FLOOD RISK ASSESSMENT

Land at Mockbeggars Farm, Uckfield, TN22 2EA

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Contents

1.0 Introduction....1
2.0 Site Description....2
3.0 Development Proposals....4
4.0 Planning Policy and Guidance....5
5.0 Sources of Potential Flooding....6
6.0 Flood Risk Assessment....8
7.0 Surface Water Drainage....10
8.0 Foul Water Drainage....17
9.0 Summary and Conclusions....18

Appendices

Appendix A: Location Plan
Appendix B: Topographical Survey and LiDAR DTM
Appendix C: Geological Mapping and Soilscapes Mapping
Appendix D: Drainage Mark-ups from Site Visit
Appendix E: Development Proposals
Appendix F: Fluvial Flood Risk Mapping
Appendix G: Surface Water Flood Risk Mapping
Appendix H: BGS Infiltration SuDS GeoReport
Appendix I: MicroDrainage Outputs_Infiltration Method
Appendix J: Greenfield Run-off Rates
Appendix K: MicroDrainage Outputs_Attenuation Method
Appendix L: Proposed Surface Water Drainage Strategy
Appendix M: Southern Water's Records
Appendix N: MicroDrainage Outputs_Foul Drainage
Appendix O: Proposed Foul Water Drainage Strategy

1.0 Introduction

1.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of Obsidian Strategic Asset Management Limited, in support of a planning application for a proposed residential development on land at Mockbeggars Farm, Uckfield, TN22 2EA.

1.2 The purpose of this document is to assess the existing level of flood risk to the site and its surroundings within the context of the development proposals and to demonstrate suitable drainage strategies for the disposal of surface and foul water from the development.

1.3 This assessment has been prepared in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF. It has also been prepared with reference to Wealden District Council Level 1 Strategic Flood Risk Assessment, published in June 2017.

1.4 This assessment was undertaken with reference to information provided and/or published by the following bodies:

- Ordnance Survey;
- British Geological Survey;
- Wealden District Council; and
- Environment Agency.

1.5 This report concludes that the site is not at risk of flooding and can be developed safely without increasing flood risk elsewhere, and that the development proposals comply with relevant planning policy concerning flood risk. The report demonstrates that suitable drainage schemes for the disposal of surface and foul water from the proposed development can be provided.

2.0 Site Description

Site Location & Description

2.1 The site extends to approximately 3.62ha in area and is located within North Uckfield, approximately 1.3km from Uckfield Town Centre and 1.4km to the south-east of Maresfield village. The site currently comprises open grassland and is bordered by an ancient woodland (Round Wood) to the south, existing residential development to the south, east and north and Mockbeggars Farm to the north-west. London Road is located along the western boundary of the site, which provides access to/from the site. The approximate centre of the site is located at Ordnance Survey National Grid reference TQ 47578 23041 and the postcode is TN22 2EA. A plan showing the extent and location of the site is included in Appendix A.

Existing Watercourses

2.2 The closest watercourse designated as a main river by the Environment Agency is the Shortbridge Stream located approximately 600m to the north-west of the site, flowing in a south-westerly direction. The Ordnance Survey mapping indicates the presence of a network of drainage ditches adjacent to the north-west of the site, flowing in a westerly direction towards Shortbridge Stream.

Topographical Survey

2.3 A topographical survey was undertaken by ASC (ref: ASC.21.599, date: August 2021) and is included at Appendix B. This indicates that the site generally falls from two high points of approximately 47.77m AOD in the southern corner of the site, and 47.72m AOD in the south-eastern corner of the site, to a low point of 34.81m AOD, adjacent to London Road and Mockbeggars Farm.

2.4 The LiDAR DTM map of the site, included in Appendix B, verifies the highest ground elevations to the south and south-eastern corners of the site and also indicates that the site falls in two different directions; the southern boundary falls northwards, while the eastern boundary falls westwards. These falls across the northern and southern sides of the site assist in gravitating any run-off away from the proposed development.

Geological Characteristics

2.5 Geological records published by the British Geological Survey (BGS) indicate the entire site is likely to be underlain by bedrock geology comprising sandstone from the Ardingly Sandstone Member. There are no superficial deposits recorded on-site. Extracts from BGS mapping are included in Appendix C.

2.6 Soilscapes mapping provided by Cranfield University on behalf of DEFRA shows that the site of the proposed development falls entirely on HOST soil class 8, which is described as "Slightly acid loamy and clayey soils with impeded drainage". This soil type is described as draining to a local stream network. An extract from Cranfield University "Soilscapes" website is included in Appendix C.

2.7 Borehole TQ42SE145 – Black House Farm, from BGS records, located approximately 350m to the north-west of the site, indicates the presence of sandstone from the Ardingly Sandstone Member, from 6m below ground level, underlaying sandy superficial deposits. Groundwater was encountered at a depth of 10m below ground level.

Site Visit to Confirm Existing Drainage Regime

2.8 A site visit carried out by Glanville Consultants on 7 September 2021 with the objective of confirming the existing drainage regime. This verified that the topography falls relatively steeply towards Mockbeggars Farm to the north-west, as shown by the contours on the topographical survey conducted by ASC, as provided in Appendix B.

2.9 In terms of local geology, the landowner confirmed that sandstone bedrock is present across the site at shallow depth, and this is relatively free draining. There was visible evidence of the sandstone in those zones where there are steps in ground level at field boundaries across the site.

2.10 Some drainage features in the form of ditches, a pond and pipes were identified in the farmyard to the north-west of the development site, within the same land ownership. These drainage features connect to each other before crossing under London Road further to the north-west and discharge into the watercourse to the west, associated with a tributary of the Shortbridge Stream. A plan showing the route of these drainage features is provided in Appendix D.

Groundwater Vulnerability

2.11 The Environment Agency (EA) defines Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The SPZs mapping indicates that the site is not located within a SPZ.

2.12 A Nitrate Vulnerable Zone (NVZ) is a conservative designation for areas of land that drain to nitrate polluted waters or waters which could become polluted by nitrates. The NVZs mapping indicates that the site is not located within a Surface Water NVZ.

2.13 The EA defines Drinking Water Safeguard Zones (SgZs) for water sources used for public drinking water supply. SgZs are catchment areas that influence the water quality for their respective Drinking Water Protected Area (Surface Water), which are at risk of failing the drinking water protection objectives. The site is located within a SgZ (Surface Water).

2.14 The bedrock Aquifer Designation Map published by the EA indicates that the bedrock underlying the site is classed as a Secondary A Aquifer. Secondary A Aquifers are permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

2.15 The superficial Aquifer Designation Map published by the EA indicates that the superficial drift of the site is classed as an Unproductive Strata. Unproductive Aquifers are geological strata with low permeability that have negligible significance for water supply or river base flow.

3.0 Development Proposals

3.1 The proposal comprises the erection of 60 no. residential units, along with associated infrastructure, including gardens, driveways and car parking, internal access roads that provide access to/from London Road to the west, open space areas, and a children's play area. A plan showing the proposed site layout is included in Appendix E.

3.2 The total impermeable area of the development is approximately 13,323m^2, which also includes the areas allocated to the proposed access road, car parking areas and internal roads, which will be built using permeable materials. A 10% additional allowance for urban creep has been included within the proposed impermeable area.

3.3 A breakdown of the impermeable surfaces associated with the proposed development is shown in Table 1.

Table 1: Proposed Impermeable Surfaces of the Development

Area Description	**Area (m^2)**
Roof areas	4,475
Access road and car parking area	7,637
Total (incl. 10% Urban Creep)	**13,323**

4.0 Planning Policy and Guidance

4.1 Set out below is a summary of the national and local planning policy and guidance relating to flood risk and surface water management that are relevant to the development proposals.

National

4.2 At a national level, the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF ensure flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development towards areas at lowest flood risk. The NPPF retains a risk based approach to the planning process and defines four Flood Zones to be used as the basis for applying the sequential test to consider a development in terms of Flood Risk Vulnerability Classifications, which define the type of development that is considered appropriate within each zone.

4.3 The NPPF establishes the Flood Zones as the starting point for assessment with the overarching aim to steer new development to areas with the lowest probability of flooding. The Flood Zones are defined as follows:

- Flood Zone 1 (Low Probability) comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

- Flood Zone 2 (Medium Probability) comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.

- Flood Zone 3a (High Probability) comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

- Flood Zone 3b (The Functional Floodplain) comprises land where water has to flow or be stored in times of flood.

Local Policy and Guidance

Wealden District Council Strategic Flood Risk Assessment (SFRA) – June 2017.

4.4 This 2017 Level 1 Strategic Flood Risk Assessment (SFRA) aims to collect and present information to define flood risk within Wealden District and make recommendations for policies and guidance for the effective management of flood risk to property and life. The SFRA includes flood maps covering the entire district as well as strategic development sites and key settlements. It also summarises the flood risk from each source of flooding within the district.

5.0 Sources of Potential Flooding

5.1 Flood risk to the site has been considered from all likely sources of flooding, as defined in the NPPF and the Planning Practice Guidance to the NPPF. These include tidal, artificial sources (reservoir), fluvial, surface water, sewer and groundwater. The following paragraphs consider flood risk to the site from all these sources.

Tidal

5.2 Given that there is no tidally influenced watercourse on or within the vicinity of the site, tidal flooding is not an issue that would prevent the development of the site.

Fluvial

5.3 The EA publishes its Flood Map for Planning on the GOV.UK website, which shows the maximum extent of fluvial flooding. The mapping indicates that entire site is located within Flood Zone 1, beyond the limits of the 1 in 1,000 year fluvial flood event (<0.1%). An extract from the GOV.UK flood map for planning is included in Appendix F.

5.4 It is therefore considered that the risk of fluvial flooding to the development is very low and fluvial flood risk is not an issue that would prevent or constrain the development of the site to any extent.

Surface Water

5.5 The EA publishes a Flood Risk from Surface Water map on the GOV.UK website which indicates the predicted risk of surface water flooding if rainwater does not drain away through normal drainage systems or soak into the ground. The mapping indicates that the vast majority of the site is at 'very low' risk of surface water flooding, with an annual probability of flooding of less than 1:1,000. There are two small and isolated overland flow paths to the south-western side of the site towards London Road and to the north-western corner of the site, at 'low' (between 1:100 and 1,000 annual probability) risk of surface water flooding. An extract from the GOV.UK surface water flood map is included in Appendix G.

Artificial Sources (Reservoir)

5.6 EA publishes indicative mapping on the GOV.UK website which shows the maximum extent of reservoir flooding in the unlikely event that a reservoir should fail. The mapping indicates that the entire the site is located outside of a reservoir flood risk area. Therefore, reservoir flooding is not considered to be an issue that would prevent the development of the site for its intended end use.

Sewer

5.7 The Wealden District Council SFRA (2017) indicates that historical incidents of sewer flooding are detailed by Southern Water in their Sewer Incident Report Form (SIRF). This database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. According to the SFRA, no incidents of sewer flooding have been recorded within Uckfield.

5.8 It is therefore reasonable to conclude that the risk of sewer flooding to the site is low and is not an issue that would prevent the development of the site for its intended use.

Groundwater

5.9 The Wealden District Council SFRA (2017) provides a mapping of the whole borough showing the areas of groundwater concern. This data provided by East Sussex County Council shows where geological and hydrogeological conditions indicate that groundwater is a concern. It does not show the likelihood of groundwater flooding occurring at any particular return period.

5.10 The SFRA states that there are large areas of Wealden that are shown to be areas of groundwater concern. In the High Weald, the steep topography and impermeable geology limit the areas of groundwater concern to the fluvial river basins, where high water tables in alluvial deposits can lead to groundwater flood risk. However, the groundwater concern is more prevalent in the north and south of the district. In the north of Wealden, a sandstone geology acts as a secondary aquifer with the potential to hold water within the rock. During high water table periods these areas are at risk of groundwater flooding to basements and at the surface. To the south of the district, large areas of the Low Weald are shown to be in an area of groundwater concern.

5.11 In addition, the SFRA states that groundwater flood risk is considered the most prevalent source of flood risk across Wealden and as such, special consideration of this should be made as part of development management decisions within the district. The areas of groundwater concern should be used to indicate where groundwater flood risk considerations should be made as part of the planning process. The SFRA shows the proposed development site located within an area of groundwater concern.

Historic Flooding

5.12 The Wealden District Council SFRA (2017) includes historical flood records and indicates between 21 and 50 historical flood incidents have been recorded in Uckfield town. However, the SFRA does not indicate that those historical flood incidents were specifically recorded within the site boundary.

Summary

5.13 With the exception of surface water and groundwater flooding, the site is at low risk from all sources of flooding examined. These sources of flooding are considered in more detail in Section 6.

6.0 Flood Risk Assessment

Fluvial

6.1 The NPPF encourages a sequential, risk-based approach to determine the suitability of land for development. This document advises that the development of sites within Flood Zone 1 should be given preference where available.

6.2 Table 2 of the Planning Practice Guidance to the NPPF categorises different types of development into five flood risk vulnerability classifications:

- Essential Infrastructure;
- Highly Vulnerable;
- More Vulnerable;
- Less Vulnerable; and
- Water Compatible Development.

6.3 The NPPF classifies the proposed residential use as being 'More Vulnerable'. Table 3 of the PPG states that 'More Vulnerable' development is compatible with Flood Zones 1 and 2, without the need to apply the Exception Test.

6.4 As discussed in Section 5 of this report, the entire site is located within Flood Zone 1. Table 3 of the PPG states that all land uses are appropriate within Flood Zone 1. Therefore, the residential use proposed is compatible with the flood zone of the site and developing the site for its intended purpose is considered appropriate in terms of flood risk. As such, no mitigation measures are required in respect of fluvial flooding, and the Sequential and Exception Tests do not need to be applied to this development.

Surface Water

6.5 The risk of surface water flooding to the majority of the site is very low. However, two small and isolated overland flow paths to the south-western side and to the north-western corner of the site, flowing towards London Road, indicate a low risk of surface water flooding.

6.6 The proposed surface water drainage strategy will drain the site effectively and offer protection against surface water flooding by providing a positive drainage system, which will intercept overland flows generated within the site. The drainage system will be designed to ensure that no flooding takes place up to and including the design rainfall event (1 in 100-year return period), with additional capacity within the system to allow for the potential future effects of climate change.

6.7 Therefore, after applying the drainage strategy (see Section 7), surface water flooding is not considered to be an issue that would prevent the development of the site for its intended end use.

Groundwater

6.8 The SFRA shows the proposed development site located within an area of groundwater concern, as shown in Section 4. Properties with subsurface structures such as basements and utility ducts will be at greater risk of groundwater flooding. However, no basements are proposed for dwellings within the development. Therefore, the only possibility of groundwater affecting the proposed development would be if groundwater emerges from the surface. However, BGS sorehole records, described in Section 2, indicate groundwater levels at 10m below ground level in the nearby borehole. In addition, the provision of a positive drainage system will enable any groundwater that should emerge to drain away.

6.9 Therefore, groundwater is not considered to be an issue that would prevent the development of the site for its intended end use.

Other Sources

6.10 A review of sources of potential flooding in Section 5 of this assessment has concluded that there is a very low risk to the proposed development from all other sources of flooding examined. As such, no specific flood risk mitigation measures will be necessary.

7.0 Surface Water Drainage

7.1 The PPG recommends that priority should be given to the use of Sustainable Drainage Systems (SuDS) as they are designed to control surface water run-off where it falls and mimic natural drainage characteristics as closely as possible. Source control techniques will be incorporated into the drainage strategy to ensure that surface water run-off is managed as close to source as possible. Sustainable drainage systems (SuDS) also provide opportunities for the following:

- Reducing the causes and impacts of flooding;
- Removing pollutants from urban run-off at source; and
- Combining water management and green space with benefits for amenity, recreation and wildlife.

7.2 SuDS encompass a wide range of drainage techniques intended to minimise the rate of discharge, volume and environmental impact of run-off and include:

- pervious pavements;
- swales and basins;
- green roofs and rainwater reuse;
- infiltration trenches and filter drains; and
- ponds and wetlands.

7.3 The Building Regulations part H3 stipulates that rainwater from roofs and paved areas is carried away from surface to discharge to one of the following, listed in order of priority:

a) An adequate soakaway or some other adequate infiltration system; where that is not practical;
b) A watercourse; or, where that is not practical
c) A sewer.

Proposed Surface Water Drainage Strategy

7.4 Infiltration-based drainage techniques, such as porous paving or soakaways, are highest in the hierarchy due to the ability for close to source dispersion of surface water. These techniques are considered the closest solution to mimic the natural drainage of undeveloped sites.

7.5 The BGS Infiltration SuDS GeoReport shown in Appendix H indicates that the southern and eastern side of the site is highly compatible for infiltration SuDS with groundwater likely to be more than 5m below ground level throughout the year, while the subsurface on the western side of the site is potentially suitable for infiltration SuDS, although the design will be influenced by the ground conditions, and groundwater is also likely to be less than 3m below the ground surface for at least part of the year. The BGS GeoReport also indicates that bedrock deposits are likely to be free draining.

7.6 During the site visit carried out by Glanville Consultants as described in Section 2, the landowner confirms the presence of sandstone bedrock throughout the site at shallow depth, which is relatively free draining.

7.7 Also as shown in Section 2, Soilscapes mapping indicates the impeded drainage nature of the superficial deposits underlying the site. Therefore, infiltration techniques may be feasible through the bedrock (sandstone) and would be the most appropriate solution to mimic the natural drainage of the undeveloped site if this proves to be the case.

7.8 An infiltration-based drainage strategy has been developed for the proposals (Option 1) based on typical infiltration rates for the underlying soil type. Soakage tests will be undertaken on-site at the appropriate stage of the development process to verify the feasibility of infiltration techniques, provide rates for detailed design purposes and establish an appropriate stand-off distance from foundations.

7.9 In the absence of infiltration, discharge to an alternative receptor – watercourse or sewer – would be needed to provide the means of disposal of surface water run-off. In this case, the most appropriate receptor is the existing ditch and pipe network located in the adjacent farmyard to the north-west of the development site, identified during the site visit as described in Section 2, with connectivity to a watercourse downstream (a tributary of Shortbridge Stream). Therefore, if infiltration techniques are proven to be unfeasible, an alternative drainage strategy (Option 2) has been devised for the proposed development that involves detaining run-off on site and releasing it at an attenuated rate, no greater than the equivalent greenfield run-off rate, to the downstream drainage network.

7.10 The proposed strategies strive to utilise sustainable drainage techniques in accordance with the guidance described in CIRIA document C753 'The SuDs Manual' (2015) to accommodate run-off from all rainfall events up to and including the 1 in 100-year event, with a 40% allowance for climate change.

Option 1 – Infiltration Proposal

7.11 For the first proposal, two infiltration basins will be used to attenuate surface water run-off from the proposed roof areas prior discharging to the underlying soil strata, with no direct discharge off-site. These infiltration basins will be established to the north of Plot 20 and Plot 36.

7.12 The main surface water drainage system will be designed to adoptable standards in accordance with *Sewers for Adoption* (7th Edition) to ensure a robust design. This drainage system will be designed to collect run-off from the roofs of dwellings and garages.

7.13 Surface water run-off from the roof areas will be collected via gutters and discharged via downpipes directly into collectors towards the drainage pipe, located beneath the proposed access road, towards the infiltration basins. In addition, water butts could be incorporated on-site and used to collect rainwater from the roof area, where appropriate. These structures would provide additional attenuation and water for reuse and would reduce the volume of water discharging to the system.

7.14 Run-off from the proposed car parking area and access road will be managed via porous paving (i.e. a gravel surface and porous sub-base material), discharging through the footprint of the paved area to the underlying strata via infiltration and providing treatment for pollution prevention. The sub-base layer has been designed to be 300mm thick with a minimum 30% void ratio.

7.15 The CIRIA document C753 'The SuDS Manual' (2015) indicates that typical infiltration rates for loamy sands vary from 0.36m/h to 0.108m/h. Therefore, in the absence of the site-specific infiltration testing, a reasonable value of 0.108m/h has been used for the purposes of developing a surface water drainage strategy. Infiltration has been assumed only through the base of the infiltration basins to reach the underlying sandstone bedrock and provide in turn a robust drainage design.

7.16 The results from the MicroDrainage model show that two infiltration basins with base areas between 88.3m^2 and 153.8m^2, 1m deep and with sides slope of 1/3, making a top area between 220m^2 and 314m^2 respectively, are suitable to accommodate the 1:100 year event plus 40% climate change. The infiltration basins would reach a maximum flood depth between 0.809m and 0.766m, as well as maximum storage volume between 110m^3 and 162m^3, associated with the critical storm durations of 240 minutes and 360 minutes Winter storm. The system would drain from full to half full within 24 hours, in line with CIRIA C753 (2015) regulations. The hydraulic calculations are included in Appendix I.

7.17 In addition, results from the MicroDrainage model show that a gravel sub-base layer of 3m wide per 10m unit length would be capable of managing run-off from the access road itself during the 1:100 year event plus 40% climate change. A maximum longitudinal slope of 1:20 has been assumed at the base level of the permeable driveway's sub-base layer. The gravel sub-base layer would reach a maximum flood depth of 0.298m. The hydraulic calculations are also included in Appendix I.

