

NORTH STREET, READING

**FOUL & SURFACE WATER DRAINAGE
STRATEGY**

READING BOROUGH COUNCIL

Report Ref:
5332-RP01
ISSUE 01 – January 2021

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Document Control Sheet

Project name: North Street, Reading
Project ref: 5332
Report Title Foul & Surface Water Drainage Strategy
Doc. ref: 5332-RP01
Date: 26th January 2021

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Revision	Date	Description	Prepared	Approved
Issue 1	26/01/2021	First Issue	MTD	TL

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1. INTRODUCTION

- 1.1. All forms of flooding and their impact on the natural and built environment are material planning considerations. The revised National Planning Policy Framework (NPPF) sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the revised NPPF and the supporting Planning Practice Guidance (PPG).
- 1.2. A Foul and Surface Water Drainage Strategy has been completed in accordance with the revised NPPF and the PPG to review all sources of flood risk both to and from the proposed development. The report also considers the most appropriate drainage options including the implementation of Sustainable Drainage Systems (SuDS) in line with national policy.

Objectives & Scope

- 1.3. This report will review the information provided to support the planning application in relation to drainage.
- 1.4. The objective of this report is:
- Review the information supplied for planning
 - Establish surface water runoff for the proposed development site.
 - Detail a suitable drainage strategy for the management and maintenance of the surface water generated from the proposed development
 - Provide sufficient information to discharge planning condition 5 of Reading Borough Council planning reference 191695
- 1.5. The scope of this drainage strategy is to provide sufficient information for the discharge of drainage related planning conditions.

Planning

- 1.6. Planning condition 5 is written as:

Planning Condition 5

5. No development shall commence on site until a Sustainable Drainage Strategy and associated detailed design, management and maintenance plan of surface water drainage for the site using SuDS methods has been submitted to and approved in writing by the Local Planning Authority. The plan shall include:

- i. a timetable for its implementation, and
- ii. a management and annual maintenance plan for the lifetime of

the development which shall include the arrangements for adoption by any public body or statutory undertaker, or any other arrangements to secure the operation of the sustainable drainage scheme throughout its lifetime.

REASON: These details are required due to insufficient information being contained within this submission and in order to reduce the risk of flooding onsite or elsewhere in accordance with Policy EN18 of the Reading Borough Local Plan 2019.

Limitations

1.7. The general limitations of this report are that:

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The Development Proposals

- 1.1. The development proposals comprise the erection of two buildings to provide 42 dwellings with associated bin and cycle storage, vehicle parking, landscaping and associated works.
- 1.2. The site is classified as a brownfield site. Refer to coombes : Everitt architects drawing 20.20.022 entitled 'Proposed Site Plan' reproduced in **Appendix A**.

2. PLANNING INFORMATION

Reading Borough Council Local Plan (Adopted 2019)

2.1. Policy EN18 of the Local Plan states:

EN18: FLOODING AND SUSTAINABLE DRAINAGE SYSTEMS

Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

All major developments** must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government's Technical Standards. Smaller schemes are encouraged to incorporate SuDS, where possible. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.

** 10 or more dwellings or equivalent non-residential or mixed developments

WSP Drainage Strategy Statement February 2020

2.2. Planning application 191695 was granted planning permission based upon WSP Drainage Strategy Statement (Project title 70012984 – RBC Housing Sites – North Street) in relation to drainage. Reading Borough Council commissioned WSP to provide advice on the provision of drainage.

2.3. The key conclusions in respects to surface water drainage are:

- The site may be suitable to support infiltration SuDS subject to ground investigations
- Discharge is proposed to the Thames Water surface water sewer located to the east of the site in North Street.
- Greenfield runoff is low at 0.1l/s due to the soil classifications. A minimum practical discharge rate of 2.5l/s is proposed subject to agreement with Thames Water.
- Micro Drainage calculations indicate 75m³ of attenuation storage is required in the site assuming 2.5l/s discharge from the site.
- Foul water drainage is to discharge to the adjacent Thames Water foul Sewer in North Street.

2.4. It is noted that the WSP statement provides an indicative drainage layout to serve the site. This layout identified the use of an attenuation tank within the central courtyard area and permeable paving to parking bays.

3. EXISTING SITE

Site Location

- 3.1. The development site is located at North Street, Reading, Berkshire, RG1 7DA. The Ordnance Survey National Grid Reference for the site is SU 70912 73659 (approximate centre). The total site covers approximately 0.212 ha and is located red in **Figure 1 & 2**.

