1 PREAMBLE

This report has been prepared by Lanes Group on the instructions of, and for the sole use and benefit of, the Client.

Lanes Group shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared and provided. If the Client wishes to pass copies of the report to other parties for information, the whole of the report should be copied. No professional liability or warranty is extended to other parties by Lanes Group as a result of permitting the report to be copied or by any other cause without the express written agreement of Lanes Group.

2 TERMS OF REFERENCE

Lanes Group has been engaged by the Client for The Bourne End Junior Sports Club to undertake an appraisal of the sustainable drainage (SuDS) requirements for the construction of a new swimming pool and associated building.

3 INTRODUCTION

The aim of this appraisal is to identify the SuDS requirements for the design of the drainage system, as set out in the county of Buckinghamshire's (BCC) SuDS guidance for minor developments. This appraisal includes a review of the net change in permeable surfaces following the proposed development using the drawings produced by the Architect (Appendix A).

4 SITE LOCATION

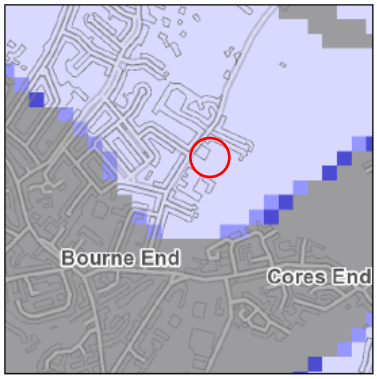
The site is located within the county of Buckinghamshire on the eastern side of New Road in the town of Bourne End. Bourne End Academy is to the immediate south with East Ridge to the north. To the east the site is bounded by a football pitch.

5 INFILTRATION FEASIBILITY

An infiltration SuDS GeoReport has been obtained from the BGS (Appendix B), the underlying geology of the site has been determined to be Lewes Nodular Chalk Formation (Bedrock) with superficial deposits of Taplow Gravel Member.

According to the Part 1 of the GeoReport, the site is within an area that is *"Highly compatible for Infiltration SuDS"*.

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



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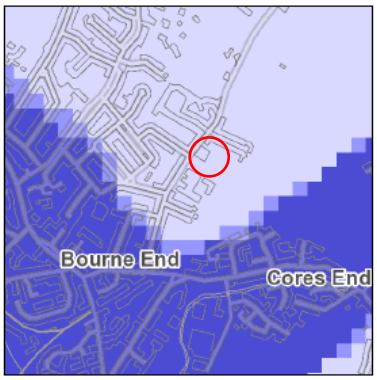
	Highly compatible for infiltration SuDS. The subsurface is likely to be suitable for free-draining infiltration SuDS.
	Probably compatible for infiltration SuDS. The subsurface is probably suitable although the design may be influenced by the ground conditions.
	Opportunities for bespoke infiltration 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.

Section 2 of the report indicates that the water table *" is likely to be more than 5m below ground surface throughout the year"*.

Depth to groundwater table



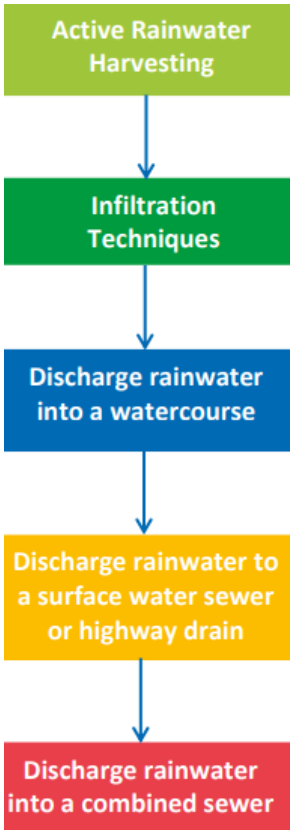
Groundwater is likely to be **more than 5 m** below the ground surface throughout the year.

Groundwater is likely to be between **3 and 5 m** below the ground surface for at least part of the year.

Groundwater is likely to be **less than 3 m** below the ground surface for at least part of the year.

6 LOCAL POLICY

Buckinghamshire's design guidance requires all new developments to follow their drainage hierarchy as shown in Figure 4 (below) of their Minor Development SuDS guidance.



7 DRAINAGE HIERARCY

The following drainage hierarchy has been followed when assessing SuDS for this site…

	Technique	Used	Comments
1	Store water for later use	**N**	Rainwater harvesting is not appropriate for this type of development.
2	Use infiltration techniques, such as porous paving surfaces in non-clay areas	**Y**	The underlying geology is suitable for the use of infiltration systems.
3	Attenuate rainwater in ponds or open water features for gradual release	**N**	Due to site constraints, open water features are not a viable option.
4	Attenuate rainwater by storing in tanks or sealed water features for gradual release	**N**	Refer to No 2.
5	Discharge rainwater direct to a watercourse	**N**	There is no suitable watercourse within the vicinity of the site.

6	Discharge rainwater to a surface water sewer/drain	**N**	No surface water sewers in the vicinity of the site.
7	Discharge rainwater to the combined sewer	**N**	Refer to No 2.

Table 1

8 EXISTING RUN-OFF

The greenfield run-off rates (based on a total site area of 7,480m^2) have been calculated using the ICP SuDS method and are shown in the table below.

Return Period (Years)	**Greenfield run-off (l/s)**
Q_{bar}	1.3
1	1.1
30	3.0
100	4.2

Table 2

Calculation have been undertaken to determine the existing surface water run-off from the site. These have been undertaken using the Modified Rational Method utilising the FEH13 rainfall model to determine the rainfall intensities for a 15 minute duration based on an existing impermeable area of 615m^2.

Return Period (years)	**Rainfall intensity (mm/hr)**	**Run-off (l/s)**
2	33.276	6.21
30	81.878	15.29
100	105.472	19.69

Table 3 (Note the FEH13 model does not allow return periods less than 2 years)

9 PROPOSED DISPOSAL OF SURFACE WATER

Asset plans from Thames Water have been obtained and indicated that a 150mm diameter foul water sewer runs north to south below New Road at a depth of approximately 1.6m (Asset plan attached in Appendix C). The closest surface water sewer is located within the curtilage of "Hillcrest" (Isis Way) some 100m from the site.

Borehole logs (undertaken in February 2021) indicate that "Orange brown sandy GRAVEL" is situated at 1.5m below ground level and extends beyond the extent of the borehole which terminated at 4.8m (WS1). In the absence of specific site infiltration testing, an infiltration rate of 3x10^{-4}m/s will be used in any calculations (refer to table 25.1 of the SuDS Manual). This infiltration test will be confirmed by tests undertaken in accordance with BRE 365. The borehole logs are included in Appendix D.

Based on the information contained in the borehole logs and the Infiltration SuDS GeoReport, it is intended to dispose of surface water run-off via infiltration systems.

The new pool hall will feature a green roof which will give several benefits…

- will provide amenity and biodiversity
- manages the first 5mm of rainfall
- improvements to the thermal performance of the building
- aid in the improvement of air quality.

The surrounding car park will be constructed using a permeable surfacing with a stone blanket below. However, the borehole logs indicate that the upper layers of ground (MADE GROUND and SAND) are less likely to be suitable for infiltration. Based on this information it is proposed to utilise a Type B (partial) infiltration system in conjunction with soakaways located within the car park area at a depth to penetrate the sandy GRAVEL layers.

Hydraulic calculations have been undertaken and are presented in Appendix E. In line with the guidance, infiltration from the base the base of the soakaways has been ignored.

A plan showing the proposed SuDS strategy is included in Appendix F.

10 MAINTENANCE STRATEGY

Maintenance of the SuDS drainage elements will be undertaken by an approved company in accordance with the SuDS Manual (CIRIA C753) extracts below…

GREEN ROOFS

Maintenance Schedule	Required Action	Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms

	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leave and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled.	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

SILT TRAPS AND CATCHPITS

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Inspection of silt traps and catch pits to assess silt accumulation	Monthly (and after large storms)
	Removal of accumulated silt from silt trap	Annually, or as required

	and catch pit sumps	
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

PERMEABLE PAVING

Maintenance Schedule	Required Action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed.	As required.
	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
Remedial actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
	Initial inspection.	Monthly for 3 months after installation

Monitoring	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	3-monthly, 48 h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

GeoReports

British Geological Survey

Peter White
tIDC Ltd
48 West End
Westbury
BA13 3JG

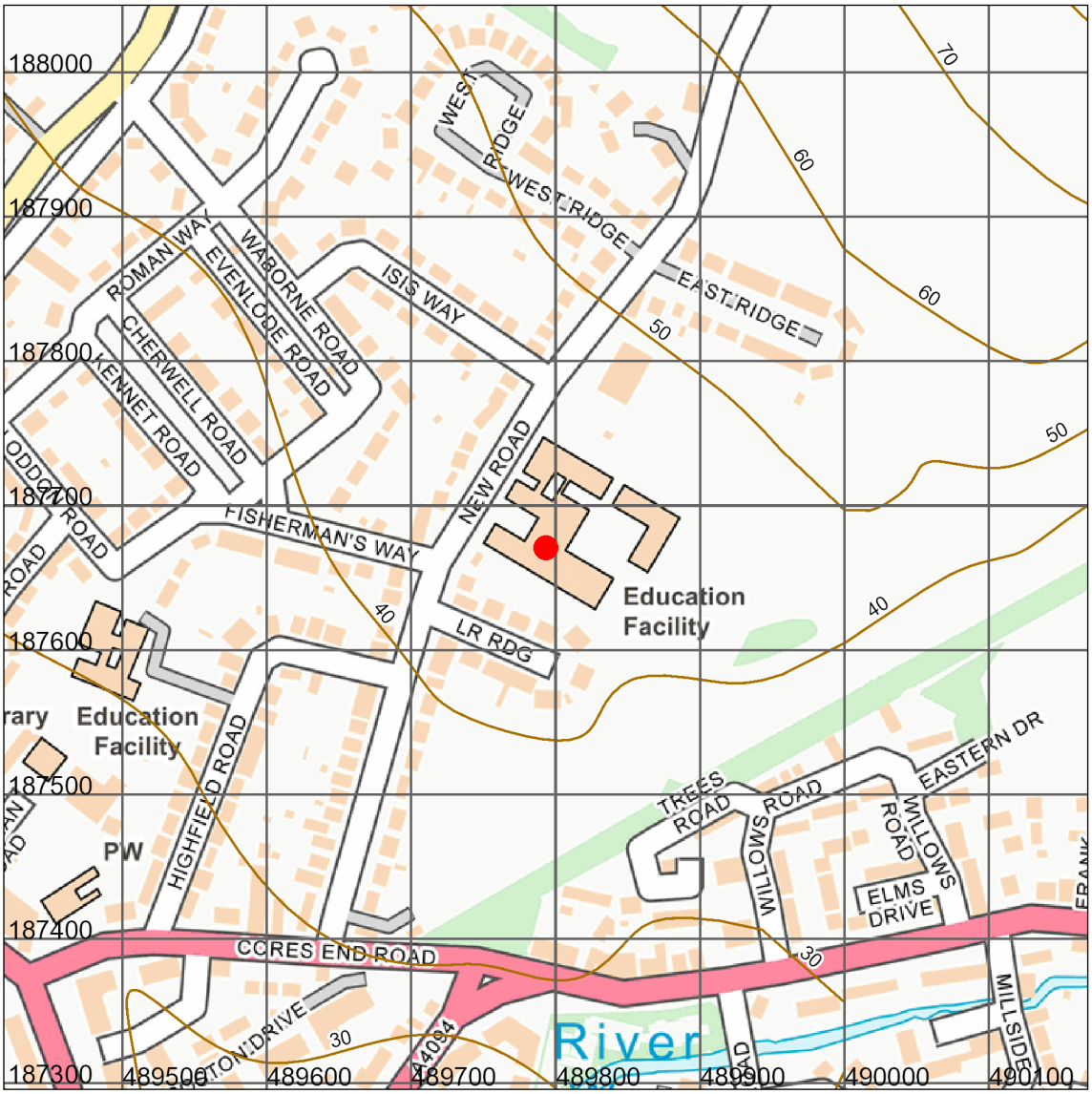
Infiltration SuDS GeoReport:

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: ***BGS_318201/23422***

Client reference:

Search location



Contains OS data © Crown Copyright and database right 2021. OS OpenMap Local: Scale: 1:5 000 (1cm = 50 m)
Search location indicated in red

Site Address:
BOURNE END ACADEMY
NEW ROAD
BOURNE END
SL8 5BW

Point centred at: grid reference obtained from Ordnance Survey AddressPoint

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.