7.18 The infiltration basins will be located a minimum of 5m away from building foundations in accordance with Building Regulations Part H.

Option 2 – Attenuation Proposal

7.19 For the second option, surface water run-off from the development site will be managed by two attenuation basins located at the same locations of the abovementioned infiltration basins as demonstrated in the infiltration proposal (i.e. to the north of Plot 20 and Plot 36), to provide storage prior discharging into the existing pipe network currently located in the adjacent farmyard to the north-west of the development site, and then into the tributary of the Shortbridge Stream.

7.20 The main surface water drainage system will be designed to adoptable standards in accordance with *Sewers for Adoption* (7th Edition) to ensure a robust design. This drainage system will be designed to collect run-off from the roofs of dwellings and garages, as well as the internal access road and car parking areas.

7.21 Roof water will be collected via gutters and discharged via downpipes directly into collectors towards the proposed surface water drain and be conveyed towards the attenuation basins, before discharging into the aforementioned pipe network, via outflow control. Water butts could also be incorporated on-site and used to collect rainwater from the roof area, which would provide additional attenuation and water for reuse and would reduce the volume of water discharging to the system.

7.22 The proposed access road and car parking areas are proposed to be constructed with permeable surfacing and a lined/tanked sub-base constructed with a minimum 30% void ratio. The proposed access road will drain under their own footprint into the porous sub-base beneath. This construction will provide a first level of water quality treatment. Run-off will then be discharged from the permeable pavement sub-base layer into dry swales / French drains, located adjacent to the access road, through collection tanks, where additional water treatment will be provided. Surface water run-off from the swales will then be intercepted and collected through a perforated pipe, located beneath the swale (i.e. French drain), and be conveyed towards the surface water drain along the proposed internal road towards the attenuation basins.

7.23 It should be noted that due to the topography of the site, as well as space constraints to establish swales / French drains in certain zones, surface water run-off from these areas will then be intercepted and collected through a perforated pipe, located in a trench beneath the permeable pavement sub-base layer, with gravel around the pipe which will connect to the pavement, thereby allowing water to flow into the pipework downstream towards the attenuation basins.

7.24 Greenfield run-off rates for the proposed development site have been calculated in accordance with the methodology provided in DEFRA document "Interim Code of Practice for Sustainable Drainage Systems" (ICoPS) (July 2004). Results show a value related to the mean annual flood flow from the site (i.e. QBAR) of approximately 6.8l/s for the total impermeable area of the site. Greenfield run-off rates are shown in Appendix J.

7.25 The results from the MicroDrainage model show that two attenuation basins with base areas between 296m^2 and 274m^2, approximately 1.4m deep and with sides slope of 1/3, making a top area between 600m^2 and 576m^2 respectively, are suitable to accommodate the 1:100 year event plus 40% climate change. The attenuation basins would reach a maximum flood depth between 1.18m and 1.2m, as well as maximum storage volume between 494m^3 and 478m^3, associated with the critical storm duration of 960 minutes Winter storm. The hydraulic calculations are included in Appendix K.

7.26 The design utilises two Hydro-Brake vortex flow controls, to attenuate surface water run-off from the proposed development. Hydro-Brake Optimum® is a very robust low maintenance solution as it has no moving parts, nor does it require power – operating solely due to the flow of water through the unit. This flow control is accepted by a number of UK water companies, the Environment Agency and many Lead Local Flood Authorities for its accuracy of flow control and low maintenance requirements. To achieve the required outflow rates, as well as reduced the blockage risk, the units selected have an 86mm orifice size (MD-SHE-0086-3500-1200-3500) and a 83mm orifice size (MD-SHE-0083-3300-1200-3300), but as they are located within a chamber with a sump, this dimension is not likely to give rise to any undue maintenance burden.

7.27 MicroDrainage shows a total maximum outflow rate of 6.8l/s for the 1:100 year+40%CC rainfall event. Therefore, run-off from the site has been limited to the target run-off rate of 6.8l/s for all return periods up to the 100 year design rainstorm plus 40% climate change.

Summary

7.28 The Building Regulations Part H indicates infiltration-based techniques as the highest priority for surface water disposal. However, in the event that run-off disposal via infiltration is not feasible, attenuated surface water run-off will be discharged into the existing pipe network located in the adjacent farmyard to the north-west of the development site, and then into the Shortbrige Stream tributary. Therefore, both surface water drainage proposals are in accordance with Building Regulations Part H.

7.29 The proposed drainage strategies for the disposal of surface water are presented in Appendix L.

7.30 As a result of the development, flood risk will not increase either on-site or elsewhere.

Pollution Control

7.31 Pollution control measures are designed to minimise the transmittal of any pollutants collected by run-off flowing over impermeable areas.

7.32 Table 26.2 of The SuDS Manual indicates the minimum treatment indices for contributing pollution hazards for different land use classifications. The treatment indices for the land uses proposed within the development are shown in Table 2. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index. Table 3 indicates the SuDS mitigation indices for the permeable pavement, dry swales / French drains and attenuation basins. The infiltration basins have been considered as a layer of dense vegetation underlain by a soil with good contaminant attenuation potential of at least 300mm in depth.

7.33 The pollution indices in Table 2 should be compared with the mitigation indices in Table 3 and the following formulae applied:

Total SuDS Mitigation Index ≥ Pollution Hazards Index (for each contaminant type)

Total SuDS Mitigation Index = 1st Stage Mitigation Index + 0.5 (2nd Stage Mitigation Index)

7.34 For a residential development, roof run-off has very low hazard potential and run-off from low traffic roads also has low hazard potential.

7.35 From inspection of Tables 2 and 3, permeable pavement in isolation is sufficient to mitigate pollution risk from individual driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change.

7.36 In addition, sediment sumps or catch pits should be included within the design immediately upstream of the SuDS features, which may thereby improve the quality of run-off to surface waters and groundwater.

Table 2: Pollution Hazard Indices

Catchment Type	Pollution Hazard Level	Requirements for Discharge to groundwater / surface water	Pollution Hazard Indices		
			Suspended solids	Metals	Hydro-carbons
Residential roofs	Very Low	Removal of gross solids and sediments only	0.2	0.2	0.05
Individual property driveways, low traffic roads (e.g. cul-de-sacs, home zones and general access roads)	Low	Simple index approach	0.5	0.4	0.4

Table 3: SuDS Mitigation Indices

Type of SuDS	SuDS Mitigation Indices		
	Suspended solids	Metals	Hydrocarbons
Permeable pavement	0.7	0.6	0.7
Swale	0.5	0.6	0.6
Detention basin	0.5	0.5	0.6
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential of at least 300mm in depth	0.6	0.5	0.6

Maintenance

7.37 All of the proposed SuDS will be the responsibility of and maintained by the future occupiers or a management company.

7.38 Table 4 shows the maintenance schedule to manage the drainage components within the development.

Table 4: SuDS Maintenance Schedule

Drainage Feature	Inspection and Maintenance	Frequency
Flow control structure (Hydro-Brake or similar)*	Inspect and remove any sediment / debris.	Annually
	Inspect flows controls and repair as necessary.	Occasional (as required)
Permeable pavements	Brushing and vacuuming of surface to remove detrimental materials such as debris, dirt and sediment.	Annually
	Stabilise / mow adjacent verges and remove weeds from pavement surface.	Occasional (as required)

Drainage Feature	Inspection and Maintenance	Frequency
	Ensure paving dewaters after rain and between storms: check joints for sedimentation; mechanically clean or jet wash and sweep surface free from silt, etc; refill joints with sealing grit.	As required
	Inspect and repair any rutting and cracked or broken blocks and replace lost jointing material.	Occasional (as required)
	Rehabilitate surface and upper substructure.	Occasional (every 10-15 years)
Swales	Remove any litter / debris	Monthly, or as required
	Cut grass and manage other vegetation, reseeding areas of poor growth as appropriate	Monthly, or as required
	Inspect and clear inlets and outlets of any blockages.	Annually
	Inspect surfaces for silt accumulation.	Monthly, or as required
	Inspect for evidence of uneven surfacing or erosion and relevel/repair as appropriate	Annually
Infiltration basin	Inspect for signs of clogging and remove any litter / debris found.	Regularly, as required
	Inspect and clear inlet of any blockages.	
	Inspect banksides for evidence of physical damage and repair as appropriate.	
	Check sediment level and remove any excess.	
	Cut and treat vegetation in accordance with landscaping maintenance schedule to prevent 'choking' and maintain biodiversity.	
	Inspect infiltration surfaces for compaction and ponding	
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	
Attenuation basin	Inspect for signs of clogging and remove any litter / debris found.	Regularly, as required
	Inspect and clear inlets and outlets of any blockages.	
	Inspect banksides for evidence of physical damage and repair as appropriate.	
	Check sediment level and remove any excess.	
Hardstanding areas	Sweep regularly to prevent silt being washed off the surface.	Frequently
Conventional pipe network	Inspect and remove any sediment / debris or root ingress.	Monthly or as required
Manholes and catchpits	Inspect manholes and for any signs of blockages. Clean, jet, and empty as required	Annually or as required
	Check, clean and empty catchpits as required to remove debris and sediment	

*Refer to manufacturer's guidance for specific maintenance instructions.

8.0 Foul Water Drainage

8.1 The peak flow from 60 no. dwellings has been calculated at 2.9l/s in accordance with the methodology provided within *Sewers for Adoption (7th Edition)*.

8.2 Foul effluent from the proposed development site is proposed to be drained to a new adoptable pumping station established to the north of Plot 20. Effluent would then be pumped along London Road towards Southern Water's 150mm diameter public foul sewer, located approximately 350m to the south of the proposed pumping station, via a direct connection between manholes ref: 5602 and 5604. Southern Water records are shown in Appendix M.

8.3 An adoptable pumping station of the size required to serve the scheme would be 12m long by 8m wide in terms of the total compound size and the wet well would need to be located a minimum of 15m from the nearest habitable building.

8.4 Foul water from the proposed development will be collected by a sealed drainage system, separate to the surface water drainage system, and discharged via the abovementioned adoptable pumping station.

8.5 *Sewers for Adoption (7th Edition)* states that sewers or lateral drains with a nominal internal diameter of 100mm, or a lateral drain serving ten or less properties should be laid to a gradient no flatter than 1:80 for self-cleaning purposes. However, the proposed foul water network employs 150mm sewers, thereby reducing the gradient required.

8.6 The pumping station will be established to the north of Plot 20, with a cover level of 37.4m AOD and an invert level of the inlet pipe of 35.95m AOD (i.e. 1.45m bgl). Assuming a maximum gradient of 1 in 135 for the 150mm sewers, as well as a minimum cover depth of 1.2m, analysis using MicroDrainage software confirms the feasibility for the collection and removal of foul water from the development through the proposed drainage network. The supporting hydraulic calculations are included in Appendix N whilst the proposed foul water drainage strategy is presented in Appendix O.

8.7 Infrastructure charging means that Southern Water, as local sewerage undertaker, is obliged to accept foul water flows generated by development and fund any network improvements that may be required to provide the necessary capacity via infrastructure charges received from the developer. As such, foul capacity should not be a constraint to development.

9.0 Summary and Conclusions

Summary

9.1 This Flood Risk Assessment has been prepared by Glanville Consultants on behalf of Obsidian Strategic Asset Management Limited, in support of a planning application for a proposed residential development on land at Mockbeggars Farm, Uckfield, TN22 2EA.

9.2 This assessment has been prepared in accordance with the requirement of National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG), flood risk and drainage guidance and with reference to the relevant Strategic Flood Risk Assessments.

9.3 The site is located entirely within Flood Zone 1, beyond the limits of the 1 in 1,000 year fluvial flood event (<0.1%) and at very low risk from all sources of flooding examined. The risk of surface water flooding to the majority of the site is very low, but two small and isolated overland flow paths to the south-western side and to the north-western corner of the site, flowing towards London Road, indicate a low risk of surface water flooding.

9.4 The proposed surface water drainage strategy will offer protection against surface water flooding by providing a positive drainage system, which will intercept overland flows generated within the site. Therefore, surface water flooding is not considered to be an issue that would prevent the development of the site for its intended end use.

9.5 It is anticipated, based on geological records, that infiltration will provide a feasible means of disposal for surface water. Soakage tests will be undertaken at the appropriate time to confirm the feasibility of infiltration, provide rates for detailed design purposes, and establish an appropriate stand-off distance.

9.6 In the event that infiltration techniques are not feasible, an alternative drainage strategy has been devised for the development that involves detaining run-off on site and releasing it at an attenuated rate, no greater than the equivalent greenfield run-off rate, to the existing drainage network currently located in the adjacent farmyard to the north-west of the development site, and then into a tributary of the Shortbridge Stream.

9.7 The proposed surface water drainage strategies utilise sustainable drainage techniques to accommodate surface water run-off from the site for all rainfall events up to and including the 1:100 year+40%CC event, without flooding from surface water. Flood risk will not increase either on-site or elsewhere due to the proposed development.

9.8 The drainage strategy employed will also degrade pollutants, thereby improving the quality of surface water discharged to ground and/or the watercourse.

9.9 A maintenance plan has been proposed to ensure the proposed drainage components are appropriately maintained in perpetuity, in accordance with the relevant guidance and standards.

9.10 Foul water from the proposed development will be drained to a new adoptable pumping station, whereby effluent would be pumped along London Road towards Southern Water's public foul sewerage network, with the point of connection located approximately 350m to the south of the proposed pumping station.

Conclusion

9.11 In conclusion, this report has demonstrated that the proposed development:

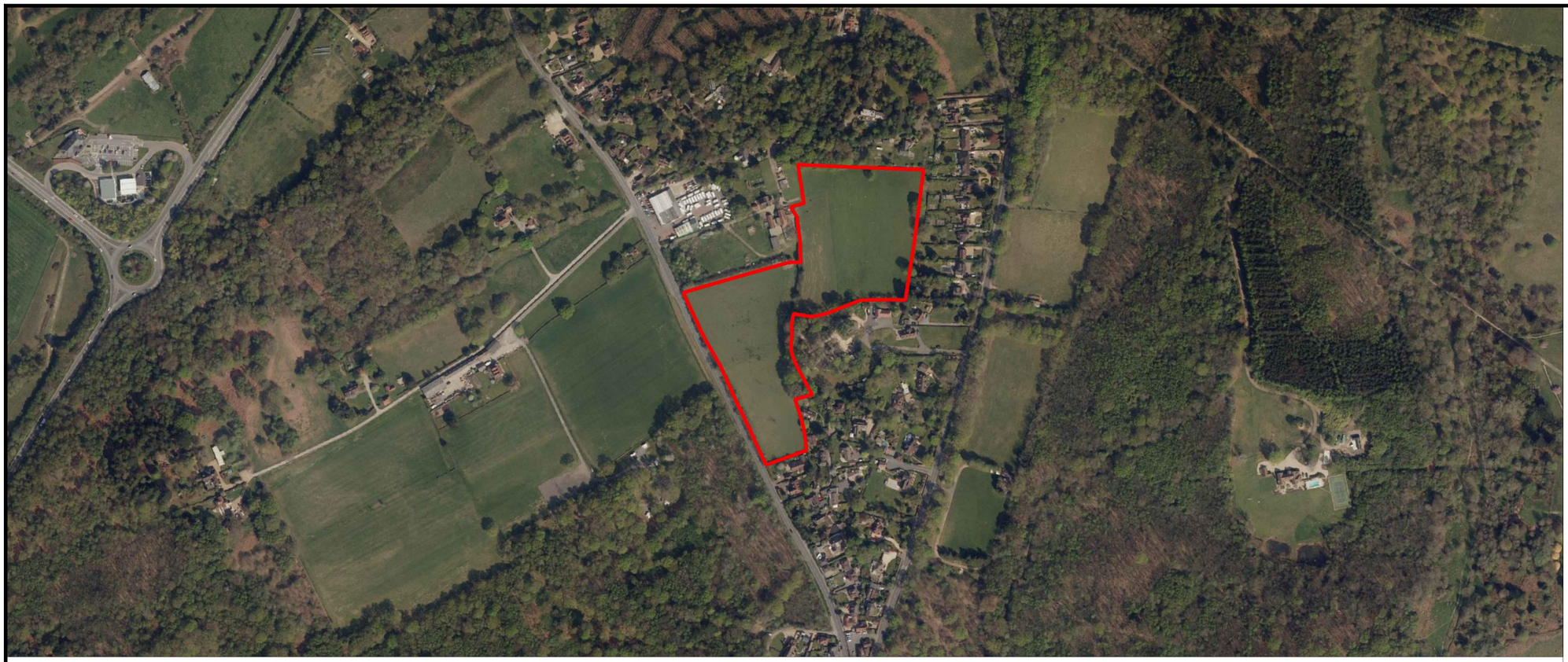
- is in accordance with the National Planning Policy Framework;
- will not be at an unacceptable risk from fluvial flooding or other sources;
- will not increase flood risk elsewhere; and
- will employ a surface water drainage strategy based on the principles of sustainable drainage.
- foul water disposal to the existing public foul sewer in London Road, to the south of the site, is feasible.

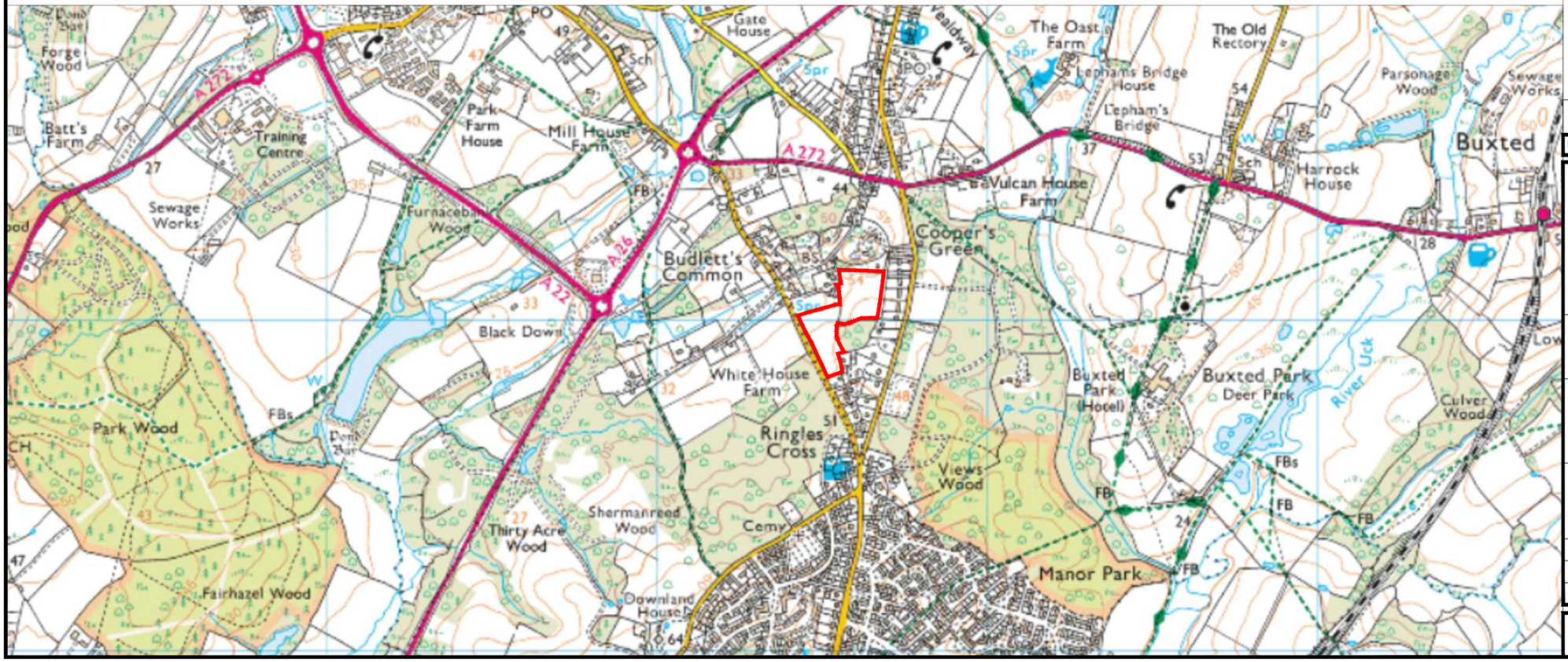
9.12 Therefore, the proposals are considered to fully comply with National, Regional and Local planning policy in respect of flood risk and surface water drainage.