Figure 1 : Site Location Plan

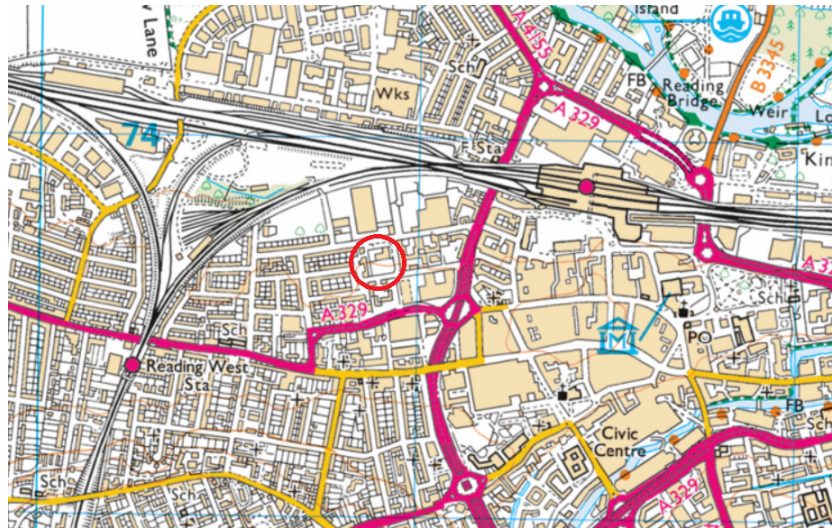


Image courtesy of © 2021 Microsoft – Bing Maps

- 3.2. The site is situated on a plot of brownfield land located in an area consisting of a mixture of industrial, commercial and residential uses. Reading Ambulance Station is located to the north of the Site and residential flats are to the east. North Street and Weldale Street are adjacent to the eastern and southern boundaries of the Site respectively.

Figure 2: Red line boundary



Image courtesy of © 2021 Google Maps

Land Use

- 3.3. The site is a brownfield site located in an area consisting of a mixture of industrial, commercial and residential use. The site is vacant with no structures present. Hard standing areas are present in the form of the existing building footprint and car parking.

Topography

- 3.4. Geomap have undertaken a topographical and utility survey to inform the development in November 2020. Refer to drawing BC-NSR-2511/20 entitled Topographical & Utility Survey 2D included in **Appendix B**.
- 3.5. The site is predominantly flat with a general fall to the north, there is raised ground to the south of the site leading up to Wealdale Street. The highest elevation is to the south of the site at 41.29 mAOD, the general level along Wealdale street is 41.200 mAOD. The site has a fall to a general level of 39.600 mAOD. The lowest elevation is 39.290 mAOD to the north east of the site adjacent to North Street.

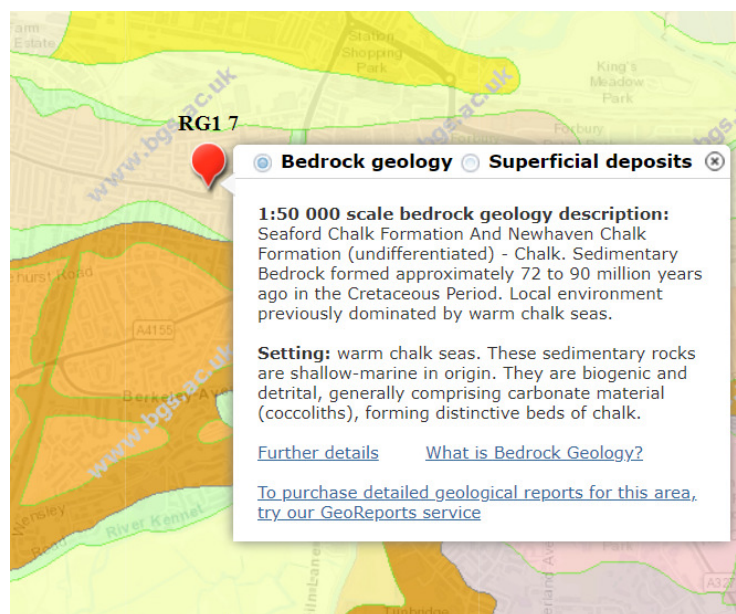
Hydrology

- 3.6. The nearest Environment Agency defined main river is the River Kennett which is located approximately 770m to the south east of the site. The River Thames is located approximately 780m to the north east..
- 3.7. There are no ordinary watercourses or ditches in the vicinity of the site.

