



**FORMULA LAND (ALDERBURY) LTD,
SOUTHAMPTON ROAD
ALDERBURY**

**FLOOD RISK ASSESSMENT AND
DRAINAGE STRATEGY**

OCTOBER 2024



the journey is the reward

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DRAINAGE STRATEGY**

OCTOBER 2024

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**Formula Land (Alderbury) Ltd,
Southampton Road
Alderbury
Flood Risk Assessment and Drainage Strategy**

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1 Introduction

- 1.1 Mayer Brown Ltd has been commissioned by Formula Land to undertake a Flood Risk Assessment (FRA) and Drainage Strategy in support of an **outline** planning application for a proposed residential development for up to 47 new homes (Development) located at land north of Southampton Road, Alderbury.

[Preplanning Advice – Wiltshire County Council](#)

- 1.2 Preplanning advice was obtained from Wiltshire Council in relation to flood risk and drainage and their response is contained in Appendix B. An extract from their response is as follows:

“A site-specific Flood Risk Assessment (FRA) is required for this application. The site-specific FRA should demonstrate that the site is not adversely affected by flood risk from different sources, and how the flood risk from all sources will be managed without increasing flood risk to the development itself or elsewhere. It should also outline the proposed drainage strategy for the site”

- 1.3 According to the Environment Agency’s (EA) flood map for planning (Appendix C) the 4.95-hectare Site is entirely located in a Flood Zone 1 which has a low probability risk of experiencing flooding from fluvial or tidal sources.
- 1.4 As outlined in NPPF, for development proposals on sites comprising more than one hectare in area, an FRA is a planning requirement and should consider i) the vulnerability of flooding from sources other than river and sea flooding, ii) the potential to increase flood risk elsewhere through the addition of hard surfaces and iii) the effect of the new development on surface water runoff.
- 1.5 This Flood Risk Assessment considers the impact of the proposed development in addition to the common ways in which flooding can occur. The conditions currently existing in the location of the site are described, together with the methods used to identify and assess potential impacts caused from the development proposals. The mitigation measures proposed have been identified in order to avoid and/or reduce the impacts caused by introducing the Development to the area.
- 1.6 This FRA and drainage strategy has been compiled in accordance with “National Planning Policy Framework (NPPF)” published by Communities and Local Government in March 2012 (Ref.1), “Technical Guidance to the National Planning Policy Framework” (Ref.2) and ‘CIRIA C624: Development and Flood Risk Guidance’.

2 Site Location and Description

Site Location

- 2.1 The application Site (Site), covering approximately 4.95 hectares, is located along the western boundary of Alderbury, which is a village approximately three miles southeast of Salisbury.
- 2.2 The Site falls under the administrative boundary of Wiltshire Council. The post code is SP5 9AG and the approximate coordinates at the centre of the site are E418790, N127170. For the site location refer to Appendix A and figure 2.1 below.
- 2.3 The Site is accessed from Southampton Road in the southwest corner, the southeast boundary runs adjacent to Junction Road for approximately 180 metres. The land to the north and southeast is comprised of open fields and Alderbury football Club with the residential properties of Alderbury to the south and northwest.



Figure 2.1: Site Location

Topography

- 2.4 A topographic survey was undertaken in October 2021 and is contained in Appendix D.
- 2.5 The Site is comprised of two open fields, the boundary between which is loosely delineated by a hedgerow running in a north easterly direction. There are no notable features within the fields and vegetation is generally limited to the Site boundaries, which are comprised of hedgerows and trees.

- 2.6 There is a significant level difference across the Site where the recorded ground levels range from 87.5m AOD in the west to 67.5m AOD in the eastern apex. This is a fall of 20 metres over a distance 470 metres, working out at an average gradient of approximately 1 in 23. The land generally falls from west to east.

Hydrology & Geology

- 2.7 There is an existing ditch within the northern boundary of the Site, which flows/falls with the land in the easterly direction toward the eastern apex adjacent Junction Road.
- 2.8 There is a spring identified within the application boundary at the northeast corner.
- 2.9 A site investigation has not yet been undertaken but according to Defra's "Magic Map Application" it has been determined that the local soils can be described as "*Naturally wet very acid sandy and loamy soils*".

Existing Drainage

Existing Surface Water Drainage

- 2.10 The Site is entirely greenfield and there are no recorded surface water sewers within the boundary.
- 2.11 According to the Wessex Water sewer records in Appendix E the nearest surface water sewer is in the residential area to the northwest. Based upon the records it is not clear where this surface water sewer outfalls because the pipe run ends at the Site boundary. (It is expected this sewer discharges into existing ditch that runs along the north of the Site boundary, although where it discharges will have no impact).

Existing Foul Water Sewers

- 2.12 According to the Wessex Water sewer records in Appendix E there are two foul water sewers within the Site:
- Ex Foul Sewer 01: 150mm diameter sewer that runs along the northern boundary, south of the ditch, for a length of approximately 330 metres.
 - Ex Foul Sewer 02: 150mm diameter sewer that runs within the main access area to the southeast for approximately 90 metres.
- 2.13 Both of these sewers eventually run into Junction Road to the south of the Site and discharge into an existing Wessex Water foul water pump station on the opposite side of the A36. The pump station pumps effluent via a rising main back up to Junction Road to a gravity sewer in Southampton Road.

3 The Development

- 3.1 The Development is for 47 new homes with associated open space and infrastructure. The proposed layout plan is contained in Appendix F and can be seen in figure 3.1 below.



Figure 3.1: Proposed Development

- 3.2 Considering the Development is located in a low-risk Flood Zone 1 area the proposed finished road and property levels will be dictated by boundary and engineering constraints as opposed to predicted fluvial or tidal levels. The levels of the proposed roads and properties aim to match existing ground levels where possible in order to minimise the volume of bulk earthworks.
- 3.3 A proposed levels strategy has been developed primarily to inform the drainage design and can be seen in Appendix F.
- 3.4 The proposed surface and foul water drainage for the development is addressed in sections 5.0 and 8.0 respectively of this report.

4 Flood Risk and Mitigation Measures

4.1 In theory there are five principal types/sources of flooding that could affect the Development. These are described below with proposed mitigation measures identified where necessary.

- **Fluvial** – The site is located in a low-risk Flood Zone 1 as can be seen in the flood map in Appendix C. This means that it has an annual probability of <0.1% of experiencing flooding from fluvial sources. There are no mitigation measures required so it will not be addressed further in this FRA.
- **Tidal** – The site is not located in a coastal area so is not at risk of tidal flooding. There are no mitigation measures required so it will not be addressed further in this FRA.
- **Groundwater** – The Groundsure report in Appendix C identifies that the site is at a low risk of ground water flooding. Therefore, flooding from groundwater is considered low risk and there are no mitigation measures required so it will not be addressed further in this FRA.
- **Surface Water Runoff** – The EA Surface Water Flood Map in Appendix C identifies a strip of land within the site that is at a low risk of flooding from surface water. This low-risk flood area is in place because the overland flow drains to the natural low point in the site. This overland flow is generated by the Site only and the naturally low area will be by default be removed by applying good engineering practice when designing the road and drainage infrastructure for the new Development.
- **Infrastructure Failure** – The SFRA does not identify a risk of sewer flooding at the location of the site. Therefore, flooding from infrastructure failure is considered a low risk and there are no mitigation measures required so it will not be addressed further in this FRA.

Flood Mechanism	Source	Flood Risk to the Development	Mitigation Required?
Fluvial	N/A	Low	No
Tidal	N/A	Low	No
Groundwater	Underlying geology and groundwater levels	Low	No
Surface Water / Overland Flow	Runoff from surrounding elevated land and highway corridors	Low	No
Infrastructure Failure	Surface water systems and Water mains	Low	No

Table 4.1: Flood Risk Summary

5 Proposed Surface Water Drainage

Summary of Proposed Surface Water Drainage

- 5.1 The proposed drainage network will broadly mimic the existing arrangement by ensuring all rainfall continues to drain into the existing ditch running along the northern boundary.
- 5.2 The completed system will manage surface water run-off up to the 1 in 100-year return period including an allowance for climate change.
- 5.3 The surface water system will include traditional positive drainage systems (Gullies, pipes, manholes, etc) that will be used in conjunction with SuDS in the form of filter trenches, swales, a detention basin and a proprietary attenuation tank.
- 5.4 The traditional positive systems will be designed in accordance with Design and Construction Guidance (DCG). This guide is for use by developers undertaking new development when planning, designing and constructing conventional foul and surface water sewers, lateral drains, pumping stations and rising mains intended for adoption by the sewerage undertaker.
- 5.5 The SuDS design is based upon guidance provided in the CIRIA Report C753 - The SuDS Manual. This document provides current best practice national guidance on the planning, design, construction, operation and maintenance of SuDS.

Consultation with Wiltshire Council

- 5.6 Consultation with Wiltshire County Council, as Lead Local Flood Authority (LLFA), has been undertaken and their response is contained in Appendix B. An extract relating to the use of sustainable drainage systems is as follows:

“The applicant should note that in all instances the preference should be to utilise blue-green SuDS which provide multi-faceted benefits to the site (in terms of water quantity, quality, amenity and biodiversity); for example, for attenuation features preference should be given to use of swales / ponds / detention basins (if technically feasible) instead of attenuation tanks. The applicant should adopt a holistic approach to planning the site, and sufficient space for SuDS features should be provided at an early stage in order to fulfil the requirements of NPPF Paragraph 169”

- 5.7 Further, more specific, and very prescriptive design advice was also provided that covers numerous headings including; Drainage Strategy, Ground Investigation, Detailed Drainage Calculations, Design Drawings, Third Party Consent, Ownership & Management and Construction.
- 5.8 The LLFA expect to receive a differing level of detail that is dictated by the stage of the planning process. Refer to figure 5.1 below that provides a useful summary of what is required to accompany an outline application. This report provides the required/expected level of detail as stipulated by Wiltshire Council.

Pre-app	Outline	Full	Reserved matters	Discharge of conditions	Document to be submitted
✓	✓	✓			Flood Risk Assessment / Statement
✓	✓	✓			Drainage Strategy / Statement & sketch layout plan
	✓				Preliminary layout drawings
	✓				Preliminary "Outline" hydraulic calculations
	✓				Preliminary landscape proposals
	✓				Ground investigation report (for infiltration)
	✓	✓			Evidence of third party agreement for discharge to their system (in principle/ consent to discharge)

Table 5.1: Information Required by Wiltshire Council for Outline Application

Existing Surface Water Drainage

- 5.9 The Site is entirely greenfield and there are no recorded surface water sewers within the boundary. There is an existing ditch along the northern boundary of the Site, which flows/falls with the land in the easterly direction toward the eastern apex adjacent Junction Road. Based upon the obvious crossfall of the land the site currently drains into this ditch.

Sustainable Drainage Systems (SuDS)

- 5.10 The use of sustainable urban drainage systems (SuDS) is promoted within the national Planning Practice Guidance (PPG) to manage surface water on new development. SuDS are an alternative approach to managing surface water runoff, which strikes a balance between the management of surface water and the need to conserve natural resources.

5.11 The three main principles within SuDS design are the:

- Reduction of quantity, in particular the large peak runoffs during storm events which could cause flooding of the receiving waters;
- Improvement of quality, by reducing the level of pollution entering the sewers, watercourses or underlying groundwater; and
- Enhancement of amenity, such as community facilities and landscaping potential.

Surface Water run-off Disposal Hierarchy

5.12 As stated in the PPG, the aim should be to discharge surface water run-off as high up the following drainage hierarchy as reasonably practicable:

- Infiltration Drainage – A BGS Infiltration SuDS Report (Appendix H) has identified opportunities for bespoke infiltration SuDS. According to this report subsurface is potentially suitable although the design will be influenced by the ground conditions. The report also identified that the ground water is likely to be less than 3.0 metres below the surface. There is a rising spring at the north of the site (discussed in flood risk) that suggests a high groundwater level will hinder the use of infiltration drainage.
- A Watercourse – There is an existing ditch on the northern boundary of the Site, which flows/falls with the land in the easterly direction toward the eastern apex adjacent Junction Road. Based upon the crossfall of the land the site currently drains into this ditch
- A Sewer – There are no surface water sewers within close proximity.

5.13 Based upon the uncertainty on the ground conditions the use of infiltration drainage will not be used as the primary source of surface water disposal. The surface water run-off from the Development will mimic the existing arrangement and continue to discharge into the existing ditch running along the northern boundary.

5.14 A Surface Water Drainage Strategy has been designed on this basis and is contained Appendix G. The proposed drainage system has been divided into three distinct catchments that are clearly identified on the drainage plan. The total positive discharge rate from the developed areas will be **5.0 litres/second**

- **Catchment 01:** Developed Catchment: Restricted discharge of **2.5 litres/second** via new Outfall 01 into the existing ditch on the northern boundary. Upstream of the outfall there is a new detention basin.
- **Catchment 02:** Undeveloped Catchment: free/unrestricted discharge of greenfield land via new outfall 01. Discharge rate unknown and is not necessary to calculate.

- **Catchment 03:** Developed Catchment: Restricted discharge of **2.5 litres/second** via new Outfall 02 on existing ditch on northern boundary. Upstream of the outfall there is a proprietary attenuation tank.
- 5.15 A hydro-brake chamber (Appendix K) will be located just downstream of the detention basin and attenuation tank that will restrict the discharge to a peak rate of 2.5 litres / second prior to discharging off site, with excess water backing up into the upstream attenuation system.
- 5.16 The proposed attenuation tank will be a proprietary crate system chosen by the Main Contractor based on availability and price. (A typical product is the Geolight system manufactured and supplied by SDS limited as shown in Appendix L).

Proposed Discharge Rates and Calculations

- 5.17 The existing greenfield rates from the 4.95-hectare site hectare have been calculated using microdrainage, see below (for full calculations refer to Appendix I):
- Q1 years: 2.0l/s
 - Q30 years: 5.4l/s
 - Q100 years: 7.6l/s
 - **QBAR: 2.4l/s**
- 5.18 This Qbar greenfield rate of 2.4 litres/second from the 4.95-hectare site is very low and it will not be possible to practically implement without introducing the risk of causing a blockage at the proposed hydro-brakes. Therefore, as listed above, the proposed combined discharge rate will be 5.0 litres/second.
- 5.19 The proposed surface water network has been modelled in Micro Drainage (Appendix J), which shows the surface water network will not flood for up to and including the critical 1in100yr+45% climate change storm event.

Exceedance Flows

- 5.20 Surface water drainage systems could potentially become blocked or overloaded resulting from extreme rainfall events. Careful consideration will be given to the proposed road levels and building floor levels at the detailed design stage to ensure overland flow resulting from sewer or infrastructure failure is safely routed around individual properties within the Development. Exceedence flow routes have been identified in on the proposed drainage plan in Appendix G.

Surface Water Quality & Treatment

5.21 Table 26.2 of the Ciria SuDS Manual 2015 identifies the pollution hazard level associated with the land uses within the Proposed Development as being 'Low'. On a scale from 0-1 a 'Low' pollution hazard level relates to the pollution hazard indices below (see Table 26.2 of the SuDS Manual). This is applicable to run-off from residential roofs, driveways, paths, residential parking areas and low traffic roads:

- Total Suspended Solids = 0.5
- Metals = 0.4
- Hydrocarbons = 0.4

5.22 Table 26.3 of the SuDS Manual sets out the indicative mitigation indices provided by different SuDS features for discharges to surface water.

Detention Basin

5.23 Catchment 01 will drain onto a new detention as shown on the proposed drainage drawing in Appendix G. Basins can treat the run-off primarily via the gravitational settling of particulate pollutants, providing mitigation indices of 0.5, 0.6 and 0.6, which are equal to or in excess of the requirement set out in paragraph 5.24.

Permeable Paving

5.24 Communal parking and private parking will be constructed using permeable paving. The rainwater falling onto permeable paved areas will be treated by the microorganisms as it passes through drainage medium. The system will be Marshalls "Priora" proprietary system designed to encourage the growth of these microorganisms in the sub-base, as shown in Figure 5.4 below.

5.25 Permeable paving provides sufficient pollution mitigation for run-off from low hazard land uses and provides mitigation indices of 0.7, 0.6 and 0.7, which are in excess of the requirement set out in paragraph 5.24.

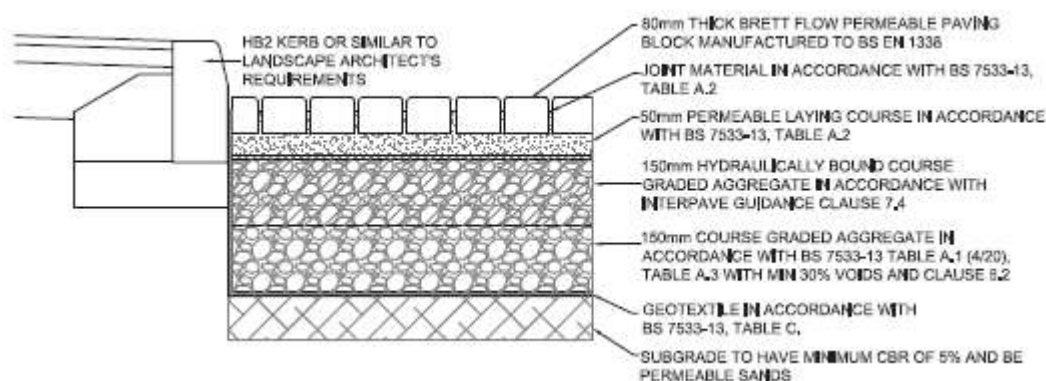


Figure 5.4: Typical Permeable Block Paving Construction

Traditional Gullies

- 5.26 Full size precast concrete gully pots draining the asphalt roads that will act as the first line of defence to trap silt and sediments in the drainage network.

Adoption and Maintenance

- 5.27 The proposed surface water sewers within the adopted and private road network will be adopted by Wessex Water under a Section 104 agreement (A Section 104 agreement, under the Water Industry Act 1991, is an agreement between a developer and sewerage undertaker for the adoption of sewers serving a development). These adopted sewers will be maintained in perpetuity in accordance with the Wessex Water maintenance schedule. (Wessex Water's maintenance schedule is not available but they have a statutory obligation to maintain their sewer networks)
- 5.28 An operation, maintenance and management plan (O&M Plan) for the SuDS systems will be secured by planning condition. The proposed SuDS elements will be maintained by a Management Company, organised by the Applicant, in accordance with the planning approved O&M Plan.
- 5.29 Taking this approach will ensure surface water systems are adequately maintained and they will continue to operate as designed/intended, which is to capture, convey, treat and dispose of all surface water run-off within the Development boundary.