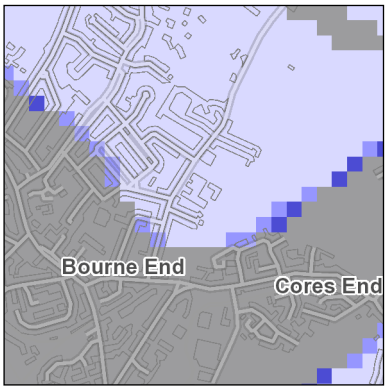
This report considers the suitability of the subsurface for the installation of infiltration SuDS, such as soakaways, infiltration basins or permeable pavements. It provides subsurface data to indicate whether, and which type of infiltration system may be appropriate. It does not state that infiltration 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.

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

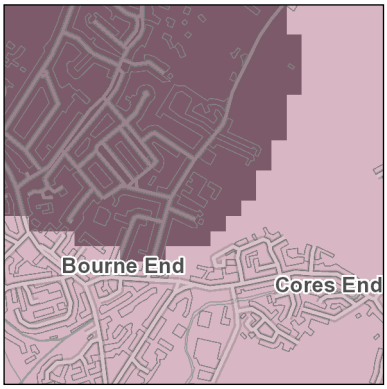


- Highly compatible for infiltration SuDS. The subsurface is likely to be suitable for free-draining infiltration SuDS.
- Probably compatible for infiltration SuDS. The subsurface is probably suitable although the design may be influenced by the ground conditions.
- Opportunities for bespoke infiltration 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.

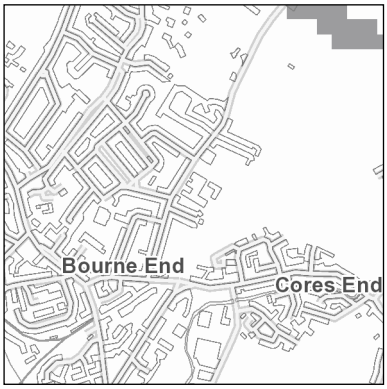
Section 1. Very significant constraints

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



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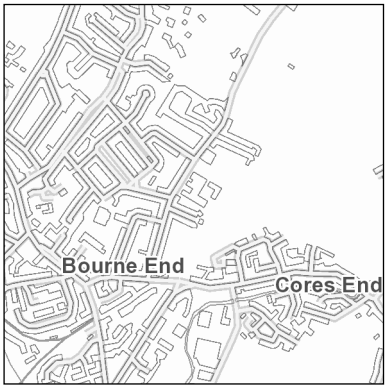
■ Very significant soluble rock hazard.

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



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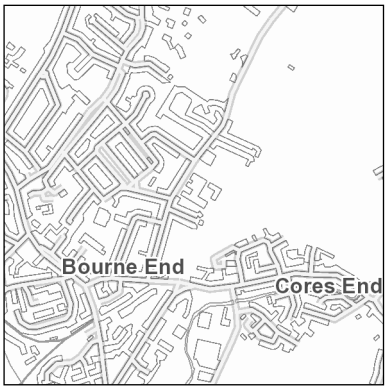
■ Very significant landslide hazard.

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.

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.

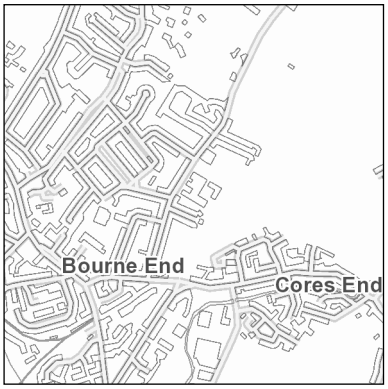
Persistent shallow groundwater

■ 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

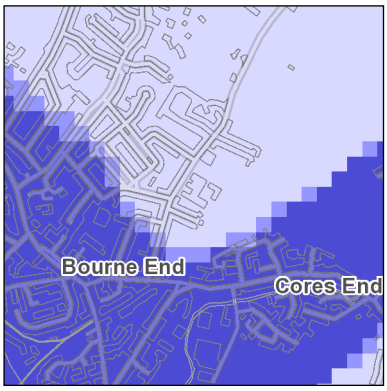
The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

- 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

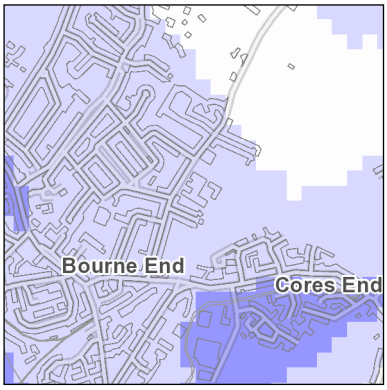


Groundwater is likely to be **more than 5 m** below the ground surface throughout the year.

Groundwater is likely to be between **3 and 5 m** below the ground surface for at least part of the year.

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**.

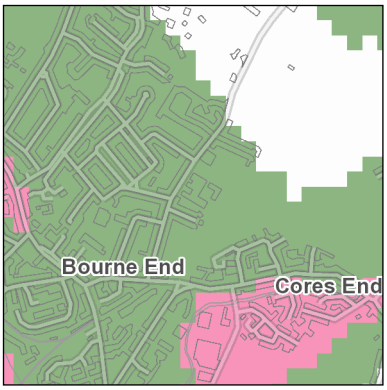
The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

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

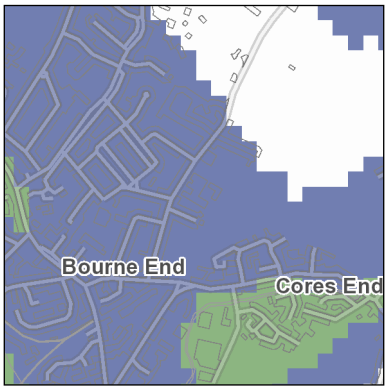
These maps show the permeability range that is summarised above.

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

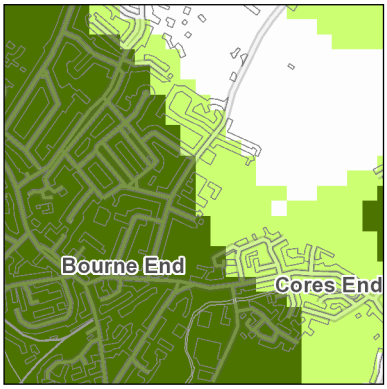
Minimum



Maximum



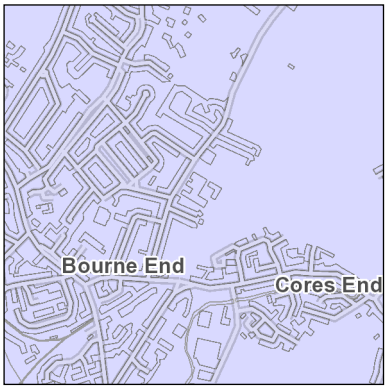
Superficial deposit thickness



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.

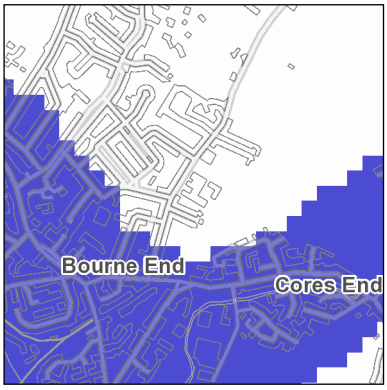
Key

- 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.

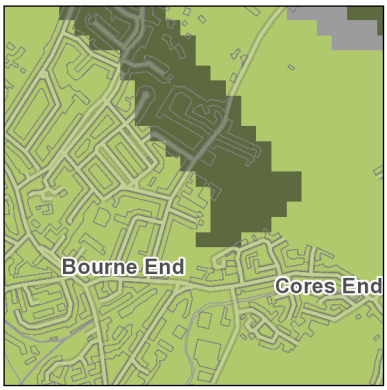
Section 3. Ground stability

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

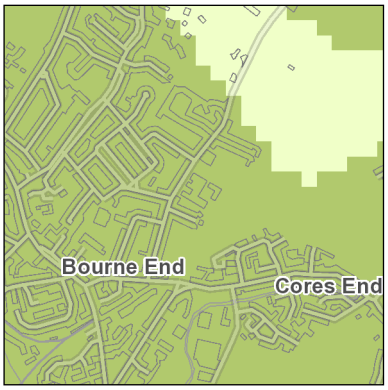
In the following maps, geohazards that are identified in green are unlikely to prevent infiltration SuDS from being installed, but they should be considered during design. For more information read 'Explanation of terms' at the end of this report.

Soluble rocks



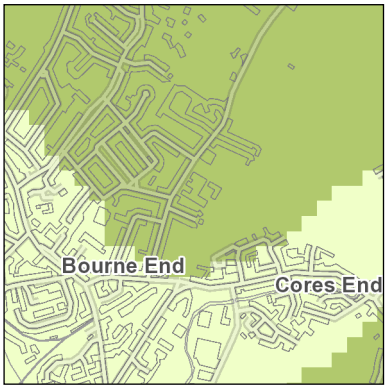
	Increased infiltration is unlikely to result in subsidence.
	Increased infiltration is unlikely to cause localised subsidence, but potential impacts should be considered.
	Increased infiltration may result in localised subsidence. The potential for or the consequences of subsidence associated with soluble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

Landslides



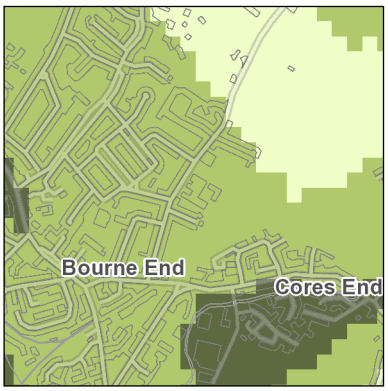
- Increased infiltration is unlikely to lead to slope instability.
- Slope instability problems may be present or anticipated, but increased infiltration is unlikely to cause instability
- Slope instability problems are probably present or have occurred in the past, and increased infiltration may result 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



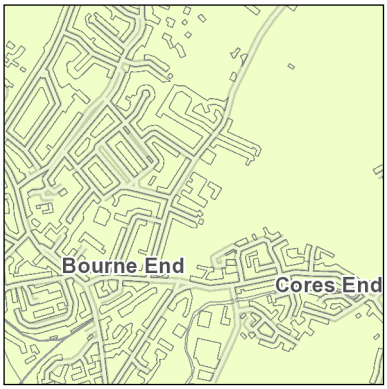
- Increased infiltration is unlikely to lead to subsidence.
- Shallow mining is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Shallow mining could be present with a significant possibility that localised subsidence could be initiated 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



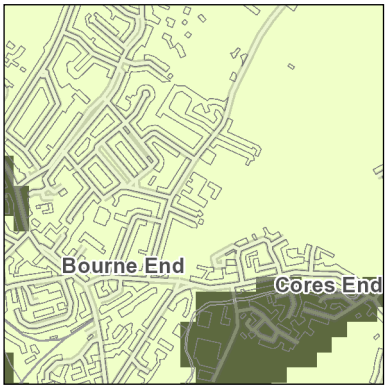
- Increased infiltration is unlikely to cause ground collapse associated with running sands.
- Running sand is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Significant possibility for running sand problems. Increased infiltration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

Swelling clays



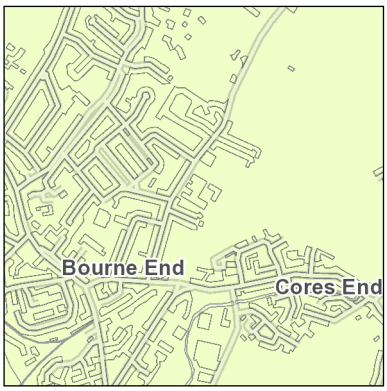
- Increased infiltration is unlikely to cause shrink-swell ground movement.
- Ground is susceptible to shrink-swell ground movement. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Ground is susceptible to shrink-swell ground movement. Increased infiltration may result in a geohazard.