Appendices

Appendix A

Location Plan





NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing

LOCATION

Nearby postcode: TN22 2EA
Grid reference: Easting: 547578
Northings: 123041

KEY

Approximate site location

N

Rev.	Description	Date	Chkd
P1	First Preliminary Issue	22.12.2021 AQ	JB

Glanville
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Oxon, OX11 7AD
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postbox@glanvillegroup.com www.glanvillegroup.com

Client :
Obsidian Strategic Asset Management Limited

Project :
Land at Mockbeggars Farm
Uckfield
TN22 2EA

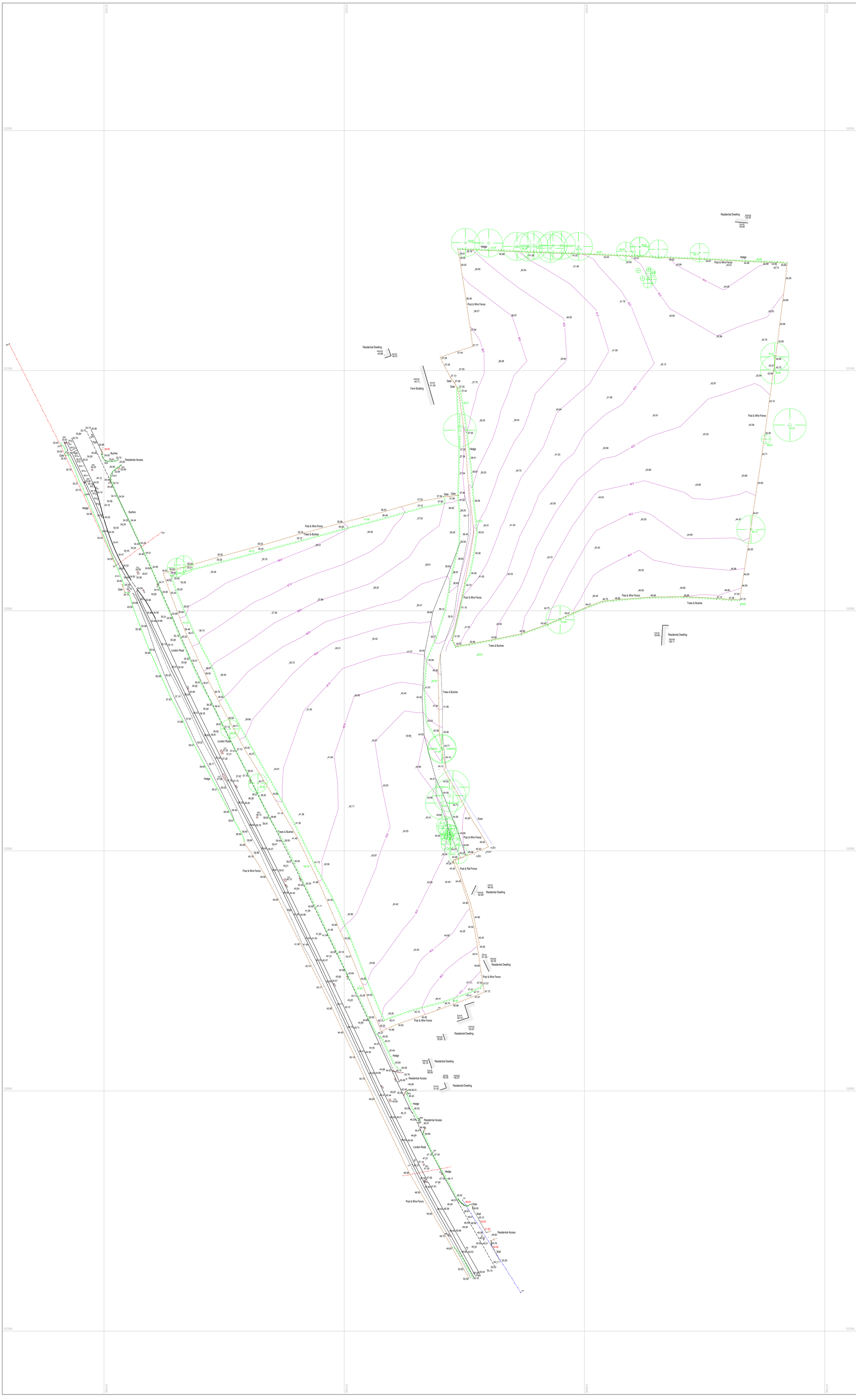
Title :
Site Location Plan

Project Engineer :	A.Quigley	Scale :	NTS
Project Director :	J. Birch	Date :	December 2021
Status :	Planning		

Drawing No.	Site Location	Rev.
		P1

Appendix B

Topographical Survey and LiDAR DTM



KEY :

BOL	-	Bollard
EP	-	Electricity Post
FH	-	Fire Hydrant
G	-	Gully
IC	-	Inspection Cover
LP	-	Lamp Post
MH	-	Manhole Cover
MP	-	Marker Post
SP	-	Sign Post
SV	-	Stop Valve
TIC	-	Telecom Inspection Cover
TP	-	Telegraph Post
WM	-	Water Meter
0.00	-	Approx. Top Of Tree/Bushes/Hedge Level
0.00	-	Top of Fence/Wall Level
	-	Overhead Electricity Line
	-	Overhead Telegraph Line

GRID :

All Survey Data Shown Has Been Orientated To National Grid With All Levels Related To OS Datum Unless Otherwise Stated.

DISCLAIMERS :

The Survey Symbol Used To Represent Tree Spreads Gives An Average Crown Dimension Only.

Detail Shown On This Drawing Relating To Services Above And Below Ground Are For Indication Only.
Verification Of This Detail Must Be Sought From The Relevant Authority.

Chartered Surveyors
The Loft
Unit 3A
Kym Road
Bicton Industrial Estate
Kimbolton
Cambridgeshire
PE28 0LW
Tel: 01480 212790 Fax: 01480 406456
Internet: www.asc-geomatics.co.uk Email: asc@asc-geomatics.co.uk
Registered in England and Wales No. 4500757

SITE : Mockbeggars Farm, Uckfield

TITLE : Topographical Survey
As Surveyed August 2021

CLIENT : Obsidian Strategic

© Crown copyright and database rights (2021) OS (100017983)

DATE :	23.08.2021	DRAWING NUMBER : ASC.21.599
SCALE :	1:500 @ A0	
DRAWN BY :	M Fairley	
SURVEYED BY :	M Fairley / A Newman	

547400 547500 547600 547700 547800

123200 123100 123000 122900 122800

0 30 60 90 120 m

KEY

Site boundary

Contours 50cm

Height (mAOD)

35
35.5
36
36.5
37
37.5
38
38.5
39
39.5
40
40.5
41
41.5
42
42.5
43
43.5
44
44.5
45
45.5
46
46.5
47
47.5
48

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Client:

Obsidian Strategic Asset Management Limited

Project:

Land at Mockbeggars Farm
Uckfield
TN22 2EA

Title:

LiDAR DTM Map

Project Engineer:	AQ	Scale:	1:1,500@A3
Project Director:	JB	Date:	22/12/2021

Drawing No:

8210667 - LiDAR DTM Map

Appendix C

Geological Mapping and Soilscapes Mapping

KEY

Approximate site location

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing

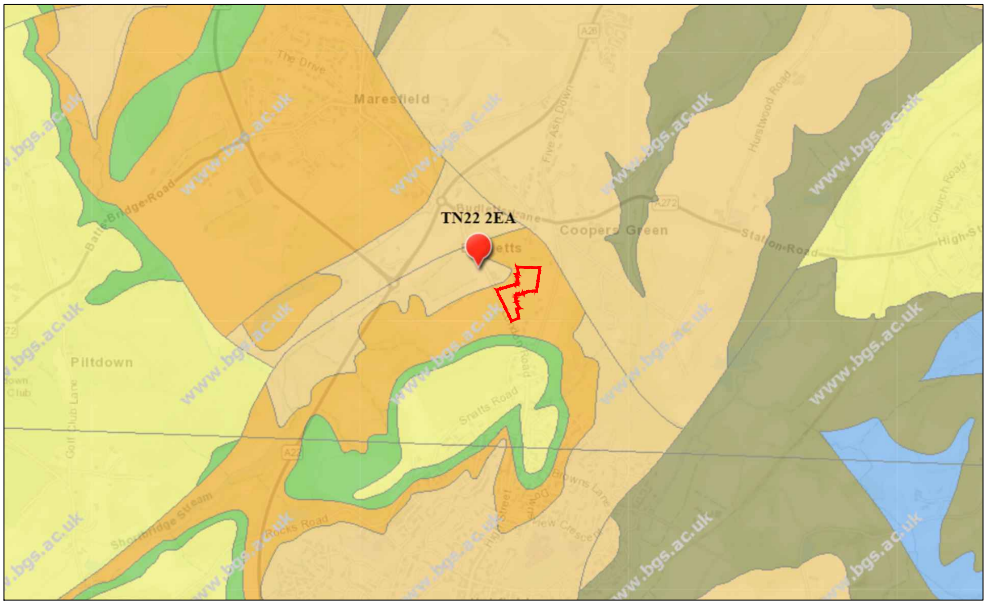
Bedrock Geology

Ardingly Sandstone Member - Sandstone

Soilscapes Map

Slightly acid loamy and clayey soils with impeded drainage.

Bedrock Geology



Soilscapes Map_Cranfield University

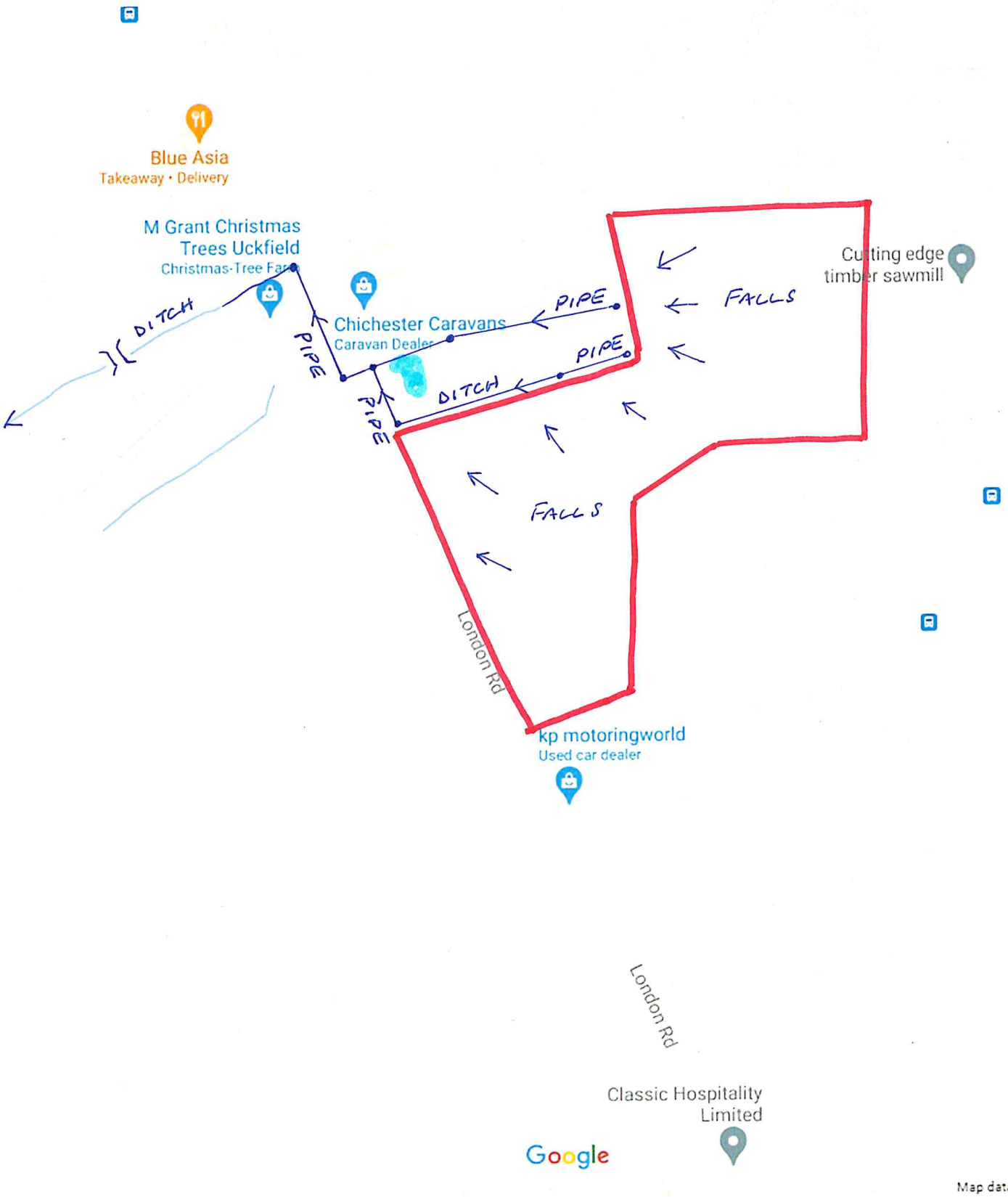


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Project :	Land at Mockbeggars Farm, Uckfield, TN22 2EA				
Title :	British Geological Survey & Soilscapes Mapping Extract				
Project Engineer :	A. Quigley	Scale :	NTS	Drawing No.	CV8210667 - SK01
Project Director :	J. Birch	Date :	December 2021		Rev -

Appendix D

Drainage Mark-ups from Site Visit



OFF-SITE DITCH / PIPE NETWORK



(c) Crown copyright and database rights 2021 Ordnance Survey 100031673
Data updated: 16/08/21

Scale: 1:1250
Map Centre: 547546,122995

Date: 24/08/21
Our Ref: 632727 - 1

Wastewater Plan A3
Powered by digdat

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
WWTW Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

dwigston@glanvillegroup.com

8210667

WATER for LIFE

from Southern Water

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Appendix E

Development Proposals

N
W
E
S

0 10m 20m

Site Plan Legend

- Application Site Boundary Line
- Existing Trees/ Hedgerow
- Proposed Trees
- 5B — Dwelling Reference (Example Shown)
- Plot XX — Plot Number
- xx-x — Allocated Parking 2.5m x 5.0m
- V — Visitor Parking 2.5m x 5.0m
- 1.8m Brick Wall
- 1.8m Timber Fence

Warrendale
The Hollies
SuDS Basin
Turning Head
Pond
SuDS Basin
Swale
Willow
San
Pumping Station
Turning Head
Swale
Round Wood
TI
LONDON ROAD
CR
Teelings Cottage
Timbers
Little Peppers
Warren Cottage
Wards Oak
Appletree Cottage
Squirrels Wood
Broadstone
Four Oaks
Greenheyes
Crofters
The Old Orchard
Brambles Cottage
Roundwood

REV.	DATE	REVISIONS:	BY	REV.	DATE	REVISIONS:	BY	STATUS:
								Preliminary

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CLIENT:	Obsidian Strategic	PROJECT:	Mockbeggars Farm, London Road Uckfield
SCALE:	1:500 (A1 ORIGINAL)	DRAWING:	Proposed Site Layout
DRAWN: RP DATE: xx/12/21	20179	P101	–

architecture planning masterplanning
Broadmede House, Farnham Business Park,
Weydon Lane, Farnham, Surrey GU9 8QT.
info@osparchitecture.com www.osparchitecture.com
Tel: 01252 267878
©Keefe Scanlon Limited. Company Registration No. 2878091

Appendix F

Fluvial Flood Risk Mapping

KEY

Flood Zone 2

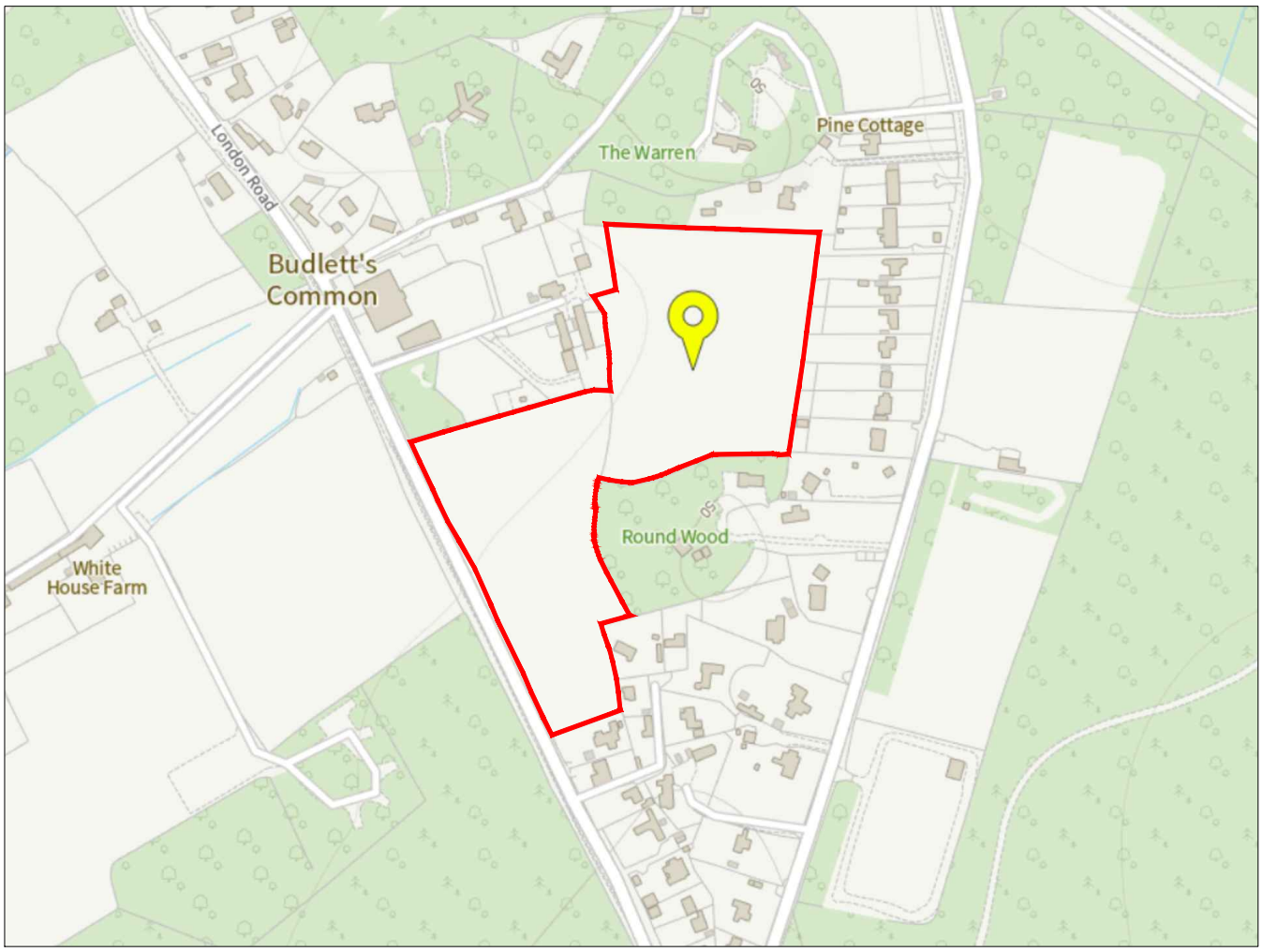
Flood Zone 3

Approximate Site Location

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing



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Project :	Land at Mockbeggars Farm, Uckfield, TN22 2EA
Title :	Environment Agency Flood Zone Map
Project Engineer : A. Quigley	Scale : NTS
Project Director : J. Birch	Date : December 2021
Drawing No.	CV8210667 - SK02
Rev	-