Design Criteria

- 5.30 The positive drainage will be designed in accordance with Sewers for Adoption, and BS EN 752 – Drain and sewer systems outside buildings and the Building Regulations - part H (2010).
- 5.31 The surface water network design and rate of surface water runoff would be based on the Modified Rational method and designed in accordance with the Wallingford Procedure. In order to carry out the design of the networks, a number of Global Variables are used. These Global Variables/parameters are related to the location of the site in the UK and have been obtained from Maps for “design and analysis of urban storm drainage – Wallingford procedure”. These are as follows;
- Region = England & Wales
 - $M(5-60) = 20.00\text{mm}$
 - Ration (r) = 0.40
- 5.32 The positive surface water system would be designed such that:
- The pipes remain unsurcharged during the 1 in 2 year design storm;

- The system should not flood during the worst case 1 in 30 year storm with a free outfall;
- The surface water run-off from the proposed development will be contained on site for up to and including the worst case 1 in 100 year storm event, plus an additional 45% for climate change;
- The pipe velocities are such that self-cleansing is achieved at lesser more moderate storm intensities :-
 - o Pipe roughness (ks) = 0.6
 - o Minimum pipe velocity at full flow = 0.75m/s
 - o Percentage Impermeable areas:
 - Buildings = 100%
 - Carriageways, footpaths and parking = 100%
 - Private and Communal Parking = 100%
 - Soft Landscaping = 0%

6 Detention Basin

- 6.1 Detention Basins are landscaped depressions with vegetation that provides amenity space as well as attenuation. The basins normally remain dry except for during and immediately following storm events.
- 6.2 A single detention basin is proposed in the surface water drainage strategy. During storm events, surface water run-off from the part of the Development will discharge into this basin. The total impermeable area draining into the basin is approximately 0.53 hectares, which is made up with a combination of buildings, roads, driveways, car parks, etc. The proposed general arrangement for the surface water drainage and basin system is shown in Appendix G.
- 6.3 The maximum side slope is designed to meet safety and maintenance requirements and is set at a maximum gradient of 1 in 3.
- 6.4 Energy dissipation and protection will be provided at the inlets to the detention basins in order to reduce erosion scour, or erosion, at its base.

Construction

- 6.5 The following measures will be implemented during the construction of the detention basins.
- The bottom and side slopes of the basin will be carefully prepared to ensure that they are structurally sound, level and true. The preparation will ensure the basin will satisfactorily retain the surface water runoff without significant erosion damage. A pond liner will be used to stop infiltration.
 - The soils used to finish the side slopes and base of the basin will be suitably fertile, porous and of sufficient depth to ensure healthy vegetation growth.
 - The landscape design will specify appropriate grass species (to give a dense sward) and plants that will grow well on the site and in the local soils. The choice of species will take into account the fact that the vegetation will be subject to periodic inundation and water flow.
 - The phasing of the construction will take into consideration the drainage needs during building and the subsequent performance of the basin.

Operation and Maintenance

- 6.6 The following action will be put in place to ensure the detention basins remains in a good working order throughout its design life.

- There will be adequate vehicular access to the basins, inlet and outlet structures so that sediment can be removed during maintenance.
- Maintenance requirements depend primarily on the nature of the landscaping employed. If planted with low-growing ground cover and shrubbery, twice-yearly inspections and repair of eroded and damaged areas should be sufficient.
- Inlet and outlet structures will be inspected at least twice a year, and after large storms, for debris and erosion. Remedial action will be taken as necessary.

6.7 Sediment accumulations will be removed when necessary, taking appropriate measures to ensure the extracted materials are disposed of properly and safely. Typically, sediment removal may be needed every seven to ten years, but periods up to twenty-five years have also been estimated. Sufficient care will be taken to avoid damaging any liner during this activity.

7 Safety at Inland Water Sites

- 7.1 The proposed surface water drainage strategy includes the introduction of detention basins, which are new bodies of water being introduced to a residential area.
- 7.2 Water flowing or standing at depth, whether natural or artificial, is potentially hazardous to the general public and in particular to children to whom it may be seen as an attraction.
- 7.3 Operators and managers of inland facilities face the task of identifying the hazards associated with open water and assessing the risks these present to the public. They must then make the appropriate safety arrangement to control the risk to an acceptable level. “The Safety at Inland Water Sites – Operational Guidelines” has been prepared by the Royal Society for the Prevention of Accidents (RoSPA) to assist operators with this task.
- 7.4 Both common and statute law have a relevance to the operation of inland waters:
- Common Law Duty of Care: Under common law, liability in negligence may arise from the breach of a fundamental duty, known as the “duty of care”. The duty is described as follows: “to take reasonable care to avoid acts or omissions that you can reasonably foresee would be likely to injure your neighbour”. On the case of inland water, duty of care and therefore a requirement to take adequate precautions will be with the site operator and/or owners.
 - Statutory Requirements: Public and employee safety at water sites is a statutory duty placed upon operators in so far as they are employers, or have effective control over sites.
- 7.5 To ensure that public and employee safety issues are properly understood a health and safety/risk assessment will need to be carried out to identify unacceptable risks that may require corrective action, which should reduce potential risks to an acceptable level. This risk assessment would be undertaken at the detailed design stage of the project.
- 7.6 As a minimum, the assessment would address the new detention basin located within the boundary of the Development.

8 Proposed Foul Drainage

Existing Foul Sewers

- 8.1 According to the Wessex Water sewer records in Appendix E there two foul water sewers within the Site:
- Ex Foul Sewer 01: 150mm diameter sewer that runs along the northern boundary, south of the ditch, for a length of approximately 330 metres.
 - Ex Foul Sewer 02: 150mm diameter sewer that runs within the main access area to the southeast for approximately 90 metres.
- 8.2 Both of these sewers eventually run into Junction Road to the south of the Site and discharge into an existing Wessex Water foul water pump station on the opposite side of the A36. The pump station pumps effluent via a rising main back up Junction Road to a gravity sewer in Southampton Road

Proposed on-site Layout

- 8.3 A number of these existing sewers that pass through the site will need to be diverted to make way for the Development as can be seen in the proposed drainage strategy in Appendix G. The Development will connect into these existing sewers on a gravity basis.
- 8.4 Statutory Authorities have their own methods of calculating peak foul flows from residential developments. It is therefore considered that Wessex Water will calculate foul flows from the Development.

Design Criteria

- 8.5 The proposed new main foul sewers be designed in accordance with Design and Construction Guidance (DCG). This guide is for use by developers undertaking new development when planning, designing and constructing conventional foul and surface water sewers, lateral drains, pumping stations and rising mains intended for adoption by the sewerage undertaker.

Adoption & Maintenance

- 8.6 The foul sewers will be adopted by Anglian Water under a Section 104 agreement (A Section 104 agreement, under the Water Industry Act 1991, is an agreement between a developer and sewerage undertaker for the adoption of sewers serving a development). These adopted sewers will be maintained in perpetuity in accordance with the Anglian Water maintenance schedule.

9 Conclusion

- 9.1 The development is located in a Flood Zone 1 area which has a low probability risk of experiencing flooding from fluvial/tidal sources.
- 9.2 The development is also at low risk of flooding from the following sources: Groundwater and Infrastructure Failure (see Table 9.1):

Flood Mechanism	Source	Flood Risk to the Development	Mitigation Required?
Fluvial	N/A	Low	No
Tidal	N/A	Low	No
Groundwater	Underlying geology and groundwater levels	Low	No
Surface Water / Overland Flow	Runoff from surrounding elevated land and highway corridors	Low	No, (applying good engineering practice will remove the flood risk)
Infrastructure Failure	Surface water systems and Water mains	Low	No

Table 9.1: Flood Risk Summary

- 9.3 The proposed drainage network will broadly mimic the existing arrangement by ensuring all rainfall continues to drain into the existing ditch running along the northern boundary.
- 9.4 The completed system will manage surface water run-off up to the 1 in 100-year return period including a 45% allowance for climate change.
- 9.5 The surface water systems will include traditional positive drainage systems (Gullies, pipes, manholes, etc) that will be used in conjunction with SuDS systems in the form of a detention basin, an attenuation tank and permeable paving.
- 9.6 The traditional positive systems will be designed in accordance with Design and Construction Guidance (DCG). The SuDS design is based upon guidance provided in the CIRIA Report C753 - The SuDS Manual.
- 9.7 The proposed surface and foul water sewers within the adopted and private road network will be adopted by Wessex under a Section 104 agreement.
- 9.8 An operation, maintenance and management plan (O&M Plan) for the SuDS systems will be secured by planning condition. The proposed SuDS elements will be maintained by a Management Company, organised by the Applicant, in accordance with the planning approved O&M Plan.

- 9.9 Having completed this FRA and drainage strategy, the conclusion is that the proposed development at Southampton Road, Alderbury, is not at risk of flooding and can be safely carried out without increasing the risk of flooding to downstream/surrounding properties.

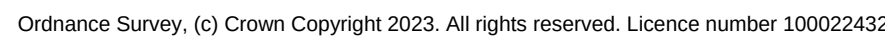
APPENDIX A: Site Location

To be read in conjunction topographical and arboricultural survey and associated drawings/reports.

Development boundary

Development boundary

Other land owned by applicant



rhp **r h partnership architects**
28 Foundry Street Brighton BN1 4A
T 01273 645220
www.rhpartnership.co.uk
brighton@rhpartnership.co.uk

Drawing

Site Location Plan

Status	Suitability
Planning	50

APPENDIX B: Wiltshire Council Pre-App Advice

Wiltshire Council Planning Consultation Response

12 January 2023

Wiltshire Council Drainage Engineer
Technical Services Drainage Engineer
Wiltshire Council

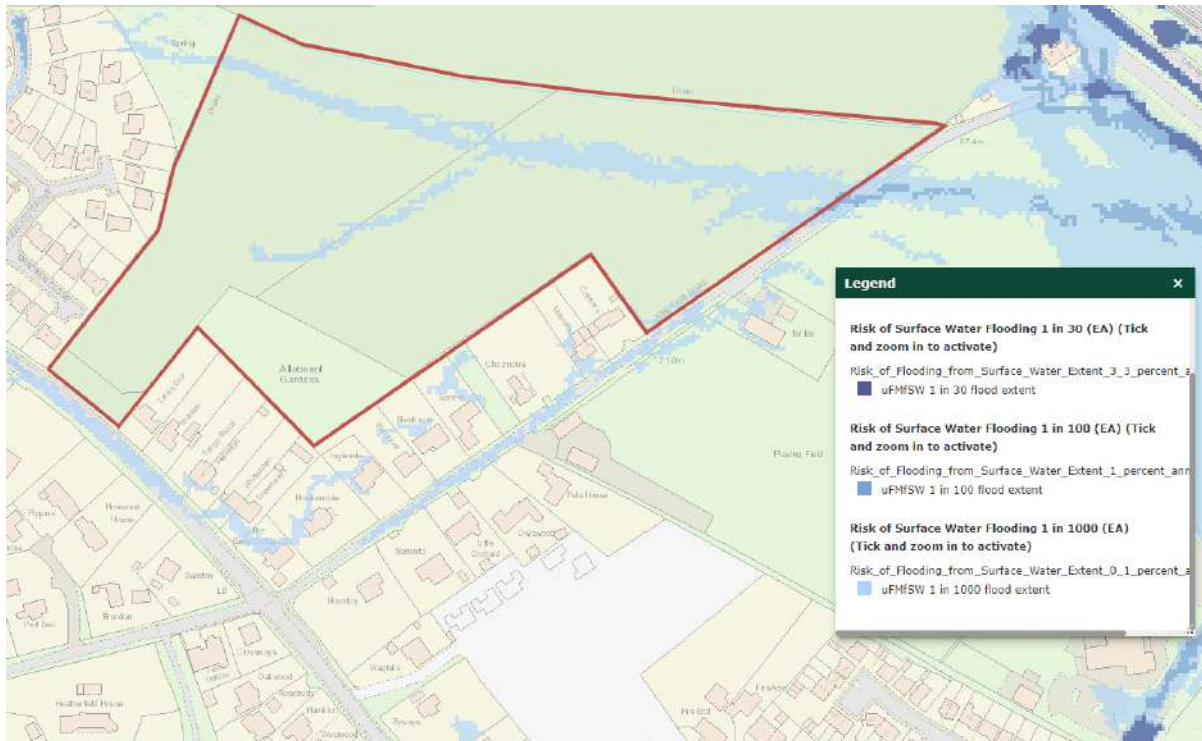
Application No: ENQ/2023/00006

Residential development comprising 77no. Dwellings.

**LAND AT SOUTHAMPTON ROAD & JUNCTION ROAD, ALDERBURY, SALISBURY,
SP5 3AG**

Pre-Application Advice: Flood Risk

The Wiltshire Council Strategic Flood Risk Assessment, [SFRA Data Explorer](#), has indicated that the site is located within Flood Zone 1. A surface water flow path has been identified running through the site, resulting in parts of the site being at low surface water flood risk; this shall be investigated further as part of the FRA.



Overall, the site is shown to be at moderate cumulative risk of flooding in the future from all sources.

A site-specific Flood Risk Assessment (FRA) is required for this application. The site-specific FRA should demonstrate that the site is not adversely affected by flood risk from different sources, and how the flood risk from **all sources** will be managed without increasing flood risk to the development itself or elsewhere. It should also outline the proposed drainage strategy for the site. The applicant is referred to the Environment Agency's [advice](#) on how to prepare an FRA, as well as their standing [advice](#) for vulnerable developments.

Pre-Application Advice: Drainage Strategy / Drainage Design

The applicant should note that in all instances the preference should be to utilise blue-green SuDS which provide multi-faceted benefits to the site (in terms of water quantity, quality, amenity and biodiversity); for example, for attenuation features preference should be given to use of swales / ponds / detention basins (if technically feasible) instead of attenuation tanks. The applicant should adopt a holistic approach to planning the site, and sufficient space for SuDS features should be provided at an early stage in order to fulfil the requirements of NPPF Paragraph 169; the LLFA will not accept statements that there is insufficient space for SuDS or that SuDS have not been utilised due to cost.

Any proposals should be designed in accordance with the Non-statutory Technical Standards for Sustainable Drainage Systems and the latest SuDS Manual (C753).

The applicant should note the EA's updated climate change guidance (dated [27 May 2022](#)) when preparing the Flood Risk Assessment / Drainage Strategy. For clarity, the LLFA would expect to see the following climate change allowances applied to rainfall:

- 1 in 30 yr = +40% Climate Change
- 1 in 100 yr = +45% Climate Change

The developer should provide the following information as part of future planning applications:

Drainage Strategy

- Evidence that SuDS have been selected, wherever possible, to provide a wide range of benefits including amenity, biodiversity and maintaining water quality.
- Evidence that SuDS source control measures to manage water quantity and maintain water quality have been implemented wherever possible and throughout the management train so the development is not reliant upon large attenuation features close to the points of discharge.
- Existing greenfield runoff rates for the site.
- Post development runoff rates in accordance with Wiltshire Council's betterment policy:
 - *With regards the control of surface water discharges from new development, Wiltshire Council requires post development discharges from greenfield sites to provide 20% betterment over pre-development discharges for all storm events between the 1 in 1year and 1 in 100year return period events.*
 - *For greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.*
- Evidence demonstrating how the surface water disposal hierarchy has been applied and how all other options have been exhausted. The hierarchy is set out below (as per the Sewerage Sector Guidance, paragraph C.3.12):
 - Surface water runoff is collected for use.
 - Discharge into the ground via infiltration.
 - Discharge to a watercourse or other surface water body.
 - Discharge to surface water sewer or other drainage system, discharging to a watercourse or other surface water body.
 - Discharge to a combined sewer.
- The drainage strategy does not increase flood risk, as a result of catchment transfer.
- A detailed plan showing the existing drainage features on the site and how the proposed drainage strategy will be implemented.
- If infiltration is proposed, it is implemented in manner that does not create an offsite impact, particularly if there are reports of groundwater flooding in the area.
- Surface water can be safely managed within the proposed development, up to and including a 1 in 100 year plus climate change event.
- Existing flood flow routes through the site have been maintained or where they will be affected, adequate measures to intercept and safely control flows through the site have been provided to ensure flood risk is not increased elsewhere.

- All proposed drainage features are outside flood zones 2 and 3 and where they are adjacent to an ordinary watercourse, they are not located within the EA surface water flood maps. Where drainage features are located adjacent to flood zones 2 and 3, they must be above the 1 in 100 year plus climate change flood level. This information can be provided by the EA.
- The strategy mimics the existing drainage characteristics of the site by retaining and utilising any existing drainage features.
- Measures to prevent pollution of the receiving groundwater and/or surface waters.
- A clearly labelled drainage layout plan showing the pipe networks and any attenuation ponds. The plan should show any pipe node numbers referred to within the drainage calculations.

Ground Investigations

- Geotechnical factual and interpretive reports, including infiltration tests in accordance with British Research Establishment (BRE) Digest 365 – Soakaway Design.
- Groundwater level monitoring (taking into account seasonal variations).
- The applicant is referred to Wiltshire Council's [Surface Water Soakaway Guidance](#) for the standards that must be met for planning approval and adoption of infiltration drainage features.

Detailed Drainage calculations

- Calculations and drawings for the drainage system design showing designated holding areas and conveyance routes based on no flooding on site for a 1 in 30 year plus climate change rainfall event.
- Calculations and drawings for the drainage system design showing designated holding areas and conveyance routes based on no flooding on site for a 1 in 100 year plus climate change rainfall event in respect to a building (including basement) or utility plant susceptible to water within the development.
- Calculations should include an allowance for increased surface water runoff, as a result of urban creep, in accordance with LASOO guidance.
- Hydraulic Models should set the MADD factor / additional storage volume factor to 0m³ / ha in order to prevent an overestimation of storage capacity in the proposed drainage network.

Design Drawings

- A plan showing the cross sections and design of any attenuation pond and its components.
- Drawings showing conveyance routes for flows exceeding the 1 in 100 year plus climate change rainfall event that minimise the risk to people and property.

Third party consent

- Consent for any outfalls from the proposed drainage systems into a public sewer or other drainage system not owned by the applicant.

Ownership and Management

- Details of how the proposed and existing drainage features on the site will be maintained and managed after completion with confirmation from the relevant authority that they will adopt any systems that are being offered for adoption.

Construction

- Adequate measures during construction to control pollution to existing watercourses and groundwater.
- A construction management plan.

