a greater extent than others. Contributory circumstances could include drought, leaking service pipes, tree roots drying-out the ground or changes to local drainage patterns, such as the creation of soakaways. Shrinkage may remove support from the foundations of buildings and structures, whereas clay expansion may lead to uplift (heave) or lateral stress on part or all of a structure; any such movements may cause cracking and distortion.

Landslides (slope stability)

A landslide is a relatively rapid outward and downward movement of a mass of ground on a slope, due to the force of gravity. A slope is under stress from gravity but will not move if its strength is greater than this stress. If the balance is altered so that the stress exceeds the strength, then movement will occur. The stability of a slope can be reduced by removing ground at the base of the slope, by placing material on the slope, especially at the top, or by increasing the water content of the materials forming the slope. Increase in subsurface water content beneath a soakaway could increase susceptibility to landslide hazards. The assessment of landslide hazard refers to the stability of the present land surface. It does not encompass a consideration of the stability of excavations.

Soluble rocks (dissolution)

Some rocks are soluble in water and can be progressively removed by the flow of water through the ground. This process tends to create cavities, potentially leading to the collapse of overlying materials and possibly subsidence at the surface. The release of water into the subsurface from infiltration systems may increase the dissolution of rock or destabilise material above or within a cavity. Dissolution cavities may create a pathway for rapid transport of contaminated water to an aquifer or water course.

Compressible ground
Many ground materials contain water-filled pores (the spaces between solid particles). Ground is compressible if a building (or other load) can cause the water in the pore space to be squeezed out, causing the ground to decrease in thickness. If ground is extremely compressible the building may sink. If the ground is not uniformly compressible, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The compressibility of the ground may alter as a result of changes in subsurface water content caused by the release of water from soakaways.

Collapsible deposits
Collapsible ground comprises certain fine-grained materials with large pore spaces (the spaces between solid particles). It can collapse when it becomes saturated by water and/or a building (or other structure) places too great a load on it. If the material below a building collapses it may cause the building to sink. If the collapsible ground is variable in thickness or distribution, different parts of the building may sink by different amounts, possibly causing tilting, cracking or distortion. The subsurface underlying a soakaway will experience an increase in water content that may affect the stability of the ground. This hazard is most likely to be encountered only in parts of southern England.

Running sand
Running sand conditions occur when loosely-packed sand, saturated with water, flows into an excavation, borehole or other type of void. The pressure of the water filling the spaces between the sand grains reduces the contact between the grains and they are carried along by the flow. This can lead to subsidence of the surrounding ground. Running sand is potentially hazardous during the drainage system installation. During installation, excavation of the ground may create a space into which sand can flow, potentially causing subsidence of surrounding ground.

Shallow mining hazards (non coal)
Current or past underground mining for coal or for other commodities can give rise to cavities at shallow or intermediate depths, which may cause fracturing, general settlement, or the formation of crown-holes in the ground above. Spoil from mineral workings may also present a pollution hazard. The release of water into the subsurface from soakaways may destabilise material above or within a cavity. Cavities arising as a consequence of mining may also create a pathway for rapid transport of contaminated water to an aquifer or watercourse. The mining hazards map is derived from the geological map and considers the potential for subsidence associated with mining on the basis of geology type. Therefore if mining is known to occur within a certain rock, the map will highlight the potential for a hazard within the area covered by that geology.

For more information regarding underground and opencast **coal mining**, the location of mine entries (shafts and adits) and matters relating to subsidence or other ground movement induced by **coal mining** please contact the Coal Authority, Mining Reports, 200 Lichfield Lane, Mansfield, Nottinghamshire, NG18 4RG; telephone 0845 762 6848 or at www.coal.gov.uk**.** For more information regarding other types of mining (i.e. non-coal), please contact the British Geological Survey.