Appendix G

Surface Water Flood Risk Mapping

KEY

Low risk of surface water flooding

Medium risk of surface water flooding

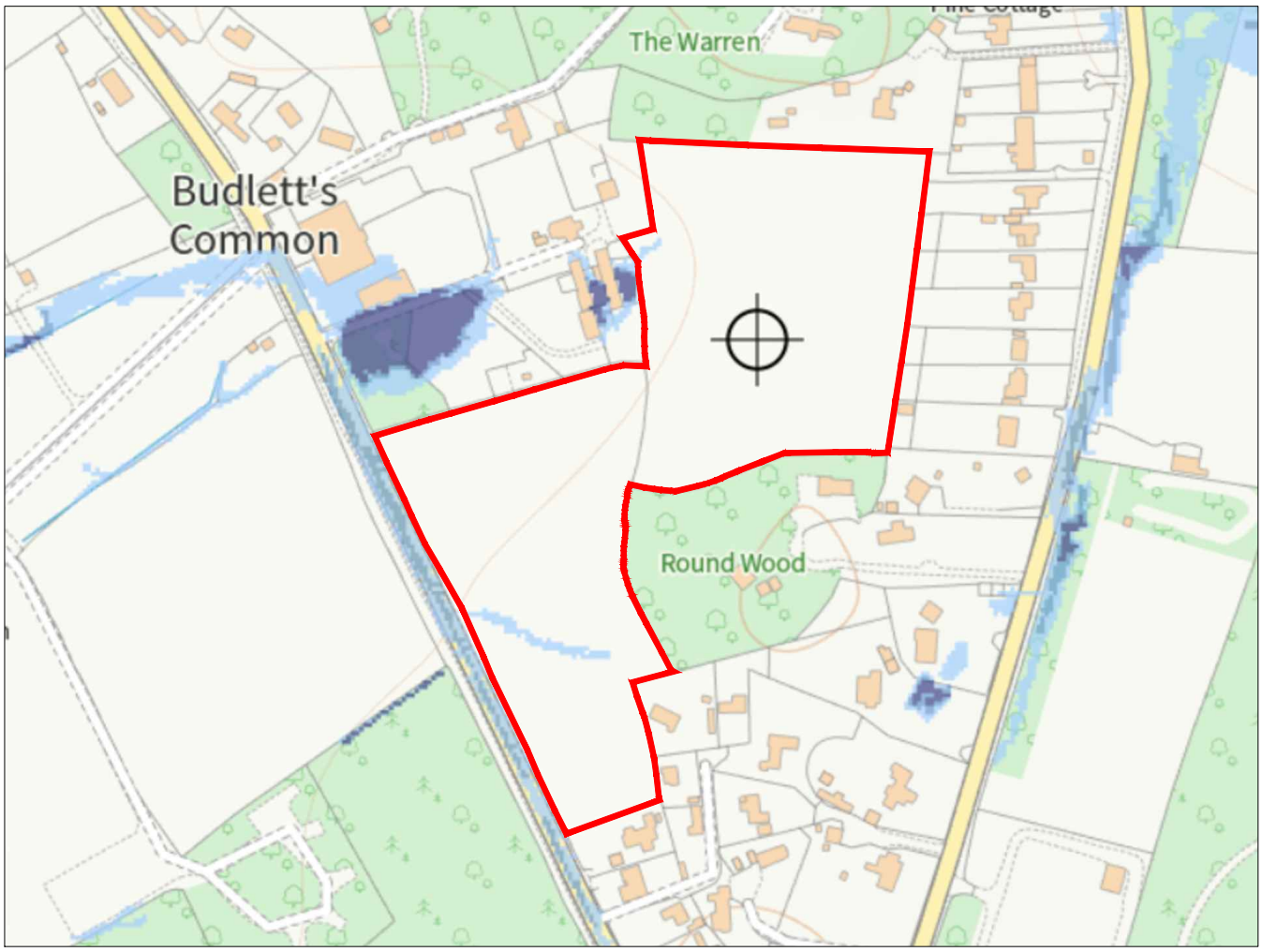
High risk of surface water flooding

Approximate Site Location

N

NOTES

1. This drawing is to be read in conjunction with all other documents and specifications
2. Dimensions not to be scaled from drawing



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Project :	Land at Mockbeggars Farm, Uckfield, TN22 2EA
Title :	Environment Agency Surface Water Flood Map
Project Engineer : A. Quigley	Scale : NTS
Project Director : J. Birch	Date : December 2021
Drawing No.	CV8210667 - SK03
Rev	-

Appendix H

BGS Infiltration SuDS GeoReport

GeoReports

British Geological Survey

Adrian Quigley
Glanville Consultants
Unit 3
Grovelands Business Centre
Boundary Way
Hemel Hempstead Industrial Estate
Hemel Hempstead
HP2 7TE

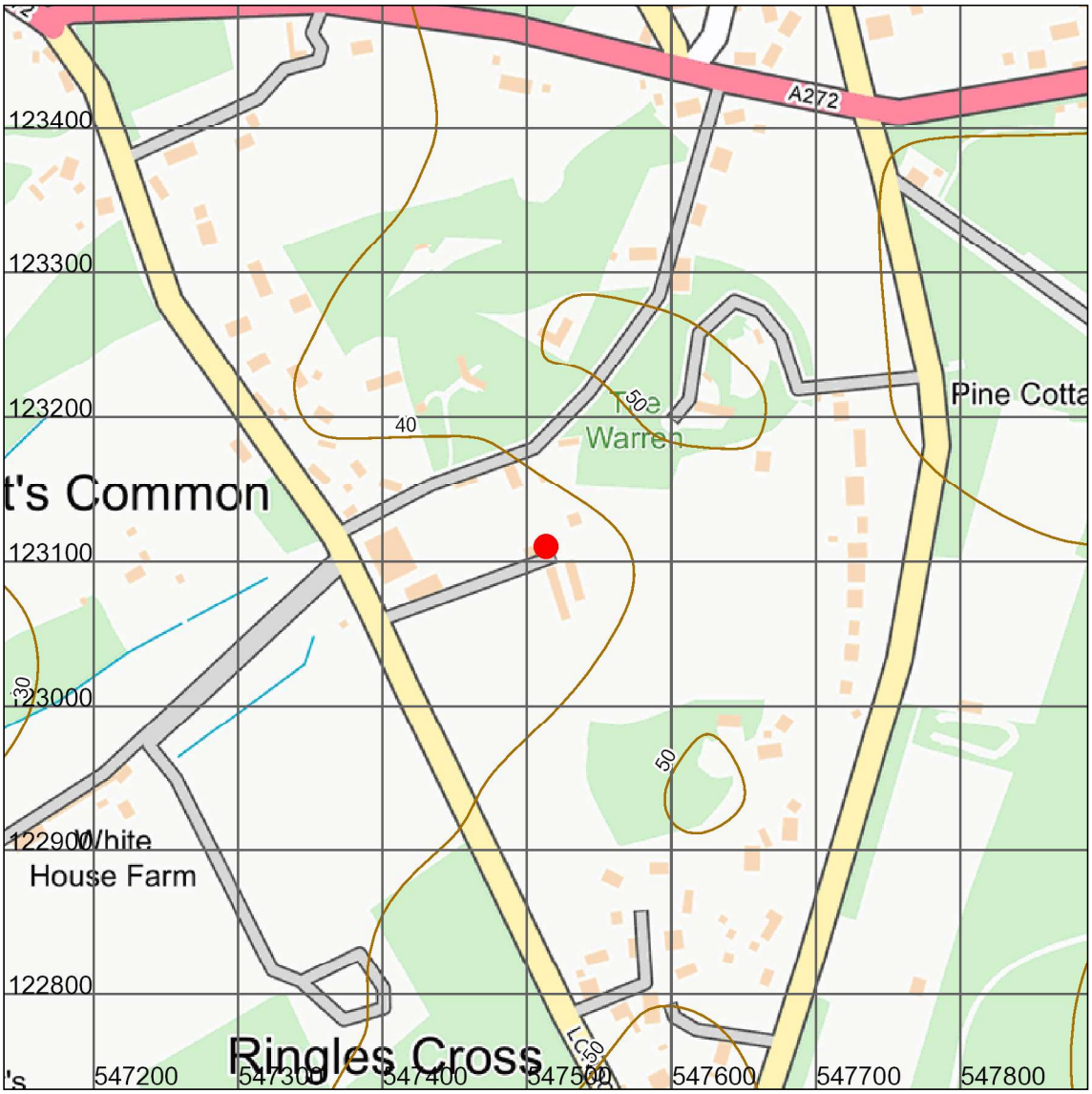
Infiltration SuDS GeoReport:

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_319794/25659***

Client reference: 8210667

Search location



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Search location indicated in red

Site Address:
MOCKBEGGARS FARM
LONDON ROAD
UCKFIELD
TN22 2EA

Point centred at: grid reference obtained from Ordnance Survey AddressPoint

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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.

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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.

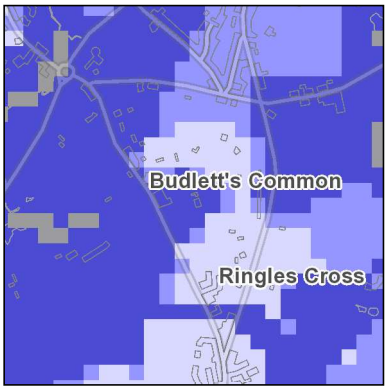
The map and text data in this report is similar to that provided in the '*Infiltration SuDS Map: Detailed'* national map product. For further information about the data, consult the '*User Guide for the Infiltration SuDS Map: Detailed'*, available from http://nora.nerc.ac.uk/16618/.

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PART 1: SUMMARY DATA

This section provides a summary of the data.

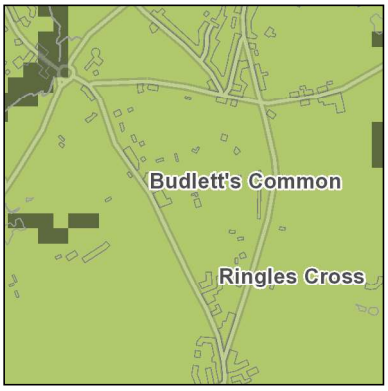
In terms of the drainage potential, is the ground suitable for infiltration SuDS?



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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.

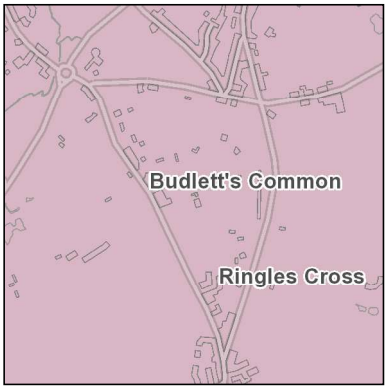
Is ground instability likely to be a problem?



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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.

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PART 2: DETAILED DATA

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

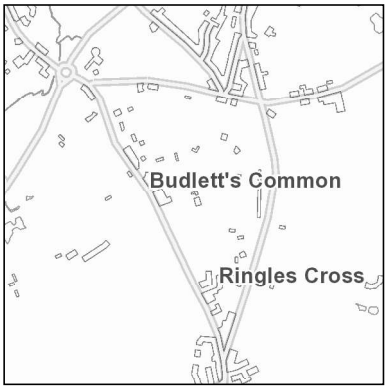
Section 1. Very significant constraints

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

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

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

Soluble rock hazard



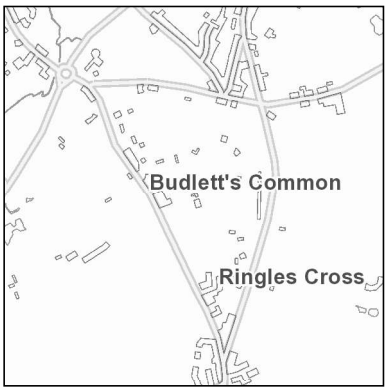
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■ Very significant soluble rock hazard.

Soluble rocks are present with a very significant possibility of localised subsidence that could be initiated or made worse by infiltration. The site investigation should consider whether the potential for or the consequences of subsidence as a result of infiltration are significant.

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

Landslide hazard



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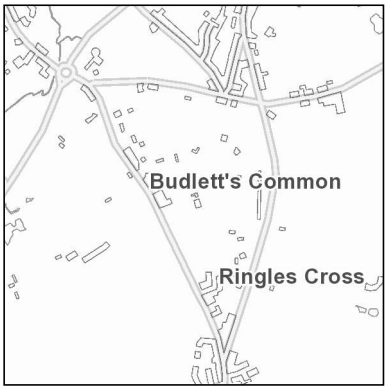
■ Very significant landslide hazard.

Slope instability problems are almost certainly present and may be active. An increase in moisture content as a result of infiltration may cause the slope to fail. The site investigation should consider whether the potential for or the consequences of landslide as a result of infiltration are significant.

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

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Shallow mining hazard



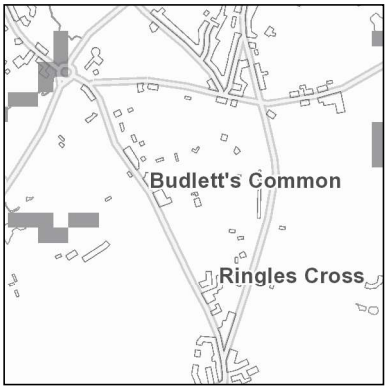
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■ Very significant mining hazard.

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



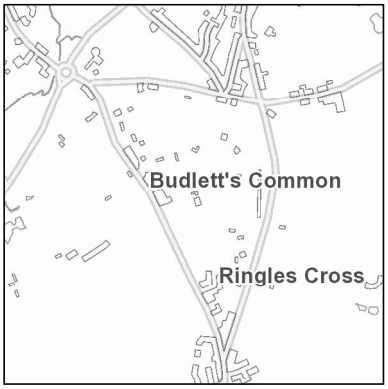
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■ Very high likelihood of persistent or seasonally shallow groundwater.

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

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Section 2. Drainage potential

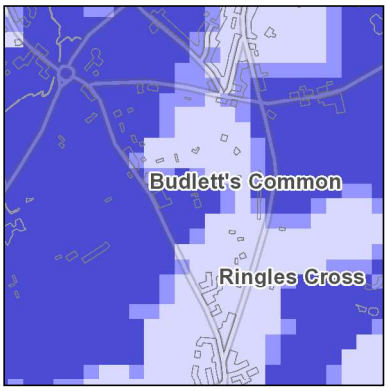
The following pages contain maps that will help you assess the drainage potential of the ground by considering the:

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

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

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

Depth to groundwater table



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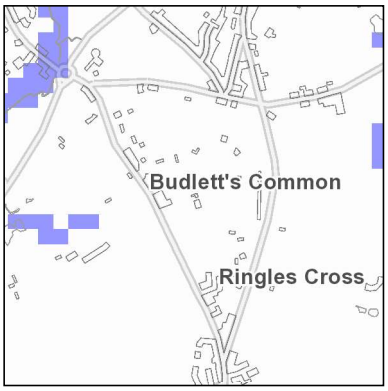
Groundwater is likely to be **more than 5 m** below the ground surface throughout the year.

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

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

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Superficial deposit permeability



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

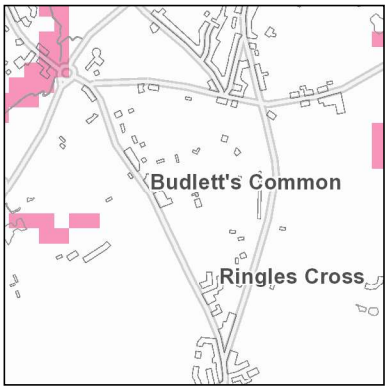
The superficial deposit permeability is **spatially variable**, but likely to permit moderate infiltration.

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

These maps show the permeability range that is summarised above.

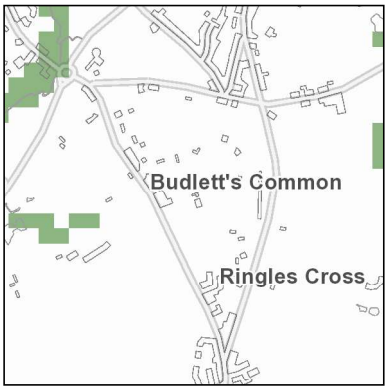
- Very Low
- Low
- Moderate
- High
- Very High

Minimum



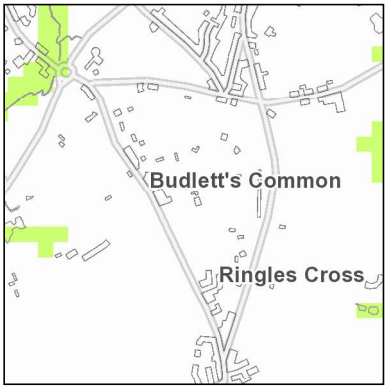
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Maximum



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Superficial deposit thickness



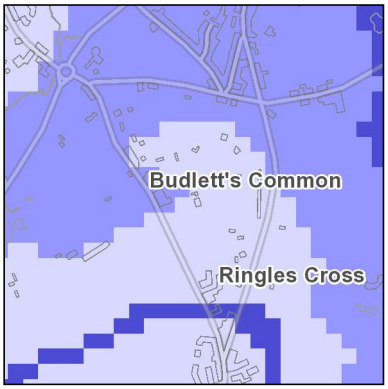
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The thickness of superficial deposits is **< 3 m** and hence the permeability of the ground may be dependent on both the superficial deposits (where present) and underlying bedrock (see below).

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.

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Bedrock permeability



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

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

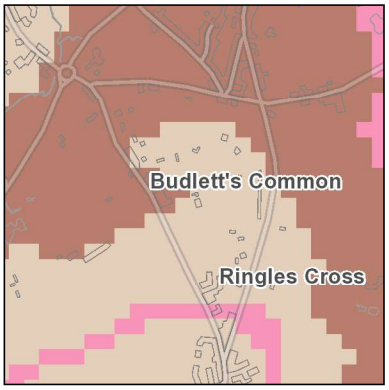
Bedrock deposits are likely to be **poorly draining**.

These maps show the permeability range that is summarised above.

Key

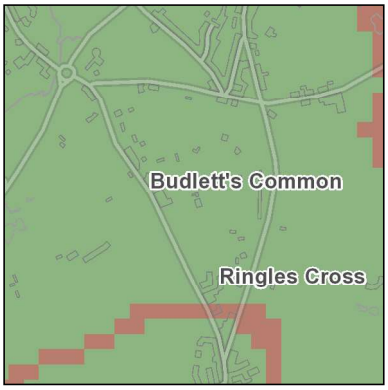
- Very Low
- Low
- Moderate
- High
- Very High

Minimum



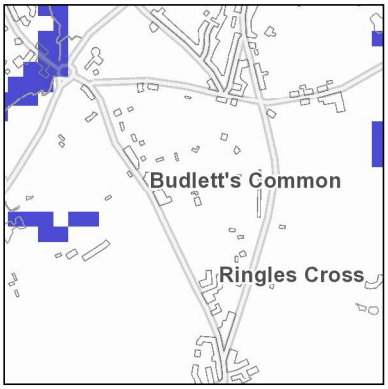
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Maximum



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Geological indicators of flooding



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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.

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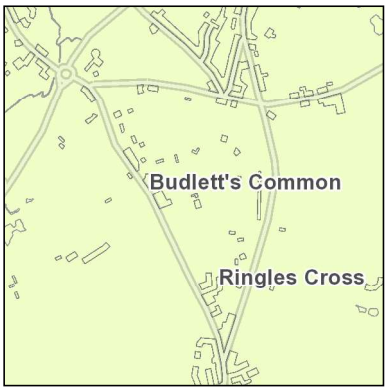
Section 3. Ground stability

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

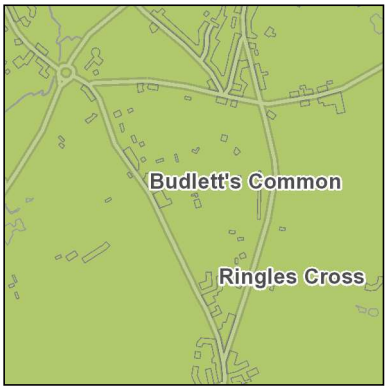


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	Increased infiltration is unlikely to result in subsidence.
	Increased infiltration is unlikely to cause localised subsidence, but potential impacts should be considered.
	Increased infiltration may result in localised subsidence. The potential for 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.

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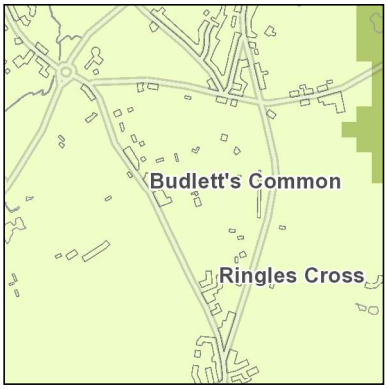
Landslides



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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.

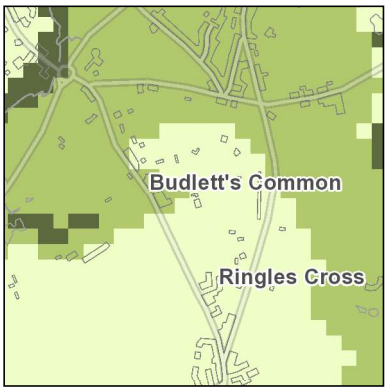
Shallow mining



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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

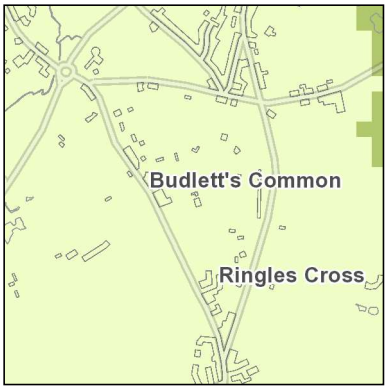


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- Increased infiltration is unlikely to cause ground collapse associated with running sands.
- Running sand is possibly present. Increased infiltration is unlikely to cause a geohazard, but potential impacts should be considered.
- Significant possibility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

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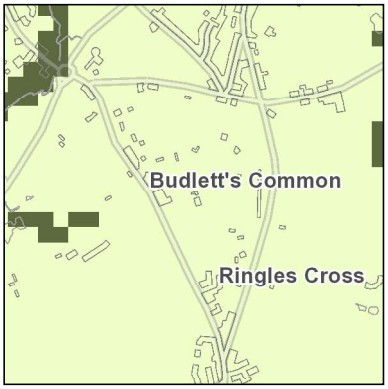
Swelling clays



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- 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.

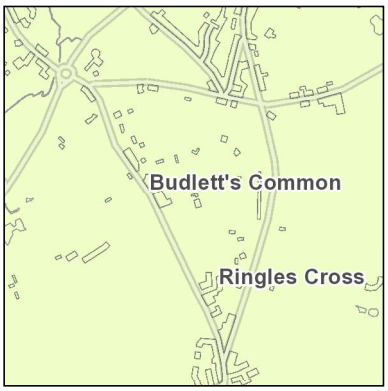
Compressible ground



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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



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- 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.