Geology

- 3.8. The published geological information available through the British Geological Society (BGS) online records indicates that the site is underlain by a bedrock of the Seaford Chalk Formation and Newhaven Chalk Formation. The site is overlain by superficial deposits of the Taplow Gravel Member – Sand and Gravel.
- 3.9. **Figure 3** shows an extract from the British Geological Survey map for the site location

Figure 3: BGS Geological Map



Site Investigation

- 3.10. A Phase 2 Geo-Environmental Risk Assessment has been undertaken within the site in March 2020 by WSP. This report was provided to inform the development proposals, updated GI investigations are due to commence late January 2021.
- 3.11. The Geo-Environmental Risk Assessment identified made ground / hardstanding's overlying Alluvium comprising of brown sandy clay or pale brown clayey sandy fine to coarse gravel or pale brown slightly clayey gravelly sand to depth of up to 5.9m BGL. Chalk was encountered below alluvium or Taplow Gravels.
- 3.12. A ground water strike was encountered at 3.2m BGL which rose to 2.9m BGL. The report assess a mean groundwater levels between 36.55 mAOD to 38.86 mAOD.
- 3.13. Infiltration testing was undertaken and recorded a rate of 4.83-05m/s to 1.99-05m/s. It is noted that this rate is likely to change across the site due to the changing ground conditions. A downhole permeability test method was applied.
- 3.14. Refer to **Appendix C** for an extract of the Phase 2 Geo-Environmental Risk Assessment showing the results of infiltration testing.

Existing Drainage

- 3.15. Refer to **Appendix D** for Thames Water sewer records. A 225mm diameter foul and a 225mm diameter surface water sewer is located to the east of the site in North Street. These sewers discharge in a northerly direction. A 225mm diameter foul and surface water sewer is located to the south of the site in Weldale Street, these sewers discharge in a easterly direction and are at a higher elevation than the site.
- 3.16. The topographical survey, refer to **Appendix B**, identifies a number of inspection chambers serving the existing site. It is assumed that there is a foul connection to the north of the site. Surface water from the car parking area is indicated to discharge to a soakaway.

4. FLOOD RISK

- 4.1. This section of the report reviews the existing risk of flooding to the site and requirements for a compliant drainage strategy to meet the requirements of the National Planning Policy Framework (NPPF, February 2019) and the Planning Practice Guidance (PPG, March 2014).
- 4.2. It is necessary to consider the potential consequences of flooding from all sources, which include directly from pluvial flows, rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

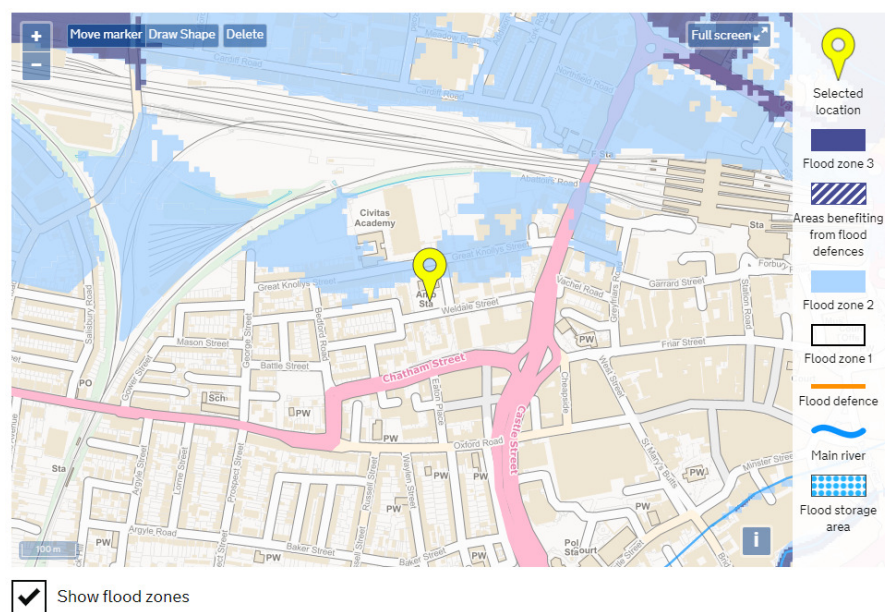
Sources of Flood Risk

- 4.3. It is necessary to consider the potential consequences of flooding from all sources, which include directly from pluvial flows, rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

Fluvial Flooding

- 4.4. The site falls within the catchment of the River Thames. **Figure 4** provides an extract of the Flood Risk Map for planning

Figure 4: Environment Agency's Flood Map for Planning



- 4.5. The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. The Environment Agency's Flood Map for Planning shows the area that could be affected by flooding, either from rivers or the sea, coloured dark blue corresponding to Flood Zone 3. The light blue area is Flood Zone 2 and shows the additional extent of an extreme flood from rivers or the sea. These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading, this shows the area where flooding from rivers and the sea is very unlikely corresponding to Flood Zone 1.
- 4.6. Flood Zone 1 Low Probability is defined as land having a less than 1 in 1000 annual probability of river or sea flooding. Flood Zone 2 Medium Probability is defined as land having between a 1 in 100