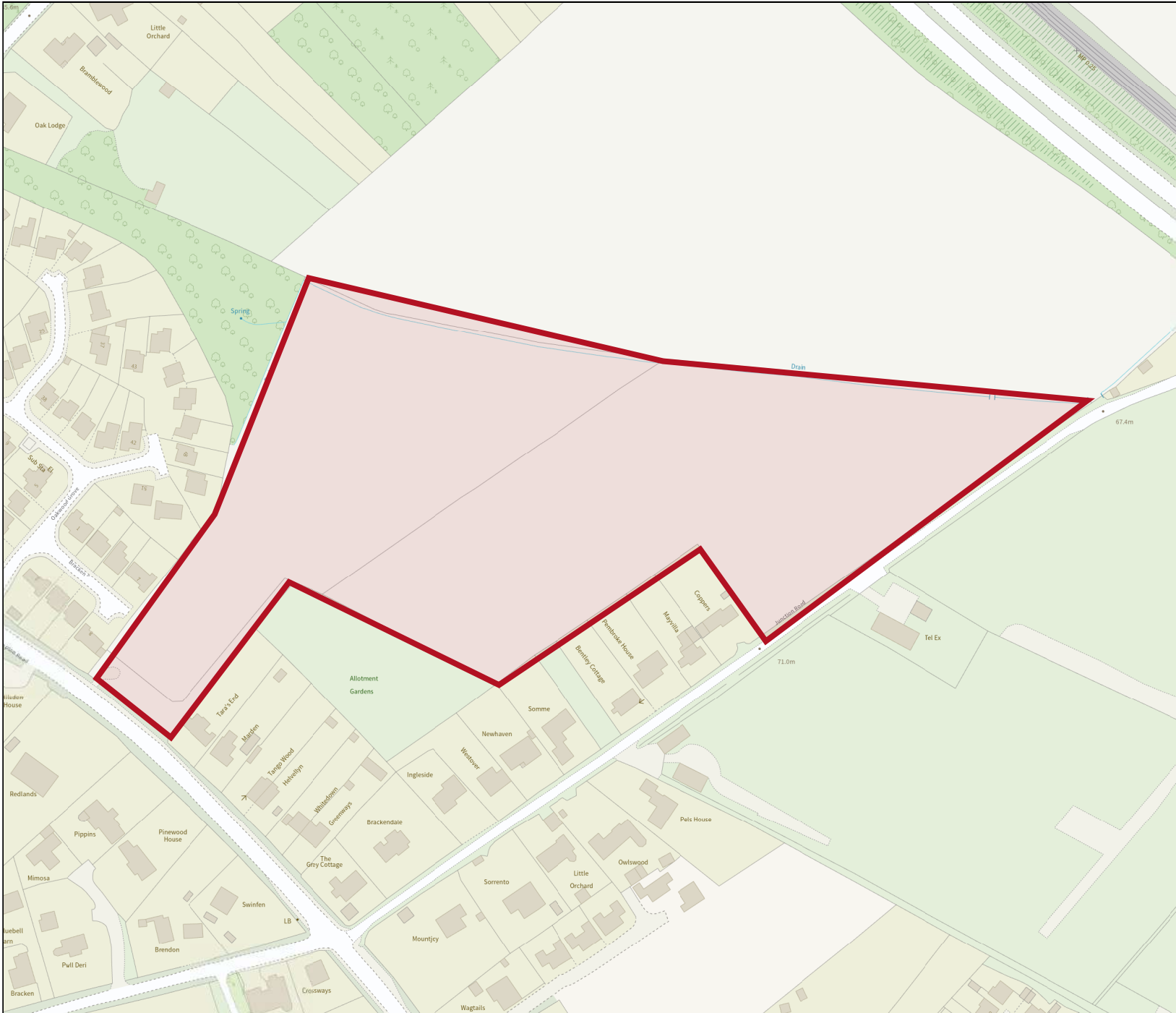
Informatives:

The table below stipulates the information typically required at each application stage. Provision of the correct information will expedite the processing of applications by the drainage team.

Pre-app	Outline	Full	Reserved matters	Discharge of conditions	Document to be submitted
✓	✓	✓			Flood Risk Assessment / Statement
✓	✓	✓			Drainage Strategy / Statement & sketch layout plan
	✓				Preliminary layout drawings
	✓				Preliminary "Outline" hydraulic calculations
	✓				Preliminary landscape proposals
	✓				Ground investigation report (for infiltration)
	✓	✓			Evidence of third party agreement for discharge to their system (in principle/ consent to discharge)
		✓		✓	Maintenance program and on-going maintenance responsibilities
		✓	✓		Detailed development layout
		✓	✓	✓	Detailed flood & drainage design drawings
		✓	✓	✓	Full Structural, hydraulic & ground investigations
		✓	✓	✓	Geotechnical factual and interpretive reports, including infiltration results
		✓	✓	✓	Evidence of measures to prevent pollution of the receiving groundwater and/or surface waters
		✓	✓	✓	Drawings showing conveyance routes for flows exceeding the 1 in 100 year plus climate change
		✓	✓	✓	Detailed landscaping details
		✓	✓	✓	Discharge agreements (temporary and permanent)
		✓	✓	✓	Development Management & Construction Phasing Plan

Ben Wilding (Atkins working on behalf of Wiltshire Council Drainage).

APPENDIX C: Flood Risk Plans

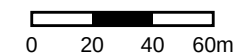


Your reference
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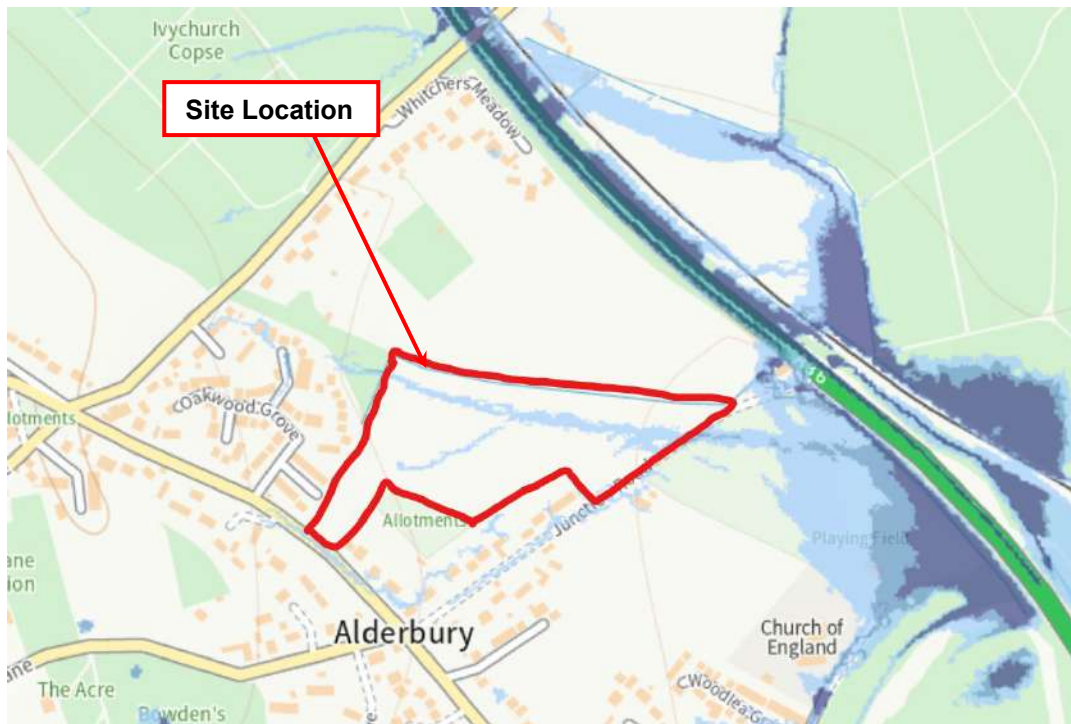
Scale
1:2500

Created
28 Apr 2023 13:58

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



ENVIRONMENT AGENCY SURFACE WATER FLOOD MAP
(December 2023)
Southampton Road, Alderbury



Wiltshire Council, Post code: SP5 3AG Co-ords: E418792, N127171

Risk of Flooding from Surface Water

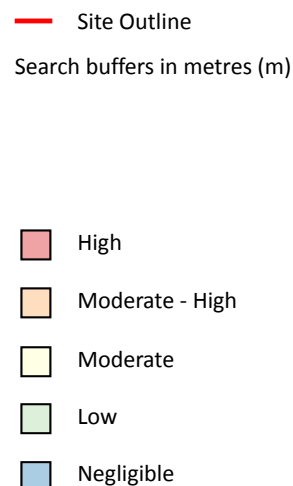
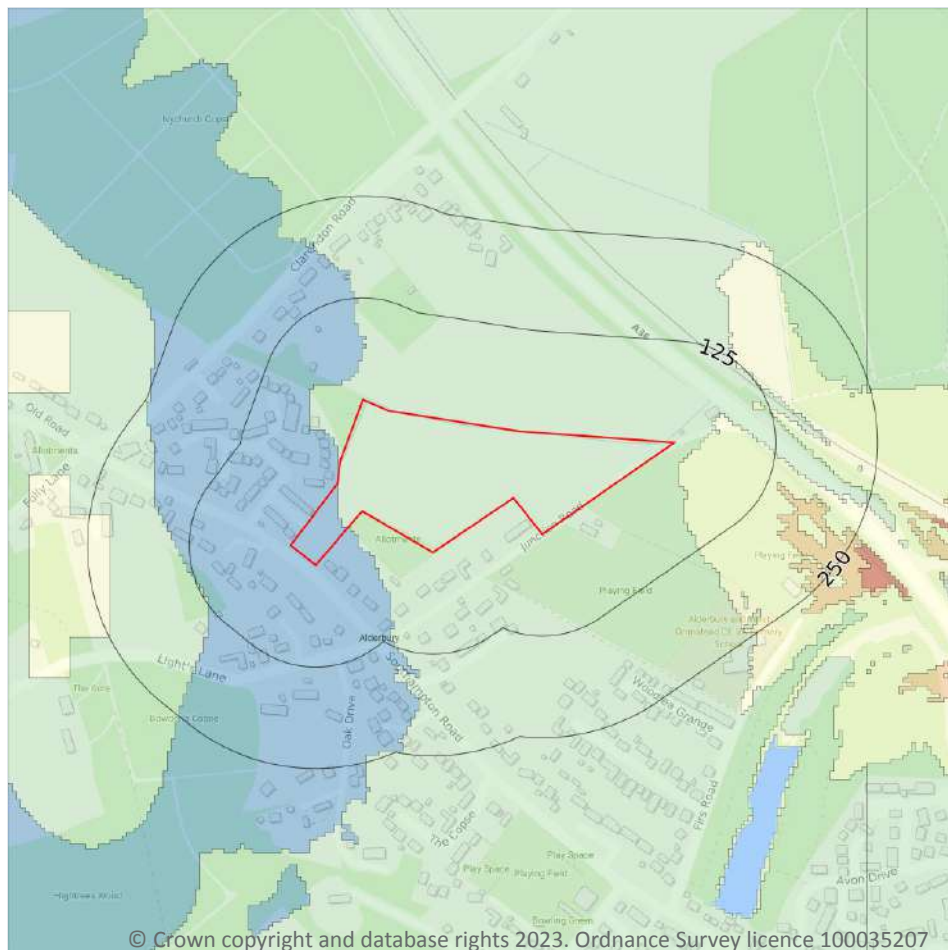
Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

The shading on the map shows the risk of flooding from surface water in this particular area.

There are four different kinds of area shown on the Flood Map. They can be described as follows:

-  High Risk Area – Each year this area has a greater than 1in30 (3.3%) chance of flooding from surface water:
-  Medium Risk Area – Each year this area has between a 1in100 and a 1in30 (1%-3.3%) chance of experiencing flooding from Surface Water:
-  Low Risk Area – Each year this area has a between a 1in1000 and 1in100 (0.1%-1%) chance of experiencing flooding from Surface Water.
-  Very Low Risk Area – Each year this area has a less than 1in1000 (0.1%) chance of experiencing flooding from Surface Water.

9 Groundwater flooding



9.1 Groundwater flooding

Highest risk on site

Low

Highest risk within 50m

Moderate

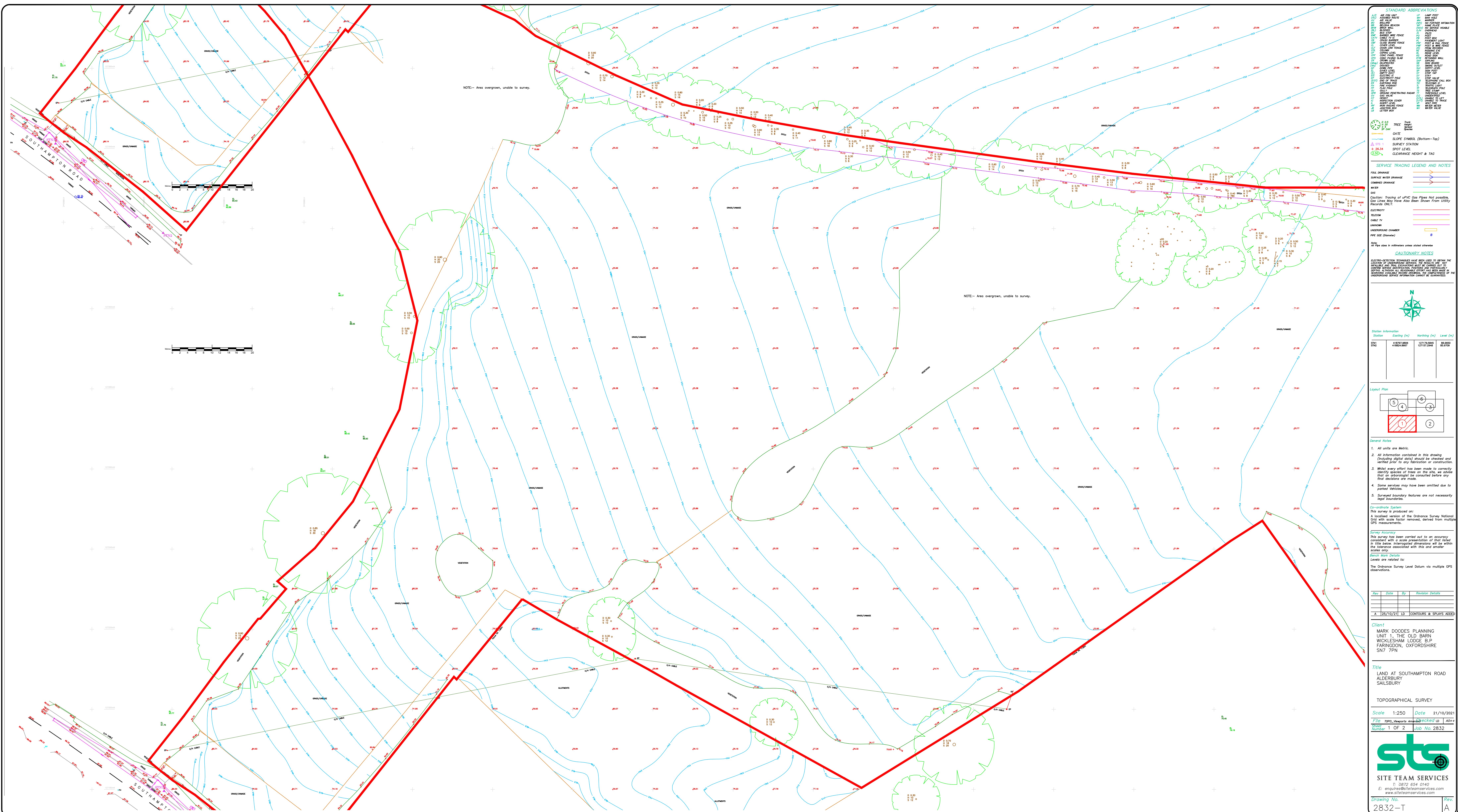
Groundwater flooding is caused by unusually high groundwater levels. It occurs when the water table rises above the ground surface or within underground structures such as basements or cellars. Groundwater flooding tends to exhibit a longer duration than surface water flooding, possibly lasting for weeks or months, and as a result it can cause significant damage to property. This risk assessment is based on a 1 in 100 year return period and a 5m Digital Terrain Model (DTM).

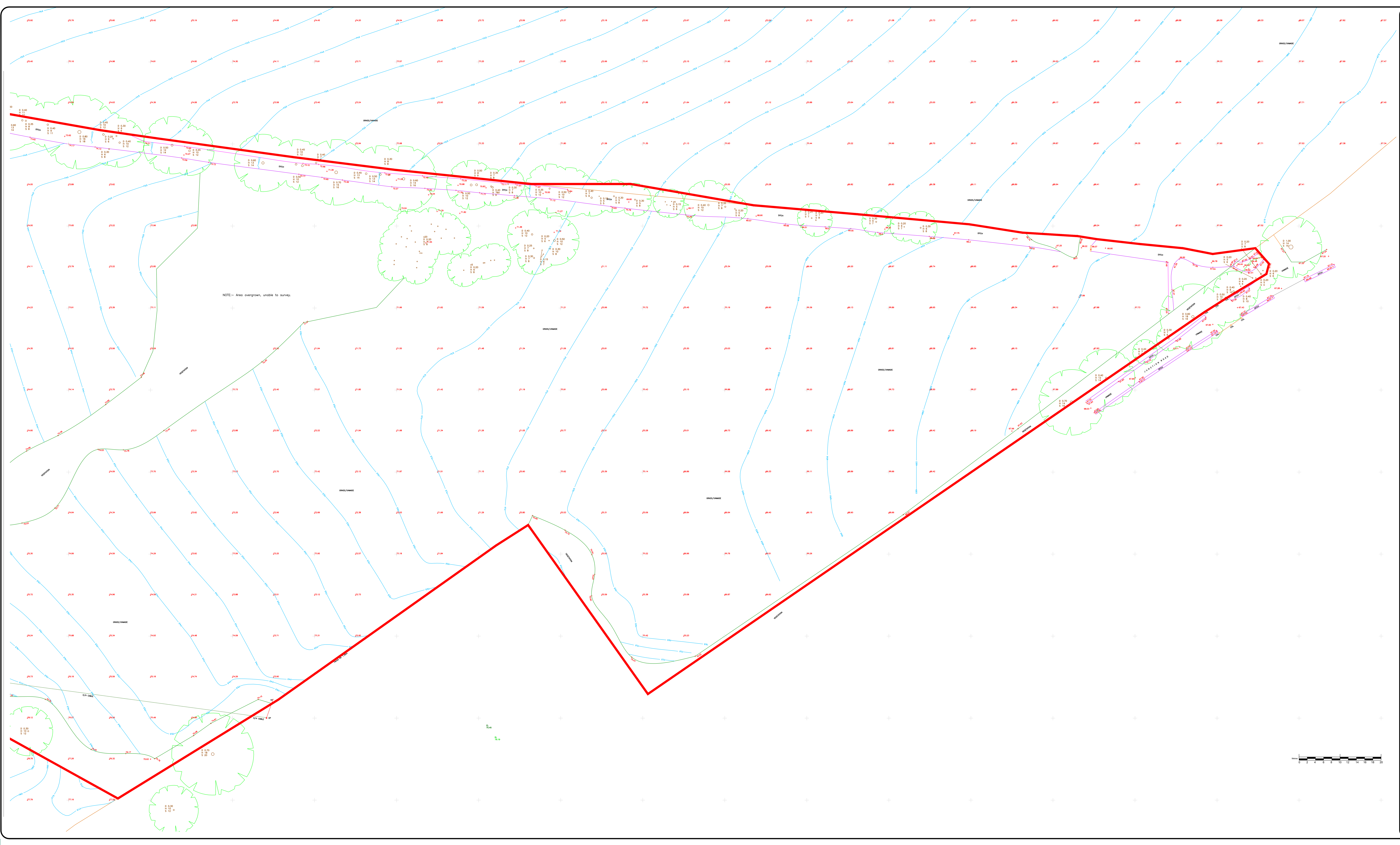
Features are displayed on the Groundwater flooding map on [page 51](#) >

This data is sourced from Ambiantal Risk Analytics.