Compressible ground



- Increased infiltration is unlikely to lead to ground compression.
- Compressibility and uneven settlement hazards are probably present. Increased infiltration may result in a geohazard.

Collapsible ground



- Increased infiltration is unlikely to result in subsidence.
- 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.
- Deposits with potential to collapse when loaded and saturated are probably present in places. Increased infiltration may result in a geohazard.

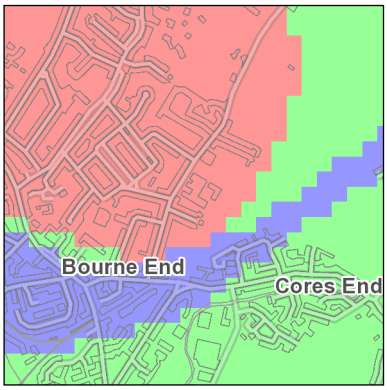
Section 4. Groundwater quality protection

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.

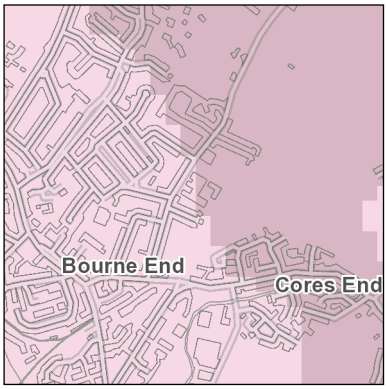
Groundwater source protection zones



Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2021.

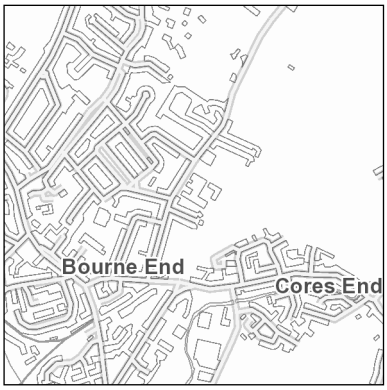
- Groundwater is not within a source protection zone.
- Source protection zone IV
- Source protection zone III
- Source protection zone II
- Source protection zone I

Predominant flow mechanism



- 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.
- 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

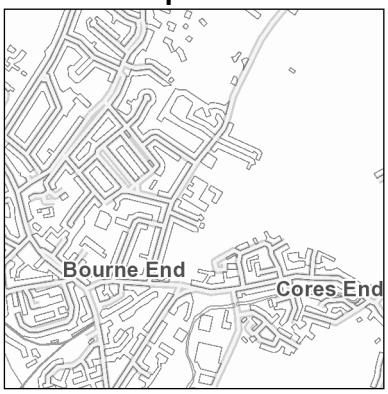


Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

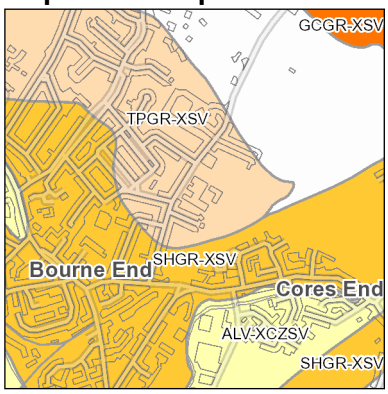
Section 5. Geological Maps

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

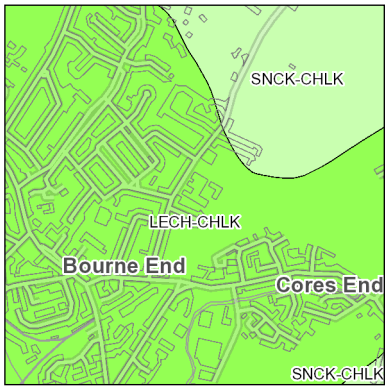
Artificial deposits



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
	SHGR-XSV	SHEPPERTON GRAVEL MEMBER	SAND AND GRAVEL
	TPGR-XSV	TAPLOW GRAVEL MEMBER	SAND AND GRAVEL
	GCGR-XSV	GERRARDS CROSS GRAVEL	SAND AND GRAVEL

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	SNCK-CHLK	SEAFORD CHALK FORMATION AND NEWHAVEN CHALK FORMATION (UNDIFFERENTIATED)	CHALK
	LECH-CHLK	LEWES NODULAR CHALK FORMATION	CHALK

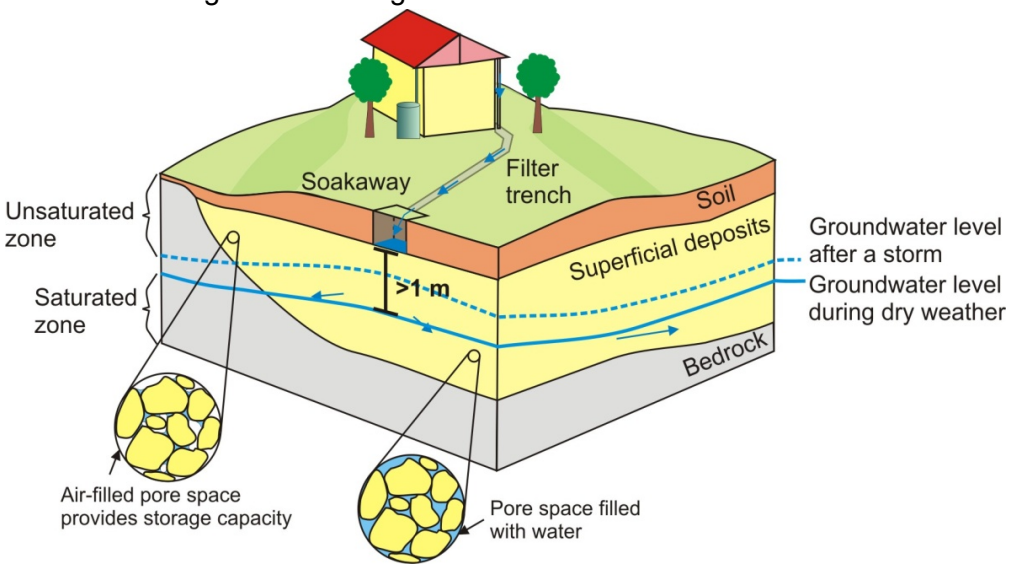
Limitations of this report:

- 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

Keyworth Office
British Geological Survey
Environmental Science Centre
Nicker Hill
Keyworth
Nottingham
NG12 5GG
Tel: 0115 9363143
Email: enquiries@bgs.ac.uk

Wallingford Office
British Geological Survey
Maclean Building
Wallingford
Oxford
OX10 8BB
Email: enquiries@bgs.ac.uk

Edinburgh Office
British Geological Survey
Lyell Centre
Research Avenue South
Edinburgh
EH14 4AP
Tel: 0131 6671000
Email: enquiry@bgs.ac.uk

Terms and Conditions

General Terms & Conditions

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Important notes about this Report

- 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.
- Data, information and related records, which have been donated to BGS, have been produced for a specific purpose, and that may affect the type and completeness of the data recorded and any interpretation. The nature and purpose of data collection, and the age of the resultant material may render it unsuitable for certain applications/uses. You must verify the suitability of the material for your intended usage.
- If a report or other output is produced for you on the basis of data you have provided to BGS, or your own data input into a BGS system, please do not rely on it as a source of information about other areas or geological features, as the report may omit important details.
- 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 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

Asset location search

Property Searches

The Infrastructure Design Consultancy Ltd
48West End
WESTBURY
BA13 3JG

Search address supplied Bourne End Academy
New Road
Bourne End
SL8 5BW

Your reference BEJSC

Our reference ALS/ALS Standard/2021_4454598

Search date 23 June 2021

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset location search

Property Searches

Search address supplied: Bourne End Academy, New Road, Bourne End, SL8 5BW

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

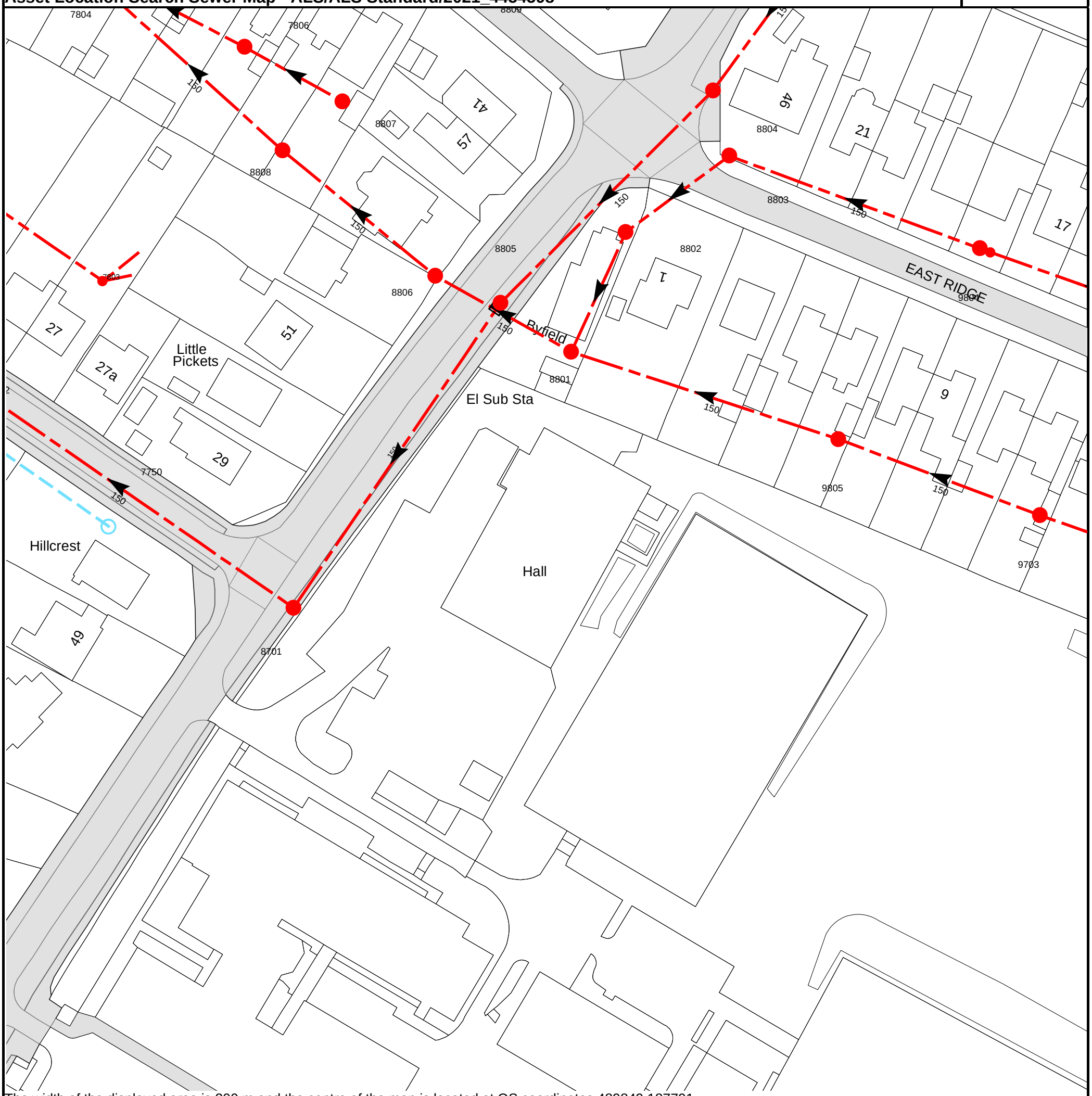
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2021_4454598