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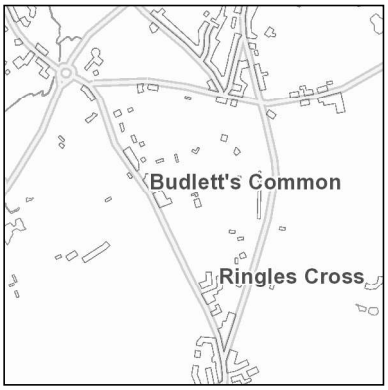
Section 4. Groundwater quality protection

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

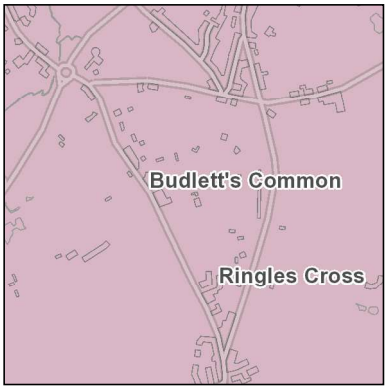


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Derived in part from Source Protection Zone data provided under licence from the Environment Agency © Environment Agency 2021.

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

Predominant flow mechanism

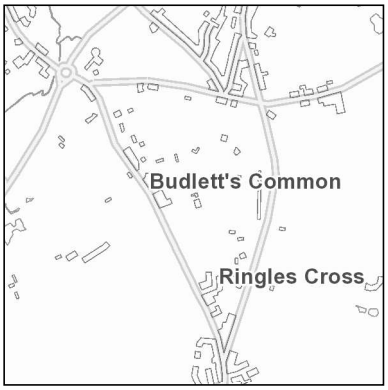


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- Water is likely to percolate through the unsaturated zone to the groundwater through either the pore space in granular media or through porespace and fractures; these processes have some potential for contaminant removal and breakdown.
- Water is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

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Made ground



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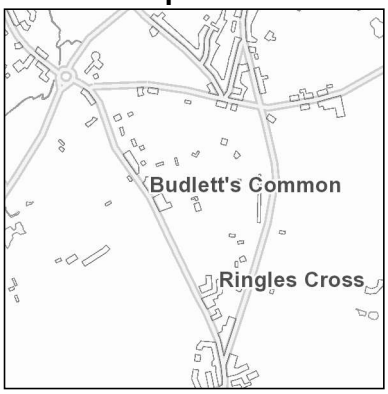
Made ground is present at the surface. Infiltration may increase the possibility of remobilising pollutants.

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Section 5. Geological Maps

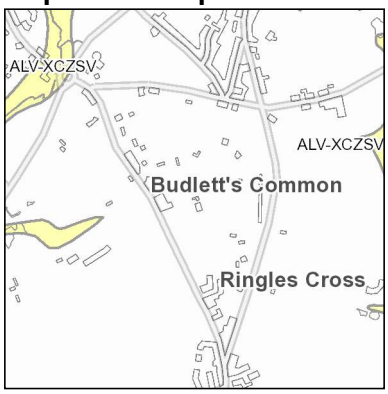
The following maps show the artificial, superficial and bedrock geology within the area of interest.

Artificial deposits



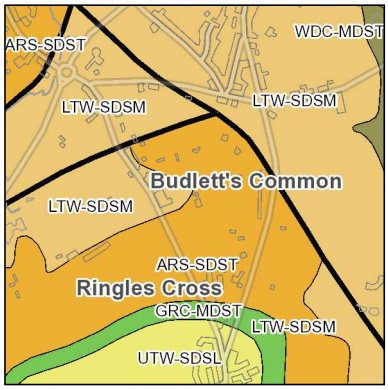
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Superficial deposits



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Bedrock



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Fault

Coal, ironstone or mineral vein

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

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

Key to Superficial deposits:

Map colour	Computer Code	Rock name	Rock type
	ALV-XCZSV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL

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Key to Bedrock geology:

Map colour	Computer Code	Rock name	Rock type
	ARS-SDST	ARDINGLY SANDSTONE MEMBER	SANDSTONE
	GRC-MDST	GRINSTEAD CLAY MEMBER	MUDSTONE
	LTW-SDSM	LOWER TUNBRIDGE WELLS SAND	SANDSTONE, SILTSTONE AND MUDSTONE
	UTW-SDSL	UPPER TUNBRIDGE WELLS SAND	SANDSTONE AND SILTSTONE, INTERBEDDED
	WDC-MDST	WADHURST CLAY FORMATION	MUDSTONE

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Limitations of this report:

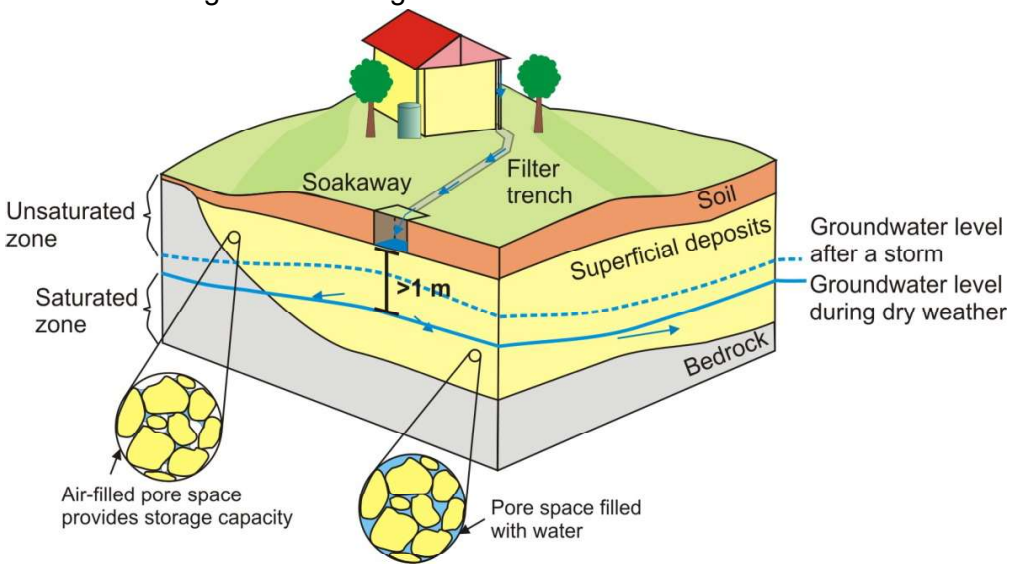
- This report is concerned with the potential for infiltration-to-the-ground to be used as a SuDS technique at the site described. It only considers the subsurface beneath the search area and does NOT consider potential surface or subsurface impacts outside of that area.
- This report is NOT an alternative 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

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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.

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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.

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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.

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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.

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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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Appendix I

MicroDrainage Outputs_Infiltration Method

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.010)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.121	4-8	0.079

Total Area Contributing (ha) = 0.200

Total Pipe Volume (m^3) = 12.469

Time Area Diagram at outfall S (pipe S5.007)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.213	4-8	0.080

Total Area Contributing (ha) = 0.293

Total Pipe Volume (m^3) = 12.757

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

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Network Design Table for Storm

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	24.685	0.417	59.2	0.034	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	11.826	0.118	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	26.235	0.262	100.1	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	26.235	0.262	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	37.254	0.629	59.2	0.011	4.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	40.716	0.407	100.0	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	21.597	0.216	100.1	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	26.403	0.264	100.1	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	23.253	1.651	14.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	20.424	0.875	23.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	40.323	0.742	54.3	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	34.034	1.900	17.9	0.029	4.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	15.453	0.154	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.002	4.789	0.226	21.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.009	24.582	2.070	11.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.31	42.387	0.034	0.0	0.0	0.0	1.31	23.1	4.6
S1.001	50.00	4.51	41.970	0.034	0.0	0.0	0.0	1.00	17.7	4.6
S1.002	50.00	4.95	41.852	0.043	0.0	0.0	0.0	1.00	17.7	5.8
S1.003	50.00	5.38	41.590	0.043	0.0	0.0	0.0	1.00	17.7	5.8
S2.000	50.00	4.47	41.153	0.011	0.0	0.0	0.0	1.31	23.1	1.5
S2.001	50.00	4.99	40.449	0.039	0.0	0.0	0.0	1.31	52.0	5.3
S1.004	50.00	5.66	40.042	0.093	0.0	0.0	0.0	1.31	51.9	12.6
S1.005	50.00	5.99	39.826	0.115	0.0	0.0	0.0	1.31	51.9	15.6
S1.006	50.00	6.10	39.563	0.115	0.0	0.0	0.0	3.51	139.4	15.6
S1.007	50.00	6.23	37.912	0.115	0.0	0.0	0.0	2.72	108.1	15.6
S1.008	50.00	6.61	37.037	0.124	0.0	0.0	0.0	1.78	70.7	16.8
S3.000	50.00	4.24	38.650	0.029	0.0	0.0	0.0	2.39	42.3	3.9
S3.001	50.00	4.49	36.750	0.029	0.0	0.0	0.0	1.00	17.7	3.9
S3.002	50.00	4.53	36.596	0.029	0.0	0.0	0.0	2.20	38.8	3.9
S1.009	50.00	6.71	36.295	0.153	0.0	0.0	0.0	3.82	151.8	20.7

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S4.000	28.099	0.474	59.3	0.047	4.00	0.0	0.600	o	150	Pipe/Conduit	
S4.001	28.099	0.281	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.002	15.975	0.134	119.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.010	3.994	0.024	166.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	9.339	0.158	59.1	0.027	4.00	0.0	0.600	o	150	Pipe/Conduit	
S5.001	15.794	0.737	21.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.000	12.339	0.375	32.9	0.015	4.00	0.0	0.600	o	150	Pipe/Conduit	
S5.002	30.743	0.307	100.1	0.054	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.003	30.743	1.549	19.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.004	30.061	1.487	20.2	0.074	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.005	30.061	0.835	36.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.006	21.423	0.847	25.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	12.425	0.210	59.2	0.025	4.00	0.0	0.600	o	150	Pipe/Conduit	
S7.001	15.534	0.408	38.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.000	50.00	4.36	35.189	0.047	0.0	0.0	0.0	1.31	23.1	6.4
S4.001	50.00	4.82	34.715	0.047	0.0	0.0	0.0	1.00	17.7	6.4
S4.002	50.00	5.11	34.434	0.047	0.0	0.0	0.0	0.92	16.2	6.4
S1.010	50.00	6.78	34.300	0.200	0.0	0.0	0.0	1.01	40.2	27.1
S5.000	50.00	4.12	43.233	0.027	0.0	0.0	0.0	1.31	23.2	3.7
S5.001	50.00	4.24	43.075	0.027	0.0	0.0	0.0	2.19	38.6	3.7
S6.000	50.00	4.12	42.400	0.015	0.0	0.0	0.0	1.76	31.1	2.0
S5.002	50.00	4.63	41.950	0.096	0.0	0.0	0.0	1.31	51.9	13.0
S5.003	50.00	4.81	41.643	0.096	0.0	0.0	0.0	2.95	117.3	13.0
S5.004	50.00	4.98	40.094	0.170	0.0	0.0	0.0	2.92	116.2	23.0
S5.005	50.00	5.21	38.607	0.170	0.0	0.0	0.0	2.19	87.0	23.0
S5.006	50.00	5.34	37.772	0.170	0.0	0.0	0.0	2.61	103.9	23.0
S7.000	50.00	4.16	41.937	0.025	0.0	0.0	0.0	1.31	23.2	3.4
S7.001	50.00	4.32	41.727	0.025	0.0	0.0	0.0	1.64	28.9	3.4

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S8.000	12.826	0.217	59.1	0.017	4.00	0.0	0.600	o	150	Pipe/Conduit	
S7.002	31.237	0.312	100.1	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	12.826	0.217	59.1	0.033	4.00	0.0	0.600	o	150	Pipe/Conduit	
S7.003	11.231	0.112	100.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.004	32.965	0.329	100.1	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.000	15.490	0.262	59.1	0.021	4.00	0.0	0.600	o	150	Pipe/Conduit	
S7.005	35.826	0.744	48.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.006	14.876	2.022	7.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.007	4.308	0.026	165.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S8.000	50.00	4.16	41.595	0.017	0.0	0.0	0.0	1.31	23.2	2.3
S7.002	50.00	4.71	41.244	0.060	0.0	0.0	0.0	1.31	52.0	8.1
S9.000	50.00	4.16	42.102	0.033	0.0	0.0	0.0	1.31	23.2	4.5
S7.003	50.00	4.86	40.932	0.093	0.0	0.0	0.0	1.31	51.9	12.6
S7.004	50.00	5.28	40.820	0.102	0.0	0.0	0.0	1.31	51.9	13.8
S10.000	50.00	4.20	40.028	0.021	0.0	0.0	0.0	1.31	23.2	2.8
S7.005	50.00	5.59	39.691	0.123	0.0	0.0	0.0	1.89	75.1	16.7
S7.006	50.00	5.65	38.947	0.123	0.0	0.0	0.0	4.85	193.0	16.7
S5.007	50.00	5.72	37.000	0.293	0.0	0.0	0.0	1.01	40.3	39.7

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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)
S1.000	o	150	S1	43.737	42.387	1.200	Open Manhole	600
S1.001	o	150	S2	44.341	41.970	2.221	Open Manhole	600
S1.002	o	150	S3	44.286	41.852	2.284	Open Manhole	600
S1.003	o	150	S4	43.423	41.590	1.683	Open Manhole	600
S2.000	o	150	S5	42.503	41.153	1.200	Open Manhole	600
S2.001	o	225	S6	41.360	40.449	0.686	Open Manhole	600
S1.004	o	225	S7	43.134	40.042	2.867	Open Manhole	600
S1.005	o	225	S8	42.848	39.826	2.797	Open Manhole	600
S1.006	o	225	S9	41.284	39.563	1.496	Open Manhole	600
S1.007	o	225	S10	39.337	37.912	1.200	Open Manhole	600
S1.008	o	225	S11	38.462	37.037	1.200	Open Manhole	600
S3.000	o	150	S12	40.000	38.650	1.200	Open Manhole	600
S3.001	o	150	S13	38.100	36.750	1.200	Open Manhole	600
S3.002	o	150	S14	38.124	36.596	1.378	Open Manhole	600

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)
S1.000	24.685	59.2	S2	44.341	41.970	2.221	Open Manhole	600
S1.001	11.826	100.1	S3	44.286	41.852	2.284	Open Manhole	600
S1.002	26.235	100.1	S4	43.423	41.590	1.683	Open Manhole	600
S1.003	26.235	100.1	S7	43.134	41.328	1.656	Open Manhole	600
S2.000	37.254	59.2	S6	41.360	40.524	0.686	Open Manhole	600
S2.001	40.716	100.0	S7	43.134	40.042	2.867	Open Manhole	600
S1.004	21.597	100.1	S8	42.848	39.826	2.797	Open Manhole	600
S1.005	26.403	100.1	S9	41.284	39.563	1.496	Open Manhole	600
S1.006	23.253	14.1	S10	39.337	37.912	1.200	Open Manhole	600
S1.007	20.424	23.3	S11	38.462	37.037	1.200	Open Manhole	600
S1.008	40.323	54.3	S15	37.720	36.295	1.200	Open Manhole	600
S3.000	34.034	17.9	S13	38.100	36.750	1.200	Open Manhole	600
S3.001	15.453	100.1	S14	38.124	36.596	1.378	Open Manhole	600
S3.002	4.789	21.2	S15	37.720	36.370	1.200	Open Manhole	600

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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)
S1.009	o	225	S15	37.720	36.295	1.200	Open Manhole	600
S4.000	o	150	S16	36.539	35.189	1.200	Open Manhole	600
S4.001	o	150	S17	36.088	34.715	1.223	Open Manhole	600
S4.002	o	150	S18	35.812	34.434	1.228	Open Manhole	600
S1.010	o	225	S19	35.322	34.300	0.797	Open Manhole	600
S5.000	o	150	S20	44.583	43.233	1.200	Open Manhole	600
S5.001	o	150	S21	44.684	43.075	1.459	Open Manhole	600
S6.000	o	150	S22	43.750	42.400	1.200	Open Manhole	600
S5.002	o	225	S23	43.688	41.950	1.513	Open Manhole	600
S5.003	o	225	S24	43.747	41.643	1.879	Open Manhole	600
S5.004	o	225	S25	41.519	40.094	1.200	Open Manhole	600
S5.005	o	225	S26	40.032	38.607	1.200	Open Manhole	600
S5.006	o	225	S27	39.197	37.772	1.200	Open Manhole	600

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)
S1.009	24.582	11.9	S19	35.322	34.225	0.872	Open Manhole	600
S4.000	28.099	59.3	S17	36.088	34.715	1.223	Open Manhole	600
S4.001	28.099	100.1	S18	35.812	34.434	1.228	Open Manhole	600
S4.002	15.975	119.2	S19	35.322	34.300	0.872	Open Manhole	600
S1.010	3.994	166.4	S	35.322	34.276	0.821	Open Manhole	0
S5.000	9.339	59.1	S21	44.684	43.075	1.459	Open Manhole	600
S5.001	15.794	21.4	S23	43.688	42.338	1.200	Open Manhole	600
S6.000	12.339	32.9	S23	43.688	42.025	1.513	Open Manhole	600
S5.002	30.743	100.1	S24	43.747	41.643	1.879	Open Manhole	600
S5.003	30.743	19.8	S25	41.519	40.094	1.200	Open Manhole	600
S5.004	30.061	20.2	S26	40.032	38.607	1.200	Open Manhole	600
S5.005	30.061	36.0	S27	39.197	37.772	1.200	Open Manhole	600
S5.006	21.423	25.3	S38	38.000	36.925	0.850	Open Manhole	600

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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)
S7.000	o	150	S28	43.287	41.937	1.200	Open Manhole	600
S7.001	o	150	S29	43.061	41.727	1.184	Open Manhole	600
S8.000	o	150	S30	42.945	41.595	1.200	Open Manhole	600
S7.002	o	225	S31	42.669	41.244	1.200	Open Manhole	600
S9.000	o	150	S32	43.452	42.102	1.200	Open Manhole	600
S7.003	o	225	S33	43.234	40.932	2.077	Open Manhole	600
S7.004	o	225	S34	43.773	40.820	2.728	Open Manhole	600
S10.000	o	150	S35	41.378	40.028	1.200	Open Manhole	600
S7.005	o	225	S36	42.017	39.691	2.101	Open Manhole	600
S7.006	o	225	S37	40.372	38.947	1.200	Open Manhole	600

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)
S7.000	12.425	59.2	S29	43.061	41.727	1.184	Open Manhole	600
S7.001	15.534	38.1	S31	42.669	41.319	1.200	Open Manhole	600
S8.000	12.826	59.1	S31	42.669	41.378	1.141	Open Manhole	600
S7.002	31.237	100.1	S33	43.234	40.932	2.077	Open Manhole	600
S9.000	12.826	59.1	S33	43.234	41.885	1.199	Open Manhole	600
S7.003	11.231	100.1	S34	43.773	40.820	2.728	Open Manhole	600
S7.004	32.965	100.1	S36	42.017	40.491	1.301	Open Manhole	600
S10.000	15.490	59.1	S36	42.017	39.766	2.101	Open Manhole	600
S7.005	35.826	48.2	S37	40.372	38.947	1.200	Open Manhole	600
S7.006	14.876	7.4	S38	38.000	36.925	0.850	Open Manhole	600

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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)
S5.007	o	225	S38	38.000	37.000	0.775	Open Manhole	600

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)
S5.007	4.308	165.7	S	38.000	36.974	0.801	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.010	S	35.322	34.276	0.000	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S5.007	S	38.000	36.974	0.000	0	0

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Online Controls for Storm

Depth/Flow Relationship Manhole: S19, DS/PN: S1.010, Volume (m³): 1.5

Invert Level (m) 34.300

Depth (m)	Flow (l/s)
1.500	0.0000

Depth/Flow Relationship Manhole: S38, DS/PN: S5.007, Volume (m³): 1.7

Invert Level (m) 37.000

Depth (m)	Flow (l/s)
1.500	0.0000

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Storage Structures for Storm

Infiltration Basin Manhole: S19, DS/PN: S1.010

Invert Level (m) 34.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.10800 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	88.3	1.022	220.0

Infiltration Basin Manhole: S38, DS/PN: S5.007

Invert Level (m) 37.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.10800 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	153.8	1.000	314.0