APPENDIX D: Topographic Survey

A0 ++



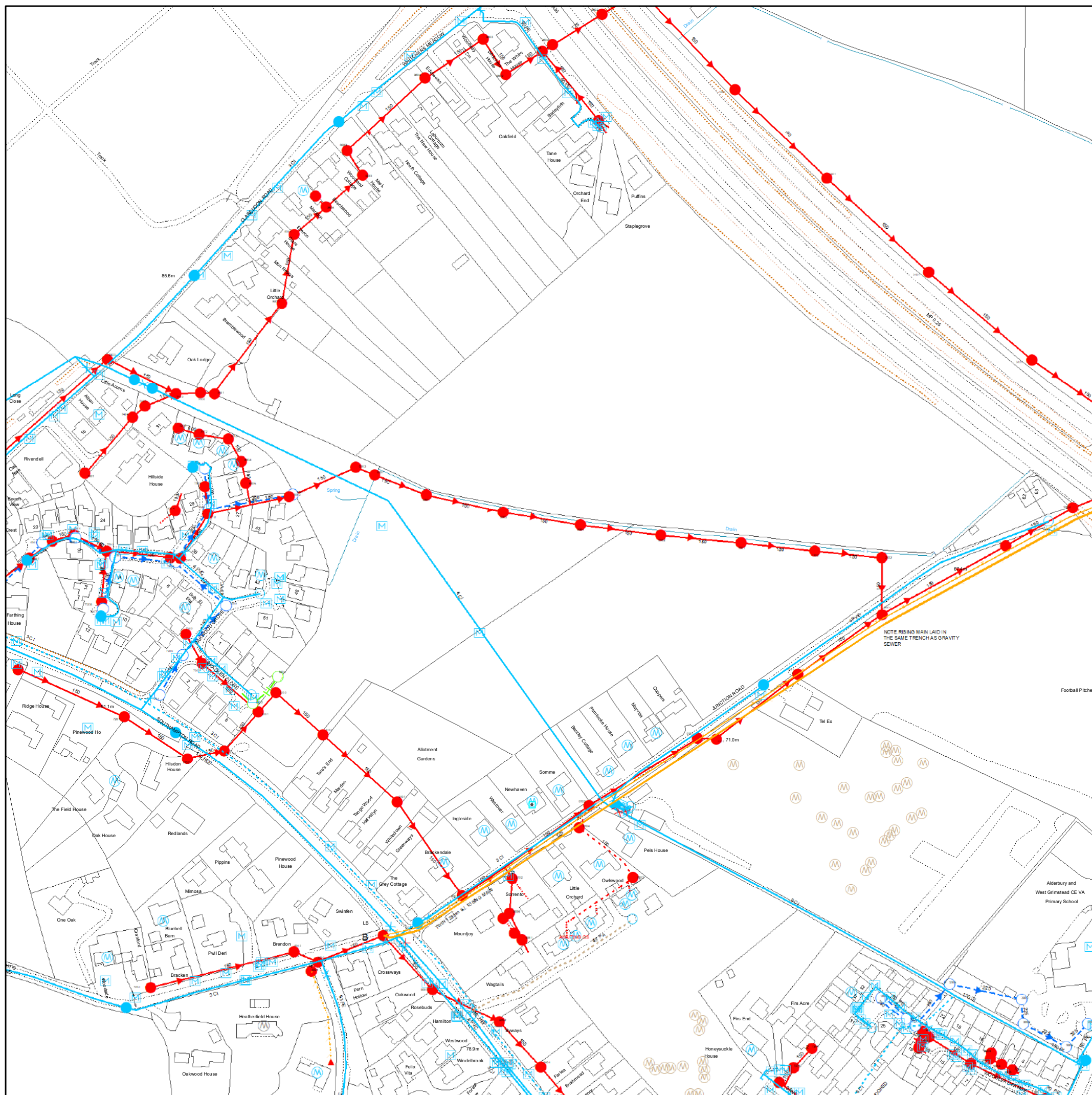


STANDARD ABBREVIATIONS

AC	ACCESS ROUTE	AW	AWAY FROM
AD	ADDITIONAL	BA	BARRIER
BE	BELONG TO	BS	BUS STOP
BL	BLOCK	CA	CABLE
BO	BORDER	CH	CHURCH
BR	BROOK	CL	CLIFF
BU	BUILDING	CO	COAST
CA	CABLE	CR	CROSS
CB	CABLE BOX	CS	CROSSING
CC	CABLE CUT	CT	CUT
CD	CABLE DRAIN	CU	CUT
CE	CABLE END	CV	CABLE VALVE
CF	CABLE FENCE	DA	DRAINAGE
CG	CABLE GATE	DE	DEVELOPMENT
CH	CHURCH	DI	DRAINAGE
CI	CABLE IN	DO	DRAINAGE
CJ	CABLE JUNCTION	DP	DRAINAGE
CK	CABLE KNOT	DR	DRAINAGE
CL	CABLE	DU	DRAINAGE
CM	CABLE MOUNT	EA	EARTH
CN	CABLE NETWORK	EB	EARTH
CO	COAST	EC	EARTH
CP	CROSSING	ED	EARTH
CQ	CROSSING	EE	EARTH
CR	CROSSING	EF	EARTH
CS	CROSSING	EG	EARTH
CT	CUT	EH	EARTH
CU	CUT	EI	EARTH
CV	CABLE VALVE	EJ	EARTH
CW	CABLE WORK	EK	EARTH
CX	CABLE CROSSING	EL	EARTH
CY	CABLE CUT	EM	EARTH
CA	CABLE	EN	EARTH
CB	CABLE BOX	EO	EARTH
CC	CABLE CUT	EP	EARTH
CD	CABLE DRAIN	EQ	EARTH
CE	CABLE END	ER	EARTH
CF	CABLE FENCE	ES	EARTH
CG	CABLE GATE	ET	EARTH
CH	CHURCH	EU	EARTH
CI	CABLE IN	EV	EARTH
CJ	CABLE JUNCTION	EW	EARTH
CK	CABLE KNOT	EX	EARTH
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CM	CABLE MOUNT	EZ	EARTH
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CD	CABLE DRAIN	FP	FENCE
CE	CABLE END	FQ	FENCE
CF	CABLE FENCE	FR	FENCE
CG	CABLE GATE	FS	FENCE
CH	CHURCH	FT	FENCE
CI	CABLE IN	FU	FENCE
CJ	CABLE JUNCTION	FV	FENCE
CK	CABLE KNOT	FW	FENCE
CL	CABLE	FX	FENCE
CM	CABLE MOUNT	FY	FENCE
CN	CABLE NETWORK	FZ	FENCE
CO	COAST	GA	GATE
CP	CROSSING	GB	GATE
CQ	CROSSING	GC	GATE
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CS	CROSSING	GE	GATE
CT	CUT	GF	GATE
CU	CUT	GG	GATE
CV	CABLE VALVE	GH	GATE
CW	CABLE WORK	GI	GATE
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CA	CABLE	GL	GATE
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CQ	CROSSING	HB	HILL
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CJ	CABLE JUNCTION	HT	HILL
CK	CABLE KNOT	HU	HILL
CL	CABLE	HV	HILL
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CP	CROSSING	HZ	HILL
CQ	CROSSING	IA	INLET
CR	CROSSING	IB	INLET
CS	CROSSING	IC	INLET
CT	CUT	ID	INLET
CU	CUT	IE	INLET
CV	CABLE VALVE	IF	INLET
CW	CABLE WORK	IG	INLET
CX	CABLE CROSSING	IH	INLET
CY	CABLE CUT	II	INLET
CA	CABLE	IJ	INLET
CB	CABLE BOX	IK	INLET
CC	CABLE CUT	IL	INLET
CD	CABLE DRAIN	IM	INLET
CE	CABLE END	IN	INLET
CF	CABLE FENCE	IO	INLET
CG	CABLE GATE	IP	INLET
CH	CHURCH	IQ	INLET
CI	CABLE IN	IR	INLET
CJ	CABLE JUNCTION	IS	INLET
CK	CABLE KNOT	IT	INLET
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CV	CABLE VALVE	JE	JUNCTION
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CL	CABLE	MM	MOUNTAIN
CM	CABLE MOUNT	MM	MOUNTAIN
CN	CABLE NETWORK	MM	MOUNTAIN
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CL	CABLE	MM	MOUNTAIN
CM	CABLE MOUNT	MM	MOUNTAIN
CN	CABLE NETWORK	MM	MOUNTAIN
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CP	CROSSING	MM	MOUNTAIN
CQ	CROSSING	MM	MOUNTAIN
CR	CROSSING	MM	MOUNTAIN
CS	CROSSING	MM	MOUNTAIN
CT	CUT	MM	MOUNTAIN
CU	CUT	MM	MOUNTAIN
CV	CABLE VALVE	MM	MOUNTAIN
CW	CABLE WORK	MM	MOUNTAIN
CX	CABLE CROSSING	MM	MOUNTAIN
CY	CABLE CUT	MM	MOUNTAIN
CA	CABLE	MM	MOUNTAIN
CB	CABLE BOX	MM	MOUNTAIN
CC	CABLE CUT	MM	MOUNTAIN
CD	CABLE DRAIN	MM	MOUNTAIN
CE	CABLE END	MM	MOUNTAIN
CF	CABLE FENCE	MM	MOUNTAIN
CG	CABLE GATE	MM	MOUNTAIN
CH	CHURCH	MM	MOUNTAIN
CI	CABLE IN	MM	MOUNTAIN
CJ	CABLE JUNCTION	MM	MOUNTAIN
CK	CABLE KNOT	MM	MOUNTAIN
CL	CABLE	MM	MOUNTAIN
CM	CABLE MOUNT	MM	MOUNTAIN
CN	CABLE NETWORK	MM	MOUNTAIN
CO	COAST	MM	MOUNTAIN
CP	CROSSING	MM	MOUNTAIN
CQ	CROSSING	MM	MOUNTAIN
CR	CROSSING	MM	MOUNTAIN
CS	CROSSING	MM	MOUNTAIN
CT	CUT	MM	MOUNTAIN
CU	CUT	MM	MOUNTAIN
CV	CABLE VALVE	MM	MOUNTAIN
CW	CABLE WORK	MM	MOUNTAIN
CX	CABLE CROSSING	MM	MOUNTAIN
CY	CABLE CUT	MM	MOUNTAIN
CA	CABLE	MM	MOUNTAIN
CB	CABLE BOX	MM	

APPENDIX E: Wessex Water Sewer Records

Wessex Water Web Map



Reproduced from the Ordnance Survey map by permission on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright . Licence 100019539.

WATER MAINS

- Distribution Main
- Washout Main
- - - Raw Water Main
- Abandoned Main
- . - . Private Main

SITES

-  Source
 Reservoir
 Pump
 Treatment Works

FITTINGS

-  Valve - Open
-  Valve - Closed
-  Fire Hydrant
-  Pressure Reducing Valve
-  Meter

SEWERS

-
- Foul
- Surface
- Combined
- Abandoned

Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow) styles of line are shown on the key in sample/typical colours.

STRUCTURES

- | | |
|------------------------------|-------------------------------|
| ● Manhole - Foul | △ Pumping Station - Surface |
| ○ Manhole - Surface | ▲ Pumping Stn - Foul/Combined |
| ● Manhole - Combined | □ Gully |
| ---T Outfall | VC Vent Column |
| ---T Inlet | RE Rodding Eye |
| LE Lamphole | CP Catchpit |
| ■ Bifurcation - Foul | FC Flushing Chamber |
| □ Bifurcation - Surface | SO Soakaway |
| ■ Bifurcation - Combined | NRV Non Return Valve |
| CSO Combined Sewage Overflow | X Washout |
| | ◆ Air Valve |
| | HB Hatch Box |

Combined Sewage Overview **▼** **All Valve** **Match Box**

Information in this plan is provided for identification purposes only. No warranty as to accuracy is given or implied. The precise route of pipe work may not exactly match that shown. Wessex Water does not accept liability for inaccuracies. Sewers and lateral drains adopted by Wessex Water under the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011 are to be plotted over time and may not yet be shown. In carrying out any works, you accept liability for the cost of any repairs to Wessex Water apparatus damaged as a result of your works. You are advised to commence excavations using hand tools only. Mechanical digging equipment should not be used until pipe work has been precisely located. If you are considering any form of building works and pipe work is shown within the boundary of your property or a property to be purchased (or very close by) a surveyor should plot its exact position prior to commencing works or purchase. Building over or near Wessex Water's apparatus is not normally permitted.

PUBLIC PRIVATE SECTION 104

-
- Rising Mains
 Standby Rising
 Effluent Disposal
 Overflow
 Syphon

OTHER WESSEX PIPES

-  Rising Mains
-  Standby Rising Mains
-  EDM Effluent Disposal
-  Overflow
-  Syphon

NON-WESSEX / UNKNOWN

-  Private Rising Mains
 CW Culverted Watercourse
 Highway Drain
 Use Unknown
 SU Status Unknown

OTHER STRUCTURES

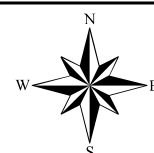
-  Attenuation Tank  Tunnel
 Storage Tank  Interceptor

Wessex Water
YTL GROUP

Date: 30/10/2023, 15:56:06

Scale: 1:2,500

Centre: 419,004, 127,314



APPENDIX F: Proposed Layout



Proposed Dwellings	
25AP Bungalow	4
25AP Dwelling Houses	9
35SP Dwelling Houses	32
45SP Dwelling Houses	2
Total Units	47

P4	24-09-2024	Planning Issue	SL	SH
P3	23-09-2024	Planning Issue	SL	SH
P2	16-08-2024	Planning Issue	SL	SR
P1	08-01-2024	First Issue	SL	SR
Rev		Date + notes	Drawn	Checked

r h partnership architects
28 Foundry Street Brighton BN1 4AT
T 01273 445200
www.rhpartnership.co.uk
brighton@rhpartnership.co.uk

Project
Land off Southampton Road
Alderbury

Drawing
Indicative Proposed Site Plan

Project	originator	author	level	type	size	number	revision
P1365-RHP-ZZ-00-DR-A-1200	P4						
Scale(s) @ A0	RHP Project		Drawn	Check			
1:500	P1365		SL	SR			
Status	Planning				Suitability		
						80	

APPENDIX G: Proposed Drainage Strategy



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A0 ORIGINAL

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KEY:

- PROPOSED SURFACE WATER SEWER AND MANHOLE
- PROPOSED HYDROBRAKE
- PROPOSED FOUL WATER SEWER AND MANHOLE
- PROPOSED SURFACE WATER SEWER AND INSPECTION CHAMBER
- EXISTING FOUL WATER SEWER AND MANHOLE
- PROPOSED SURFACE WATER INTERCEPTION DRAIN
- PROPOSED SURFACE WATER ATTENUATION TANK
- PROPOSED ATTENUATION BASIN
- PROPOSED SURFACE WATER HEADWALL
- PROPOSED CATCHMENT
- PROPOSED INDICATIVE OVERLAND FLOW ROUTE

NOTES:

- This drawing is not to be scaled.
- Drawing based on RH Partnership Architect's "Proposed Indicative Site Plan" drawing reference P1365-RHP-ZZ-00-DR-A-1200 revision P4, received on 25/09/2024.
- This drawing is to be read in conjunction with all relevant engineering and landscaping drawings. Any discrepancies are to be reported to the engineer immediately for clarification.

FOR INFORMATION
NOT FOR CONSTRUCTION

P3	Latest proposed site layout used. Adjustments made to drainage and levels design accordingly. Key and notes added. (TC)	SF	07/10/2024
P2	Latest proposed site layout used, landscape strategy added. Adjustments made to drainage and levels design accordingly. (SF)		05/01/2024
P1	Initial Issue (SF)		04/01/2024

rev.	amendment	checked	date

mb
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client
FORMULA LAND (ALDERBURY) Ltd

project
SOUTHAMPTON ROAD
ALDERBURY

scale 1:500	drawn by TC	checked by SF
date OCTOBER 2024	cad file 20 - DRAINAGE.DWG	

title
PROPOSED DRAINAGE STRATEGY

Mayer Brown Limited jobcode WP/ALDERBURY	submittal P3	revision
drawing number WPALDERBURY.23_20		

APPENDIX H: BGS Infiltration SuDS GeoReport

TOM CASSIDY
MAYER BROWN
BROWN & CO PLANNING LTD
LION HOUSE
147 ORIENTAL ROAD
WOKING
GU22 8AR

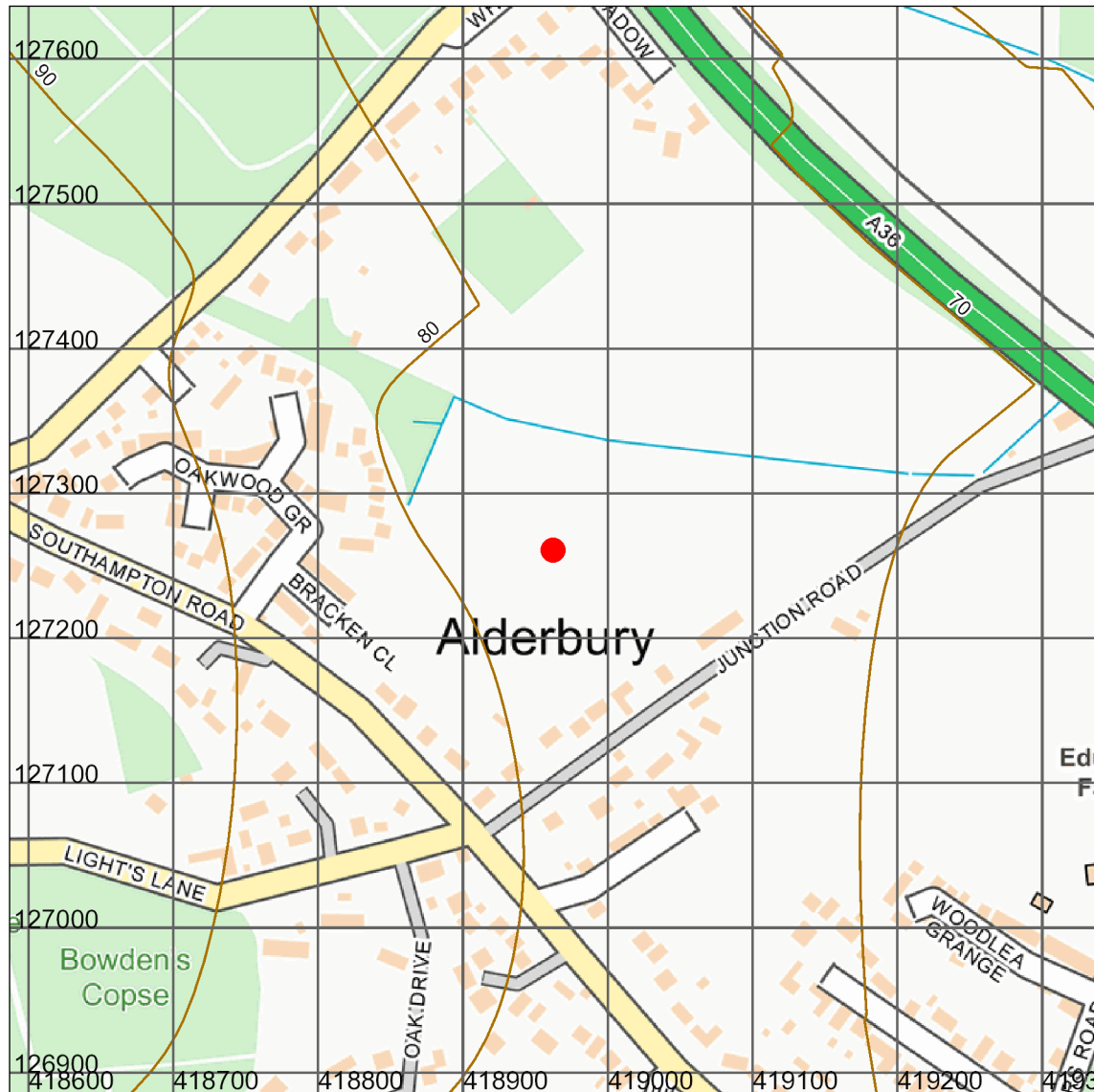
Infiltration SuDS GeoReport:

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_336572/51343*

Client reference: *WPALDBURY.23*

Search location



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Search location indicated in red

Point centred at: 418962,127261

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.