Groundwater source protection zones
In England and Wales, the Environment Agency has defined areas around wells, boreholes and springs that are used for the abstraction of public drinking water as source protection zones. In conjunction with Groundwater Protection Policy the zones are used to restrict activities that may impact groundwater quality, thereby preventing pollution of underlying aquifers, such that drinking water quality is upheld. The Environment Agency can provide advice on the location and implications of source protection zones in your area (www.environment-agency.gov.uk/)

Contact Details

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Environmental Science Centre
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Tel: 0115 9363143
Fax: 0115 9363276
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- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
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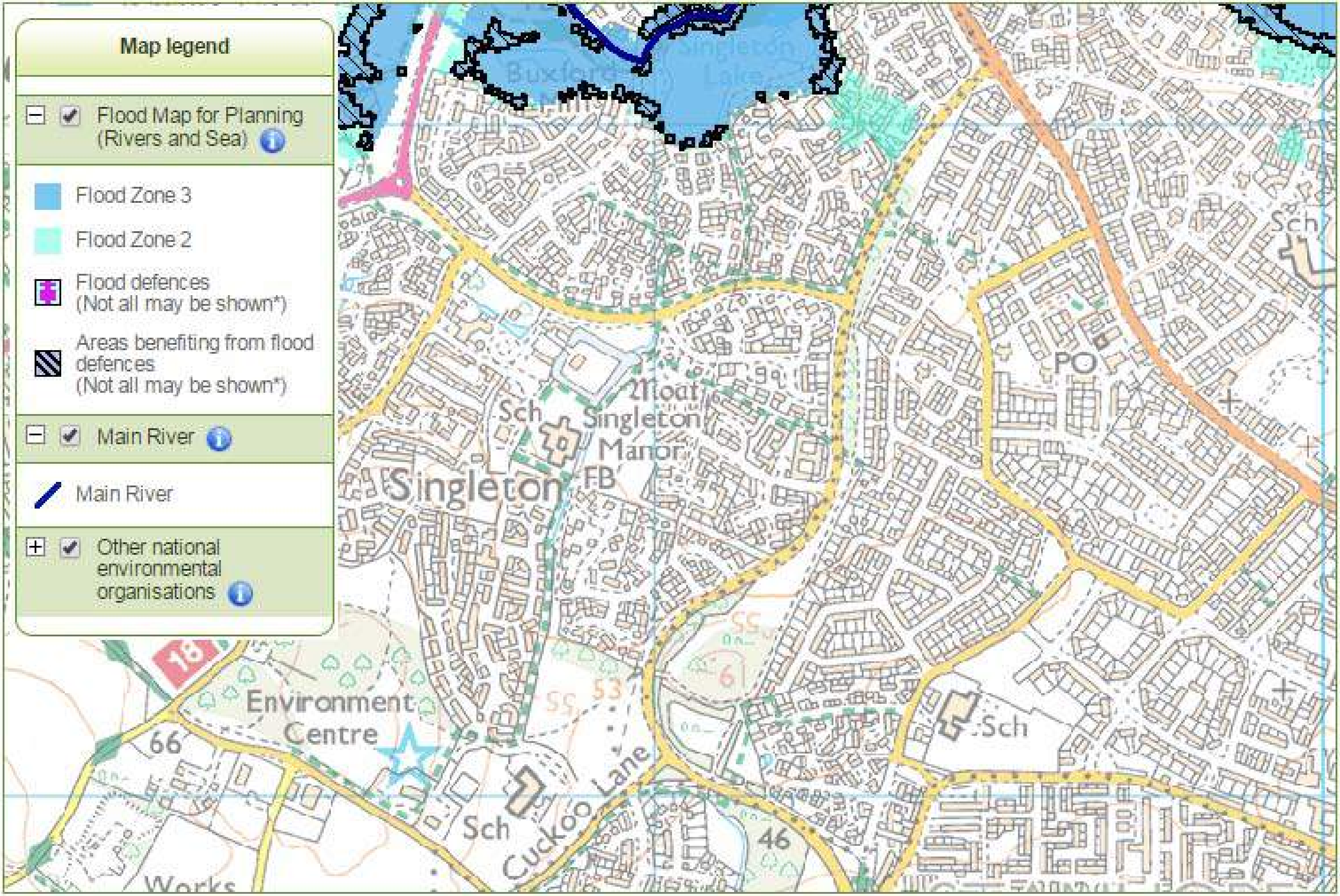
- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