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S1	15 minute 100 year Winter I+40%	43.737	42.767	0.230	0.000	0.89
S1.001	S2	15 minute 100 year Winter I+40%	44.341	42.491	0.371	0.000	1.11
S1.002	S3	15 minute 100 year Winter I+40%	44.286	42.347	0.345	0.000	1.31
S1.003	S4	15 minute 100 year Winter I+40%	43.423	41.900	0.160	0.000	1.28
S2.000	S5	15 minute 100 year Winter I+40%	42.503	41.210	-0.093	0.000	0.31
S2.001	S6	15 minute 100 year Winter I+40%	41.360	40.562	-0.112	0.000	0.49
S1.004	S7	15 minute 100 year Winter I+40%	43.134	40.373	0.106	0.000	1.00
S1.005	S8	15 minute 100 year Winter I+40%	42.848	40.161	0.109	0.000	1.19
S1.006	S9	15 minute 100 year Winter I+40%	41.284	39.668	-0.119	0.000	0.45
S1.007	S10	15 minute 100 year Winter I+40%	39.337	38.035	-0.101	0.000	0.58
S1.008	S11	15 minute 100 year Winter I+40%	38.462	37.205	-0.056	0.000	0.91
S3.000	S12	15 minute 100 year Winter I+40%	40.000	38.721	-0.079	0.000	0.45
S3.001	S13	15 minute 100 year Winter I+40%	38.100	36.932	0.032	0.000	1.12
S3.002	S14	15 minute 100 year Winter I+40%	38.124	36.681	-0.065	0.000	0.61
S1.009	S15	15 minute 100 year Winter I+40%	37.720	36.414	-0.106	0.000	0.55

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Infil. Flow (l/s)	Maximum Vol (m^3)	Discharge Vol (m^3)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1		0.106	9.411	1.4	19.5	SURCHARGED
S1.001	S2		0.561	9.411	1.0	17.9	SURCHARGED
S1.002	S3		0.337	11.902	1.3	22.2	SURCHARGED
S1.003	S4		0.473	11.904	1.2	21.6	SURCHARGED
S2.000	S5		0.015	3.046	1.1	6.9	OK
S2.001	S6		0.036	10.799	1.2	24.2	OK
S1.004	S7		0.929	25.747	1.3	47.3	SURCHARGED
S1.005	S8		0.816	31.842	1.4	57.2	SURCHARGED
S1.006	S9		0.100	31.843	3.1	57.3	OK
S1.007	S10		0.050	31.846	2.6	57.3	OK
S1.008	S11		0.103	34.337	1.9	60.8	OK
S3.000	S12		0.019	8.032	2.3	18.4	OK
S3.001	S13		0.082	8.031	1.1	18.3	SURCHARGED
S3.002	S14		0.065	8.032	1.8	18.2	OK
S1.009	S15		0.095	42.371	3.6	76.7	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S4.000	S16	15 minute 100 year Winter I+40%	36.539	35.977	0.638	0.000	1.16
S4.001	S17	15 minute 100 year Winter I+40%	36.088	35.408	0.543	0.000	1.40
S4.002	S18	360 minute 100 year Winter I+40%	35.812	35.112	0.528	0.000	0.27
S1.010	S19	360 minute 100 year Winter I+40%	35.322	35.109	0.584	0.000	0.00
S5.000	S20	15 minute 100 year Winter I+40%	44.583	43.338	-0.045	0.000	0.84
S5.001	S21	15 minute 100 year Winter I+40%	44.684	43.148	-0.077	0.000	0.48
S6.000	S22	15 minute 100 year Winter I+40%	43.750	42.460	-0.090	0.000	0.34
S5.002	S23	15 minute 100 year Winter I+40%	43.688	42.338	0.163	0.000	1.22
S5.003	S24	15 minute 100 year Winter I+40%	43.747	41.762	-0.106	0.000	0.54
S5.004	S25	15 minute 100 year Winter I+40%	41.519	40.525	0.206	0.000	0.91
S5.005	S26	15 minute 100 year Winter I+40%	40.032	39.325	0.493	0.000	1.20
S5.006	S27	15 minute 100 year Winter I+40%	39.197	38.157	0.160	0.000	1.01
S7.000	S28	15 minute 100 year Winter I+40%	43.287	42.035	-0.052	0.000	0.75
S7.001	S29	15 minute 100 year Winter I+40%	43.061	41.810	-0.067	0.000	0.59
S8.000	S30	15 minute 100 year Winter I+40%	42.945	41.671	-0.074	0.000	0.51
S7.002	S31	15 minute 100 year Winter I+40%	42.669	41.497	0.028	0.000	0.74
S9.000	S32	15 minute 100 year Summer I+40%	43.452	42.233	-0.019	0.000	1.00
S7.003	S33	15 minute 100 year Winter I+40%	43.234	41.334	0.177	0.000	1.21
S7.004	S34	15 minute 100 year Winter I+40%	43.773	41.172	0.127	0.000	1.19
S10.000	S35	15 minute 100 year Winter I+40%	41.378	40.114	-0.064	0.000	0.62
S7.005	S36	15 minute 100 year Winter I+40%	42.017	39.869	-0.047	0.000	0.97
S7.006	S37	15 minute 100 year Winter I+40%	40.372	39.047	-0.125	0.000	0.41
S5.007	S38	240 minute 100 year Winter I+40%	38.000	37.766	0.541	0.000	0.00

PN	US/MH Name	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S4.000	S16		0.221	13.012	1.5	25.6	SURCHARGED
S4.001	S17		0.680	13.008	1.4	23.7	SURCHARGED
S4.002	S18		0.676	35.910	0.5	4.0	SURCHARGED
S1.010	S19	2.9	110.069	0.000	0.0	0.0	FLOOD RISK
S5.000	S20		0.028	7.477	1.3	17.1	OK
S5.001	S21		0.040	7.477	2.0	17.1	OK
S6.000	S22		0.016	4.154	1.5	9.5	OK
S5.002	S23		0.237	26.581	1.5	59.3	SURCHARGED
S5.003	S24		0.142	26.581	2.8	59.4	OK
S5.004	S25		0.362	47.070	3.0	98.8	SURCHARGED
S5.005	S26		0.676	47.071	2.4	97.1	SURCHARGED
S5.006	S27		0.483	47.071	2.7	95.6	SURCHARGED
S7.000	S28		0.026	6.923	1.3	15.9	OK
S7.001	S29		0.046	6.923	1.6	15.9	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Infil. Flow (l/s)	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S8.000	S30		0.020	4.708	1.2	10.8	OK
S7.002	S31		0.184	16.614	1.3	36.2	SURCHARGED
S9.000	S32		0.036	8.159	1.3	21.1	OK
S7.003	S33		1.172	25.752	1.3	53.4	SURCHARGED
S7.004	S34		0.518	28.247	1.5	57.8	SURCHARGED
S10.000	S35		0.023	5.815	1.3	13.3	OK
S7.005	S36		0.087	34.062	2.1	69.0	OK
S7.006	S37		0.059	34.062	4.1	68.6	OK
S5.007	S38	4.1	162.005	0.000	0.0	0.0	FLOOD RISK

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

Half Drain Time : 32 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.232	0.232	0.2	0.5	Flood Risk
30 min Summer	0.262	0.262	0.2	0.6	Flood Risk
60 min Summer	0.280	0.280	0.3	0.7	Flood Risk
120 min Summer	0.282	0.282	0.3	0.7	Flood Risk
180 min Summer	0.271	0.271	0.2	0.7	Flood Risk
240 min Summer	0.258	0.258	0.2	0.6	Flood Risk
360 min Summer	0.235	0.235	0.2	0.5	Flood Risk
480 min Summer	0.215	0.215	0.2	0.4	O K
600 min Summer	0.198	0.198	0.2	0.4	O K
720 min Summer	0.184	0.184	0.2	0.3	O K
960 min Summer	0.161	0.161	0.1	0.2	O K
1440 min Summer	0.129	0.129	0.1	0.1	O K
2160 min Summer	0.099	0.099	0.1	0.1	O K
2880 min Summer	0.081	0.081	0.1	0.1	O K
4320 min Summer	0.059	0.059	0.1	0.0	O K
5760 min Summer	0.049	0.049	0.0	0.0	O K
7200 min Summer	0.044	0.044	0.0	0.0	O K
8640 min Summer	0.041	0.041	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	131.851	0.0	16
30 min Summer	88.566	0.0	27
60 min Summer	56.713	0.0	44
120 min Summer	35.004	0.0	78
180 min Summer	25.973	0.0	112
240 min Summer	20.877	0.0	144
360 min Summer	15.365	0.0	206
480 min Summer	12.341	0.0	268
600 min Summer	10.402	0.0	328
720 min Summer	9.042	0.0	390
960 min Summer	7.241	0.0	510
1440 min Summer	5.284	0.0	748
2160 min Summer	3.848	0.0	1104
2880 min Summer	3.068	0.0	1468
4320 min Summer	2.226	0.0	2200
5760 min Summer	1.771	0.0	2856
7200 min Summer	1.483	0.0	3672
8640 min Summer	1.284	0.0	4304

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	0.039	0.039	0.0	0.0	O K
15 min Winter	0.250	0.250	0.2	0.6	Flood Risk
30 min Winter	0.282	0.282	0.3	0.7	Flood Risk
60 min Winter	0.298	0.298	0.3	0.8	Flood Risk
120 min Winter	0.293	0.293	0.3	0.8	Flood Risk
180 min Winter	0.276	0.276	0.2	0.7	Flood Risk
240 min Winter	0.257	0.257	0.2	0.6	Flood Risk
360 min Winter	0.225	0.225	0.2	0.5	O K
480 min Winter	0.199	0.199	0.2	0.4	O K
600 min Winter	0.178	0.178	0.2	0.3	O K
720 min Winter	0.160	0.160	0.1	0.2	O K
960 min Winter	0.134	0.134	0.1	0.2	O K
1440 min Winter	0.101	0.101	0.1	0.1	O K
2160 min Winter	0.074	0.074	0.1	0.0	O K
2880 min Winter	0.059	0.059	0.1	0.0	O K
4320 min Winter	0.046	0.046	0.0	0.0	O K
5760 min Winter	0.041	0.041	0.0	0.0	O K
7200 min Winter	0.038	0.038	0.0	0.0	O K
8640 min Winter	0.035	0.035	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.137	0.0	5008
15 min Winter	131.851	0.0	16
30 min Winter	88.566	0.0	29
60 min Winter	56.713	0.0	46
120 min Winter	35.004	0.0	84
180 min Winter	25.973	0.0	118
240 min Winter	20.877	0.0	152
360 min Winter	15.365	0.0	216
480 min Winter	12.341	0.0	278
600 min Winter	10.402	0.0	338
720 min Winter	9.042	0.0	398
960 min Winter	7.241	0.0	512
1440 min Winter	5.284	0.0	750
2160 min Winter	3.848	0.0	1100
2880 min Winter	3.068	0.0	1448
4320 min Winter	2.226	0.0	2184
5760 min Winter	1.771	0.0	2880
7200 min Winter	1.483	0.0	3584
8640 min Winter	1.284	0.0	4368

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
10080 min Winter	0.033	0.033	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
10080 min Winter	1.137	0.0	5128

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.003

Time (mins) From:	To:	Area (ha)
0	4	0.003

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Model Details

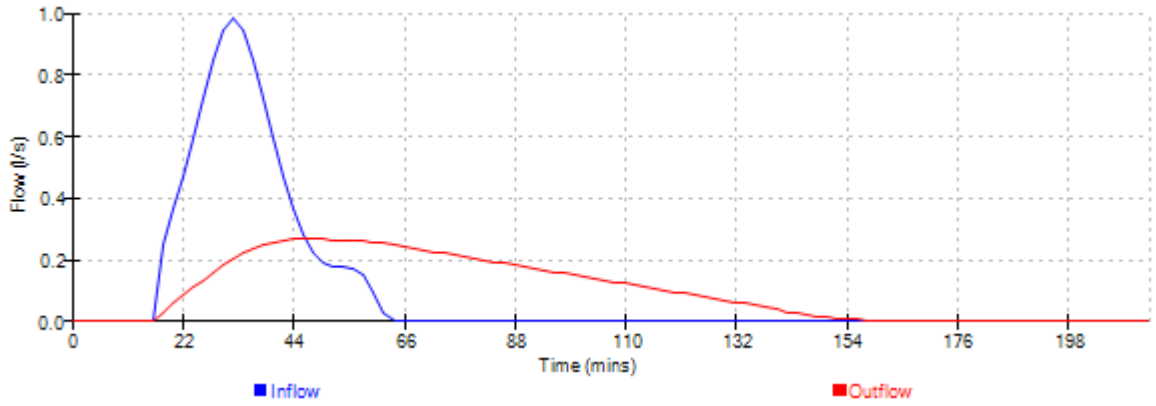
Storage is Online Cover Level (m) 0.530

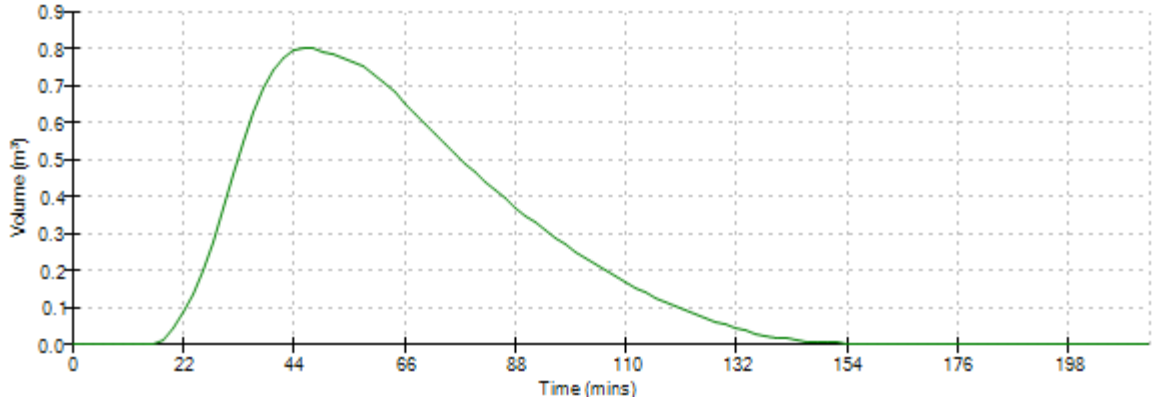
Porous Car Park Structure

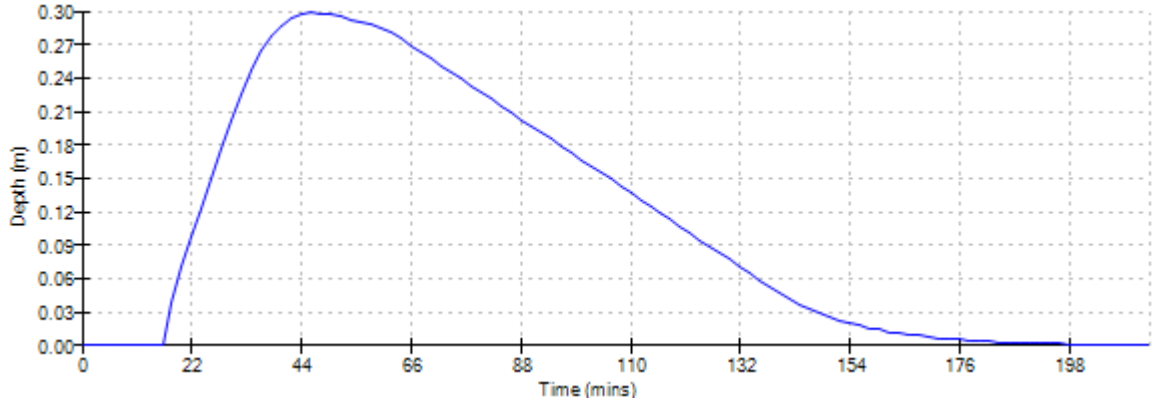
Infiltration Coefficient Base (m/hr)	0.10800	Width (m)	3.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	8.3	Slope (1:X)	20.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	0.000	Membrane Depth (m)	230

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Event: 60 min Winter







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Appendix J

Greenfield Run-off Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 800 Urban 0.000
Area (ha) 1.333 Soil 0.450 Region Number Region 7

Results l/s

QBAR Rural 6.8
QBAR Urban 6.8

Q100 years 21.8

Q1 year 5.8
Q30 years 15.5
Q100 years 21.8

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Appendix K

MicroDrainage Outputs_Attenuation Method

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.011)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.409	4-8	0.270

Total Area Contributing (ha) = 0.679

Total Pipe Volume (m^3) = 27.378

Time Area Diagram at outfall S (pipe S6.006)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.518	4-8	0.134

Total Area Contributing (ha) = 0.652

Total Pipe Volume (m^3) = 20.094

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	25.817	0.153	168.7	0.079	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	8.624	0.051	169.1	0.006	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	5.438	0.032	169.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	53.245#	0.315	169.1	0.046	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	5.498	0.033	169.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	66.685#	3.272	20.4	0.111	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	5.809	2.060	2.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	46.441#	2.917	15.9	0.053	4.00	0.0	0.600	o	150	Pipe/Conduit	
S2.001	5.766	0.289	20.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.002	35.583#	0.712	50.0	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	8.236	0.061	135.0	0.017	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	20.424	0.084	243.1	0.023	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	40.323	0.301	134.0	0.104	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	38.077	0.687	55.4	0.011	4.00	0.0	0.600	o	150	Pipe/Conduit	
S4.000	40.716	1.917	21.2	0.108	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.43	42.286	0.079	0.0	0.0	0.0	1.00	39.9	10.7
S1.001	50.00	4.57	42.133	0.085	0.0	0.0	0.0	1.00	39.9	11.5
S1.002	50.00	4.66	42.082	0.085	0.0	0.0	0.0	1.00	39.9	11.5
S1.003	50.00	5.55	42.050	0.131	0.0	0.0	0.0	1.00	39.9	17.7
S1.004	50.00	5.64	41.735	0.131	0.0	0.0	0.0	1.00	39.9	17.7
S1.005	50.00	6.02	41.702	0.242	0.0	0.0	0.0	2.91	115.8	32.8
S1.006	50.00	6.03	38.431	0.242	0.0	0.0	0.0	7.85	312.1	32.8
S2.000	50.00	4.31	40.364	0.053	0.0	0.0	0.0	2.54	44.8	7.2
S2.001	50.00	4.35	37.297	0.053	0.0	0.0	0.0	2.27	40.0	7.2
S2.002	50.00	4.61	37.008	0.070	0.0	0.0	0.0	2.23	157.6	9.5
S1.007	50.00	6.13	36.296	0.329	0.0	0.0	0.0	1.35	95.5	44.6
S1.008	50.00	6.47	36.235	0.352	0.0	0.0	0.0	1.00	71.0	47.7
S1.009	50.00	6.97	36.151	0.456	0.0	0.0	0.0	1.36	95.9	61.7
S3.000	50.00	4.47	41.013	0.011	0.0	0.0	0.0	1.35	23.9	1.5
S4.000	50.00	4.24	41.627	0.108	0.0	0.0	0.0	2.85	113.4	14.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.001	42.729	1.060	40.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	33.363	2.173	15.4	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	15.453	0.092	168.0	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.004	4.789	0.256	18.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	35.593	1.698	21.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	27.443	0.463	59.3	0.037	4.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	28.099	0.281	100.0	0.038	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.002	29.126	0.274	106.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	6.429	0.029	221.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	13.248	0.224	59.1	0.032	4.00	0.0	0.600	o	150	Pipe/Conduit	
S6.001	30.743	0.570	53.9	0.112	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.002	30.743	2.228	13.8	0.057	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.003	30.061	1.487	20.2	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.004	30.061	0.835	36.0	0.111	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.005	22.886	0.897	25.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.001	50.00	4.81	39.710	0.119	0.0	0.0	0.0	2.07	82.2	16.1
S3.002	50.00	4.98	38.650	0.132	0.0	0.0	0.0	3.36	133.5	17.9
S3.003	50.00	5.23	36.477	0.148	0.0	0.0	0.0	1.01	40.0	20.0
S3.004	50.00	5.26	36.385	0.148	0.0	0.0	0.0	3.04	120.9	20.0
S1.010	50.00	7.14	35.850	0.604	0.0	0.0	0.0	3.45	243.8	81.8
S5.000	50.00	4.27	35.170	0.037	0.0	0.0	0.0	1.70	67.7	5.0
S5.001	50.00	4.63	34.707	0.075	0.0	0.0	0.0	1.31	52.0	10.2
S5.002	50.00	5.01	34.426	0.075	0.0	0.0	0.0	1.27	50.4	10.2
S1.011	50.00	7.26	34.152	0.679	0.0	0.0	0.0	0.87	34.8«	91.9
S6.000	50.00	4.17	43.191	0.032	0.0	0.0	0.0	1.31	23.2	4.3
S6.001	50.00	4.46	42.892	0.144	0.0	0.0	0.0	1.78	71.0	19.5
S6.002	50.00	4.60	42.322	0.201	0.0	0.0	0.0	3.54	140.8	27.2
S6.003	50.00	4.74	40.019	0.245	0.0	0.0	0.0	3.51	248.3	33.2
S6.004	50.00	4.93	38.532	0.356	0.0	0.0	0.0	2.63	185.8	48.2
S6.005	50.00	5.06	37.697	0.356	0.0	0.0	0.0	3.13	220.9	48.2