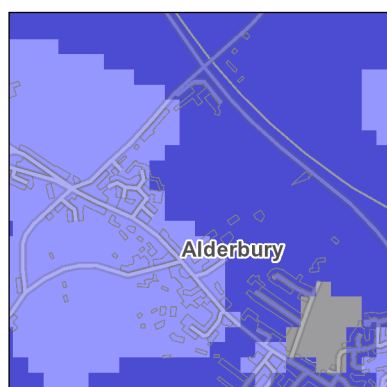
This report considers the suitability of the subsurface for the installation of infiltration SuDS, such as soakaways, infiltration basins or permeable pavements. It provides subsurface data to indicate whether, and which type of infiltration system may be appropriate. It does not state that infiltration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

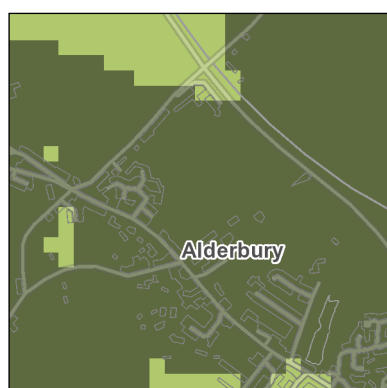
In terms of the drainage potential, is the ground suitable for infiltration SuDS?



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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.

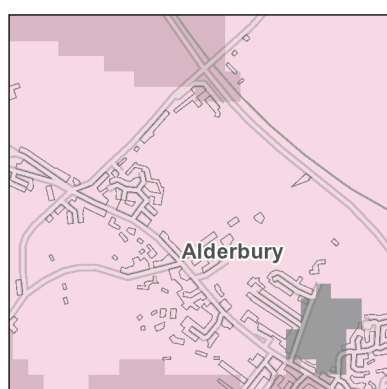
Is ground instability likely to be a problem?



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-  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?



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-  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.

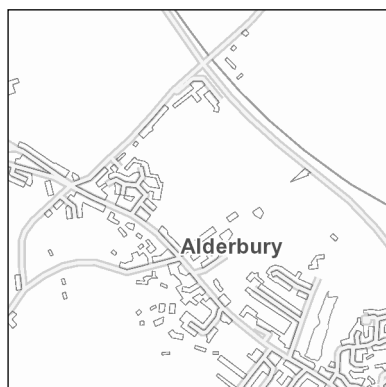
Section 1. Very significant constraints

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 (not including coal)
- shallow groundwater
- made ground

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

Soluble rock hazard

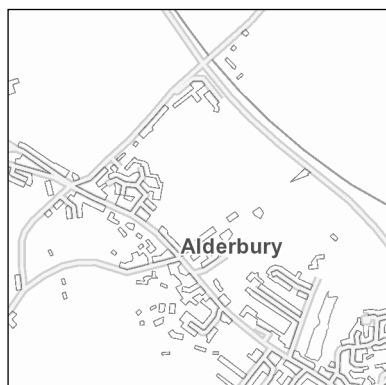


Contains OS data © Crown Copyright and database right 2024

☒ 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

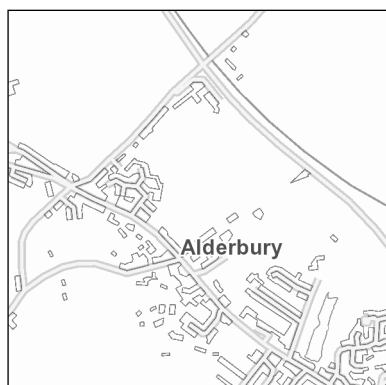


Contains OS data © Crown Copyright and database right 2024

☒ 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 (not including coal)

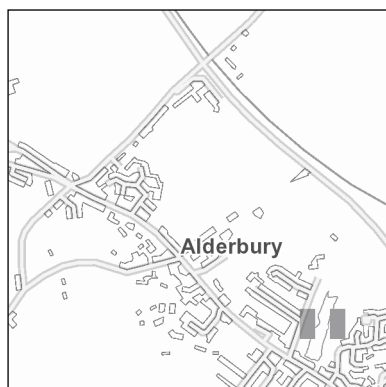


Contains OS data © Crown Copyright and database right 2024

☒ 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



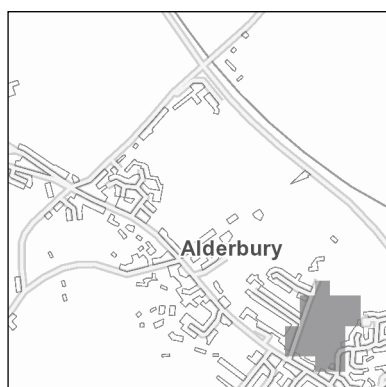
Contains OS data © Crown Copyright and database right 2024

☒ 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



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☒ 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

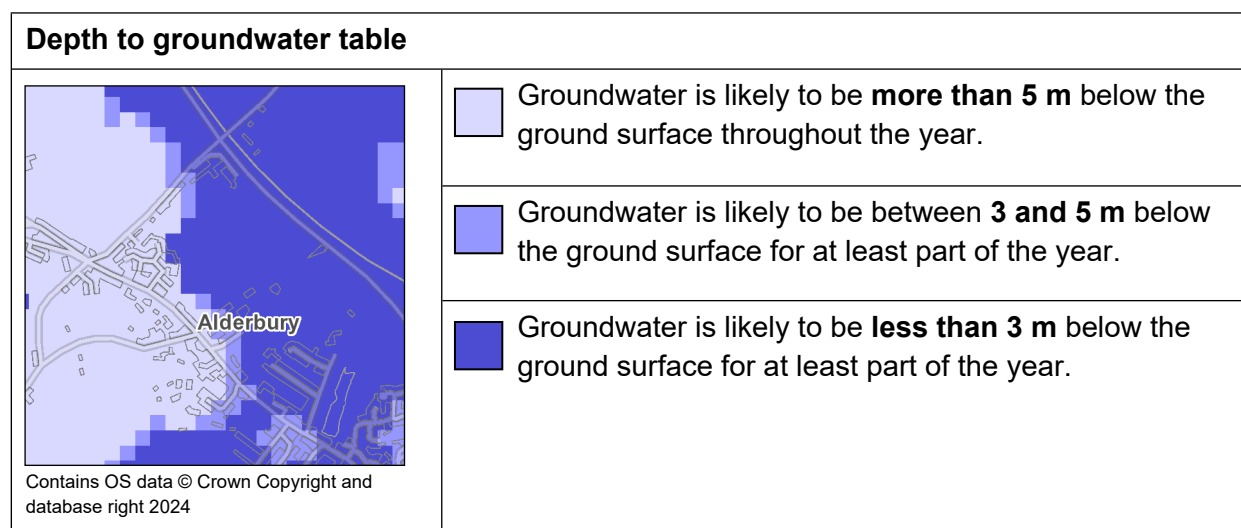
Section 2. Drainage potential

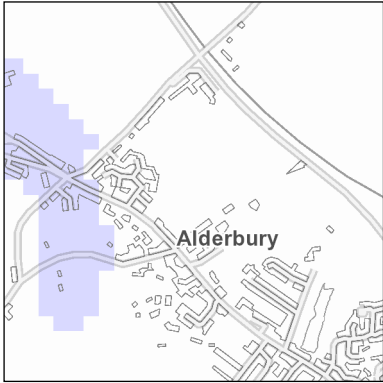
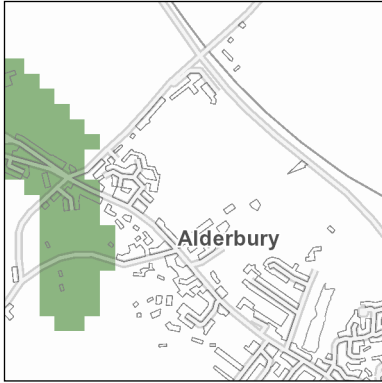
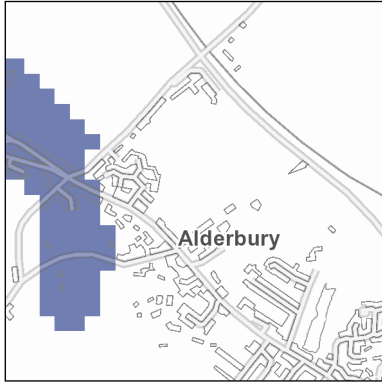
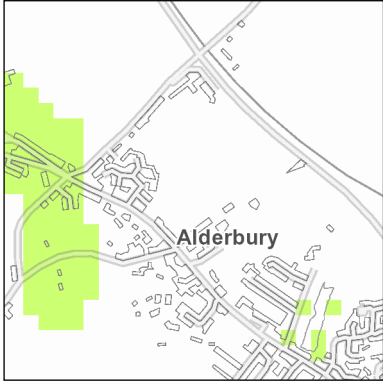
The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

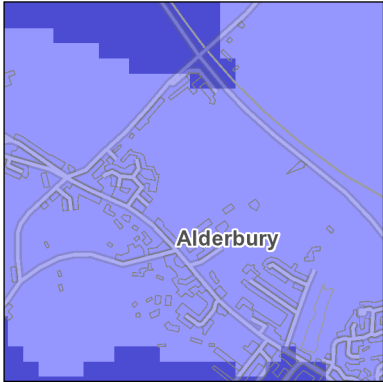
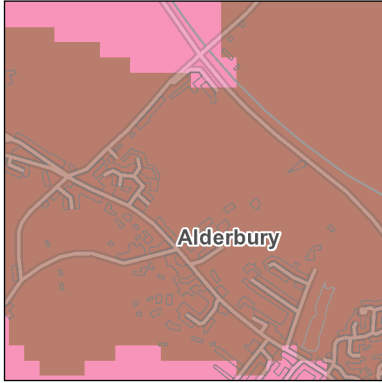
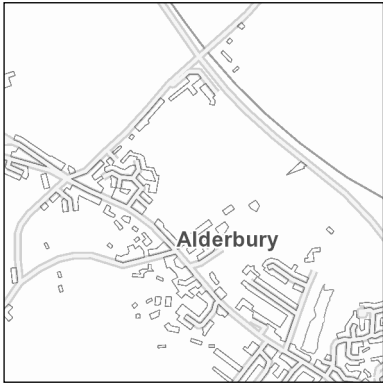
- depth to water table
- permeability of the superficial deposits
- thickness of the superficial deposits
- permeability of the bedrock
- presence of floodplains

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.



Superficial deposit permeability		
 Contains OS data © Crown Copyright and database right 2024	 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  Contains OS data © Crown Copyright and database right 2024	Maximum  Contains OS data © Crown Copyright and database right 2024
Superficial deposit thickness		
 Contains OS data © Crown Copyright and database right 2024	 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.	

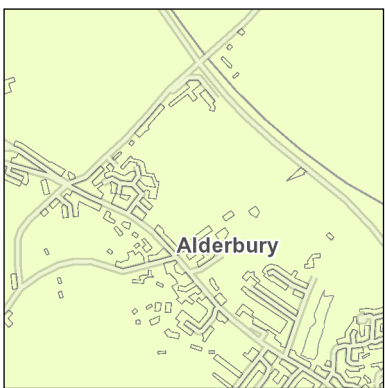
Bedrock permeability		
 Contains OS data © Crown Copyright and database right 2024	 Bedrock deposits are likely to be free-draining .	
	 The bedrock permeability is spatially variable , but likely to permit moderate infiltration.	
	 Bedrock deposits are likely to be poorly draining .	
These maps show the permeability range that is summarised above. Key  Very Low  Low  Moderate  High  Very High	Minimum  Contains OS data © Crown Copyright and database right 2024	Maximum  Contains OS data © Crown Copyright and database right 2024
Geological indicators of flooding		
 Contains OS data © Crown Copyright and database right 2024	 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

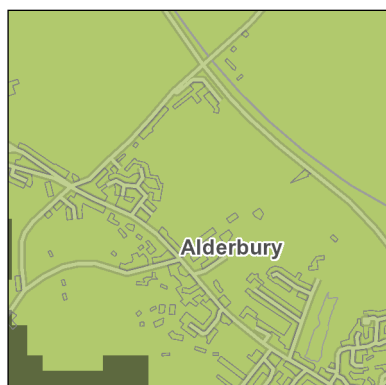
The following pages contain maps that will help you assess whether infiltration may impact the stability of the ground. They consider hazards associated with:

- 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	
 Contains OS data © Crown Copyright and database right 2024	 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.

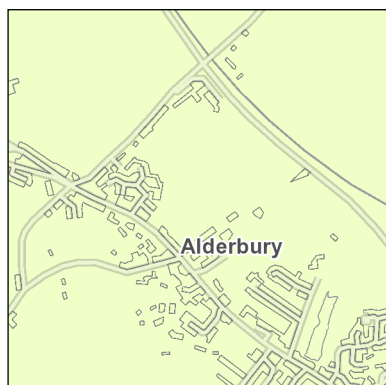
Landslides



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-  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.

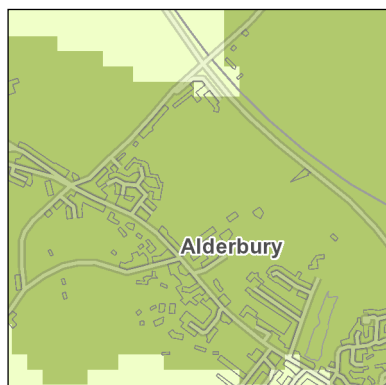
Shallow mining



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-  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.

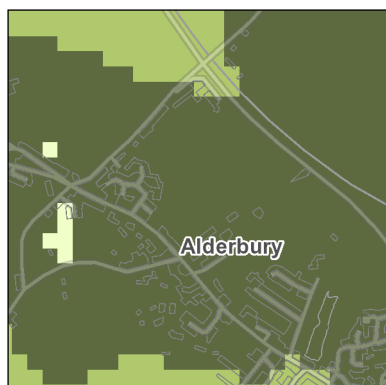
Running sand



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-  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.

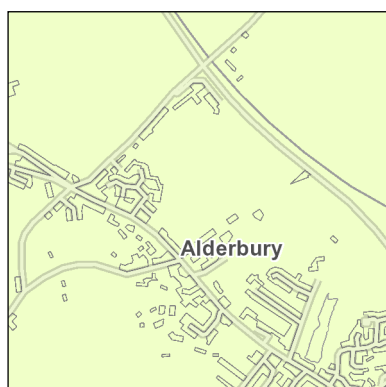
Swelling clays



Contains OS data © Crown Copyright and database right 2024

-  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.

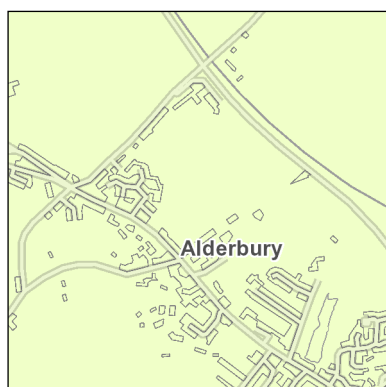
Compressible ground



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-  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



Contains OS data © Crown Copyright and database right 2024

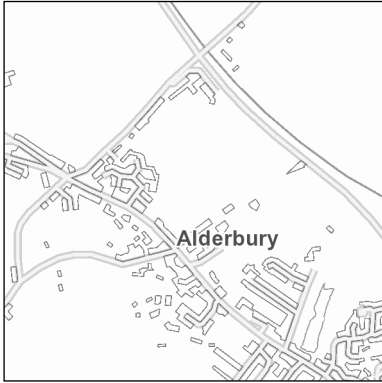
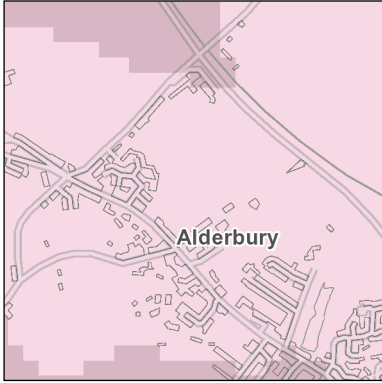
-  Increased infiltration is unlikely to result in subsidence.
-  Deposits with potential to collapse when loaded and saturated are possibly present in places. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
-  Deposits with potential to collapse when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

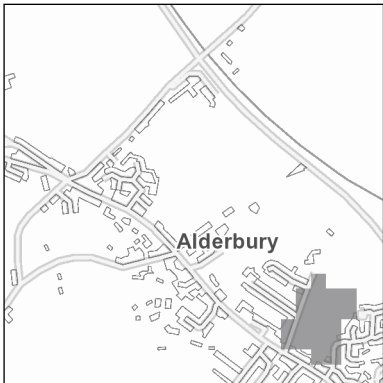
Section 4. Groundwater quality protection

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

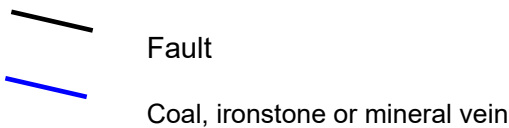
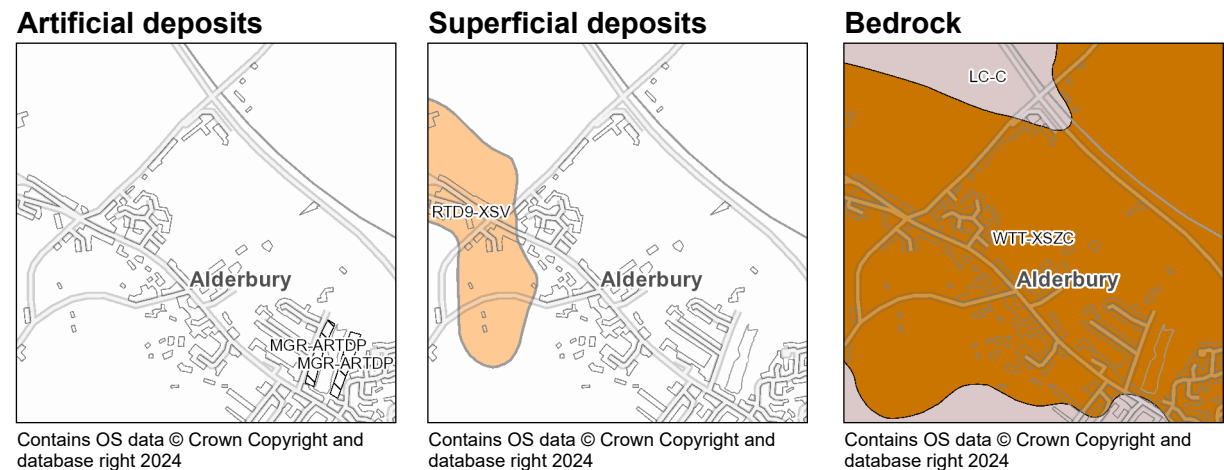
For more information read ‘Explanation of terms’ at the end of this report.

Groundwater source protection zones	
 Contains OS data © Crown Copyright and database right 2024 Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2024.	 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	
 Contains OS data © Crown Copyright and database right 2024	 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	
 A map of Alderbury, Dorset, showing the town's layout with roads and buildings. A specific area in the southeast of the town is highlighted in grey, indicating the presence of made ground. The label 'Alderbury' is placed in the center of the town area. Contains OS data © Crown Copyright and database right 2024	 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.