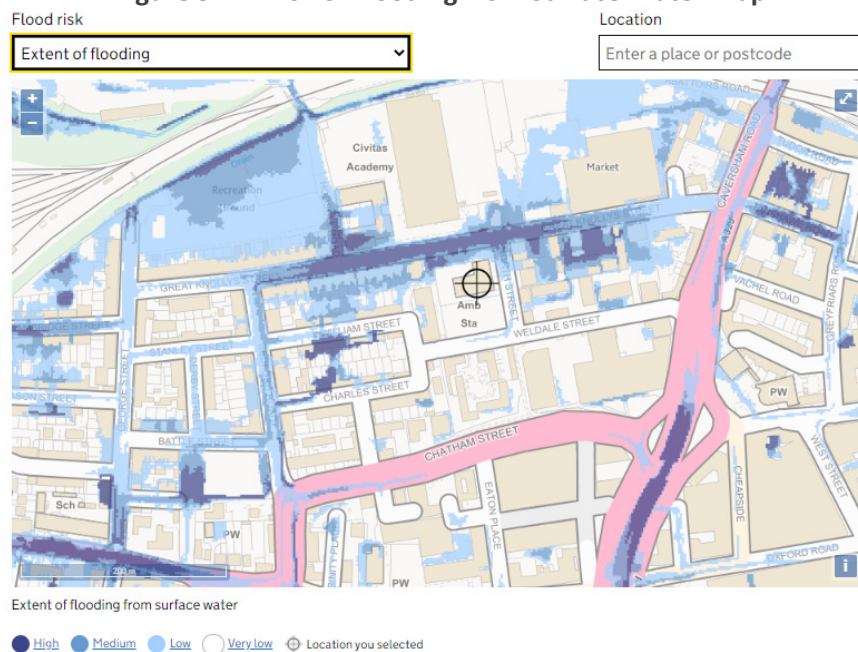
and 1 in 1000 annual probability of river flooding. Flood Zone 3a High Probability is defined as having a 1 in 100 or greater annual probability of river flooding. Flood Zone 3b The Functional Floodplain is defined as the zone which comprises land where water has to flow or be stored in times of flood.

- 4.7. From an inspection of the Flood Map it can be seen that the site lies within Flood Zone 1. Flood zone 2 is located approximately 50m to the north of the site. The Thames Water asset mapping indicates that the cover level in this area is approximately 38.00 mAOD which is 1.75m below the proposed FFL of the development.

Pluvial Flooding

- 4.8. The Environment Agency's Risk of Flooding from Surface Water Map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. A copy of the Environment Agency's Risk of Flooding from Surface Water Map is reproduced in **Figure 5** below.

Figure 5: EA Risk of Flooding from Surface Water Map



- 4.9. The Risk of Flooding from Surface Water Map shows that the site is not at risk of surface water flooding. A low risk flood path is located from Weldale Street heading north along north street to the lower ground. The Reading Borough Council SFRA 2017 shows the same extent of surface water flood risk within Figure F6 of the Updated Flood Map for Surface Water.

Flooding from Groundwater

- 4.10. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks such as sands, gravels, limestone and chalk. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas, the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.

- 4.11. Map F8 of the Reading Borough Council SFRA 2017 Level 1 identifies that the site is located in an area susceptible to 50-75% groundwater flood risk – likely to be due to the geological conditions.

Flooding from Overwhelmed Sewers and Drainage Systems

- 4.12. Flooding from sewers and drainage systems occurs when the sewer or drainage system is overwhelmed as a result of a blockage or excessive flow exceeding its capacity.
- 4.13. Map F9 of the Reading Borough Council SFRA 2017 Level 1 shows that the site lies in an area where Thames Water have registered 51-100 incidents of sewer flooding. Map F3 does not identify any historical flood incidents within the site or its immediate vicinity.

Flooding from Artificial Sources

- 4.14. The Environment Agency's Risk of Flooding from Reservoirs Map indicates the site is unaffected by flooding from any reservoirs.

Flood Risk Vulnerability and Flood Zone 'Compatibility'

- 4.15. Table 2: Flood Risk Vulnerability Classification, in Section 25 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-066-20140306), categorises different types of development according to their vulnerability to flood risk. Table 3: Flood risk vulnerability and flood zone 'compatibility', in Section 25 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-067-20140306), maps these vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

Figure 6: Extract of Table 2: Flood Risk Vulnerability Classification

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.