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.000	27.751	0.469	59.2	0.048	4.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	28.475	0.302	94.3	0.086	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.002	38.598	0.539	71.6	0.079	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.003	29.306	1.299	22.6	0.083	0.00	0.0	0.600	o	300	Pipe/Conduit	
S7.004	38.653	2.108	18.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S6.006	22.632	0.910	24.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.000	50.00	4.27	41.592	0.048	0.0	0.0	0.0	1.70	67.7	6.5
S7.001	50.00	4.56	41.048	0.134	0.0	0.0	0.0	1.62	114.5	18.1
S7.002	50.00	4.91	40.746	0.213	0.0	0.0	0.0	1.86	131.5	28.8
S7.003	50.00	5.06	40.207	0.296	0.0	0.0	0.0	3.32	235.0	40.1
S7.004	50.00	5.23	38.908	0.296	0.0	0.0	0.0	3.69	260.8	40.1
S6.006	50.00	5.38	36.800	0.652	0.0	0.0	0.0	2.63	104.7	88.3

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PIPELINE SCHEDULES for Storm

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	43.711	42.286	1.200	Open Manhole	600
S1.001	o	225	S2	44.341	42.133	1.983	Open Manhole	600
S1.002	o	225	S3	44.295	42.082	1.988	Open Manhole	600
S1.003	o	225	S4	44.584	42.050	2.309	Open Manhole	600
S1.004	o	225	S5	43.418	41.735	1.458	Open Manhole	600
S1.005	o	225	S6	43.533	41.702	1.606	Open Manhole	600
S1.006	o	225	S7	39.856	38.431	1.200	Open Manhole	600
S2.000	o	150	S8	42.714	40.364	2.200	Open Manhole	600
S2.001	o	150	S9	38.797	37.297	1.350	Open Manhole	600
S2.002	o	300	S10	38.733	37.008	1.425	Open Manhole	1200
S1.007	o	300	S11	39.340	36.296	2.744	Open Manhole	1200
S1.008	o	300	S12	39.337	36.235	2.802	Open Manhole	1200
S1.009	o	300	S13	38.462	36.151	2.011	Open Manhole	1200
S3.000	o	150	S14	42.363	41.013	1.200	Open Manhole	900

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)
S1.000	25.817	168.7	S2	44.341	42.133	1.983	Open Manhole	600
S1.001	8.624	169.1	S3	44.295	42.082	1.988	Open Manhole	600
S1.002	5.438	169.1	S4	44.584	42.050	2.309	Open Manhole	600
S1.003	53.245#	169.1	S5	43.418	41.735	1.458	Open Manhole	600
S1.004	5.498	169.1	S6	43.533	41.702	1.606	Open Manhole	600
S1.005	66.685#	20.4	S7	39.856	38.431	1.200	Open Manhole	600
S1.006	5.809	2.8	S11	39.340	36.371	2.744	Open Manhole	1200
S2.000	46.441#	15.9	S9	38.797	37.447	1.200	Open Manhole	600
S2.001	5.766	20.0	S10	38.733	37.008	1.575	Open Manhole	1200
S2.002	35.583#	50.0	S11	39.340	36.296	2.744	Open Manhole	1200
S1.007	8.236	135.0	S12	39.337	36.235	2.802	Open Manhole	1200
S1.008	20.424	243.1	S13	38.462	36.151	2.011	Open Manhole	1200
S1.009	40.323	134.0	S20	37.720	35.850	1.570	Open Manhole	1200
S3.000	38.077	55.4	S16	41.060	40.326	0.584	Open Manhole	900

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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)
S4.000	o	225	S15	42.977	41.627	1.125	Open Manhole	900
S3.001	o	225	S16	41.060	39.710	1.125	Open Manhole	900
S3.002	o	225	S17	40.000	38.650	1.125	Open Manhole	900
S3.003	o	225	S18	37.827	36.477	1.125	Open Manhole	900
S3.004	o	225	S19	38.124	36.385	1.514	Open Manhole	900
S1.010	o	300	S20	37.720	35.850	1.570	Open Manhole	1200
S5.000	o	225	S21	36.510	35.170	1.115	Open Manhole	900
S5.001	o	225	S22	36.088	34.707	1.156	Open Manhole	900
S5.002	o	225	S23	35.812	34.426	1.161	Open Manhole	900
S1.011	o	225	S24	35.522	34.152	1.145	Open Manhole	1200
S6.000	o	150	S25	44.541	43.191	1.200	Open Manhole	600
S6.001	o	225	S26	43.688	42.892	0.571	Open Manhole	900

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)
S4.000	40.716	21.2	S16	41.060	39.710	1.125	Open Manhole	900
S3.001	42.729	40.3	S17	40.000	38.650	1.125	Open Manhole	900
S3.002	33.363	15.4	S18	37.827	36.477	1.125	Open Manhole	900
S3.003	15.453	168.0	S19	38.124	36.385	1.514	Open Manhole	900
S3.004	4.789	18.7	S20	37.720	36.129	1.366	Open Manhole	1200
S1.010	35.593	21.0	S24	35.522	34.152	1.070	Open Manhole	1200
S5.000	27.443	59.3	S22	36.088	34.707	1.156	Open Manhole	900
S5.001	28.099	100.0	S23	35.812	34.426	1.161	Open Manhole	900
S5.002	29.126	106.3	S24	35.522	34.152	1.145	Open Manhole	1200
S1.011	6.429	221.7	S	35.322	34.123	0.974	Open Manhole	0
S6.000	13.248	59.1	S26	43.688	42.967	0.571	Open Manhole	900
S6.001	30.743	53.9	S27	43.747	42.322	1.200	Open Manhole	900

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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)
S6.002	o	225	S27	43.747	42.322	1.200	Open Manhole	900
S6.003	o	300	S28	41.519	40.019	1.200	Open Manhole	900
S6.004	o	300	S29	40.032	38.532	1.200	Open Manhole	900
S6.005	o	300	S30	39.197	37.697	1.200	Open Manhole	900
S7.000	o	225	S31	43.017	41.592	1.200	Open Manhole	900
S7.001	o	300	S32	42.594	41.048	1.246	Open Manhole	900
S7.002	o	300	S33	43.773	40.746	2.727	Open Manhole	900
S7.003	o	300	S34	41.707	40.207	1.200	Open Manhole	900
S7.004	o	300	S35	40.408	38.908	1.200	Open Manhole	900
S6.006	o	225	S36	38.200	36.800	1.175	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)
S6.002	30.743	13.8	S28	41.519	40.094	1.200	Open Manhole	900
S6.003	30.061	20.2	S29	40.032	38.532	1.200	Open Manhole	900
S6.004	30.061	36.0	S30	39.197	37.697	1.200	Open Manhole	900
S6.005	22.886	25.5	S36	38.200	36.800	1.100	Open Manhole	1200
S7.000	27.751	59.2	S32	42.594	41.123	1.246	Open Manhole	900
S7.001	28.475	94.3	S33	43.773	40.746	2.727	Open Manhole	900
S7.002	38.598	71.6	S34	41.707	40.207	1.200	Open Manhole	900
S7.003	29.306	22.6	S35	40.408	38.908	1.200	Open Manhole	900
S7.004	38.653	18.3	S36	38.200	36.800	1.100	Open Manhole	1200
S6.006	22.632	24.9	S	37.090	35.890	0.975	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.011	S	35.322	34.123	34.122	0	0

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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S6.006	S	37.090	35.890	35.890	0	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S24, DS/PN: S1.011, Volume (m³): 5.1

Unit Reference	MD-SHE-0086-3500-1200-3500
Design Head (m)	1.200
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	34.152
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.5	Kick-Flo®	0.746	2.8
Flush-Flo™	0.367	3.5	Mean Flow over Head Range	-	3.1

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	2.6	1.200	3.5	3.000	5.4	7.000	8.0
0.200	3.3	1.400	3.8	3.500	5.8	7.500	8.3
0.300	3.5	1.600	4.0	4.000	6.1	8.000	8.5
0.400	3.5	1.800	4.2	4.500	6.5	8.500	8.8
0.500	3.4	2.000	4.4	5.000	6.8	9.000	9.0
0.600	3.3	2.200	4.6	5.500	7.1	9.500	9.2
0.800	2.9	2.400	4.8	6.000	7.4		
1.000	3.2	2.600	5.0	6.500	7.7		

Hydro-Brake® Optimum Manhole: S36, DS/PN: S6.006, Volume (m³): 5.8

Unit Reference	MD-SHE-0083-3300-1200-3300
Design Head (m)	1.200
Design Flow (l/s)	3.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	83
Invert Level (m)	36.800
Minimum Outlet Pipe Diameter (mm)	100

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Hydro-Brake® Optimum Manhole: S36, DS/PN: S6.006, Volume (m³): 5.8

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.3	Kick-Flo®	0.741	2.6
Flush-Flo™	0.363	3.3	Mean Flow over Head Range	-	2.9

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	2.5	1.200	3.3	3.000	5.0	7.000	7.5
0.200	3.1	1.400	3.5	3.500	5.4	7.500	7.8
0.300	3.3	1.600	3.8	4.000	5.8	8.000	8.0
0.400	3.3	1.800	4.0	4.500	6.1	8.500	8.3
0.500	3.2	2.000	4.2	5.000	6.4	9.000	8.5
0.600	3.1	2.200	4.4	5.500	6.7	9.500	8.7
0.800	2.7	2.400	4.5	6.000	7.0		
1.000	3.0	2.600	4.7	6.500	7.3		

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Storage Structures for Storm

Swale Manhole: S5, DS/PN: S1.004

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	53.2
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	171.8
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	42.918	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5	Include Swale Volume	Yes

Swale Manhole: S7, DS/PN: S1.006

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	66.7
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	21.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	39.356	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5	Include Swale Volume	Yes

Swale Manhole: S9, DS/PN: S2.001

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	46.4
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	15.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	38.297	Cap Infiltration Depth (m)	0.000
Base Width (m)	0.5	Include Swale Volume	Yes

Swale Manhole: S11, DS/PN: S1.007

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	38.840
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	0.5
Safety Factor	2.0	Length (m)	35.6
Porosity	1.00	Side Slope (1:X)	3.0

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Swale Manhole: S11, DS/PN: S1.007

Slope (1:X) 100.0 Cap Infiltration Depth (m) 0.000
Cap Volume Depth (m) 0.000 Include Swale Volume Yes

Tank or Pond Manhole: S24, DS/PN: S1.011

Invert Level (m) 34.152

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	296.0	1.370	599.7

Tank or Pond Manhole: S36, DS/PN: S6.006

Invert Level (m) 36.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	274.0	1.400	575.9

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	2	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S1.000	S1	15 minute 100 year Winter I+40%	43.711	43.613	1.102	0.000	1.11
S1.001	S2	15 minute 100 year Winter I+40%	44.341	43.458	1.100	0.000	1.37
S1.002	S3	15 minute 100 year Winter I+40%	44.295	43.373	1.066	0.000	1.45
S1.003	S4	15 minute 100 year Winter I+40%	44.584	43.291	1.017	0.000	1.66
S1.004	S5	15 minute 100 year Winter I+40%	43.418	42.432	0.472	0.000	2.20
S1.005	S6	15 minute 100 year Winter I+40%	43.533	42.234	0.307	0.000	0.99
S1.006	S7	15 minute 100 year Winter I+40%	39.856	39.211	0.555	0.000	0.54
S2.000	S8	15 minute 100 year Winter I+40%	42.714	40.463	-0.051	0.000	0.77
S2.001	S9	15 minute 100 year Winter I+40%	38.797	38.709	1.262	0.000	0.86
S2.002	S10	15 minute 100 year Winter I+40%	38.733	38.657	1.349	0.000	0.28
S1.007	S11	15 minute 100 year Winter I+40%	39.340	38.632	2.036	0.000	2.30
S1.008	S12	15 minute 100 year Winter I+40%	39.337	38.374	1.839	0.000	2.42
S1.009	S13	15 minute 100 year Winter I+40%	38.462	37.992	1.541	0.000	2.03
S3.000	S14	15 minute 100 year Winter I+40%	42.363	41.069	-0.094	0.000	0.30
S4.000	S15	15 minute 100 year Winter I+40%	42.977	41.757	-0.095	0.000	0.64

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S1.000	S1	0.374	21.871	1.0	40.9	FLOOD RISK
S1.001	S2	1.376	23.533	1.1	43.6	SURCHARGED
S1.002	S3	0.683	23.533	1.1	42.9	SURCHARGED
S1.003	S4	0.542	36.268	1.6	63.5	SURCHARGED
S1.004	S5	2.289	36.270	1.7	65.3	SURCHARGED
S1.005	S6	0.344	66.993	3.2	111.2	SURCHARGED
S1.006	S7	0.752	66.993	5.1	108.2	SURCHARGED
S2.000	S8	0.027	14.676	2.7	33.6	OK
S2.001	S9	2.414	14.678	2.0	28.4	FLOOD RISK
S2.002	S10	1.946	19.386	1.6	40.2	FLOOD RISK
S1.007	S11	5.260	91.089	2.0	142.4	SURCHARGED
S1.008	S12	2.910	97.453	2.1	149.8	SURCHARGED
S1.009	S13	3.435	126.244	2.6	181.1	SURCHARGED
S3.000	S14	0.033	3.046	1.2	7.0	OK
S4.000	S15	0.080	29.907	2.9	68.5	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S3.001	S16	15 minute 100 year Winter I+40%	41.060	39.885	-0.050	0.000	0.96
S3.002	S17	15 minute 100 year Winter I+40%	40.000	38.785	-0.090	0.000	0.66
S3.003	S18	15 minute 100 year Winter I+40%	37.827	37.516	0.814	0.000	2.49
S3.004	S19	15 minute 100 year Winter I+40%	38.124	37.050	0.440	0.000	1.20
S1.010	S20	15 minute 100 year Winter I+40%	37.720	36.731	0.581	0.000	1.16
S5.000	S21	960 minute 100 year Winter I+40%	36.510	35.330	-0.065	0.000	0.03
S5.001	S22	960 minute 100 year Winter I+40%	36.088	35.330	0.398	0.000	0.06
S5.002	S23	960 minute 100 year Winter I+40%	35.812	35.329	0.678	0.000	0.06
S1.011	S24	960 minute 100 year Winter I+40%	35.522	35.328	0.951	0.000	0.13
S6.000	S25	15 minute 100 year Winter I+40%	44.541	43.632	0.291	0.000	0.87
S6.001	S26	15 minute 100 year Winter I+40%	43.688	43.452	0.335	0.000	1.25
S6.002	S27	15 minute 100 year Winter I+40%	43.747	42.489	-0.058	0.000	0.87
S6.003	S28	15 minute 100 year Winter I+40%	41.519	40.195	-0.124	0.000	0.63
S6.004	S29	15 minute 100 year Winter I+40%	40.032	39.280	0.448	0.000	1.20
S6.005	S30	15 minute 100 year Winter I+40%	39.197	38.090	0.093	0.000	1.03
S7.000	S31	15 minute 100 year Winter I+40%	43.017	41.702	-0.115	0.000	0.48
S7.001	S32	15 minute 100 year Winter I+40%	42.594	41.290	-0.058	0.000	0.80
S7.002	S33	15 minute 100 year Winter I+40%	43.773	41.098	0.052	0.000	1.05
S7.003	S34	15 minute 100 year Winter I+40%	41.707	40.419	-0.088	0.000	0.82
S7.004	S35	15 minute 100 year Winter I+40%	40.408	39.101	-0.107	0.000	0.73
S6.006	S36	960 minute 100 year Winter I+40%	38.200	38.003	0.978	0.000	0.03

PN	US/MH Name	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S3.001	S16	0.164	32.953	2.3	75.3	OK
S3.002	S17	0.143	36.553	3.4	83.3	OK
S3.003	S18	1.205	40.984	2.3	87.8	SURCHARGED
S3.004	S19	0.999	40.984	2.2	85.5	SURCHARGED
S1.010	S20	3.905	167.232	3.7	259.8	SURCHARGED
S5.000	S21	0.099	36.014	0.8	1.6	OK
S5.001	S22	1.424	72.341	0.7	3.0	SURCHARGED
S5.002	S23	1.653	70.904	0.6	2.9	SURCHARGED
S1.011	S24	494.102	349.067	0.6	3.5	FLOOD RISK
S6.000	S25	0.123	8.861	1.3	18.5	SURCHARGED
S6.001	S26	0.574	39.868	2.1	83.1	FLOOD RISK
S6.002	S27	0.232	55.651	3.7	115.0	OK
S6.003	S28	0.121	67.834	3.4	141.8	OK
S6.004	S29	1.295	98.568	2.9	203.2	SURCHARGED
S6.005	S30	0.834	98.568	3.2	200.3	SURCHARGED
S7.000	S31	0.067	13.291	1.6	30.4	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Maximum Vol (m³)	Discharge Vol (m³)	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S7.001	S32	0.290	37.102	1.6	83.2	OK
S7.002	S33	1.458	58.974	1.9	127.8	SURCHARGED
S7.003	S34	0.471	81.956	3.4	175.4	OK
S7.004	S35	0.207	81.956	3.7	175.4	OK
S6.006	S36	477.886	334.520	1.2	3.3	FLOOD RISK

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Appendix L

Proposed Surface Water Drainage Strategy

N

Infiltration Basin 2:
Top Area: 314m²
Base Area: 153.8m²
Max. Side Slope: 1/3
Depth = 1.0m
Min. CL = 38.000m AOD
IL = 37.000m AOD

Infiltration Basin 1:
Top Area: 220m²
Base Area: 88.3m²
Max. Side Slope: 1/3
Depth = 1.02m
Min. CL = 35.322m AOD
IL = 34.3m AOD

Permeable pavement
Depth of sub-base layer: 0.3m
Area: 8,400m²

12.0 0.0 12.0 24.0 36.0 48.0 60.0
Scale = 1:600 @ A1

NOTES

1. This drawing to be read in conjunction with all other drawings and specifications.
2. Dimensions not to be scaled.
3. Site layout from OSP Architects (Ref: 20179/P101, date: December 2021).
4. Topographical Survey from ASC (Ref: ASC.21.599, date: August 2021)
5. This drawing is indicative and not intended for construction.
6. SuDS sizing based on MicroDrainage calculations.

KEY

- Application Site Boundary
- Proposed Surface Water Drain
- Proposed Headwall
- Root Protection Area

Proposed Impermeable Areas:
- Access Road + Car Parks (Total Area: 8,400m² *(+10% Urban creep)*)
- Roof Area (Total Area: 4,923m² *(+10% Urban creep)*)

Infiltration Basin 1:
Top Area: 220m²
Base Area: 88.3m²
Max. Side Slope: 1/3
Infiltration rate: 0.108 m/h (Base)
Depth = 1.02m
Min. CL = 35.322m AOD
IL = 34.3m AOD
Max. Water Level: 35.109m AOD *(1%AEP+40%CC)*
Max. Water Depth: 0.809m deep *(1%AEP+40%CC)*
Max. Volume: 110m³ *(1%AEP+40%CC)*

Infiltration Basin 2:
Top Area: 314m²
Base Area: 153.8m²
Max. Side Slope: 1/3
Infiltration rate: 0.108 m/h (Base)
Depth = 1.0m
Min. CL = 38.000m AOD
IL = 37.000m AOD
Max. Water Level: 37.766m AOD *(1%AEP+40%CC)*
Max. Water Depth: 0.766m deep *(1%AEP+40%CC)*
Max. Volume: 162m³ *(1%AEP+40%CC)*

Permeable Paving:
Area: 8,400m²
Sub-base depth: 0.3m
Infiltration rate: 0.108 m/h
Max. Longitudinal Slope = 1/20
Max. Water depth: 0.298m deep *(1%AEP+40%CC)*

DRAINAGE STRATEGY

- Surface water run-off from the proposed development site will be managed by a complex SuDS structure based on porous paving and two infiltration basins, for attenuation storage prior discharging into the underlying soil strata, with no direct discharges off-site.
- The total impermeable area of the proposed development is approximately 13,323m², which also includes the areas allocated to the proposed access road and car parking, which will be built using permeable materials. A 10% addition for urban creep has been included accordingly within the proposed impermeable area.
- Soakage tests will be undertaken on site at the appropriate stage of the development process in order to verify the feasibility of infiltration techniques, provide rates for detailed design purposes and to establish an appropriate stand-off distance from foundations.
- An infiltration rate of 1.08m/h (i.e. $3.0x10^{-4}$m/s), based on The CIRIA C753 'The SuDS Manual' (2015) typical sandy gravels, has been used for the design of the infiltration basin.
- The SuDS features have been designed to cater for all storm events up to and including the 1 in 100 year + 40% climate change storm event.

Proposed Development Site
Impermeable Areas
1:2,000@A1



Rev.	Description	Date	Chkd
P1	Draft for comment	23/12/2021 AQ	JB

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Client :
Obsidian Strategic Asset Management Limited

Project :
Land at Mockbeggars Farm
Uckfield
TN22 2EA

Title :
Surface Water Drainage Strategy
Infiltration Proposal

Project Engineer :	A. Quigley	Scale :	1:600@A1
Project Director :	J. Birch	Date :	December 2021
Status :	Planning		

Drawing No. CV8210667 - SK04/A Rev P1

N

Attenuation Basin 2:
Top Area: 576m²
Base Area: 274.0m²
Max. Side Slope: 1/3
Depth = 1.4m
Min. CL = 38.200m AOD
IL = 36.800m AOD

Flow Restriction Manhole
Discharge Rate: 3.3l/s
IL: 36.800m AOD
Orifice: 83mm

Attenuated surface water run-off will be discharged into the existing pipe network located in the adjacent farmyard to the north-west of the development site, and then into the Shortbrige Stream tributary to the north.