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:

Map colour	Computer Code	Rock name	Rock type
	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

Key to Superficial deposits:

Map colour	Computer Code	Rock name	Rock type
	RTD9-XSV	RIVER TERRACE DEPOSITS, 9	SAND AND GRAVEL

Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	LC-C	LONDON CLAY FORMATION	CLAY
	WTT-XSZC	WITTERING FORMATION	SAND, SILT AND CLAY

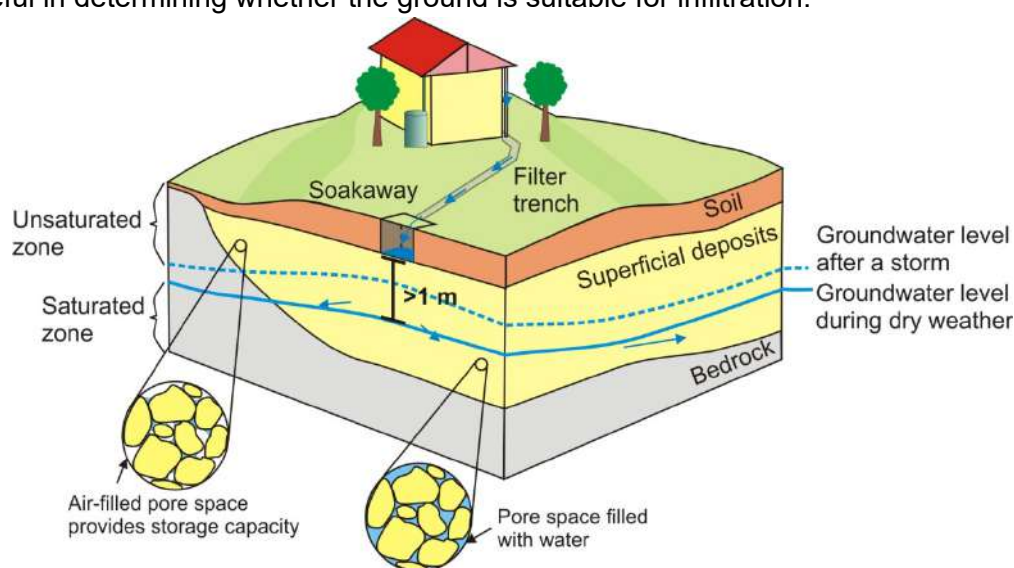
Limitations of this report:

- 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/)

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- 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.
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- 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.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be 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.

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**Report issued by
BGS Enquiry Service**

APPENDIX I: Greenfield Run-off Rates

Mayer Brown Limited		Page 1
Lion House Oriental Road Woking, GU22 8AR	Southampton Road Alderbury Greenfield Run-off	
Date 29/12/2023 15:23 File	Designed by SF Checked by SF	
Innovyze Source Control 2020.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	SAAR (mm)	810	Urban	0.000
Area (ha)	4.950	Soil	0.150	Region Number	Region 7

Results l/s

QBAR Rural	2.4
QBAR Urban	2.4
Q100 years	7.6
Q1 year	2.0
Q30 years	5.4
Q100 years	7.6

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APPENDIX J: Windes Calculations

Mayer Brown Limited										Page 1																																																																																																																																																																																																																																																																																																																																																																						
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Existing Network Details for Storm * - Indicates pipe has been modified outside of System 1 <table><thead><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th><th>Section</th><th>Type</th></tr></thead><tbody><tr><td>* 1.000</td><td>21.724</td><td>1.850</td><td>11.7</td><td>0.048</td><td>5.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 1.001</td><td>43.678</td><td>3.600</td><td>12.1</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 1.002</td><td>13.362</td><td>1.150</td><td>11.6</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 1.003</td><td>21.589</td><td>1.400</td><td>15.4</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 1.004</td><td>46.427</td><td>1.650</td><td>28.1</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 2.000</td><td>16.694</td><td>0.110</td><td>151.8</td><td>0.048</td><td>5.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 1.005</td><td>11.587</td><td>0.090</td><td>128.7</td><td>0.048</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 1.006</td><td>52.651</td><td>2.050</td><td>25.7</td><td>0.049</td><td>0.00</td><td>0.600</td><td>o</td><td>300</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 3.000</td><td>28.023</td><td>0.550</td><td>51.0</td><td>0.049</td><td>5.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 3.001</td><td>22.548</td><td>0.950</td><td>23.7</td><td>0.049</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 3.002</td><td>20.823</td><td>0.800</td><td>26.0</td><td>0.000</td><td>0.00</td><td>0.600</td><td>o</td><td>225</td><td>Pipe/Conduit</td><td></td></tr><tr><td>* 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(mm)</th></tr></thead><tbody><tr><td>* 1.000</td><td>SW1-01</td><td>86.150</td><td>84.700</td><td>1.225</td><td>84.300</td><td>82.850</td><td>1.225</td><td></td><td>1200</td></tr><tr><td>* 1.001</td><td>SW1-02</td><td>84.300</td><td>82.850</td><td>1.225</td><td>80.700</td><td>79.250</td><td>1.225</td><td></td><td>1200</td></tr><tr><td>* 1.002</td><td>SW1-03</td><td>80.700</td><td>79.250</td><td>1.225</td><td>79.600</td><td>78.100</td><td>1.275</td><td></td><td>1200</td></tr><tr><td>* 1.003</td><td>SW1-04</td><td>79.600</td><td>78.100</td><td>1.275</td><td>78.200</td><td>76.700</td><td>1.275</td><td></td><td>1200</td></tr><tr><td>* 1.004</td><td>SW1-05</td><td>78.200</td><td>76.700</td><td>1.275</td><td>76.400</td><td>75.050</td><td>1.125</td><td></td><td>1200</td></tr><tr><td>* 2.000</td><td>SW1-06</td><td>75.700</td><td>74.200</td><td>1.275</td><td>76.400</td><td>74.090</td><td>2.085</td><td></td><td>1200</td></tr><tr><td>* 1.005</td><td>SW1-07</td><td>76.400</td><td>74.090</td><td>2.010</td><td>75.500</td><td>74.000</td><td>1.200</td><td></td><td>1200</td></tr><tr><td>* 1.006</td><td>SW1-08</td><td>75.500</td><td>74.000</td><td>1.200</td><td>73.300</td><td>71.950</td><td>1.050</td><td></td><td>1200</td></tr><tr><td>* 3.000</td><td>SW1-09</td><td>76.950</td><td>75.550</td><td>1.175</td><td>76.450</td><td>75.000</td><td>1.225</td><td></td><td>1200</td></tr><tr><td>* 3.001</td><td>SW1-10</td><td>76.450</td><td>75.000</td><td>1.225</td><td>75.500</td><td>74.050</td><td>1.225</td><td></td><td>1200</td></tr><tr><td>* 3.002</td><td>SW1-11</td><td>75.500</td><td>74.050</td><td>1.225</td><td>74.700</td><td>73.250</td><td>1.225</td><td></td><td>1200</td></tr><tr><td>* 3.003</td><td>SW1-12</td><td>74.700</td><td>73.250</td><td>1.225</td><td>73.300</td><td>71.950</td><td>1.125</td><td></td><td>1200</td></tr><tr><td>* 1.007</td><td>SW1-13</td><td>73.300</td><td>71.950</td><td>1.050</td><td>73.200</td><td>71.800</td><td>1.100</td><td></td><td>1200</td></tr><tr><td>* 1.008</td><td>HW-01</td><td>73.200</td><td>71.700</td><td>1.200</td><td>73.200</td><td>71.450</td><td>1.450</td><td></td><td>1200</td></tr><tr><td>* 1.009</td><td>HW-02_BASIN</td><td>73.200</td><td>71.450</td><td>1.450</td><td>73.200</td><td>71.400</td><td>1.500</td><td></td><td>1200</td></tr><tr><td>* 1.010</td><td>SW1-14 (HB)</td><td>73.200</td><td>71.400</td><td>1.500</td><td>71.600</td><td>70.100</td><td>1.200</td><td>Depth/Flow Relationship</td><td>1200</td></tr></tbody></table>												PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section	Type	* 1.000	21.724	1.850	11.7	0.048	5.00	0.600	o	225	Pipe/Conduit		* 1.001	43.678	3.600	12.1	0.048	0.00	0.600	o	225	Pipe/Conduit		* 1.002	13.362	1.150	11.6	0.048	0.00	0.600	o	225	Pipe/Conduit		* 1.003	21.589	1.400	15.4	0.048	0.00	0.600	o	225	Pipe/Conduit		* 1.004	46.427	1.650	28.1	0.048	0.00	0.600	o	225	Pipe/Conduit		* 2.000	16.694	0.110	151.8	0.048	5.00	0.600	o	225	Pipe/Conduit		* 1.005	11.587	0.090	128.7	0.048	0.00	0.600	o	300	Pipe/Conduit		* 1.006	52.651	2.050	25.7	0.049	0.00	0.600	o	300	Pipe/Conduit		* 3.000	28.023	0.550	51.0	0.049	5.00	0.600	o	225	Pipe/Conduit		* 3.001	22.548	0.950	23.7	0.049	0.00	0.600	o	225	Pipe/Conduit		* 3.002	20.823	0.800	26.0	0.000	0.00	0.600	o	225	Pipe/Conduit		* 3.003	30.609	1.300	23.5	0.049	0.00	0.600	o	225	Pipe/Conduit		* 1.007	22.050	0.150	147.0	0.000	0.00	0.600	o	300	Pipe/Conduit		* 1.008	30.135	0.250	120.5	0.000	0.00	0.600	o	300	Pipe/Conduit		* 1.009	6.873	0.050	137.5	0.000	0.00	0.600	o	300	Pipe/Conduit		* 1.010	30.099	1.300	23.2	0.000	0.00	0.600	o	300	Pipe/Conduit		PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)	* 1.000	SW1-01	86.150	84.700	1.225	84.300	82.850	1.225		1200	* 1.001	SW1-02	84.300	82.850	1.225	80.700	79.250	1.225		1200	* 1.002	SW1-03	80.700	79.250	1.225	79.600	78.100	1.275		1200	* 1.003	SW1-04	79.600	78.100	1.275	78.200	76.700	1.275		1200	* 1.004	SW1-05	78.200	76.700	1.275	76.400	75.050	1.125		1200	* 2.000	SW1-06	75.700	74.200	1.275	76.400	74.090	2.085		1200	* 1.005	SW1-07	76.400	74.090	2.010	75.500	74.000	1.200		1200	* 1.006	SW1-08	75.500	74.000	1.200	73.300	71.950	1.050		1200	* 3.000	SW1-09	76.950	75.550	1.175	76.450	75.000	1.225		1200	* 3.001	SW1-10	76.450	75.000	1.225	75.500	74.050	1.225		1200	* 3.002	SW1-11	75.500	74.050	1.225	74.700	73.250	1.225		1200	* 3.003	SW1-12	74.700	73.250	1.225	73.300	71.950	1.125		1200	* 1.007	SW1-13	73.300	71.950	1.050	73.200	71.800	1.100		1200	* 1.008	HW-01	73.200	71.700	1.200	73.200	71.450	1.450		1200	* 1.009	HW-02_BASIN	73.200	71.450	1.450	73.200	71.400	1.500		1200	* 1.010	SW1-14 (HB)	73.200	71.400	1.500	71.600	70.100	1.200	Depth/Flow Relationship	1200
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section	Type																																																																																																																																																																																																																																																																																																																																																																						
* 1.000	21.724	1.850	11.7	0.048	5.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.001	43.678	3.600	12.1	0.048	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.002	13.362	1.150	11.6	0.048	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.003	21.589	1.400	15.4	0.048	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.004	46.427	1.650	28.1	0.048	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 2.000	16.694	0.110	151.8	0.048	5.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.005	11.587	0.090	128.7	0.048	0.00	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.006	52.651	2.050	25.7	0.049	0.00	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 3.000	28.023	0.550	51.0	0.049	5.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 3.001	22.548	0.950	23.7	0.049	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 3.002	20.823	0.800	26.0	0.000	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 3.003	30.609	1.300	23.5	0.049	0.00	0.600	o	225	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.007	22.050	0.150	147.0	0.000	0.00	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.008	30.135	0.250	120.5	0.000	0.00	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.009	6.873	0.050	137.5	0.000	0.00	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
* 1.010	30.099	1.300	23.2	0.000	0.00	0.600	o	300	Pipe/Conduit																																																																																																																																																																																																																																																																																																																																																																							
PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)																																																																																																																																																																																																																																																																																																																																																																							
* 1.000	SW1-01	86.150	84.700	1.225	84.300	82.850	1.225		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.001	SW1-02	84.300	82.850	1.225	80.700	79.250	1.225		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.002	SW1-03	80.700	79.250	1.225	79.600	78.100	1.275		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.003	SW1-04	79.600	78.100	1.275	78.200	76.700	1.275		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.004	SW1-05	78.200	76.700	1.275	76.400	75.050	1.125		1200																																																																																																																																																																																																																																																																																																																																																																							
* 2.000	SW1-06	75.700	74.200	1.275	76.400	74.090	2.085		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.005	SW1-07	76.400	74.090	2.010	75.500	74.000	1.200		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.006	SW1-08	75.500	74.000	1.200	73.300	71.950	1.050		1200																																																																																																																																																																																																																																																																																																																																																																							
* 3.000	SW1-09	76.950	75.550	1.175	76.450	75.000	1.225		1200																																																																																																																																																																																																																																																																																																																																																																							
* 3.001	SW1-10	76.450	75.000	1.225	75.500	74.050	1.225		1200																																																																																																																																																																																																																																																																																																																																																																							
* 3.002	SW1-11	75.500	74.050	1.225	74.700	73.250	1.225		1200																																																																																																																																																																																																																																																																																																																																																																							
* 3.003	SW1-12	74.700	73.250	1.225	73.300	71.950	1.125		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.007	SW1-13	73.300	71.950	1.050	73.200	71.800	1.100		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.008	HW-01	73.200	71.700	1.200	73.200	71.450	1.450		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.009	HW-02_BASIN	73.200	71.450	1.450	73.200	71.400	1.500		1200																																																																																																																																																																																																																																																																																																																																																																							
* 1.010	SW1-14 (HB)	73.200	71.400	1.500	71.600	70.100	1.200	Depth/Flow Relationship	1200																																																																																																																																																																																																																																																																																																																																																																							
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Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
* 1.016	36.657	0.120	305.5	0.046	0.00	0.600	o	450	Pipe/Conduit
* 1.017	20.661	0.070	295.2	0.046	0.00	0.600	o	450	Pipe/Conduit
* 1.018	6.406	0.060	106.8	0.000	0.00	0.600	o	150	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
* 1.016	SW-13_TANK	69.450	67.400	1.600	69.100	67.280	1.370		1200
* 1.017	SW2-14	69.100	67.280	1.370	68.600	67.210	0.940		1200
* 1.018	SW2-15 (HB)	68.600	67.210	1.240	68.000	67.150	0.700	Hydro-Brake®	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	SW1-01	86.150	84.700	1.225	Open Manhole	1200
1.001	o	225	SW1-02	84.300	82.850	1.225	Open Manhole	1200
1.002	o	225	SW1-03	80.700	79.250	1.225	Open Manhole	1200
1.003	o	225	SW1-04	79.600	78.100	1.275	Open Manhole	1200
1.004	o	225	SW1-05	78.200	76.700	1.275	Open Manhole	1200
2.000	o	225	SW1-06	75.700	74.200	1.275	Open Manhole	1200
1.005	o	300	SW1-07	76.400	74.090	2.010	Open Manhole	1200
1.006	o	300	SW1-08	75.500	74.000	1.200	Open Manhole	1200
3.000	o	225	SW1-09	76.950	75.550	1.175	Open Manhole	1200
3.001	o	225	SW1-10	76.450	75.000	1.225	Open Manhole	1200
3.002	o	225	SW1-11	75.500	74.050	1.225	Open Manhole	1200
3.003	o	225	SW1-12	74.700	73.250	1.225	Open Manhole	1200
1.007	o	300	SW1-13	73.300	71.950	1.050	Open Manhole	1200
1.008	o	300	HW-01	73.200	71.700	1.200	Open Manhole	1200
1.009	o	300	HW-02_BASIN	73.200	71.450	1.450	Open Manhole	1200
1.010	o	300	SW1-14 (HB)	73.200	71.400	1.500	Open Manhole	1200
1.011	o	225	Dummy MH	71.600	70.100	1.275	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	21.724	11.7	SW1-02	84.300	82.850	1.225	Open Manhole	1200
1.001	43.678	12.1	SW1-03	80.700	79.250	1.225	Open Manhole	1200
1.002	13.362	11.6	SW1-04	79.600	78.100	1.275	Open Manhole	1200
1.003	21.589	15.4	SW1-05	78.200	76.700	1.275	Open Manhole	1200
1.004	46.427	28.1	SW1-07	76.400	75.050	1.125	Open Manhole	1200
2.000	16.694	151.8	SW1-07	76.400	74.090	2.085	Open Manhole	1200
1.005	11.587	128.7	SW1-08	75.500	74.000	1.200	Open Manhole	1200
1.006	52.651	25.7	SW1-13	73.300	71.950	1.050	Open Manhole	1200
3.000	28.023	51.0	SW1-10	76.450	75.000	1.225	Open Manhole	1200
3.001	22.548	23.7	SW1-11	75.500	74.050	1.225	Open Manhole	1200
3.002	20.823	26.0	SW1-12	74.700	73.250	1.225	Open Manhole	1200
3.003	30.609	23.5	SW1-13	73.300	71.950	1.125	Open Manhole	1200
1.007	22.050	147.0	HW-01	73.200	71.800	1.100	Open Manhole	1200
1.008	30.135	120.5	HW-02_BASIN	73.200	71.450	1.450	Open Manhole	1200
1.009	6.873	137.5	SW1-14 (HB)	73.200	71.400	1.500	Open Manhole	1200
1.010	30.099	23.2	Dummy MH	71.600	70.100	1.200	Open Manhole	1200
1.011	13.488	67.4	SW2-04	71.400	69.900	1.275	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	o	225	SW2-01	74.650	73.200	1.225	Open Manhole	1200
4.001	o	225	SW2-02	73.750	72.250	1.275	Open Manhole	1200
4.002	o	225	SW2-03	72.150	70.650	1.275	Open Manhole	1200
1.012	o	225	SW2-04	71.400	69.900	1.275	Open Manhole	1200
5.000	o	225	SW2-05	71.300	69.850	1.225	Open Manhole	1200
1.013	o	225	SW2-06	71.000	69.400	1.375	Open Manhole	1200
1.014	o	225	SW2-07	70.500	69.000	1.275	Open Manhole	1200
6.000	o	225	SW2-08	70.140	68.640	1.275	Open Manhole	1200
6.001	o	225	SW2-09	70.360	68.410	1.725	Open Manhole	1200
1.015	o	450	SW2-10	70.800	67.630	2.720	Open Manhole	1200
7.000	o	225	SW2-11	70.010	68.510	1.275	Open Manhole	1200
7.001	o	225	SW2-12	69.800	67.960	1.615	Open Manhole	1200
1.016	o	450	SW-13_TANK	69.450	67.400	1.600	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.000	22.632	23.8	SW2-02	73.750	72.250	1.275	Open Manhole	1200
4.001	44.988	28.1	SW2-03	72.150	70.650	1.275	Open Manhole	1200
4.002	36.205	48.3	SW2-04	71.400	69.900	1.275	Open Manhole	1200
1.012	22.151	44.3	SW2-06	71.000	69.400	1.375	Open Manhole	1200
5.000	25.426	56.5	SW2-06	71.000	69.400	1.375	Open Manhole	1200
1.013	26.666	66.7	SW2-07	70.500	69.000	1.275	Open Manhole	1200
1.014	13.432	38.4	SW2-10	70.800	68.650	1.925	Open Manhole	1200
6.000	34.327	149.2	SW2-09	70.360	68.410	1.725	Open Manhole	1200
6.001	13.501	24.5	SW2-10	70.800	67.860	2.715	Open Manhole	1200
1.015	58.000	252.2	SW-13_TANK	69.450	67.400	1.600	Open Manhole	1200
7.000	29.946	54.4	SW2-12	69.800	67.960	1.615	Open Manhole	1200
7.001	13.863	41.4	SW-13_TANK	69.450	67.625	1.600	Open Manhole	1200
1.016	36.657	305.5	SW2-14	69.100	67.280	1.370	Open Manhole	1200