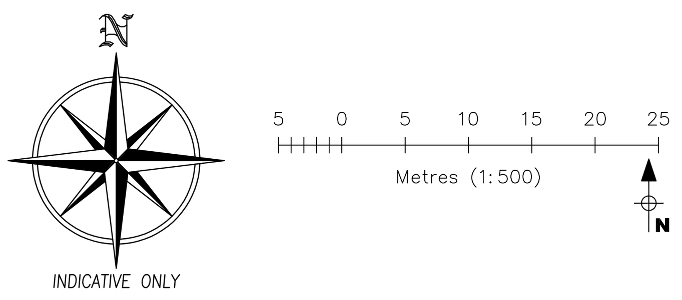
Report issued by
BGS Enquiry Service

APPENDIX 6.0 – ENVIRONMENT AGENCY FLOOD RISK MAP

TN23 5EF at scale 1:10,000

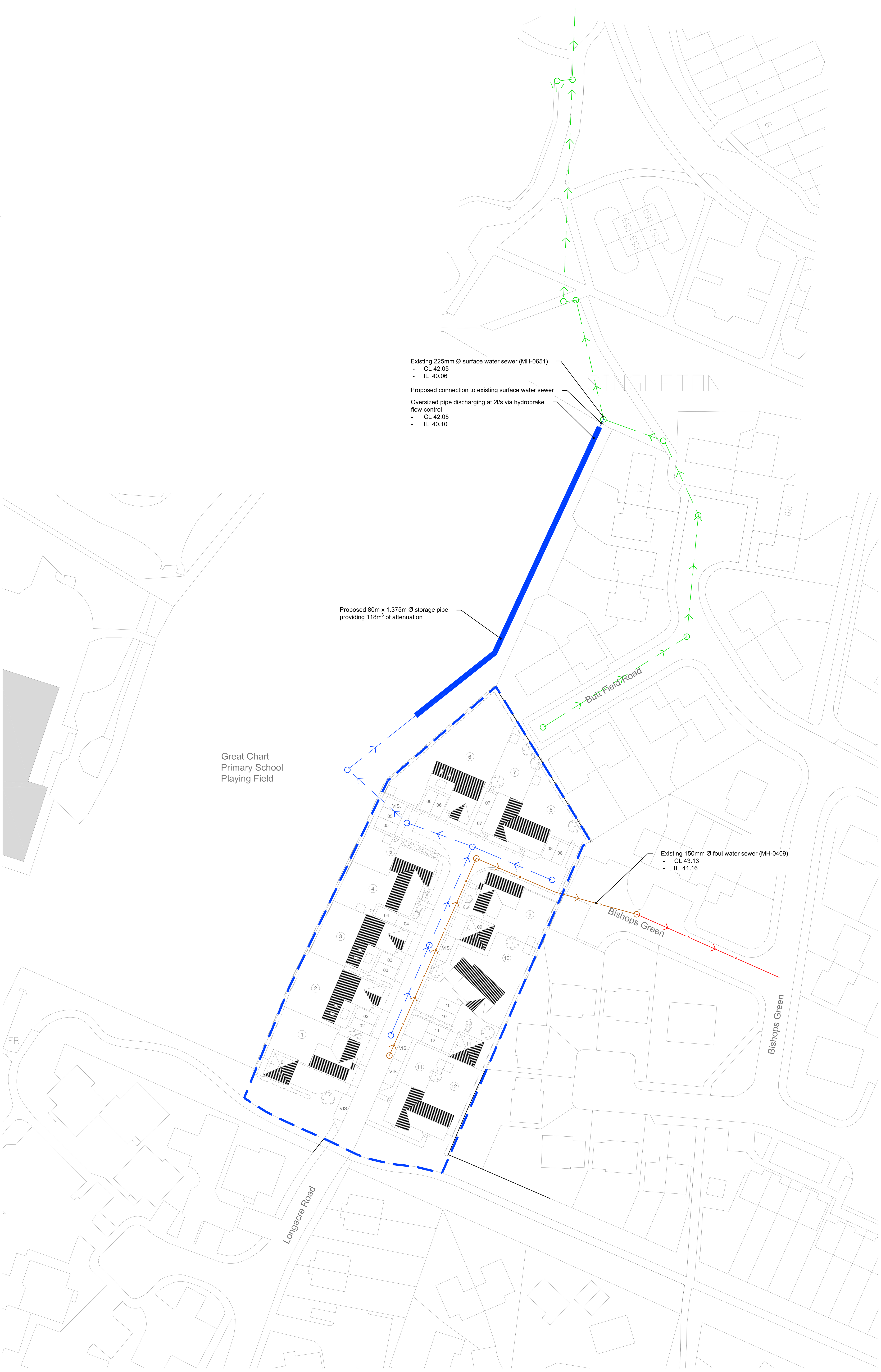


APPENDIX 7.0 – PROPOSED DRAINAGE STRATEGY AND CALCULATIONS



Key

- Existing surface water sewer
- Existing foul water sewer
- Proposed foul water sewer
- Proposed surface water sewer
- Proposed storage pipe
- Catchment boundary



REV	AMENDMENTS	DATE	CHK
P1	First issue	26.04.17	CS

Client

KENT COUNTY COUNCIL

Project

LAND ADJACENT TO GREAT CHART PRIMARY SCHOOL

Title

PROPOSED DRAINAGE SRATEGY

Drwg	Rev	Scale	Date
12268-D02	P1	1:500	26.04.17

dha transport
integrated transport & travel planning

Eclipse House, Eclipse Park, Sittingbourne Road
Maidstone, Kent. ME14 3EN
t: 01622 776226 f: 01622 776227
e: info@dhaplanning.co.uk w: www.dhatransport.co.uk

CAD Reference: CAD REF A1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	40.860	0.760	1.6	55.9	O K
30 min Summer	41.002	0.902	1.6	72.4	O K
60 min Summer	41.141	1.041	1.8	88.4	O K
120 min Summer	41.269	1.169	1.9	102.0	O K
180 min Summer	41.325	1.225	1.9	107.4	O K
240 min Summer	41.346	1.246	1.9	109.4	O K
360 min Summer	41.344	1.244	1.9	109.3	O K
480 min Summer	41.317	1.217	1.9	106.7	O K
600 min Summer	41.288	1.188	1.9	103.9	O K