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 489849,187791

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7803	48.21	47.27
7750	47.14	45.84
7806	50.14	49.25
8808	50.02	48.24
8701	47.48	45.92
8807	50.76	49.87
8806	50.69	49.26
8805	50.06	48.78
8801	50.46	49.66
8802	51.12	50.19
8804	52.63	50.84
8803	52.65	51.36
9805	51.19	50.5
9804	53.73	52.21
9703	52.49	51.28

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

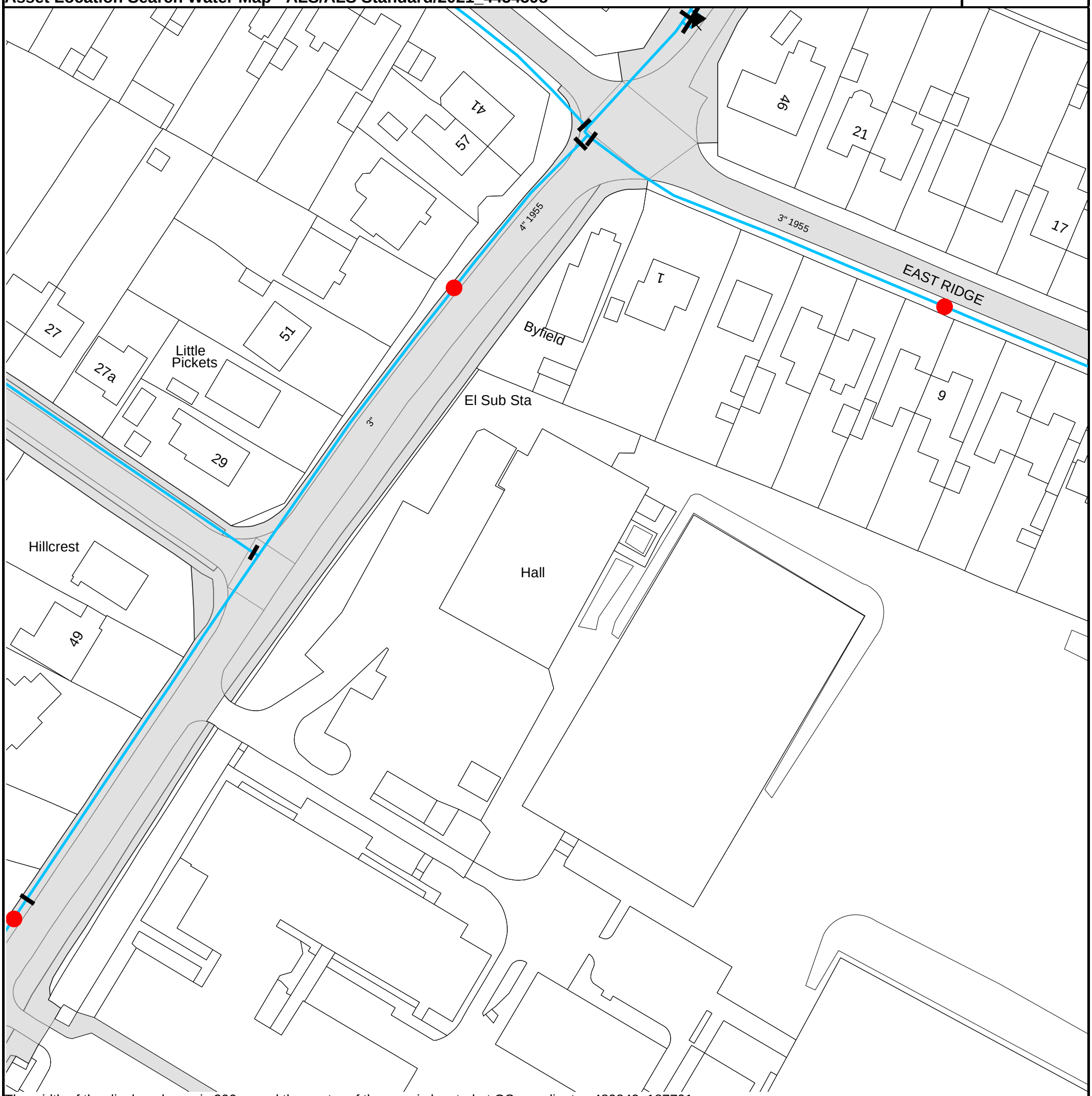
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0800 009 4540.

Asset Location Search Water Map - ALS/ALS Standard/2021_4454598



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 489849, 187791.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

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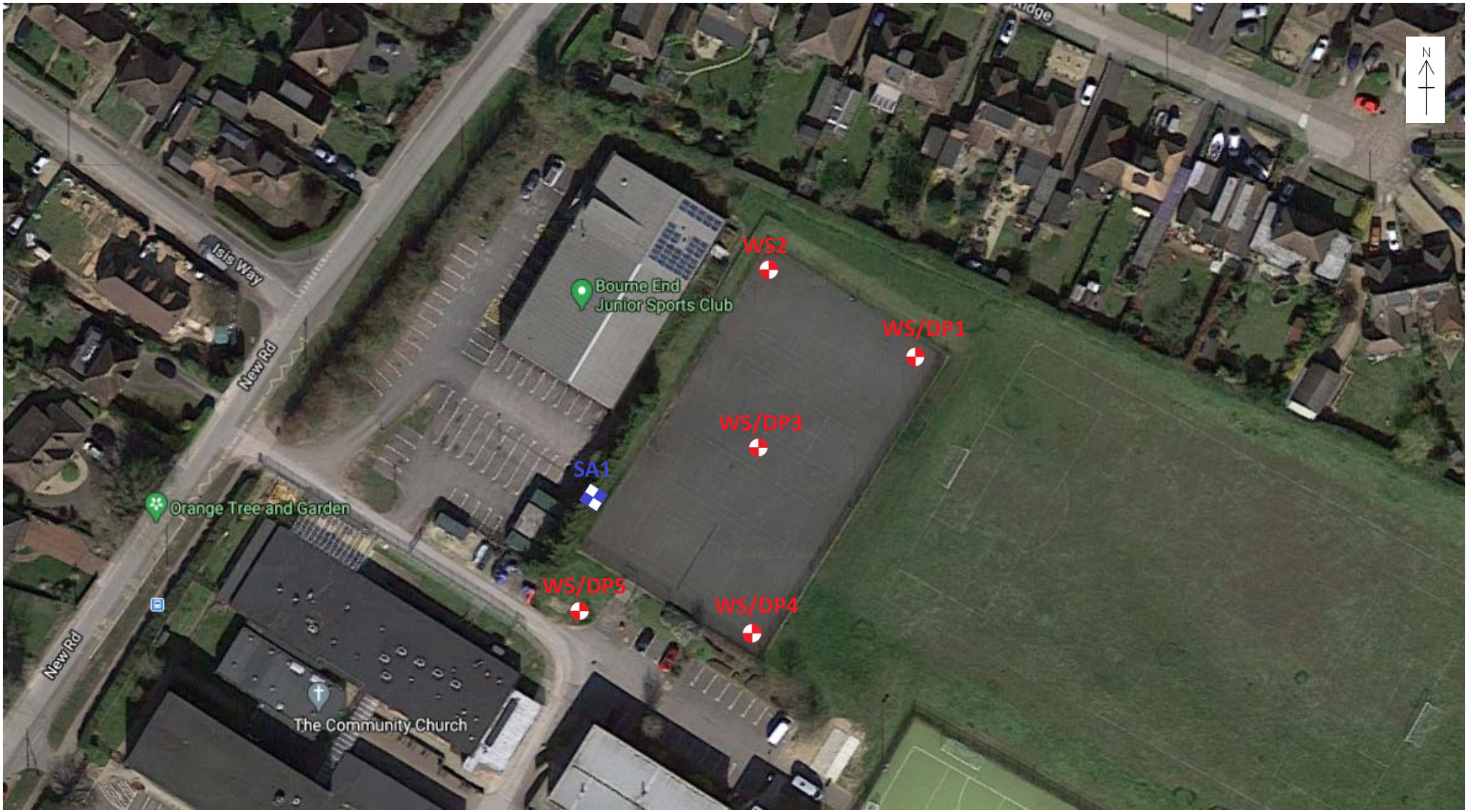


Notes:
1. Do not scale from this drawing.
2. All dimensions must be checked on site prior to commencement of work.
3. Where applicable this drawing is to be read in conjunction with other consultants drawings.
4. This drawing is the copyright of Impact Geotechnical Ltd.