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Lion House Oriental Road Woking, GU22 8AR	Southampton Road Alderbury Windes Calculations	
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Innovyze	Network 2020.1	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd	Diam	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)
1.017	o	450	SW2-14	69.100	67.280	1.370	Open Manhole	1200
1.018	o	150	SW2-15 (HB)	68.600	67.210	1.240	Open Manhole	1200

Downstream Manhole

PN	Length	Slope	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	(m)	(1:X)	Name	(m)	(m)	(m)	Connection	(mm)
1.017	20.661	295.2	SW2-15 (HB)	68.600	67.210	0.940	Open Manhole	1200
1.018	6.406	106.8		68.000	67.150	0.700	Open Manhole	0

Mayer Brown Limited				Page 7			
Lion House Oriental Road Woking, GU22 8AR		Southampton Road Alderbury Windes Calculations					
Date 20/07/2024 12:09 File Surface Water Network_A...		Designed by SF Checked by SF					
Innovyze		Network 2020.1					
<u>Online Controls for Storm</u>							
Depth/Flow Relationship Manhole: SW1-14(HB), DS/PN: 1.010, Volume (m³): 2.4							
Invert Level (m) 71.400							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.200	0.0001	1.800	0.0001	3.400	0.0001	5.000	0.0001
0.400	0.0001	2.000	0.0001	3.600	0.0001	5.200	0.0001
0.600	0.0001	2.200	0.0001	3.800	0.0001	5.400	0.0001
0.800	0.0001	2.400	0.0001	4.000	0.0001	5.600	0.0001
1.000	0.0001	2.600	0.0001	4.200	0.0001	5.800	0.0001
1.200	0.0001	2.800	0.0001	4.400	0.0001	6.000	0.0001
1.400	0.0001	3.000	0.0001	4.600	0.0001		
1.600	0.0001	3.200	0.0001	4.800	0.0001		
Hydro-Brake® Optimum Manhole: SW2-15 (HB), DS/PN: 1.018, Volume (m³): 4.7							
Unit Reference MD-SHE-0075-2500-1000-2500							
Design Head (m) 1.000							
Design Flow (l/s) 2.5							
Flush-Flo™ Calculated							
Objective Minimise upstream storage							
Application Surface							
Sump Available Yes							
Diameter (mm) 75							
Invert Level (m) 67.210							
Minimum Outlet Pipe Diameter (mm) 100							
Suggested Manhole Diameter (mm) 1200							
Control Points Head (m) Flow (l/s)							
Design Point (Calculated) 1.000 2.5							
Flush-Flo™ 0.307 2.5							
Kick-Flo® 0.627 2.0							
Mean Flow over Head Range - 2.2							
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated							
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		
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Lion House Oriental Road Woking, GU22 8AR	Southampton Road Alderbury Windes Calculations																	
Date 20/07/2024 12:09 File Surface Water Network_A...	Designed by SF Checked by SF																	
Innovyze Network 2020.1																		
Offline Controls for Storm Pipe Manhole: SW1-14 (HB), DS/PN: 1.010, Loop to PN: None <table><tr><td>Diameter (m)</td><td>0.450</td><td>Roughness k (mm)</td><td>0.600</td></tr><tr><td>Section Type</td><td>Pipe/Conduit</td><td>Entry Loss Coefficient</td><td>0.500</td></tr><tr><td>Slope (1:X)</td><td>150.0</td><td>Coefficient of Contraction</td><td>0.600</td></tr><tr><td>Length (m)</td><td>15.000</td><td>Upstream Invert Level (m)</td><td>71.400</td></tr></table>			Diameter (m)	0.450	Roughness k (mm)	0.600	Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500	Slope (1:X)	150.0	Coefficient of Contraction	0.600	Length (m)	15.000	Upstream Invert Level (m)	71.400
Diameter (m)	0.450	Roughness k (mm)	0.600															
Section Type	Pipe/Conduit	Entry Loss Coefficient	0.500															
Slope (1:X)	150.0	Coefficient of Contraction	0.600															
Length (m)	15.000	Upstream Invert Level (m)	71.400															
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Mayer Brown Limited		Page 9																										
Lion House Oriental Road Woking, GU22 8AR	Southampton Road Alderbury Windes Calculations																											
Date 20/07/2024 12:09 File Surface Water Network_A...	Designed by SF Checked by SF																											
Innovyze	Network 2020.1																											
Storage Structures for Storm Tank or Pond Manhole: HW-02 BASIN, DS/PN: 1.009 Invert Level (m) 71.450 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>217.0</td><td>1.750</td><td>655.0</td></tr></tbody></table> Cellular Storage Manhole: SW-13 TANK, DS/PN: 1.016 Invert Level (m) 67.400 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>804.0</td><td>804.0</td><td>0.751</td><td>0.0</td><td>930.4</td></tr><tr><td>0.750</td><td>804.0</td><td>930.4</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	217.0	1.750	655.0	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	804.0	804.0	0.751	0.0	930.4	0.750	804.0	930.4			
Depth (m)	Area (m²)	Depth (m)	Area (m²)																									
0.000	217.0	1.750	655.0																									
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																							
0.000	804.0	804.0	0.751	0.0	930.4																							
0.750	804.0	930.4																										
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Mayer Brown Limited											Page 3			
Lion House Oriental Road Woking, GU22 8AR							Southampton Road Alderbury Windes Calculations							
Date 20/07/2024 12:12 File Surface Water Network_Aldbury.MDX							Designed by SF Checked by SF							
Innovyze							Network 2020.1							
<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>														
PN	US/MH Name	Event				US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
7.000	SW2-11	1440 minute	100 year	Winter I+45%	70.010	68.614	-0.121	0.000	0.03			0.8	1.7	OK
7.001	SW2-12	1440 minute	100 year	Winter I+45%	69.800	68.613	0.428	0.000	0.05			1.0	3.4	SURCHARGED
1.016	SW-13_TANK	1440 minute	100 year	Winter I+45%	69.450	68.613	0.763	0.000	0.21			0.5	34.0	SURCHARGED
1.017	SW2-14	1440 minute	100 year	Winter I+45%	69.100	68.611	0.881	0.000	0.09			0.3	13.3	SURCHARGED
1.018	SW2-15 (HB)	1440 minute	100 year	Winter I+45%	68.600	68.610	1.250	9.967	0.20			0.7	2.9	FLOOD
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APPENDIX K: Vortex Flow Control Chamber

RIDGISTORMCheck Vortex Flow Control Chambers

Data Sheet

Where flows within a drainage system are required to be limited (i.e. prior to discharge from site), with improved hydraulic performance and reduced maintenance, we are able to offer our RIDGISTORMCheck Vortex Flow Control Chamber.

Pre-fabricated under factory controlled conditions, the RIDGISTORMCheck Chamber is available in a range of diameters from 1050-3000mm and incorporates a vortex flow control unit, fitted onto a preformed headwall. Each vortex flow control unit is manufactured to suit the unique hydraulic characteristics of the site's drainage system design. RIDGISTORMCheck Vortex Flow Control Chambers are typically supplied as a single unit, allowing simple installation and eliminating a number of construction risks associated with in-situ construction. When installed in conjunction with our range of pipe systems, they offer a fully integrated drainage system.



Applications

Site specific RIDGISTORMCheck Vortex Flow Control Chambers are engineered to suit a range of stormwater systems, providing a hydraulically efficient means of flow regulation that does not use moving parts or require power to operate.

Key Features and Benefits

- Self-activating vortex flow controller which controls forward flow of water
- No moving parts - virtually maintenance free
- Manufactured with an integral sump for silt catchment/removal
- Can be manufactured to adoptable standards
- Multiple inlet and outlet options, allowing quick and seamless connection to pipelines
- Depths can be tailored to suit project requirements
- Optional integral benching
- Optional step rungs to BS EN 13101 and ladders to BS EN 14396
- Optional riser section and riser location ring
- Integral lifting points available on request to improve Health and Safety during handling and installation
- Stub connections and rocker pipes are available
- Manufactured in a factory controlled environment for improved quality of finish
- Eliminates wastage associated with in-situ construction

Other fabrications in our RIDGISTORMCheck range:

- Orifice Plate Flow Control Chambers

Performance

RIDGISTORMCheck Vortex Flow Control Chambers are fabricated from Ridgistorm-XL pipework, which is manufactured to meet the material requirements of BS EN 13476.

RIDGISTORMCHECK VORTEX FLOW CONTROL CHAMBER	
PHYSICAL PROPERTIES	
Diameter	1050-3000mm
Depth	To suit requirements
Material	HDPE
Colour	Black with Blue Interior
Flow control units	Grade 304 Stainless Steel
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets	100-3000mm
Hydraulic performance	Unit manufactured to suit site specific conditions

Our Ridgistorm-XL Fabrications range

All of our Ridgistorm-XL fabrications are tailor-made, fully-welded, watertight structured wall chambers to suit project-specific requirements. Health and Safety benefits become apparent during handling and installation, due to our fabrications' strong but light in weight nature. In addition, off-site construction ensures uncompromised, high quality products being delivered to site ready-to-install, reducing installation time and costs.



RIDGISTORMCheck Vortex Flow Control Chambers

Data Sheet

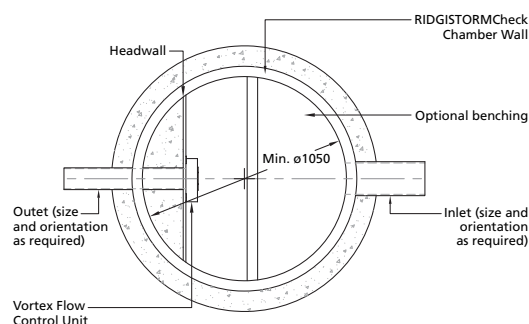
PRODUCT INFORMATION

P2

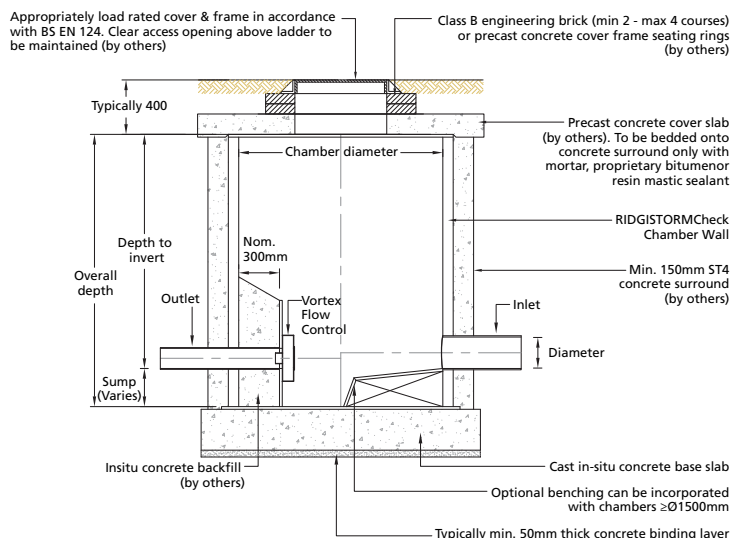
ISSUE 2 - MAR 2019

Non-Bypass Chamber

For sites where discharge rates must be guaranteed to not exceed a prescribed limit(s).

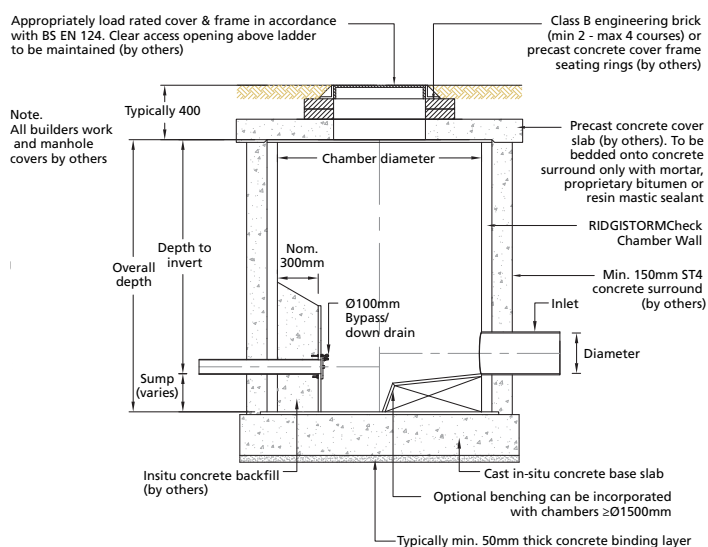
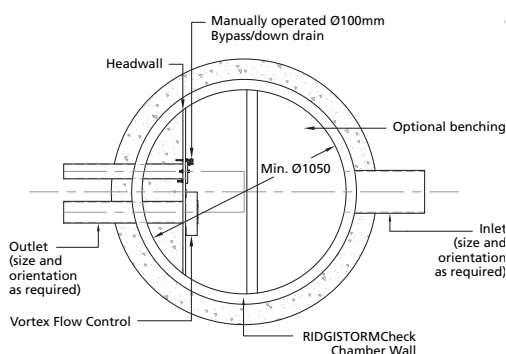


Note.
All builders work and
manhole covers by others



Manual Bypass Design

The manual bypass design offers a bypass the ability to flow control device to facilitate maintenance. Manually operated from the surface, the activation of the bypass system opens a door in the head wall allowing water in the chamber to drain down via the bypass pipe.



For further information please contact our Technical Team on +44 (0) 1509 615100 or download our CAD Standard Details from our website www.polypipe.com/civils-technical-hub

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APPENDIX L: Geolight Proprietary Soakaway Tank

SDS

Water
Infrastructure
Systems

INNOVATORS IN
WATER TECHNOLOGY

SDS GEOLight®

Stormwater Management System



SDS GEOLight® is an ultra lightweight honeycombed modular structure, made from recycled PVC, that provides an underground storage facility for the application of stormwater attenuation or infiltration.

SDS
Water
Infrastructure
Systems

Stormwater Management

The Environment Agency is keen to promote the wider use of sustainable drainage systems, which reduce the impact of surface water runoff. There are two main ways of storing surface water for stormwater management:

- Stormwater attenuation tanks
- Soakaway infiltration systems

Stormwater Attenuation Systems

This consists of underground water storage facilities that hold excess water during periods of peak rainfall.

The stored water is gradually released in a controlled manner into the surface water drainage system or directly into watercourses, reducing the risk of upstream and downstream flooding.

Soakaway Infiltration Systems

Soakaways are designed to store surface water runoff until it can be gradually absorbed by the surrounding ground.

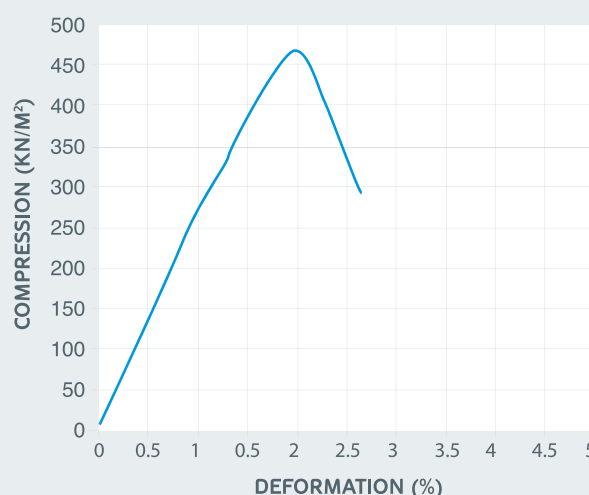
SDS GEOLight® – an efficient and economic solution for stormwater management.

SDS GEOLight® Attenuation

SDS GEOLight® has been specifically designed to form underground water storage reservoirs in stormwater management schemes. Its honeycombed structure gives it certain unique characteristics that make it ideal for this purpose:

- The high void rate (95%) of GEOLight® means that the maximum volume of water is stored in the minimum volume of storage unit.
- High compressive strength. GEOLight® is available in two strengths as standard: 200 and 400kN/m². Note: Higher compressive strengths available from 600 to 1000 kN/m². The graph on the right shows the results of a compression test, where samples of GEOLight® 400 were compressed at the rate of 1mm per minute. The deformation at 400kN/m² is about 1.6%.

RESULTS OF COMPRESSION TEST ON SDS GEOLIGHT® 400



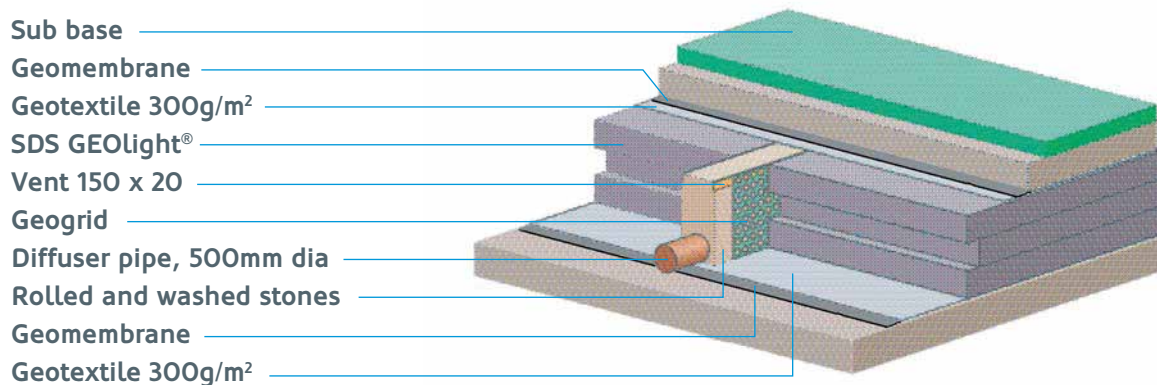
The GEOLight® Stormwater Attenuation System consists of two manholes (inspection chambers) connected by a length of perforated distribution pipe which feeds the stormwater storage reservoirs on either side formed from GEOLight®.

The distribution pipe is normally from 225mm up to 500mm diameter, generally covered in a trench that is filled with draining material such as 15/25 clean graded stone, free from fines.

The reservoirs and distribution pipe are wrapped in a waterproof membrane, such as butyl, to prevent seepage of water into the surrounding ground. The top of each GEOLight® reservoir has a vent which is connected back to the upstream manhole.

A geotextile or 10mm mesh geogrid is laid between the distribution pipe and GEOLight® to prevent the GEOLight® units being clogged by the draining materials.

SDS GEOLight® Attenuation



How does it work?

- 1. In normal conditions, water enters a back drop manhole. This is the upstream manhole and any silt or sediment will collect in the bottom of the chamber. The water then flows along the distribution pipe into the downstream manhole. The upstream pipework is sized to cope with normal flow conditions. The distribution pipe and attenuation tank are sized to cope with storm conditions. The outflow pipe is sized to cope with the permissible discharge.
- 2. In storm conditions the flow restrictor (vortex flow control or orifice plate) in the downstream manhole limits the amount of water flowing out of the manhole. This causes the water level in the distribution pipe to rise and water to spill into the GEOLight® reservoirs on either side. As the water level rises in the reservoirs, air is forced out of the high level vents into the upstream manhole.