720 min Summer	41.261	1.161	1.8	101.2	O K
960 min Summer	41.217	1.117	1.8	96.6	O K
1440 min Summer	41.146	1.046	1.8	88.9	O K
2160 min Summer	41.053	0.953	1.7	78.3	O K
2880 min Summer	40.969	0.869	1.6	68.6	O K
4320 min Summer	40.821	0.721	1.6	51.3	O K
5760 min Summer	40.681	0.581	1.6	35.5	O K
7200 min Summer	40.518	0.418	1.6	18.9	O K
8640 min Summer	40.409	0.309	1.6	9.7	O K
10080 min Summer	40.325	0.225	1.6	4.6	O K
15 min Winter	40.919	0.819	1.6	62.8	O K
30 min Winter	41.081	0.981	1.7	81.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	57.5	19
30 min Summer	90.705	0.0	75.5	34
60 min Summer	56.713	0.0	94.4	64
120 min Summer	34.246	0.0	114.0	122
180 min Summer	25.149	0.0	125.6	182
240 min Summer	20.078	0.0	133.7	242
360 min Summer	14.585	0.0	145.7	360
480 min Summer	11.622	0.0	154.8	450
600 min Summer	9.738	0.0	162.1	506
720 min Summer	8.424	0.0	168.3	570
960 min Summer	6.697	0.0	178.4	694
1440 min Summer	4.839	0.0	193.4	968
2160 min Summer	3.490	0.0	209.2	1384
2880 min Summer	2.766	0.0	221.0	1788
4320 min Summer	1.989	0.0	238.5	2592
5760 min Summer	1.573	0.0	251.5	3400
7200 min Summer	1.311	0.0	261.9	3968
8640 min Summer	1.129	0.0	270.6	4584
10080 min Summer	0.994	0.0	278.1	5240
15 min Winter	138.153	0.0	64.4	19
30 min Winter	90.705	0.0	84.6	33