Drawing Title:
Hole Location Plan

Site Name:
Bourne End Junior Sports Club

Project Reference:
P21.116

Revision: 0
Drawn by: RM
Scale: Not to Scale

Percussion Drilling Log

Project Name: Bourne End Junior Sports Club	Client: Norton Associates	Date: 18/02/2021
Location: Bourn End, Buckinghamshire	Contractor: Impact Geotechnical Ltd	
Project No. : P21.116	Crew Name: SG	Drilling Equipment: Archway Dart

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS1			RM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.10			MADE GROUND: Tarmac
					0.30			MADE GROUND: Brown sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse sized flint, brick and concrete. Occasional cobbles of brick and concrete (Sub-base).
		0.50	D					Orange brown locally slightly clayey very silty slightly gravelly SAND. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		0.80	D					
	▼	1.00 - 1.50	D					
		1.00	SPT	N=43 (2,8/9,10,11,13)				
					1.30			Orange brown sandy GRAVEL. Sand is fine to coarse Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		1.50 - 2.00	D					
		2.00 - 2.50	D					
		2.00	SPT	N=25 (4,5/7,5,7,6)				
		2.50 - 3.00	D					
								Between 2.80-3.00m becoming very gravelly Sand.
		3.00	SPT	N=28 (1,1/3,4,6,15)				*Between 3.00-3.3.0m becoming slightly sandy Clay.*
		3.80	SPT	67 (16,28/32,35,,)				
					4.00			End of Borehole at 4.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

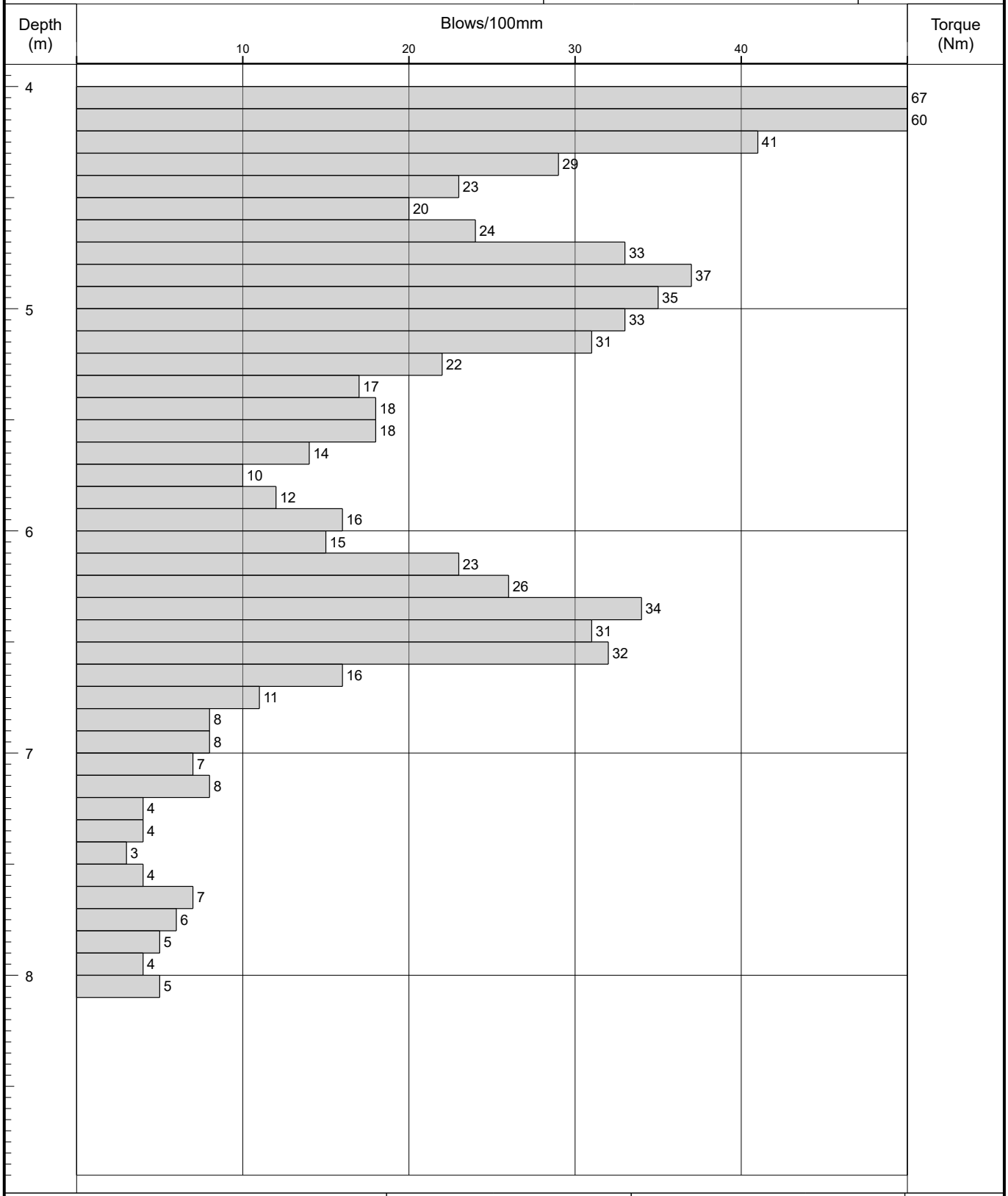
Hand dug starter pit dug to 1.00mbgl. Groundwater noted at ~1.00mbgl (groundwater felt to be perched within shallow soils). Refusal met at 4.00mbgl.

Probe Log

Probe No. **DP1**

Sheet 1 of 1

Project Name: Bourne End Junior Sports Club	Project No. P21.116	Co-ords: -	Hole Type
Location: Bourn End, Buckinghamshire		Level: mbgl	Scale 1:25
Client: Norton Associates		Dates: 18/02/2021 - 18/02/2021	Logged By



Remarks	Fall Height	750	Cone Base Diameter	
Dynamic probing completed through base of window sample borehole at 4.00mbgl.	Hammer Wt	64	Final Depth	8.00
	Probe Type	DPSH-B	Log Scale	1:25
Abort Reason			Ground Water Level	

AGS

Percussion Drilling Log

Project Name: Bourne End Junior Sports Club	Client: Norton Associates	Date: 18/02/2021
Location: Bourn End, Buckinghamshire	Contractor: Impact Geotechnical Ltd	
Project No. : P21.116	Crew Name: SG	Drilling Equipment: Archway Dart

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS2			RM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Tarmac
					0.30			MADE GROUND: Brown sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse sized flint, brick and concrete. Occasional cobbles of brick and concrete (Sub-base).
		0.50	D					Orange brown locally slightly clayey silty slightly gravelly SAND. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		0.80	D					
	▼	1.00 - 1.50	D					
		1.00	SPT	N=19 (2,2/3,4,6,6)				*Between 1.10-1.40m becoming clayey to very clayey.*
		1.50 - 2.00	D		1.50			Orange brown sandy GRAVEL. Sand is fine to coarse Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		2.00 - 3.00	D					
		2.00	SPT	N=26 (6,6/6,6,7,7)				
		3.00 - 4.00	D					
		3.00	SPT	N=40 (6,8/8,8,12,12)				*Between 3.00-3.50m becoming very fine to coarse sandy .*
		4.00 - 4.50	D					
		4.00	SPT	N=45 (5,7/9,10,12,14)				
		4.50	SPT	50 (6,17/50 for 265mm)				
					4.80			End of Borehole at 4.800m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Hand dug starter pit dug to 1.00mbgl. Groundwater noted at ~1.00mbgl (groundwater felt to be perched within shallow soils). Refusal met at 4.80mbgl.

Percussion Drilling Log

Project Name: Bourne End Junior Sports Club	Client: Norton Associates	Date: 19/02/2021
Location: Bourn End, Buckinghamshire	Contractor: Impact Geotechnical Ltd	
Project No. : P21.116	Crew Name: SG	Drilling Equipment: Archway Dart

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS3			RM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	▼				0.10			MADE GROUND: Tarmac
					0.30			MADE GROUND: Brown sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse sized flint, brick and concrete. Occasional cobbles of brick and concrete (Sub-base).
		0.40	D					Orange clayey silty slightly gravelly SAND. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		0.80	D					
		1.00 - 1.60	D		1.00			
		1.00	SPT	N=38 (6,7/10,10,8,10)				Orange brown silty sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		1.60 - 2.00	D		1.60			Orange brown sandy GRAVEL. Sand is fine to coarse Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		2.00 - 3.00	D					
		2.00	SPT	N=73 (4,10/17,18,19,19)				
		3.00	SPT	54 (19,24/25,29,,)	3.00			End of Borehole at 3.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

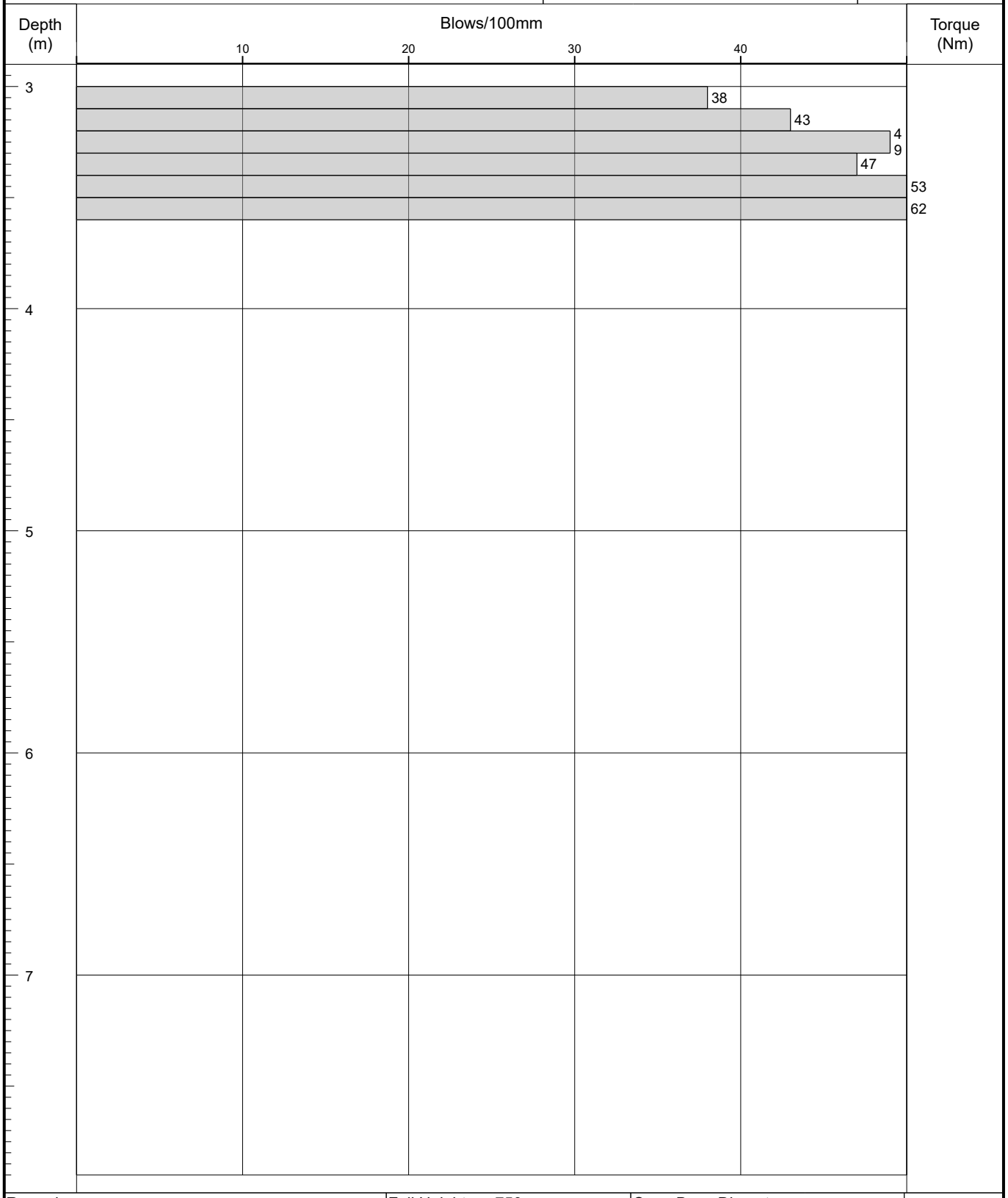
Remarks

Hand dug starter pit dug to 1.00mbgl. Groundwater noted at ~0.10-0.30mbgl and recorded at a standing level of 1.20mbgl. at end of hole (groundwater felt to be perched within shallow soils). Refusal met at 3.00mbgl.