- 4.16. With reference to Table 2, the proposed residential development falls into the 'More Vulnerable' flood risk vulnerability classification, which includes buildings used for dwelling houses
- 4.17. With reference to Table 3, the proposed development is appropriate land use in Flood Zone 1.

Figure 7: Table 3: Flood Risk Vulnerability and Flood Zone ‘Compatibility’

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

Key:

✓ Development is appropriate

x Development should not be permitted.

The Sequential & Exception Test

- 4.18. The NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.
- 4.19. Paragraph 101 of the NPPF states: *‘The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.’*
- 4.20. The site falls within Flood Zone 1 and on this basis the Sequential Test is passed. In accordance with the NPPF, a sequential approach has been used such that no built development would be located in Flood Zones 2 or 3. On this basis the Sequential Test is passed.

Climate Change

- 4.21. The NPPF requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.
- 4.22. The peak rainfall intensity allowances to be used when designing urban drainage systems are given in Table 2 of ‘Flood risk assessments: climate change allowances. Both the central and upper end allowances need to be assessed to understand the range of impact. The total potential change anticipated for 2060 to 2115 is 20% for the central category, and 40% for the upper end category. The previous normal climate change allowance used for peak rainfall intensity was 30%.

Standard of Protection

- 4.23. In terms of providing an acceptable standard of protection against flooding for new development, paragraph 54 in Section 22 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-054-20150415) advises how development can be made safe from flood risk. Reference is made to the ability of residents and users to safely access and exit a building during a 'design flood'. Paragraph 55 in Section 22 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-055-20140306) defines a 'design flood': *'This is a flood event of a given annual probability, which is generally taken as:*

- *a fluvial (river) flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year) or;*
- *tidal flooding with a 0.5 per cent annual probability (1 in 200 chance each year),*

against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed.'

- 4.24. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, no flooding of property should occur as a result of the 'design flood' corresponding to a 1 in 100-year fluvial flood event, or a 1 in 200 year tidal flood event.
- 4.25. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

Residual Risk

- 4.26. Paragraph 41 in Section 14 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-041-20140306) advises that residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions.
- 4.27. The site lies within Flood Zone 1 and so the proposed development is fully in accordance with the sequential approach to development set out in the NPPF, the aim of which is to steer new development to areas with the lowest probability of flooding.
- 4.28. The proposed drainage measures would ensure that there is little or no residual risk of property flooding occurring during events well in excess of the minimum acceptable standard of protection for new property, which requires that no flooding of property should occur as a result of a one in 100 year storm event including an appropriate allowance for climate change.
- 4.29. For extreme events it is considered that the proposed development would intercept any uncontrolled overland flow and direct it into the proposed drainage system. The proposed drainage measures would ensure the proposed development would have adequate flood protection for extreme events over the lifetime of the development.

5. SURFACE WATER MANAGEMENT

Design Principles

- 5.1. Key design principles in the following guidance documents steer the approach to managing surface water runoff at sites:
- Building Regulations hierarchy of drainage (H3);
 - Interim Code of Practice for SuDS; and
 - CIRIA best practice guidance, including the use of the 'SuDS management train'
- 5.2. Building Regulations hierarchy of drainage outlines the preferred methods for the disposal of surface water with infiltration methods being the preferred option. If this is not possible the next favoured option is to drain to an existing watercourse. If neither of these options are feasible, the regulations state that rainwater discharge should be directed to a sewer.
- 5.3. The Interim Code of Practice for SuDS provides guidance about the hydraulic design criteria for Sustainable drainage systems. This in general refers to both peak rate of runoff and the volume of runoff, post development. Prior to mitigation measures such as the use of SuDS attenuation features, both the volume and peak rate of runoff may increase post development.
- 5.4. The design principles for surface water management extend beyond simple hydraulic criteria. CIRIA guidance promotes the use of the SuDS management train, a concept where SuDS techniques are used to treat, convey and store surface water runoff. This approach is considered as part of the SuDS selection methodology.