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
60 min Winter	41.247	1.147	1.8	99.8	O K
120 min Winter	41.419	1.319	2.0	115.7	O K
180 min Winter	41.520	1.420	2.0	122.6	O K
240 min Winter	41.590	1.490	2.1	125.6	O K
360 min Winter	41.642	1.542	2.1	126.9	O K
480 min Winter	41.586	1.486	2.1	125.5	O K
600 min Winter	41.518	1.418	2.0	122.5	O K
720 min Winter	41.463	1.363	2.0	119.1	O K
960 min Winter	41.388	1.288	1.9	113.2	O K
1440 min Winter	41.274	1.174	1.9	102.5	O K
2160 min Winter	41.129	1.029	1.7	87.0	O K
2880 min Winter	41.003	0.903	1.6	72.6	O K
4320 min Winter	40.782	0.682	1.6	46.9	O K
5760 min Winter	40.509	0.409	1.6	18.1	O K
7200 min Winter	40.322	0.222	1.6	4.4	O K
8640 min Winter	40.223	0.123	1.5	1.1	O K
10080 min Winter	40.184	0.084	1.3	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
60 min Winter	56.713	0.0	105.8	62
120 min Winter	34.246	0.0	127.7	120
180 min Winter	25.149	0.0	140.7	178
240 min Winter	20.078	0.0	149.8	236
360 min Winter	14.585	0.0	163.2	348
480 min Winter	11.622	0.0	173.4	458
600 min Winter	9.738	0.0	181.6	560
720 min Winter	8.424	0.0	188.5	592
960 min Winter	6.697	0.0	199.8	740
1440 min Winter	4.839	0.0	216.6	1052
2160 min Winter	3.490	0.0	234.3	1496
2880 min Winter	2.766	0.0	247.6	1932
4320 min Winter	1.989	0.0	267.1	2768
5760 min Winter	1.573	0.0	281.6	3400
7200 min Winter	1.311	0.0	293.3	3888
8640 min Winter	1.129	0.0	303.0	4408
10080 min Winter	0.994	0.0	311.5	5136

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.222

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.222

Model Details

Storage is Online Cover Level (m) 42.000

Pipe Structure

Diameter (m)	1.375	Length (m)	85.000
Slope (1:X)	300.000	Invert Level (m)	40.100

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0062-2000-1375-2000
Design Head (m)	1.375
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	62
Invert Level (m)	40.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.375	2.0
Flush-Flo™	0.272	1.6
Kick-Flo®	0.553	1.3
Mean Flow over Head Range	-	1.6

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	1.4	1.200	1.9	3.000	2.9	7.000	4.2
0.200	1.6	1.400	2.0	3.500	3.1	7.500	4.4
0.300	1.6	1.600	2.1	4.000	3.3	8.000	4.5
0.400	1.6	1.800	2.3	4.500	3.4	8.500	4.6
0.500	1.5	2.000	2.4	5.000	3.6	9.000	4.8
0.600	1.4	2.200	2.5	5.500	3.8	9.500	4.9
0.800	1.6	2.400	2.6	6.000	3.9		
1.000	1.7	2.600	2.7	6.500	4.1		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	40.789	0.689	1.6	47.7	O K
30 min Summer	40.910	0.810	1.6	61.7	O K
60 min Summer	41.024	0.924	1.7	75.0	O K
120 min Summer	41.121	1.021	1.7	86.1	O K
180 min Summer	41.157	1.057	1.8	90.1	O K
240 min Summer	41.167	1.067	1.8	91.2	O K
360 min Summer	41.156	1.056	1.8	90.0	O K
480 min Summer	41.130	1.030	1.7	87.1	O K
600 min Summer	41.106	1.006	1.7	84.4	O K
720 min Summer	41.086	0.986	1.7	82.1	O K
960 min Summer	41.050	0.950	1.7	78.0	O K
1440 min Summer	40.988	0.888	1.6	70.8	O K
2160 min Summer	40.902	0.802	1.6	60.7	O K
2880 min Summer	40.822	0.722	1.6	51.4	O K
4320 min Summer	40.667	0.567	1.6	34.0	O K
5760 min Summer	40.499	0.399	1.6	17.2	O K
7200 min Summer	40.386	0.286	1.6	8.1	O K
8640 min Summer	40.298	0.198	1.6	3.4	O K
10080 min Summer	40.239	0.139	1.5	1.5	O K
15 min Winter	40.841	0.741	1.6	53.6	O K
30 min Winter	40.977	0.877	1.6	69.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.417	0.0	49.3	19
30 min Summer	77.747	0.0	64.7	33
60 min Summer	48.611	0.0	80.9	64
120 min Summer	29.354	0.0	97.7	122
180 min Summer	21.556	0.0	107.7	182
240 min Summer	17.210	0.0	114.6	242
360 min Summer	12.501	0.0	124.9	360
480 min Summer	9.962	0.0	132.7	426
600 min Summer	8.347	0.0	139.0	486
720 min Summer	7.221	0.0	144.3	550
960 min Summer	5.740	0.0	152.9	682
1440 min Summer	4.148	0.0	165.7	954
2160 min Summer	2.992	0.0	179.3	1364
2880 min Summer	2.371	0.0	189.5	1784
4320 min Summer	1.705	0.0	204.4	2592
5760 min Summer	1.348	0.0	215.5	3176
7200 min Summer	1.123	0.0	224.4	3824
8640 min Summer	0.967	0.0	231.9	4488
10080 min Summer	0.852	0.0	238.4	5144
15 min Winter	118.417	0.0	55.2	19
30 min Winter	77.747	0.0	72.5	33