Probe Log

Probe No.
DP3
Sheet 1 of 1

Project Name: Bourne End Junior Sports Club	Project No. P21.116	Co-ords: -	Hole Type
Location: Bourn End, Buckinghamshire		Level: mbgl	Scale 1:25
Client: Norton Associates		Dates: 19/02/2021 - 19/02/2021	Logged By



Remarks	Fall Height	750	Cone Base Diameter	
Dynamic probing completed through base of window sample borehole at 3.00mbgl.	Hammer Wt	64	Final Depth	3.50
	Probe Type	DPSH-B	Log Scale	1:25
Abort Reason			Ground Water Level	

Percussion Drilling Log

Project Name: Bourne End Junior Sports Club	Client: Norton Associates	Date: 19/02/2021
Location: Bourn End, Buckinghamshire	Contractor: Impact Geotechnical Ltd	
Project No. : P21.116	Crew Name: SG	Drilling Equipment: Archway Dart

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS4			RM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Tarmac
		0.50	D					MADE GROUND: Brown sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse sized flint, brick and concrete. Occasional cobbles of brick and concrete (Sub-base).
					0.60			Orange brown very clayey silty slightly gravelly SAND. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
	▼	0.80	D					
		1.00 - 1.30	D		1.00			Orange brown silty sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		1.00	SPT	N=27 (,3/2,4,9,12)				
		1.30 - 2.00	D		1.30			Orange brown sandy GRAVEL. Sand is fine to coarse Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS). *Between 1.30-1.80m orange brown clayey sandy SILT).*
		2.00	SPT	64 (,3/9,23,32,)				
					2.20			End of Borehole at 2.200m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

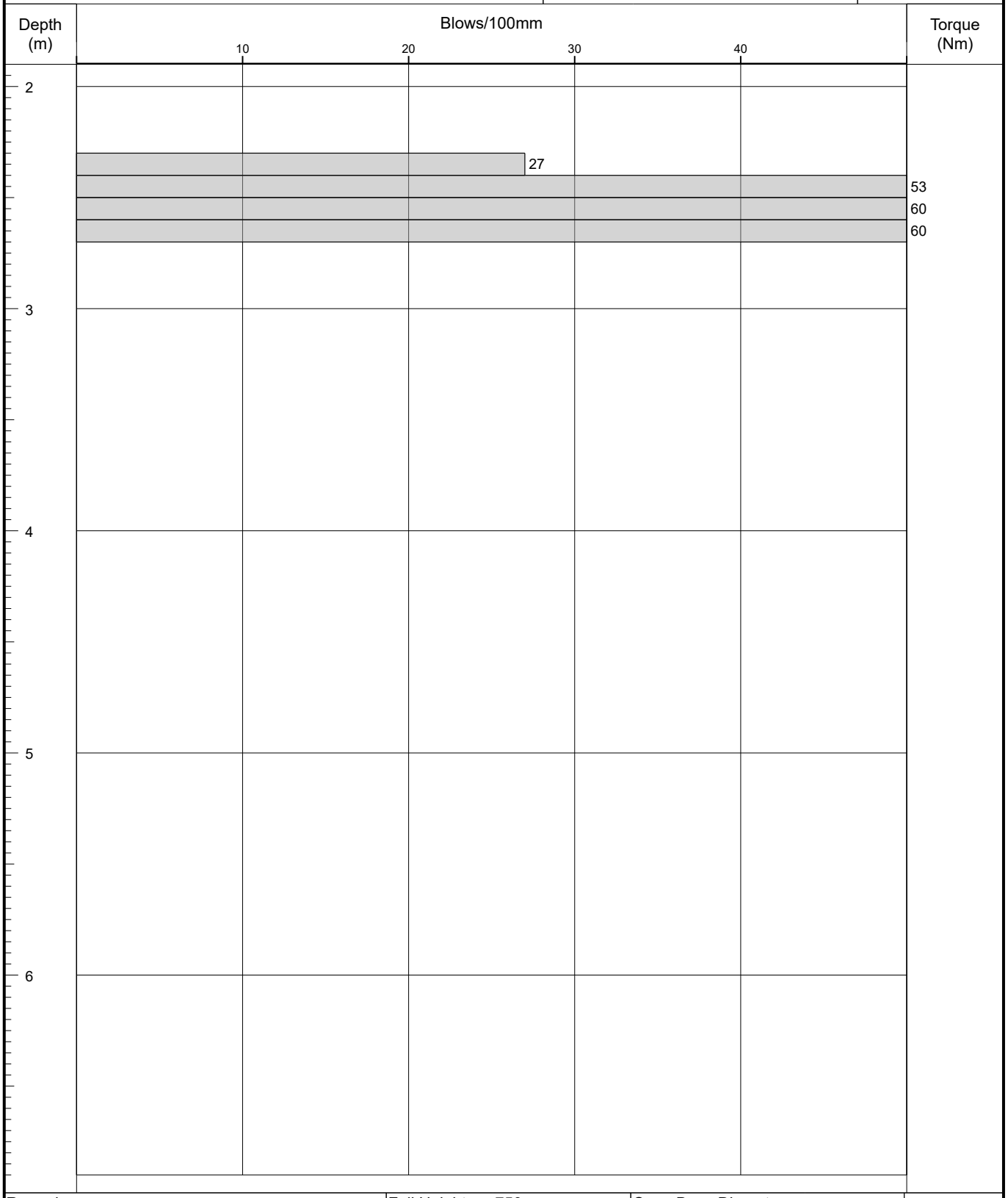
Remarks

Hand dug starter pit dug to 1.00mbgl. Groundwater noted at ~0.90mbgl (groundwater felt to be perched within shallow soils). Refusal met at 2.20mbgl.

Probe Log

Probe No.
DP4
Sheet 1 of 1

Project Name:	Bourne End Junior Sports Club	Project No. P21.116	Co-ords: -	Hole Type
Location:	Bourn End, Buckinghamshire		Level: mbgl	Scale 1:25
Client:	Norton Associates		Dates: 19/02/2021 - 19/02/2021	Logged By



Remarks	Fall Height	750	Cone Base Diameter	
Dynamic probing completed through base of window sample borehole at 2.20mbgl.	Hammer Wt	64	Final Depth	2.60
	Probe Type	DPSH-B	Log Scale	1:25
Abort Reason			Ground Water Level	

Percussion Drilling Log

Project Name: Bourne End Junior Sports Club	Client: Norton Associates	Date: 19/02/2021
Location: Bourn End, Buckinghamshire	Contractor: Impact Geotechnical Ltd	
Project No. : P21.116	Crew Name: SG	Drilling Equipment: Archway Dart

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS5			RM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	D					MADE GROUND: Grass over brown slightly clayey sandy slightly gravelly SILT. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse sized flint.
					0.70			
		0.80	D					Orange brown silty sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		1.00 - 1.60 1.00	D SPT	N=12 (2,3/3,3,3,3)				
					1.60			
		2.00 - 3.00 2.00	D SPT	N=59 (6,12/14,14,16,15)				Orange brown sandy GRAVEL. Sand is fine to coarse Gravel is subangular to subrounded fine to coarse sized flint (RIVER TERRACE DEPOSITS).
		3.00	SPT	N=45 (10,13/14,11,10,10)	3.00			End of Borehole at 3.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

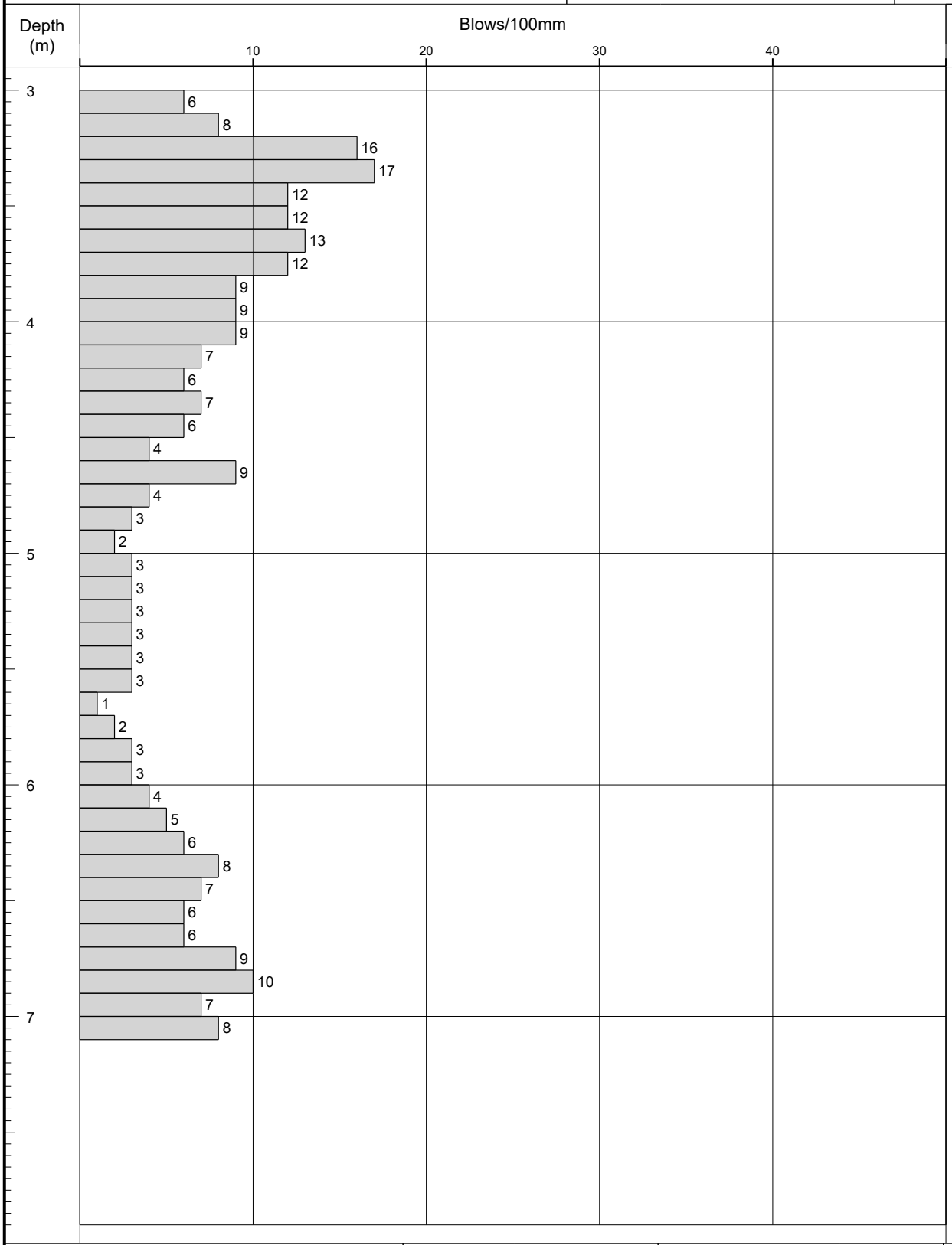
Hand dug starter pit dug to 1.00mbgl. Groundwater not encountered. Refusal met at 3.00mbgl.