Non-statutory technical standards for sustainable drainage systems

- 5.5. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. The technical standards relate to the design, construction, operation and maintenance of sustainable drainage systems and have been published as guidance. The Government expect these standards to apply to all developments of 10 homes or more and to major commercial development.
- 5.6. The Government's 'Non-statutory technical standards for sustainable drainage systems' set out peak flow control standards (S2 and S3) and volume control technical standards (S4, S5 and S6). Standard S1 states that where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body the peak flow control standards (S2 and S3) and volume control technical standards (S4 and S6) need not apply.
- 5.7. For the proposed development site, the following non-technical standards apply for a brownfield site –

Peak Flow Control

- 5.8. Standard S3 states: For developments which were previously developed, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

Volume Control

- 5.9. Standard S5 states: Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.
- 5.10. Standard S6 states: Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

Sustainable Drainage Systems

- 5.11. Peak surface water discharge rates to watercourses and sewers should be appropriately managed and where possible reduced. Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical. Sustainable Drainage Systems (SuDS) can address the four key sustainability objectives including: water quantity, water quality, amenity and biodiversity.
- 5.12. Paragraph 51 in Section 21 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-051-20150323) advises that sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems provide opportunities to:
- reduce the causes and impacts of flooding;
 - remove pollutants from urban runoff at source;
 - combine water management with green space with benefits for amenity, recreation and wildlife.
- 5.13. Promoting SuDS to deal with surface water at the source, will limit the required attenuation and in turn reduce the volume of surface water in the nearby watercourse and sewer infrastructure. There may be the potential to utilise SuDS features for conveyance/attenuation of surface water flows within the proposed drainage strategy, opposed to the traditional below ground storage methods. Detailed design should confirm whether this site would be suitable for incorporation of SuDS following more detailed analysis of levels, ground conditions and attenuation requirements.

SuDS Selection

- 5.14. Based upon the indicative layout, SuDS can be incorporated into the development to provide a degree of treatment before flows are carried off site. The following SuDS Selection matrix reviews those measures that can be implemented in the site, this matrix is indicative only and does not impart that the viable SuDS within the site are to be installed. Appropriate selection and implementation of the various SuDS are to be discussed between the design team.
- 5.15. This drainage strategy provides a review of the minimum SuDS measures to be implemented based upon viable SuDS Selection Matrix (**Table A**) and based upon site requirements for conveyance, treatment and attenuation of surface water flows.

Table A: SuDS Feasibility Matrix

SuDS Component	Site Suitability	Comments
Green Roofs	✓	Potential for use
Soakaways	✓	Potential for use
Rainwater harvesting systems	✗	Not proposed
Rainwater harvesting systems	✗	Not proposed
Filter Trenches	✗	Not proposed
Infiltration trenches	✓	Potential for use
Swales	✗	Not suitable due to site layout constraints
Bioretention	✗	Not suitable due to site layout constraints
Pervious Pavements	✓	Potential for use
Geo-cellular Systems	✓	Potential for use
Infiltration Basins	✗	Not proposed due to solution features
Detention Basins	✗	Not suitable due to site layout constraints
Ponds	✗	Not suitable due to site layout constraints
Wetlands	✗	Not suitable due to site layout constraints
Proprietary Devices	✗	Not proposed

Surface Water Flow Balancing

Catchment Areas

- 5.16. The existing and proposed impermeable and permeable site areas have been reviewed and are presented in **Table B** below.

Table B: Pre and Post development Catchment Areas

	Permeable (Greenfield)	Impermeable (Hardstanding's)	Totals
Pre Development Catchment Areas	1365 m ²	755 m ²	2120 m ²
Post Development Catchment Areas	790 m ²	1365 m ²	2120 m ²

- 5.17. The proposed development will increase impermeable areas by approximately 610m².

Greenfield Runoff Rate

- 5.18. Greenfield runoff rates have been determined using XP Solutions' Micro Drainage software system (Version 2017.1) based on the method set out in IH Report 124, and with catchment descriptors obtained from the Flood Estimation Handbook (FEH), published by the Institute of Hydrology. FSSR 2 and 14 regional growth curve factors have been used to calculate the greenfield peak flow rates for 1, 30 and 100 year return periods.
- 5.19. Copies of the Micro Drainage greenfield runoff calculations for the site are included in **Appendix E**. A summary of the greenfield runoff rates for the various return period events is shown in **Table C**. The mean annual peak rate of runoff, referred to as Q_{BAR} in IH Report 124, is 0.1 l/s/.

Table C: Greenfield Runoff Rates

Return Period (Years)	1	Q_{bar}	30	100
Greenfield Runoff Rates (l/s)	0.1	0.1	0.2	0.2

Pre Development Peak Runoff Rate

- 5.20. The Modified Rational Method has been used to determine the runoff from the impermeable areas of the existing site (refer to **Table D**)–

$$Q = 2.78CiA$$

Where

Q= flow (l/s)

I = rainfall intensity (mm/hr)

A = Impermeable Area (ha)

C = runoff coefficient

Table D: Pre development site Modified Rational Method impermeable runoff

Return Period	C	I	A	Flow (l/s)
1:1 year	0.95	24.335	0.0755	4.852
1:30 year	0.95	59.521	0.0755	11.868
1:100 year	0.95	76.512	0.0755	15.256

Post development unattenuated Peak Runoff Rate

- 5.21. Where assessing the redeveloped sites peak runoff rate, including allowance for climate change and changes in impermeable areas, the unattenuated peak runoff rate is as presented in **Table E** (calculated utilising the Modified Rational Method).