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	41.110	1.010	1.7	84.9	O K
120 min Winter	41.230	1.130	1.8	97.9	O K
180 min Winter	41.281	1.181	1.9	103.2	O K
240 min Winter	41.302	1.202	1.9	105.2	O K
360 min Winter	41.303	1.203	1.9	105.4	O K
480 min Winter	41.281	1.181	1.9	103.2	O K
600 min Winter	41.248	1.148	1.8	99.8	O K
720 min Winter	41.218	1.118	1.8	96.7	O K
960 min Winter	41.167	1.067	1.8	91.2	O K
1440 min Winter	41.075	0.975	1.7	80.9	O K
2160 min Winter	40.946	0.846	1.6	65.9	O K
2880 min Winter	40.827	0.727	1.6	52.0	O K
4320 min Winter	40.551	0.451	1.6	22.1	O K
5760 min Winter	40.336	0.236	1.6	5.1	O K
7200 min Winter	40.220	0.120	1.5	1.0	O K
8640 min Winter	40.181	0.081	1.3	0.4	O K
10080 min Winter	40.170	0.070	1.1	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	48.611	0.0	90.7	62
120 min Winter	29.354	0.0	109.5	120
180 min Winter	21.556	0.0	120.6	178
240 min Winter	17.210	0.0	128.4	236
360 min Winter	12.501	0.0	139.9	348
480 min Winter	9.962	0.0	148.6	456
600 min Winter	8.347	0.0	155.7	554
720 min Winter	7.221	0.0	161.6	576
960 min Winter	5.740	0.0	171.3	730
1440 min Winter	4.148	0.0	185.6	1038
2160 min Winter	2.992	0.0	200.8	1476
2880 min Winter	2.371	0.0	212.2	1904
4320 min Winter	1.705	0.0	228.9	2636
5760 min Winter	1.348	0.0	241.4	3120
7200 min Winter	1.123	0.0	251.4	3672
8640 min Winter	0.967	0.0	259.7	4304
10080 min Winter	0.852	0.0	267.0	4984

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.222

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.222

Model Details

Storage is Online Cover Level (m) 42.000

Pipe Structure

Diameter (m)	1.375	Length (m)	85.000
Slope (1:X)	300.000	Invert Level (m)	40.100

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0062-2000-1375-2000
Design Head (m)	1.375
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	62
Invert Level (m)	40.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.375	2.0
Flush-Flo™	0.272	1.6
Kick-Flo®	0.553	1.3
Mean Flow over Head Range	-	1.6

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	1.4	1.200	1.9	3.000	2.9	7.000	4.2
0.200	1.6	1.400	2.0	3.500	3.1	7.500	4.4
0.300	1.6	1.600	2.1	4.000	3.3	8.000	4.5
0.400	1.6	1.800	2.3	4.500	3.4	8.500	4.6
0.500	1.5	2.000	2.4	5.000	3.6	9.000	4.8
0.600	1.4	2.200	2.5	5.500	3.8	9.500	4.9
0.800	1.6	2.400	2.6	6.000	3.9		
1.000	1.7	2.600	2.7	6.500	4.1		