Probe Log

Probe No. **DP5**

Sheet 1 of 1

Project Name: Bourne End Junior Sports Club	Project No. P21.116	Co-ords: -	Hole Type
Location: Bourn End, Buckinghamshire		Level: mbgl	Scale 1:25
Client: Norton Associates		Dates: 19/02/2021 - 19/02/2021	Logged By



Remarks	Fall Height	750	Cone Base Diameter	
Dynamic probing completed through base of window sample borehole at 3.00mbgl.	Hammer Wt	64	Final Depth	7.00
	Probe Type	DPSH-B	Log Scale	1:25
Abort Reason			Ground Water Level	

Cascade Summary of Results for PermPave 1.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Soakaway 1.SRCX	(None)

Half Drain Time : 14 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	46.715	0.095	15.0	0.4	15.4	16.7	O K
30 min Summer	46.726	0.106	15.0	0.4	15.4	20.1	O K
60 min Summer	46.727	0.107	15.0	0.4	15.4	20.3	O K
120 min Summer	46.715	0.095	15.0	0.4	15.4	16.8	O K
180 min Summer	46.703	0.083	15.0	0.3	15.3	13.1	O K
240 min Summer	46.694	0.074	14.2	0.3	14.5	10.6	O K
360 min Summer	46.682	0.062	11.9	0.3	12.2	7.4	O K
480 min Summer	46.674	0.054	10.3	0.3	10.5	5.6	O K
600 min Summer	46.669	0.049	9.1	0.2	9.3	4.5	O K
720 min Summer	46.665	0.045	7.8	0.2	8.1	3.9	O K
960 min Summer	46.660	0.040	6.2	0.2	6.4	3.1	O K
1440 min Summer	46.654	0.034	4.4	0.2	4.5	2.2	O K
2160 min Summer	46.648	0.028	3.1	0.1	3.2	1.5	O K
2880 min Summer	46.645	0.025	2.3	0.1	2.5	1.2	O K
4320 min Summer	46.641	0.021	1.6	0.1	1.7	0.8	O K
5760 min Summer	46.638	0.018	1.3	0.1	1.3	0.6	O K
7200 min Summer	46.637	0.017	1.1	0.1	1.1	0.5	O K
8640 min Summer	46.636	0.016	0.9	0.1	1.0	0.5	O K
10080 min Summer	46.635	0.015	0.8	0.1	0.9	0.4	O K
15 min Winter	46.725	0.105	15.0	0.4	15.4	19.7	O K
30 min Winter	46.736	0.116	15.0	0.4	15.4	23.0	O K
60 min Winter	46.732	0.112	15.0	0.4	15.4	21.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.661	0.0	24.3	14
30 min Summer	97.197	0.0	33.6	23
60 min Summer	60.756	0.0	43.2	40
120 min Summer	37.840	0.0	54.9	72
180 min Summer	28.429	0.0	62.4	102
240 min Summer	23.063	0.0	67.8	132
360 min Summer	16.965	0.0	75.2	192
480 min Summer	13.527	0.0	80.0	250
600 min Summer	11.288	0.0	83.5	308
720 min Summer	9.706	0.0	86.1	368
960 min Summer	7.602	0.0	89.7	490
1440 min Summer	5.332	0.0	93.7	734
2160 min Summer	3.720	0.0	97.0	1084
2880 min Summer	2.885	0.0	99.1	1468
4320 min Summer	2.028	0.0	102.1	2196
5760 min Summer	1.590	0.0	104.3	2848
7200 min Summer	1.326	0.0	106.5	3552
8640 min Summer	1.150	0.0	108.6	4360
10080 min Summer	1.024	0.0	110.7	5128
15 min Winter	147.661	0.0	27.8	15
30 min Winter	97.197	0.0	38.2	25
60 min Winter	60.756	0.0	49.0	44

Cascade Summary of Results for PermPave 1.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
120 min Winter	46.711	0.091	15.0	0.4	15.4	15.7	O K
180 min Winter	46.695	0.075	14.4	0.3	14.7	10.9	O K
240 min Winter	46.686	0.066	12.6	0.3	12.9	8.2	O K
360 min Winter	46.672	0.052	9.9	0.3	10.2	5.2	O K
480 min Winter	46.666	0.046	8.0	0.2	8.2	4.0	O K
600 min Winter	46.662	0.042	6.8	0.2	7.1	3.4	O K
720 min Winter	46.659	0.039	5.7	0.2	6.0	2.9	O K
960 min Winter	46.654	0.034	4.5	0.2	4.7	2.3	O K
1440 min Winter	46.649	0.029	3.2	0.1	3.3	1.6	O K
2160 min Winter	46.644	0.024	2.2	0.1	2.4	1.1	O K
2880 min Winter	46.641	0.021	1.7	0.1	1.8	0.8	O K
4320 min Winter	46.638	0.018	1.2	0.1	1.3	0.6	O K
5760 min Winter	46.636	0.016	0.9	0.1	1.0	0.5	O K
7200 min Winter	46.634	0.014	0.8	0.0	0.8	0.4	O K
8640 min Winter	46.633	0.013	0.7	0.0	0.7	0.3	O K
10080 min Winter	46.632	0.012	0.6	0.0	0.6	0.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	37.840	0.0	62.1	76
180 min Winter	28.429	0.0	70.6	104
240 min Winter	23.063	0.0	76.6	134
360 min Winter	16.965	0.0	84.9	192
480 min Winter	13.527	0.0	90.4	252
600 min Winter	11.288	0.0	94.3	308
720 min Winter	9.706	0.0	97.2	372
960 min Winter	7.602	0.0	101.3	492
1440 min Winter	5.332	0.0	106.0	722
2160 min Winter	3.720	0.0	109.8	1084
2880 min Winter	2.885	0.0	112.3	1428
4320 min Winter	2.028	0.0	116.1	2192
5760 min Winter	1.590	0.0	119.1	2856
7200 min Winter	1.326	0.0	121.9	3736
8640 min Winter	1.150	0.0	124.7	4328
10080 min Winter	1.024	0.0	127.5	5096

Cascade Rainfall Details for PermPave 1.SRCX

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 489849 187793 SU 89849 87793	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.106

Time (mins) From:	To:	Area (ha)
0	4	0.106

Cascade Model Details for PermPave 1.SRCX

Storage is Online Cover Level (m) 47.050

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	1.08000	Width (m)	25.5
Membrane Percolation (mm/hr)	1000	Length (m)	39.2
Max Percolation (l/s)	277.7	Slope (1:X)	500.0
Safety Factor	20.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.620	Cap Volume Depth (m)	0.225

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 46.620

Cascade Summary of Results for Soakaway 1.SRCX

Upstream Structures	Outflow To	Overflow To
PermPave 1.SRCX	(None)	(None)

Half Drain Time : 101 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	44.335	0.335	3.6	31.5	O K
30 min Summer	44.465	0.465	5.0	43.7	O K
60 min Summer	44.592	0.592	6.4	55.7	O K
120 min Summer	44.711	0.711	7.7	66.9	O K
180 min Summer	44.745	0.745	8.0	70.0	O K
240 min Summer	44.758	0.758	8.2	71.3	O K
360 min Summer	44.754	0.754	8.1	71.0	O K
480 min Summer	44.731	0.731	7.9	68.7	O K
600 min Summer	44.699	0.699	7.6	65.8	O K
720 min Summer	44.666	0.666	7.2	62.6	O K
960 min Summer	44.602	0.602	6.5	56.6	O K
1440 min Summer	44.499	0.499	5.4	46.9	O K
2160 min Summer	44.396	0.396	4.3	37.2	O K
2880 min Summer	44.330	0.330	3.6	31.0	O K
4320 min Summer	44.250	0.250	2.7	23.5	O K
5760 min Summer	44.204	0.204	2.2	19.2	O K
7200 min Summer	44.174	0.174	1.9	16.4	O K
8640 min Summer	44.153	0.153	1.7	14.4	O K
10080 min Summer	44.138	0.138	1.5	13.0	O K
15 min Winter	44.385	0.385	4.2	36.2	O K
30 min Winter	44.529	0.529	5.7	49.8	O K
60 min Winter	44.672	0.672	7.3	63.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	147.661	0.0	57
30 min Summer	97.197	0.0	65
60 min Summer	60.756	0.0	82
120 min Summer	37.840	0.0	122
180 min Summer	28.429	0.0	154
240 min Summer	23.063	0.0	186
360 min Summer	16.965	0.0	250
480 min Summer	13.527	0.0	314
600 min Summer	11.288	0.0	378
720 min Summer	9.706	0.0	442
960 min Summer	7.602	0.0	570
1440 min Summer	5.332	0.0	818
2160 min Summer	3.720	0.0	1184
2880 min Summer	2.885	0.0	1548
4320 min Summer	2.028	0.0	2268
5760 min Summer	1.590	0.0	3000
7200 min Summer	1.326	0.0	3712
8640 min Summer	1.150	0.0	4424
10080 min Summer	1.024	0.0	5152
15 min Winter	147.661	0.0	57
30 min Winter	97.197	0.0	64
60 min Winter	60.756	0.0	82

Cascade Summary of Results for Soakaway 1.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
120 min Winter	44.804	0.804	8.7	75.6	O K
180 min Winter	44.835	0.835	9.0	78.5	O K
240 min Winter	44.841	0.841	9.1	79.1	O K
360 min Winter	44.814	0.814	8.8	76.6	O K
480 min Winter	44.768	0.768	8.3	72.2	O K
600 min Winter	44.717	0.717	7.7	67.5	O K
720 min Winter	44.669	0.669	7.2	62.9	O K
960 min Winter	44.584	0.584	6.3	54.9	O K
1440 min Winter	44.459	0.459	5.0	43.2	O K
2160 min Winter	44.345	0.345	3.7	32.5	O K
2880 min Winter	44.277	0.277	3.0	26.0	O K
4320 min Winter	44.200	0.200	2.2	18.8	O K
5760 min Winter	44.158	0.158	1.7	14.9	O K
7200 min Winter	44.132	0.132	1.4	12.4	O K
8640 min Winter	44.114	0.114	1.2	10.8	O K
10080 min Winter	44.101	0.101	1.1	9.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
120 min Winter	37.840	0.0	122
180 min Winter	28.429	0.0	160
240 min Winter	23.063	0.0	192
360 min Winter	16.965	0.0	262
480 min Winter	13.527	0.0	330
600 min Winter	11.288	0.0	396
720 min Winter	9.706	0.0	462
960 min Winter	7.602	0.0	592
1440 min Winter	5.332	0.0	844
2160 min Winter	3.720	0.0	1212
2880 min Winter	2.885	0.0	1580
4320 min Winter	2.028	0.0	2300
5760 min Winter	1.590	0.0	3016
7200 min Winter	1.326	0.0	3752
8640 min Winter	1.150	0.0	4488
10080 min Winter	1.024	0.0	5168

Cascade Rainfall Details for Soakaway 1.SRCX

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 489849 187793 SU 89849 87793	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Green Roof

Area (m^3)	1883	Evaporation (mm/day)	3
Depression Storage (mm)	5	Decay Coefficient	0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.034218	32	36	0.006908	64	68	0.001395	96	100	0.000282
4	8	0.028015	36	40	0.005656	68	72	0.001142	100	104	0.000231
8	12	0.022937	40	44	0.004631	72	76	0.000935	104	108	0.000189
12	16	0.018779	44	48	0.003791	76	80	0.000765	108	112	0.000155
16	20	0.015375	48	52	0.003104	80	84	0.000627	112	116	0.000127
20	24	0.012588	52	56	0.002541	84	88	0.000513	116	120	0.000104
24	28	0.010306	56	60	0.002081	88	92	0.000420			
28	32	0.008438	60	64	0.001704	92	96	0.000344			

Cascade Model Details for Soakaway 1.SRCX

Storage is Online Cover Level (m) 47.050

Cellular Storage Structure

Invert Level (m) 44.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 1.08000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	99.0	0.0	1.200	99.0	86.4	1.201	0.0	86.4

Cascade Summary of Results for PermPave 2.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Soakaway 2.SRCX	(None)