- 3. Once the storm has passed, the water level in the GEOLight® reservoirs gradually falls as water passes through the flow restrictor in the downstream manhole. The vents now allow air to return into the GEOLight® reservoirs. Gradually the reservoirs empty. The flow restrictor prevents excess surges of flood water to pass downstream and uses the storage reservoirs to store the water for the period of the storm.

Calculating the storage capacity

The storage capacity of the GEOLight® reservoirs is determined by the maximum outflow permitted, (set by the water company or Environment Agency), the impermeable area of the site and the rainfall return period – normally 1 in 30 years, but again can be dictated by the water company. A full design service, including calculations, can be supplied via a third party consultant.

Please contact SDS for details.

Other uses

The water storage ability of SDS GEOLight® lends itself to a number of other uses:

- Water recycling combines with irrigation systems – this is increasingly popular: GEOLight® is used to retain stormwater which is then pumped as required to a network of standpipes for irrigation.
- Drainage channels – the natural permeability of GEOLight® lends itself for use as an underground drainage channel that collects and drains away groundwater.
- Pollution control – improved water runoff quality. When used in combination with oil / petrol separators, GEOLight® can replenish groundwater without the risk of contamination from oil, chemicals or suspended solids.
- To form lightweight embankments (slope stabilisation) – GEOLight® can be used to quickly form the base of embankments that only weigh a fraction of earth embankments.

Stormwater Attenuation System

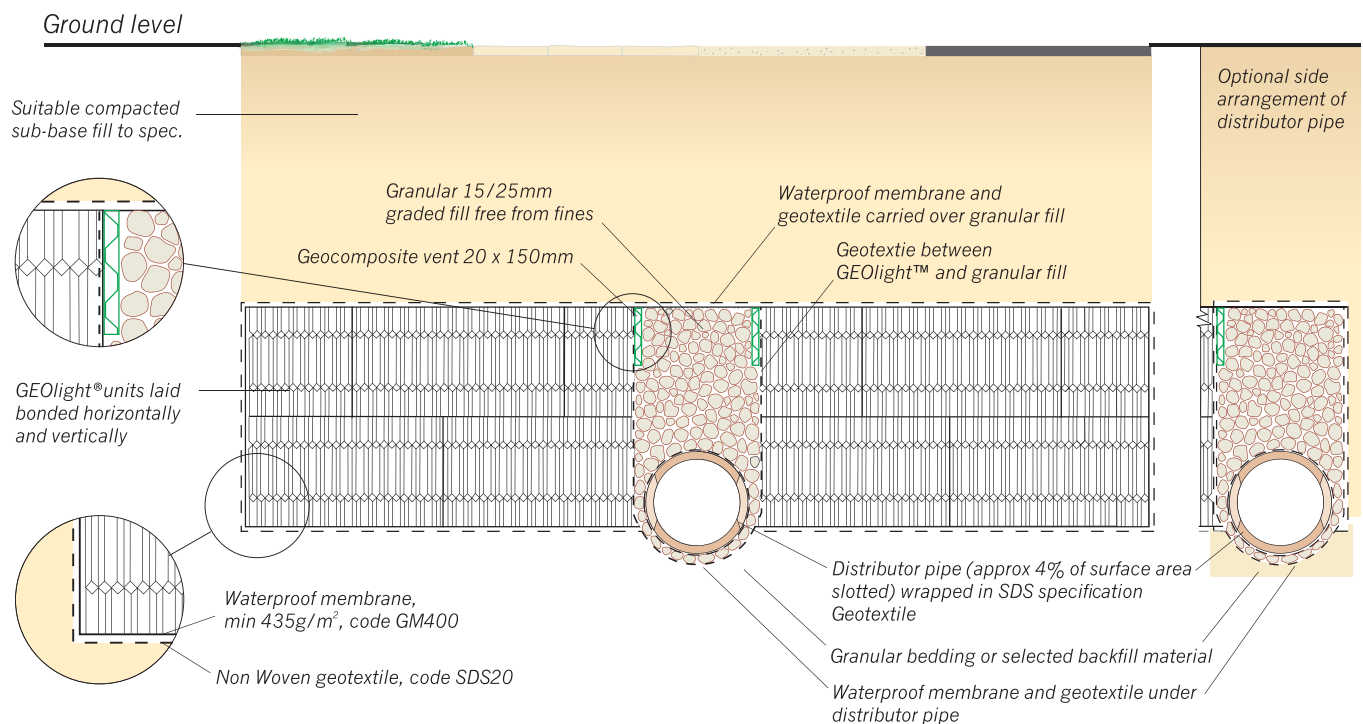
Design Details

The details on these two pages illustrate the construction of a typical SDS GEOLight® Stormwater Attenuation System. The length and height of the GEOLight® reservoirs is determined by the quantity of water to be stored.

The layout of each scheme is specifically designed to suit the characteristics and limitation of the site. Typically the distributor pipe would be arranged in the centre of the reservoir, but can alternatively be placed at the side where topographical constraints dictate.

The high performance waterproof membrane should be sealed continuously to encapsulate the GEOLight® reservoirs, distributor pipe and granular fill. It is protected by a heavyweight needle punched, non woven geotextile. To help with maintenance a high flow geotextile is placed between the granular fill and GEOLight® attenuation units to prevent silt and particles being washed into the reservoir. GEOLight® can be used under a range of surfaces e.g. grass, porous paving, standard paving block, tarmac and concrete.

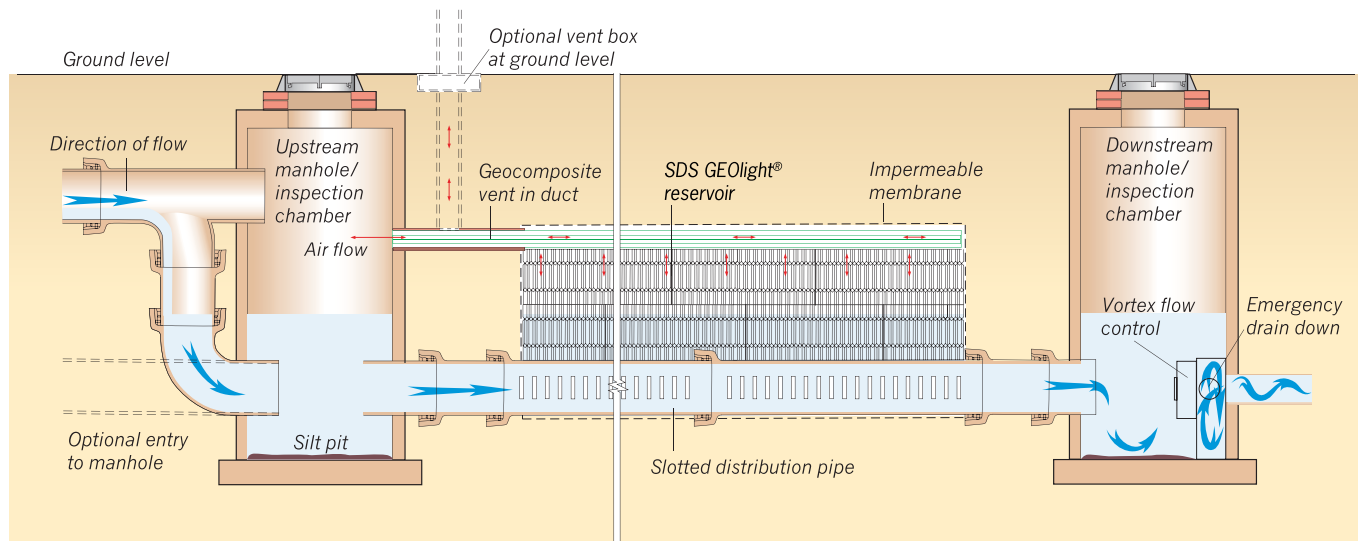
Cross Section



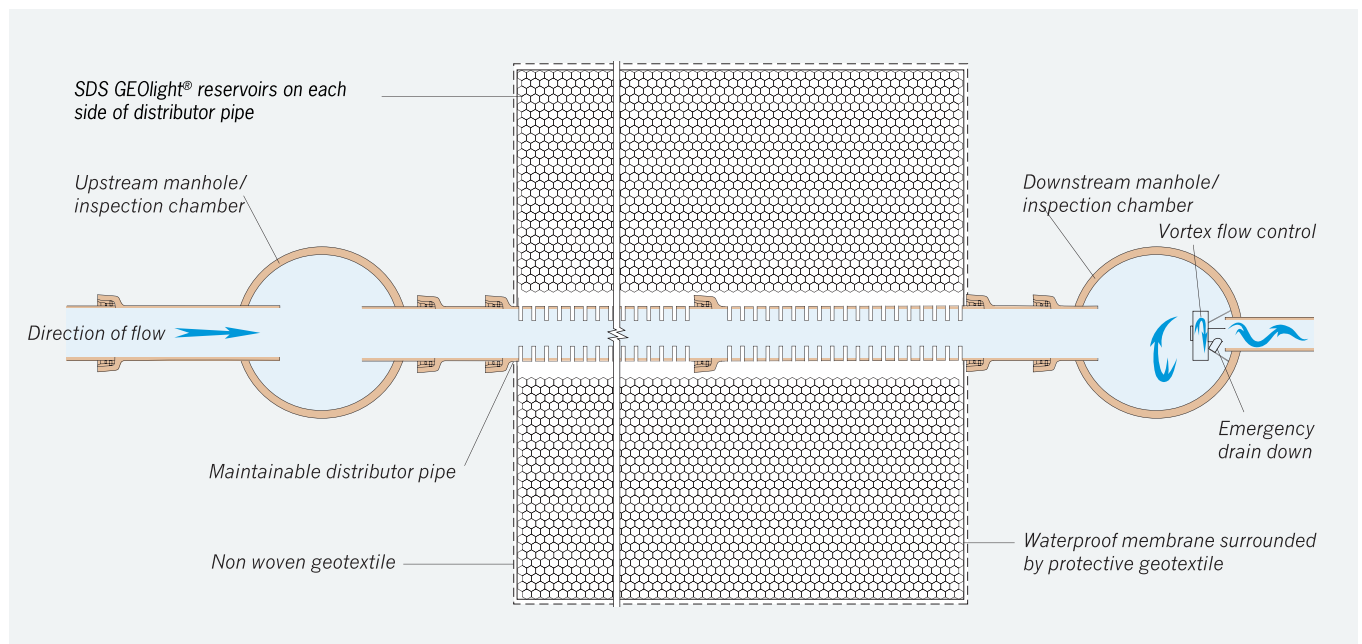
Stormwater Attenuation System

Design Details

Long Section



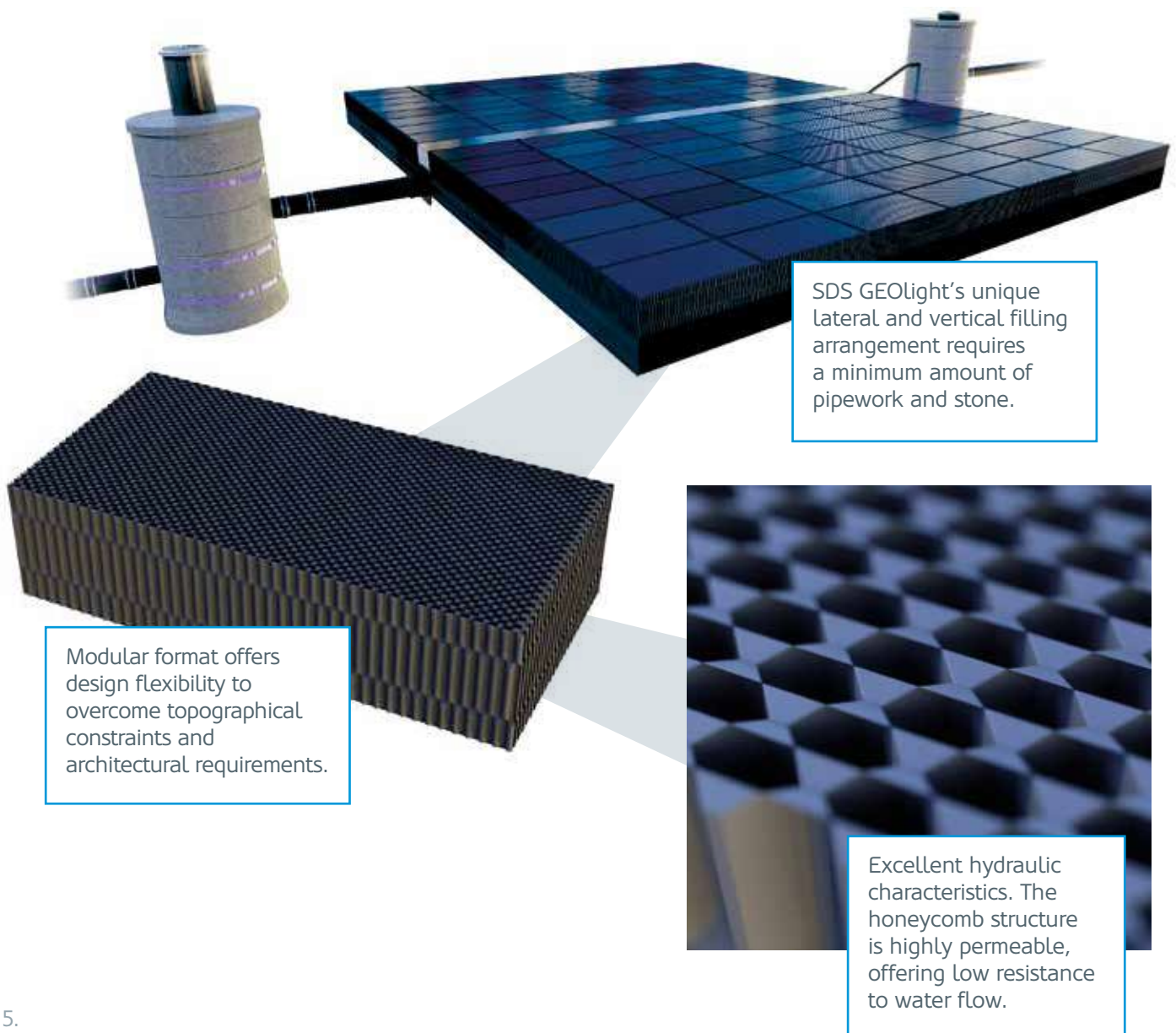
Plan



Benefits

- High compressive strength – can be located under all roads, car parks and amenity area surfaces.
- Reduced excavation costs – the very high void rate (95%) minimises the required volume of earthworks.
- Speed of installation – 1000m³ reservoir, completed in one week.
- Light and easy to handle.
- Depth of tank invert reduced by using patented lateral supply.
- Simplified distribution pipe network, easy maintenance – dispensing with costly and complicated pipework configurations.
- Greatly reduces the risk of flooding when used as stormwater storage.
- Can also be used for water recycling and combining with irrigation systems.
- Can virtually eliminate pollution when used in combination with specialist petrol / oil separators.
- Design service available, including calculations.

GEOLight® block



COSHH and Handling Information

1. COMPOSITION/INFORMATION ON INGREDIENTS:

Hazardous ingredients:

None as finished goods or products.

Types of materials:

Polyvinyl chloride (PVC)
MEK

2. HAZARDS IDENTIFICATION

Nature of hazard:

There are no health risks from the products during normal use. The products may contain various pigment colours and stabilisers that may be toxic. The chemicals are, however, bound within the product material and not easily extracted.

3. FIRST-AID MEASURES

Eye contact:

Plastic materials may cause physical irritation in the eyes. Wash out with large amounts of water. If irritation persists, seek medical advice.

Skin contact:

Not applicable.

Inhalation:

Not applicable.

Ingestion:

Not expected to have any toxic effects.

4. FIRE-FIGHTING MEASURES

Extinguishing media:

On small fires use any hand-held extinguisher type.
On large fires use water.

Fire and explosion hazards:

Melting plastics may flow and spread in a large fire.
Products of fire will be thick black toxic smoke.

Material characteristics:

PVC products will burn in the presence of a flame but are classed as self-extinguishing.

Protective equipment:

Wear self-contained breathing apparatus and protective clothing.

5. HANDLING AND STORAGE

Handling:

There are no hazards associated with the finished products. However, when cutting SDS GEOLight®, we recommend that the correct tools are used e.g. Handsaw or Alligator saw. When cutting, dust may be created; avoid inhaling these dusts. Take care of heat build-up within materials during cutting etc. The pallets of SDS GEOLight® units should be placed on level ground and should not be stacked on site. The maximum weight of the pallet of SDS GEOLight® units as delivered to site is 650kg (700kg on one copy), including packaging. Machines used to lift the pallet should be able to lift this weight safely. Loose individual units should not be stored more than three units high. SDS GEOLight® units are lightweight ranging from 23kg to 55kg and can be easily handled – one or two person lift.

Storage:

SDS GEOLight® units will resist the effects of UV light for up to six months; however, prolonged storage in direct sunlight should be avoided. SDS GEOLight® units should not be stored near to any fuel storage areas or any other solvents. SDS GEOLight® units are very robust and resistant to damage during normal handling; however, they should be secured in areas where impacts from vehicles or construction plant will be avoided.

Material characteristics:

PVC products will burn in the presence of a flame but are classed as self-extinguishing.

Protective equipment:

Wear self-contained breathing apparatus and protective clothing.

6. EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory protection:

Not required under normal conditions of use. Where cutting etc. creates dust, wear a disposable half-mask to the standard FFP2S.

Hand protection:

Wear impervious strong gloves to prevent cuts to the hands while handling, cutting etc.

Eye protection:

Wear safety glasses when cutting etc.

Skin protection:

Wear overalls.

7. SITE HAZARDS

Other hazards for consideration:

Working in excavations and trenches – SDS GEOLight® may be designed with a shallow invert for infiltration (soakaway) or attenuation (storage) system. This negates the need for deep excavations or trenches, excavation near services e.g. gas, electricity or contaminated soil areas. N.B. All risk assessments should be undertaken by the main contractor for forklift, access to and working in excavations and trench support.

8. STABILITY AND REACTIVITY

Decomposition products:

Major thermal decomposition products are oxides of carbon. Relevant differences are (in addition): PVC may produce amounts of Hydrogen Chloride.

Stability:

These materials are stable at temperatures up to normal operating limits (moulding parameters).

9. ECOLOGICAL INFORMATION

Biodegradability:

Plastic products are not readily biodegradable but are not detrimental to terrestrial wildlife.

Aquatic toxicity:

Non-toxic to marine life.

10. DISPOSAL CONSIDERATIONS

Method:

The preferred method of disposal is collection and recycling. Plastics can safely be placed with regular industrial or household wastes where recycling is not available.

11. OTHER INFORMATION

As the handling, storage, use and disposal of the product are beyond our control SDS disclaims all liability for loss, damage, injury or expense in any way connected with such activities and further makes no warranties, expressed or implied, as to the suitability of the product for any particular use.

The preferred method of disposal is collection and recycling. Plastics can safely be placed with regular industrial or household wastes where recycling is not available.

SDS

Water
Infrastructure
Systems

INNOVATORS IN WATER TECHNOLOGY



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