Table E: Post development site Modified Rational Method impermeable runoff

Return Period	C	I	A	Flow (l/s)
1:1 year	0.95	24.335	0.133	8.547
1:30 year (+10%cc)	0.95	65.743	0.133	23.092
1:100 year (+40%cc)	0.95	107.117	0.133	37.625

- 5.22. If the site were to discharge at unattenuated rates, the post development site would increase flows for all events due to the increase in impermeable areas and allowance for climate change.

Proposed surface water discharge arrangements

- 5.23. The site is a brownfield site and as such is to conform with the non-technical standards for SuDS and Reading Borough Council Local Plan policy EN18 where proposed surface water discharge should aim to reflect greenfield conditions.
- 5.24. The WSP Drainage strategy Statement proposes a discharge rate of 2.5l/s to which planning is approved. The drainage strategy presented in this report and for implementation within the site will utilise this approved discharge rate.

Outfall Location

- 5.25. In terms of what sort of sustainable drainage system should be considered, paragraph 80 in Section 21 of the Flood Risk and Coastal Change Planning Practice Guidance (Reference ID: 7-080-20150323) advises that, generally, the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable (also stated within The SuDS Manual (CIRIA C753) paragraph 3.2.3):

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

Infiltration

- 5.26. Intrusive ground investigations have been undertaken within the site to determine the infiltration capacity (Refer to **Appendix C**). It is noted that a ground water strike was encountered at 3.2m BGL which rose to 2.9m BGL. The report assess a mean groundwater levels between 36.55 mAOD to 38.86 mAOD.
- 5.27. Infiltration testing was undertaken and recorded a rate of 4.83-05m/s to 1.99-05m/s. It is noted that this rate is likely to change across the site due to the changing ground conditions. A downhole permeability test method was applied.
- 5.28. Due to the presence of chalk, an offset of 10 - 20m should be applied between buildings and soakaways, in accordance with CIRIA 574 Engineering in Chalk
- 5.29. The site can not provide the minimum offset requirements for a soakaway in chalk and therefore infiltration SuDS cannot be implemented within the site. Furthermore a mean groundwater level of 38.86 mAOD would provide a 740mm depth from ground level to the water table therefore the minimum 1m depth from the base of infiltration SUDS to groundwater cannot be achieved.

Surface water body

- 5.30. There are no watercourses in close proximity to the site.

Surface water sewer, highway drain, or another drainage system;

- 5.31. It is proposed that the site is to discharge to the adjacent Thames Water sewers subject to necessary agreements and capacity enquiries with Thames Water. This is as per the existing site discharge methodology.

Surface Water Drainage Strategy

- 5.32. In view of the requirements of the NPPF, PPG, and design parameters and constraints associated with redeveloping this site, a surface water drainage strategy design has been devised and hydraulically modelled to demonstrate that the scheme can be suitably implemented without increasing the level of flood risk, when the surface water drainage system experiences a 1:100-year rainfall event (including 40% allowance for climate change).
- 5.33. The surface water drainage scheme has been designed to ensure:
- Sustainable Urban Drainage systems are wholly incorporated within the scheme.
 - Consideration is given for the improvement of water quality within the design.
 - The designed drainage scheme can satisfactorily retain a critical 1 in 100 Year storm event with climate change.
- 5.34. The surface water drainage strategy proposes the use of permeable paving to the car parking spaces and an attenuation tank beneath the courtyard area.
- 5.35. The discharge from the site is proposed to be 2.5l/s as per the WSP approved Drainage Strategy Statement. This reduced discharge rate represents a significant reduction in pre development discharge rates.
- 5.36. Drawing 5332-C-001 entitled 'Drainage Strategy' is included in **Appendix F**, this drawing indicates the location and sizes of the required storage facilities to serve the various development areas. The layout is subject to detailed design.
- 5.37. The hydraulic assessment provides various scenarios up to and included the critical 1 in 100 Year storm event with additional 40% allowance for climate change. The simulations confirm that the storm can be managed and maintained within the site without flooding. The hydraulic models of the proposed surface water network and SuDS devices can be found in **Appendix G**.
- 5.38. The above plan and calculations demonstrate that a suitable means of drainage can be provided to drain the developed site in terms of surface water runoff in accordance with the guidance and standards.
- 5.39. The proposed drainage strategy option would ensure that surface water arising from the developed site would be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

Timetable for the implementation of SuDS

- 5.40. Due to the small nature of the site, it is assumed that the car parking area of the site will be utilised as the construction compound / offices / welfare facilities. As such it is recommended that the implementation of the attenuation tank is undertaken at the start or at the earliest opportunity of the project dependant upon the siting of cranes etc.
- 5.41. The implementation of the SuDS will be dependent upon a workable construction programme and methodology. Due to the size of the site, the implementation will be restricted by other activities

and as such will need to be considered for installation at the relevant time that causes minimal disruption.