Half Drain Time : 15 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	46.737	0.117	28.5	0.4	28.9	33.5	O K
30 min Summer	46.749	0.129	31.2	0.4	31.7	40.2	O K
60 min Summer	46.750	0.130	31.2	0.4	31.7	41.3	O K
120 min Summer	46.743	0.123	29.8	0.4	30.3	36.6	O K
180 min Summer	46.733	0.113	27.4	0.4	27.8	31.0	O K
240 min Summer	46.724	0.104	25.2	0.4	25.6	26.2	O K
360 min Summer	46.709	0.089	21.6	0.4	21.9	19.2	O K
480 min Summer	46.697	0.077	18.8	0.3	19.1	14.5	O K
600 min Summer	46.688	0.068	16.6	0.3	16.9	11.2	O K
720 min Summer	46.681	0.061	14.8	0.3	15.0	8.9	O K
960 min Summer	46.671	0.051	12.3	0.3	12.6	6.2	O K
1440 min Summer	46.662	0.042	8.7	0.2	8.9	4.4	O K
2160 min Summer	46.655	0.035	6.0	0.2	6.2	3.0	O K
2880 min Summer	46.651	0.031	4.7	0.2	4.9	2.3	O K
4320 min Summer	46.646	0.026	3.3	0.1	3.5	1.6	O K
5760 min Summer	46.643	0.023	2.5	0.1	2.6	1.3	O K
7200 min Summer	46.641	0.021	2.1	0.1	2.2	1.0	O K
8640 min Summer	46.639	0.019	1.8	0.1	1.9	0.9	O K
10080 min Summer	46.638	0.018	1.6	0.1	1.7	0.8	O K
15 min Winter	46.747	0.127	30.8	0.4	31.2	39.1	O K
30 min Winter	46.757	0.137	31.2	0.5	31.7	45.7	O K
60 min Winter	46.755	0.135	31.2	0.5	31.7	44.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	147.661	0.0	47.1	14
30 min Summer	97.197	0.0	65.3	23
60 min Summer	60.756	0.0	84.1	40
120 min Summer	37.840	0.0	107.1	72
180 min Summer	28.429	0.0	121.9	104
240 min Summer	23.063	0.0	132.5	134
360 min Summer	16.965	0.0	146.8	194
480 min Summer	13.527	0.0	156.3	254
600 min Summer	11.288	0.0	163.1	314
720 min Summer	9.706	0.0	168.2	372
960 min Summer	7.602	0.0	175.2	490
1440 min Summer	5.332	0.0	183.0	734
2160 min Summer	3.720	0.0	189.2	1100
2880 min Summer	2.885	0.0	193.1	1440
4320 min Summer	2.028	0.0	198.6	2192
5760 min Summer	1.590	0.0	202.7	2936
7200 min Summer	1.326	0.0	206.6	3672
8640 min Summer	1.150	0.0	210.4	4400
10080 min Summer	1.024	0.0	214.1	5064
15 min Winter	147.661	0.0	54.0	15
30 min Winter	97.197	0.0	74.4	25
60 min Winter	60.756	0.0	95.5	42

Cascade Summary of Results for PermPave 2.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
120 min Winter	46.741	0.121	29.5	0.4	29.9	35.9	O K
180 min Winter	46.727	0.107	26.1	0.4	26.5	28.1	O K
240 min Winter	46.715	0.095	23.1	0.4	23.5	22.1	O K
360 min Winter	46.697	0.077	18.7	0.3	19.0	14.3	O K
480 min Winter	46.684	0.064	15.5	0.3	15.8	9.8	O K
600 min Winter	46.674	0.054	13.2	0.3	13.4	7.1	O K
720 min Winter	46.669	0.049	11.6	0.2	11.8	5.7	O K
960 min Winter	46.663	0.043	9.1	0.2	9.3	4.5	O K
1440 min Winter	46.656	0.036	6.4	0.2	6.6	3.2	O K
2160 min Winter	46.650	0.030	4.4	0.2	4.6	2.2	O K
2880 min Winter	46.646	0.026	3.3	0.1	3.5	1.7	O K
4320 min Winter	46.642	0.022	2.4	0.1	2.5	1.2	O K
5760 min Winter	46.639	0.019	1.8	0.1	1.9	0.9	O K
7200 min Winter	46.638	0.018	1.5	0.1	1.6	0.8	O K
8640 min Winter	46.636	0.016	1.3	0.1	1.3	0.6	O K
10080 min Winter	46.635	0.015	1.1	0.1	1.2	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
120 min Winter	37.840	0.0	121.3	76
180 min Winter	28.429	0.0	137.8	108
240 min Winter	23.063	0.0	149.7	138
360 min Winter	16.965	0.0	165.9	198
480 min Winter	13.527	0.0	176.6	256
600 min Winter	11.288	0.0	184.2	314
720 min Winter	9.706	0.0	190.0	368
960 min Winter	7.602	0.0	197.9	490
1440 min Winter	5.332	0.0	206.9	734
2160 min Winter	3.720	0.0	214.3	1092
2880 min Winter	2.885	0.0	219.1	1428
4320 min Winter	2.028	0.0	226.2	2180
5760 min Winter	1.590	0.0	231.6	2936
7200 min Winter	1.326	0.0	236.9	3728
8640 min Winter	1.150	0.0	242.0	4376
10080 min Winter	1.024	0.0	247.1	4944

Cascade Rainfall Details for PermPave 2.SRCX

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 489849 187793 SU 89849 87793	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.208

Time (mins) From:	To:	Area (ha)
0	4	0.208

Cascade Model Details for PermPave 2.SRCX

Storage is Online Cover Level (m) 47.050

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	1.08000	Width (m)	32.4
Membrane Percolation (mm/hr)	1000	Length (m)	64.3
Max Percolation (l/s)	578.7	Slope (1:X)	500.0
Safety Factor	20.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.620	Cap Volume Depth (m)	0.225

Orifice Outflow Control

Diameter (m) 0.025 Discharge Coefficient 0.600 Invert Level (m) 46.620

Cascade Summary of Results for Soakaway 2.SRCX

Upstream Structures	Outflow To	Overflow To
PermPave 2.SRCX	(None)	(None)

Half Drain Time : 101 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	44.252	0.252	2.7	23.7	O K
30 min Summer	44.318	0.318	3.4	29.9	O K
60 min Summer	44.364	0.364	3.9	34.3	O K
120 min Summer	44.398	0.398	4.3	37.5	O K
180 min Summer	44.411	0.411	4.4	38.7	O K
240 min Summer	44.413	0.413	4.5	38.8	O K
360 min Summer	44.401	0.401	4.3	37.7	O K
480 min Summer	44.382	0.382	4.1	35.9	O K
600 min Summer	44.361	0.361	3.9	34.0	O K
720 min Summer	44.342	0.342	3.7	32.1	O K
960 min Summer	44.307	0.307	3.3	28.8	O K
1440 min Summer	44.254	0.254	2.7	23.9	O K
2160 min Summer	44.203	0.203	2.2	19.1	O K
2880 min Summer	44.170	0.170	1.8	16.0	O K
4320 min Summer	44.130	0.130	1.4	12.2	O K
5760 min Summer	44.106	0.106	1.1	10.0	O K
7200 min Summer	44.091	0.091	1.0	8.6	O K
8640 min Summer	44.081	0.081	0.9	7.6	O K
10080 min Summer	44.073	0.073	0.8	6.9	O K
15 min Winter	44.282	0.282	3.0	26.5	O K
30 min Winter	44.357	0.357	3.9	33.5	O K
60 min Winter	44.410	0.410	4.4	38.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	147.661	0.0	18
30 min Summer	97.197	0.0	32
60 min Summer	60.756	0.0	60
120 min Summer	37.840	0.0	90
180 min Summer	28.429	0.0	124
240 min Summer	23.063	0.0	158
360 min Summer	16.965	0.0	226
480 min Summer	13.527	0.0	292
600 min Summer	11.288	0.0	358
720 min Summer	9.706	0.0	422
960 min Summer	7.602	0.0	550
1440 min Summer	5.332	0.0	796
2160 min Summer	3.720	0.0	1168
2880 min Summer	2.885	0.0	1528
4320 min Summer	2.028	0.0	2248
5760 min Summer	1.590	0.0	2992
7200 min Summer	1.326	0.0	3680
8640 min Summer	1.150	0.0	4416
10080 min Summer	1.024	0.0	5144
15 min Winter	147.661	0.0	18
30 min Winter	97.197	0.0	32
60 min Winter	60.756	0.0	58

Cascade Summary of Results for Soakaway 2.SRCX

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
120 min Winter	44.445	0.445	4.8	41.9	O K
180 min Winter	44.454	0.454	4.9	42.7	O K
240 min Winter	44.449	0.449	4.9	42.2	O K
360 min Winter	44.425	0.425	4.6	39.9	O K
480 min Winter	44.395	0.395	4.3	37.1	O K
600 min Winter	44.366	0.366	4.0	34.4	O K
720 min Winter	44.340	0.340	3.7	32.0	O K
960 min Winter	44.296	0.296	3.2	27.9	O K
1440 min Winter	44.234	0.234	2.5	22.0	O K
2160 min Winter	44.177	0.177	1.9	16.6	O K
2880 min Winter	44.143	0.143	1.5	13.4	O K
4320 min Winter	44.104	0.104	1.1	9.8	O K
5760 min Winter	44.083	0.083	0.9	7.8	O K
7200 min Winter	44.070	0.070	0.8	6.6	O K
8640 min Winter	44.061	0.061	0.7	5.8	O K
10080 min Winter	44.055	0.055	0.6	5.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
120 min Winter	37.840	0.0	94
180 min Winter	28.429	0.0	132
240 min Winter	23.063	0.0	170
360 min Winter	16.965	0.0	240
480 min Winter	13.527	0.0	310
600 min Winter	11.288	0.0	378
720 min Winter	9.706	0.0	444
960 min Winter	7.602	0.0	576
1440 min Winter	5.332	0.0	824
2160 min Winter	3.720	0.0	1192
2880 min Winter	2.885	0.0	1560
4320 min Winter	2.028	0.0	2288
5760 min Winter	1.590	0.0	3000
7200 min Winter	1.326	0.0	3744
8640 min Winter	1.150	0.0	4480
10080 min Winter	1.024	0.0	5152

Cascade Rainfall Details for Soakaway 2.SRCX

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 489849 187793 SU 89849 87793	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.090

Time (mins) From:	To:	Area (ha)
0	4	0.090

Cascade Model Details for Soakaway 2.SRCX

Storage is Online Cover Level (m) 47.050

Cellular Storage Structure

Invert Level (m) 44.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 1.08000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	99.0	0.0	1.200	99.0	86.4	1.201	0.0	86.4

EXISTING ROOF
894m²

PERMEABLE PAVING
2,084m²

GREEN ROOF
1,883m²

NEW CURVED GREEN ROOF

PERMEABLE PAVING
1,060m²

EXISTING CAR PARK
78 SPACES AFTER REALIGNMENT

NEW SHELTERED CYCLE STANDS 10 NO.

AMBULANCE ZONE

CHRG

Inspection chamber

Catchpit

Permeable Paving Surface

Soakaway 2
38.0 x 3.0 x 1.2m
Infiltration rate, 3x10⁻⁵m/s
Effective volume, 112.5m³

Soakaway 1
38.0 x 3.0 x 1.2m
Infiltration rate, 3x10⁻⁵m/s
Effective volume, 112.5m³

NORTH

EXISTING CAR PARK 65 SPACES
REVISED EXISTING CAR PARK 18 SPACES
NEW BUILDING CAR PARK 25 SPACES
SOMEWHERE ON SITE 35 SCHOOL SPACES

EXISTING BUILDING CAR PARK 35 SPACES NEEDED
NEW BUILDING CAR PARK 60 SPACES NEEDED