Flow Restriction Manhole
Discharge Rate: 3.5l/s
IL: 34.152m AOD
Orifice: 85mm

Attenuation Basin 1:
Top Area: 600m²
Base Area: 296m²
Max. Side Slope: 1/3
Depth = 1.37m
Min. CL = 35.522m AOD
IL = 34.152m AOD

Permeable pavement
Depth of sub-base layer: 0.3m
Area: 8,400m²

Dry Swales / French Drains

NOTES

1. This drawing to be read in conjunction with all other drawings and specifications.
2. Dimensions not to be scaled.
3. Site layout from OSP Architects (Ref: 20179/P101, date: December 2021).
4. Topographical Survey from ASC (Ref: ASC.21.599, date: August 2021)
5. This drawing is indicative and not intended for construction.
6. SuDS sizing based on MicroDrainage calculations.

KEY

- Application Site Boundary
- Proposed Surface Water Drain
- Proposed Perforated Pipe
- Collection Tank / Discharge Point to Dry Swale
- Existing Surface Water Drain
- Proposed Headwall
- Root Protection Area
- Proposed Impermeable Areas:
  - Access Road + Car Parks (Total Area: 8,400m² *(+10% Urban creep)*)
  - Roof Area (Total Area: 4,923m² *(+10% Urban creep)*)
- Attenuation Basin 1:
  Top Area: 600m²
  Base Area: 296m²
  Max. Side Slope: 1/3
  Depth = 1.37m
  Min. CL = 35.522m AOD
  IL = 34.152m AOD
  Max. Water Level: 35.328m AOD *(1%AEP+40%CC)*
  Max. Water Depth: 1.176m deep *(1%AEP+40%CC)*
  Max. Volume: 494m³ *(1%AEP+40%CC)*
- Attenuation Basin 2:
  Top Area: 576m²
  Base Area: 274.0m²
  Max. Side Slope: 1/3
  Depth = 1.4m
  Min. CL = 38.200m AOD
  IL = 36.800m AOD
  Max. Water Level: 38.003m AOD *(1%AEP+40%CC)*
  Max. Water Depth: 1.203m deep *(1%AEP+40%CC)*
  Max. Volume: 478m³ *(1%AEP+40%CC)*
- Swales / French Drains
- Permeable Paving
- Ouflow Control:
  Hydro-Brake Optimum®
  Model: MD-SHE-0086-3500-1200-3500
  Ø Orifice: 86mm

  Hydro-Brake Optimum®
  Model: MD-SHE-0083-3300-1200-3300
  Orifice: 83mm

DRAINAGE STRATEGY

- Surface water run-off from the proposed development site will be managed by a complex SuDS structure based on porous paving, dry swales / french drains, and two attenuation basins, for attenuation storage prior discharging into the existing pipe network currently located in the adjacent farmyard to the north-west of the development site, and then into the Shortbrige Stream tributary, with no direct discharges off-site.
- The total impermeable area of the proposed development is approximately 13,323m², which also includes the areas allocated to the proposed access road and car parking, which will be built using permeable materials. A 10% addition for urban creep has been included accordingly within the proposed impermeable area.
- The surface water discharge rate has been restricted to a value of 6.8l/s for the total impermeable area of the site, associated with Greenfield Run-off Rate.
- The SuDS features have been designed to cater for all storm events up to and including the 1 in 100 year + 40% climate change storm event.

12.0 0.0 12.0 24.0 36.0 48.0 60.0
Scale = 1:600 @ A1

Proposed Development Site
Impermeable Areas
1:2,000@A1



Rev.	Description	Date	Chkd
P1	Draft for comment	23/12/2021 AQ	JB

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Tel: (01235) 515550 Fax: (01235) 817799
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Client :
Obsidian Strategic Asset Management Limited

Project :
Land at Mockbeggars Farm
Uckfield
TN22 2EA

Title :
Surface Water Drainage Strategy
Attenuation Proposal

Project Engineer :	A. Quigley	Scale :	1:600@A1
Project Director :	J. Birch	Date :	December 2021
Status :	Planning		

Drawing No. CV8210667 - SK04/B
Rev P1

Appendix M

Southern Water's Records



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Scale: 1:1250

Date: 24/08/21

Wastewater Plan A3

Data updated: 16/08/21

Map Centre: 547546,122995

Our Ref: 632727 - 1

Powered by digdat

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
WWTW Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

dwigston@glanvillegroup.com

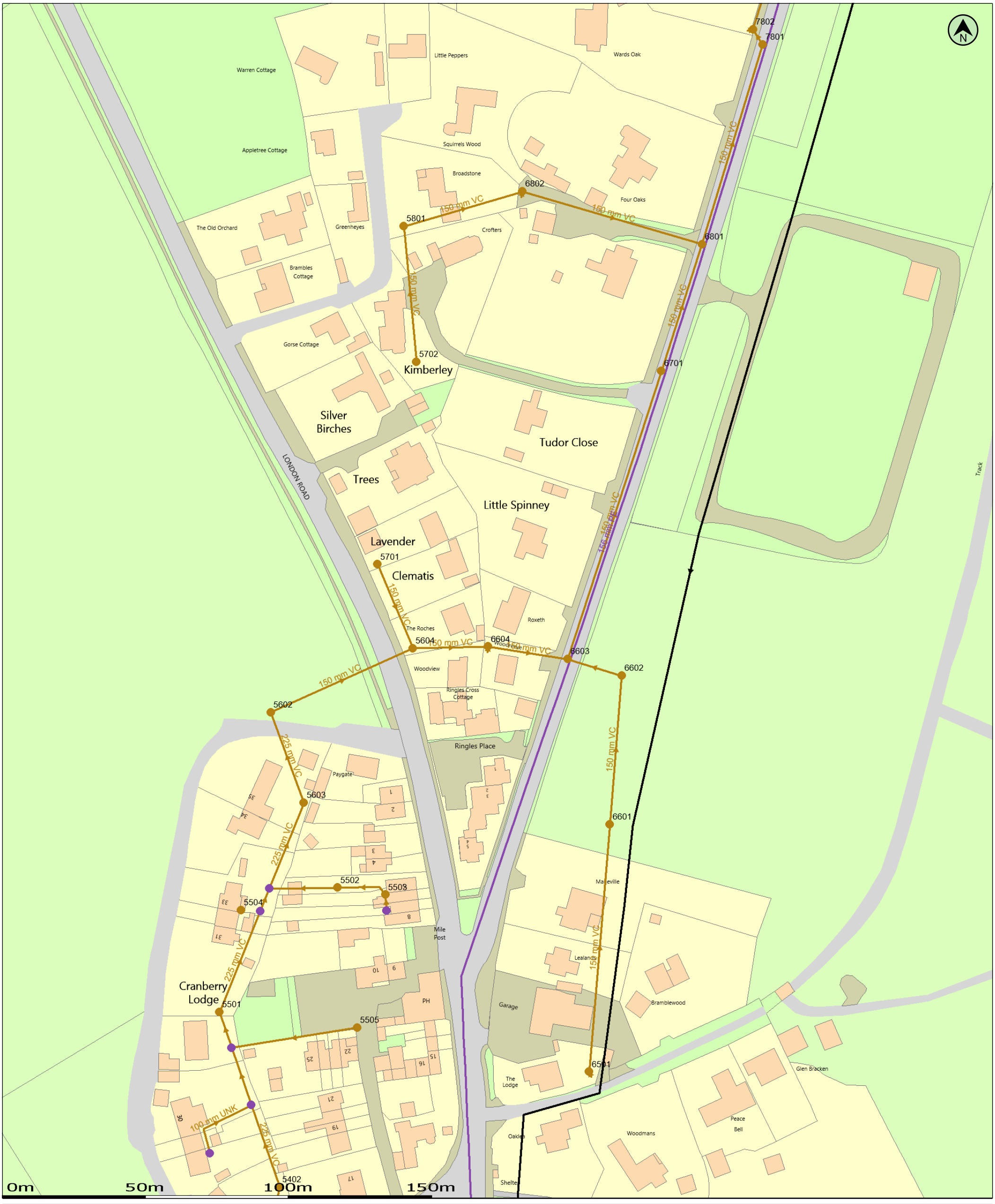
8210667

from Southern Water

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



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Scale: 1:1250 | Date: 01/09/21 | Wastewater Plan A3

Data updated: 16/08/21 | Map Centre: 547623,122693 | Our Ref: 638088 - 1 | Powered by digdat

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
WWTW Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

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8210667

WATER for LIFE from Southern Water

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5402	F	56.16	0.00	
5501	F	52.93	0.00	
5502	F	0.00	0.00	
5503	F	0.00	0.00	
5504	F	0.00	0.00	
5505	F	0.00	0.00	
5602	F	51.56	0.00	
5603	F	52.87	0.00	
5604	F	0.00	0.00	
5701	F	51.09	0.00	
5702	F	0.00	0.00	
5801	F	50.00	0.00	
6501	F	51.45	50.16	
6601	F	51.62	49.08	
6602	F	49.71	48.33	
6603	F	49.81	47.99	
6604	F	50.43	48.93	
6701	F	48.02	46.41	
6801	F	47.12	45.56	
6802	F	48.55	46.84	
7801	F	45.82	44.12	
7802	F	45.59	44.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5801	F	50.00	0.00	
6801	F	47.12	45.56	
6802	F	48.55	46.84	
7103	F	0.00	0.00	
7801	F	45.82	44.12	
7802	F	45.59	44.00	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix N

MicroDrainage Outputs Foul Drainage

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	164.00	Maximum Backdrop Height (m)	1.500
Persons per House	5.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	5.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	20.785	0.264	78.7	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F1.001	13.070	0.096	135.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.002	25.805	0.190	135.6	0.000	1	0.0	1.500	o	150	Pipe/Conduit	
F1.003	25.805	2.181	11.8	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F2.000	29.553	0.835	35.4	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F2.001	40.702	0.300	135.6	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F1.004	22.586	0.167	135.6	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F1.005	26.134	0.193	135.6	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F1.006	21.701	3.035	7.2	0.000	1	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	42.597	0.000	0.0	3	0.0	10	0.28	0.99	17.5	0.1
F1.001	42.333	0.000	0.0	3	0.0	11	0.24	0.75	13.3	0.1
F1.002	42.237	0.000	0.0	4	0.0	13	0.26	0.75	13.3	0.2
F1.003	42.046	0.000	0.0	4	0.0	7	0.59	2.56	45.2	0.2
F2.000	41.000	0.000	0.0	2	0.0	7	0.32	1.48	26.1	0.1
F2.001	40.165	0.000	0.0	7	0.0	17	0.31	0.75	13.3	0.3
F1.004	39.865	0.000	0.0	13	0.0	22	0.38	0.75	13.3	0.6
F1.005	39.698	0.000	0.0	15	0.0	24	0.39	0.75	13.3	0.7
F1.006	39.505	0.000	0.0	16	0.0	12	1.11	3.29	58.1	0.8

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Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F3.000	12.296	0.215	57.2	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F3.001	29.495	0.503	58.6	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F3.002	29.495	0.218	135.6	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F3.003	32.386	0.274	118.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F3.004	32.386	1.487	21.8	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.005	25.537	1.414	18.1	0.000	1	0.0	1.500	o	150	Pipe/Conduit	
F3.006	30.116	0.222	135.6	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F3.007	30.116	0.222	135.6	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F4.000	15.432	0.938	16.5	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F4.001	29.106	0.215	135.6	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F4.002	29.106	4.860	6.0	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F3.008	12.425	0.092	135.6	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F3.009	35.217	0.582	60.5	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.010	42.716	0.315	135.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.007	21.530	0.159	135.6	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F1.008	38.508	0.284	135.6	0.000	4	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F3.000	42.015	0.000	0.0	2	0.0	8	0.28	1.16	20.5	0.1
F3.001	41.800	0.000	0.0	6	0.0	13	0.39	1.15	20.2	0.3
F3.002	41.297	0.000	0.0	8	0.0	18	0.32	0.75	13.3	0.4
F3.003	41.079	0.000	0.0	12	0.0	21	0.39	0.81	14.2	0.6
F3.004	40.805	0.000	0.0	12	0.0	14	0.69	1.88	33.3	0.6
F3.005	39.318	0.000	0.0	13	0.0	14	0.75	2.07	36.5	0.6
F3.006	37.904	0.000	0.0	18	0.0	26	0.42	0.75	13.3	0.9
F3.007	37.682	0.000	0.0	20	0.0	27	0.43	0.75	13.3	0.9
F4.000	43.472	0.000	0.0	2	0.0	6	0.42	2.17	38.3	0.1
F4.001	42.534	0.000	0.0	5	0.0	14	0.28	0.75	13.3	0.2
F4.002	42.319	0.000	0.0	8	0.0	9	0.94	3.60	63.5	0.4
F3.008	37.460	0.000	0.0	30	0.0	33	0.49	0.75	13.3	1.4
F3.009	37.368	0.000	0.0	30	0.0	27	0.65	1.13	19.9	1.4
F3.010	36.786	0.000	0.0	30	0.0	33	0.49	0.75	13.3	1.4
F1.007	36.471	0.000	0.0	51	0.0	44	0.57	0.75	13.3	2.4
F1.008	36.312	0.000	0.0	55	0.0	45	0.58	0.75	13.3	2.6

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Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F5.000	35.793	2.204	16.2	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F5.001	15.216	0.112	135.6	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F5.002	4.718	0.043	110.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.009	10.024	0.074	135.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F5.000	38.884	0.000	0.0	2	0.0	6	0.42	2.18	38.5	0.1
F5.001	36.680	0.000	0.0	5	0.0	14	0.28	0.75	13.3	0.2
F5.002	36.568	0.000	0.0	5	0.0	14	0.30	0.83	14.7	0.2
F1.009	36.028	0.000	0.0	60	0.0	47	0.60	0.75	13.3	2.8

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PIPELINE SCHEDULES for Foul - Main

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)
F1.000	o	150	F1	43.897	42.597	1.150	Open Manhole	600
F1.001	o	150	F2	44.428	42.333	1.945	Open Manhole	600
F1.002	o	150	F3	44.358	42.237	1.971	Open Manhole	600
F1.003	o	150	F4	43.486	42.046	1.290	Open Manhole	600
F2.000	o	150	F5	42.300	41.000	1.150	Open Manhole	600
F2.001	o	150	F6	41.465	40.165	1.150	Open Manhole	600
F1.004	o	150	F7	43.250	39.865	3.235	Open Manhole	600
F1.005	o	150	F8	42.899	39.698	3.051	Open Manhole	600
F1.006	o	150	F9	41.330	39.505	1.675	Open Manhole	600
F3.000	o	150	F10	43.315	42.015	1.150	Open Manhole	600
F3.001	o	150	F11	43.100	41.800	1.150	Open Manhole	600
F3.002	o	150	F12	42.647	41.297	1.200	Open Manhole	600
F3.003	o	150	F13	43.873	41.079	2.644	Open Manhole	600
F3.004	o	150	F14	42.155	40.805	1.200	Open Manhole	600
F3.005	o	150	F15	40.668	39.318	1.200	Open Manhole	600

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)
F1.000	20.785	78.7	F2	44.428	42.333	1.945	Open Manhole	600
F1.001	13.070	135.6	F3	44.358	42.237	1.971	Open Manhole	600
F1.002	25.805	135.6	F4	43.486	42.046	1.290	Open Manhole	600
F1.003	25.805	11.8	F7	43.250	39.865	3.235	Open Manhole	600
F2.000	29.553	35.4	F6	41.465	40.165	1.150	Open Manhole	600
F2.001	40.702	135.6	F7	43.250	39.865	3.235	Open Manhole	600
F1.004	22.586	135.6	F8	42.899	39.698	3.051	Open Manhole	600
F1.005	26.134	135.6	F9	41.330	39.505	1.675	Open Manhole	600
F1.006	21.701	7.2	F24	39.543	36.471	2.922	Open Manhole	600
F3.000	12.296	57.2	F11	43.100	41.800	1.150	Open Manhole	600
F3.001	29.495	58.6	F12	42.647	41.297	1.200	Open Manhole	600
F3.002	29.495	135.6	F13	43.873	41.079	2.644	Open Manhole	600
F3.003	32.386	118.0	F14	42.155	40.805	1.200	Open Manhole	600
F3.004	32.386	21.8	F15	40.668	39.318	1.200	Open Manhole	600
F3.005	25.537	18.1	F16	39.254	37.904	1.200	Open Manhole	600

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PIPELINE SCHEDULES for Foul - Main

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)
F3.006	o	150	F16	39.254	37.904	1.200	Open Manhole	600
F3.007	o	150	F17	40.211	37.682	2.379	Open Manhole	600
F4.000	o	150	F18	44.772	43.472	1.150	Open Manhole	600
F4.001	o	150	F19	43.834	42.534	1.150	Open Manhole	600
F4.002	o	150	F20	43.861	42.319	1.392	Open Manhole	600
F3.008	o	150	F21	41.730	37.460	4.120	Open Manhole	600
F3.009	o	150	F22	41.750	37.368	4.232	Open Manhole	600
F3.010	o	150	F23	38.136	36.786	1.200	Open Manhole	600
F1.007	o	150	F24	39.543	36.471	2.922	Open Manhole	600
F1.008	o	150	F25	38.623	36.312	2.161	Open Manhole	600
F5.000	o	150	F26	40.184	38.884	1.150	Open Manhole	600
F5.001	o	150	F27	37.980	36.680	1.150	Open Manhole	600
F5.002	o	150	F28	38.303	36.568	1.585	Open Manhole	600

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)
F3.006	30.116	135.6	F17	40.211	37.682	2.379	Open Manhole	600
F3.007	30.116	135.6	F21	41.730	37.460	4.120	Open Manhole	600
F4.000	15.432	16.5	F19	43.834	42.534	1.150	Open Manhole	600
F4.001	29.106	135.6	F20	43.861	42.319	1.392	Open Manhole	600
F4.002	29.106	6.0	F21	41.730	37.460	4.120	Open Manhole	600
F3.008	12.425	135.6	F22	41.750	37.368	4.232	Open Manhole	600
F3.009	35.217	60.5	F23	38.136	36.786	1.200	Open Manhole	600
F3.010	42.716	135.6	F24	39.543	36.471	2.922	Open Manhole	600
F1.007	21.530	135.6	F25	38.623	36.312	2.161	Open Manhole	600
F1.008	38.508	135.6	F29	37.875	36.028	1.697	Open Manhole	600
F5.000	35.793	16.2	F27	37.980	36.680	1.150	Open Manhole	600
F5.001	15.216	135.6	F28	38.303	36.568	1.585	Open Manhole	600
F5.002	4.718	110.3	F29	37.875	36.525	1.200	Open Manhole	600

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PIPELINE SCHEDULES for Foul - Main

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)
F1.009	o	150	F29	37.875	36.028	1.697	Open Manhole	600

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)
F1.009	10.024	135.6	F	37.402	35.954	1.298	Open Manhole	0

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.009	F	37.402	35.954	0.000	0	0

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Appendix O

Proposed Foul Water Drainage Strategy

N

NOTES

1. This drawing to be read in conjunction with all other drawings and specifications.
2. Dimensions not to be scaled.
3. Site layout from OSP Architects (Ref: 20179/P101, date: December 2021).
4. Topographical Survey from ASC (Ref: ASC.21.599, date: August 2021)
5. This drawing is indicative and not intended for construction.
6. All proposed foul water sewers and levels shown on this drawing are indicative only.

KEY

Application Site Boundary

Proposed Foul Water Drain

Proposed Foul Rising Main

DRAINAGE STRATEGY

- Foul effluent from the proposed development site is proposed to be drained to a new adoptable pumping station established to the north of Plot 20. Effluent would then be pumped along London Road towards Southern Water's 150mm diameter public foul sewer, located approximately 360 to the south of the proposed pumping station, via a direct connection between Manholes Ref: 5602 and 5604. The incoming peak design flow from the 60 properties would be 2.9l/s. The minimum storage capacity of the foul pumping station would be 9.6m^3.

Proposed Foul Water Pumping Station

Proposed foul water rising main along London Road towards Southern Water public sewers to the south of the development site.

Pumped foul effluents from the proposed pumping station to be discharged into Southern Water's 150mm diameter public foul sewer, via a direct connection between Manholes Ref: 5602 and 5604.

Proposed Connection to Southern Water Sewers
1:800@A1

12.0 0.0 12.0 24.0 36.0 48.0 60.0
Scale = 1:600 @ A1

Rev.	Description	Date	Chkd
P1	Draft for comment	23/12/2021 AQ	JB

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Obsidian Strategic Asset Management Limited

Project :
Land at Mockbeggars Farm
Uckfield
TN22 2EA

Title :
Foul Water Drainage Strategy

Project Engineer :	A. Quigley	Scale :	1:600@A1
Project Director :	J. Birch	Date :	December 2021
Status :	Planning		

Drawing No. CV8210667 - SK05 Rev P1

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