- 5.42. Where SuDS are to be implemented towards the end of the proposed works, construction SuDS are to be considered for implementation in accordance with CIRIA C698.

Pollution Prevention

- 5.43. In terms of water quality, the proposed surface water system offers a suitable level of mitigation in accordance with Environment Agency, DEFRA and CIRIA guidance.
- 5.44. The CIRIA SuDS Manual C753, 2015 details an approach for establishing the hazard posed by the intended land use activities and the extent to which the proposed SuDS components can reduce and mitigate the contamination risk to the receiving waterbody. Referring to Table 26.2 – ‘Pollution hazard indices for different land use classifications’ (CIRIA C753, 2015) the proposed development and land use results in a low pollution hazard, therefore a ‘simple index’ method can be used to make a qualitative assessment of the proposed SuDS management.

Figure 8: CIRIA C753, 2015. Table 26.2 – ‘Pollution hazard indices for different land use classifications’

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Notes

- ¹ Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).
² These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

- 5.45. To ensure that there is adequate treatment, all SuDS components utilised should have a pollution mitigation index that equals or exceeds the pollution hazard index. In reference to Table 26.2, the total pollution hazard index for the development site is (roofs and private driveway):

$$TSS = 0.7,$$

$$Metals = 0.6,$$

$$Hydrocarbons = 0.45.$$

- 5.46. In reference to Table 26.3 – ‘Indicative SuDS mitigation indices for discharges to surface waters’ (CIRIA C753, 2015) the inclusion of permeable paving provides a total mitigation of:

$$TSS = 0.7$$

$$Metals = 0.6$$

$$Hydrocarbons = 0.7.$$

Figure 9: CIRIA C753, 2015. Table 26.3 – ‘Indicative SuDS mitigation indices for discharges to surface waters’

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters				
Type of SuDS component	Mitigation indices¹			
	TSS	Metals	Hydrocarbons	
Filter strip	0.4	0.4	0.5	
Filter drain	0.4 ²	0.4	0.4	
Swale	0.5	0.6	0.6	
Bioretention system	0.8	0.8	0.8	
Permeable pavement	0.7	0.6	0.7	
Detention basin	0.5	0.5	0.6	
Pond ⁴	0.7 ³	0.7	0.5	
Wetland	0.8 ³	0.8	0.8	
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			

Notes

- 1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.
- 2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
- 3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
- 4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.
- 5 See **Chapter 14** for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: <http://tinyurl.com/qf7yuj7>
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

- 5.47. The inclusion of SuDS within the proposed scheme ensures that there is adequate mitigation of the potential hazards from surface water flows. Both sites provide a minimum mitigation measure of permeable paving, additional SuDS may be applicable within the site and as such the mitigation measures and water quality treatment is increased.
- 5.48. Where a variety of SuDS or a different arrangement of SuDS are proposed for the development site, the mitigation indices will need to be reviewed to ensure that sufficient treatment is being provided to surface water flows.

Overland Flood Flow Paths

- 5.49. Standard S9 in the Government’s ‘Non-statutory technical standards for sustainable drainage systems’ states that the design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of 1 in 100 year rainfall event are managed in exceedance routes that minimise the risk to people or property.

- 5.50. Refer to drawing 5332-C-001 in **Appendix F** for an indication of the overland flow routes. The overland flows are to follow the existing topography of the site and discharge towards the site entrance.

6. SuDS MANAGEMENT & MAINTENANCE PLAN

Management & Maintenance

- 6.1. Maintenance refers to the inspections required to identify performance issues and plan maintenance as required, operation and maintenance of the drainage system, landscape management and waste management associated with contaminated silt and other waste materials resulting from maintenance.
- 6.2. CIRIA C753 The SuDS Manual provides information in Chapter 32 for the Operation and maintenance of SuDS. The maintenance activities are broadly defined as regular, occasional and remedial maintenance. It is noted that some scenarios may require one-off maintenance activities. The SuDS Manual defines maintenance as –
- Regular Maintenance: consists of basic tasks carried out to a frequent and predictable schedule, including inspections/monitoring, silt or oil removal if required more frequently than once a year, vegetation management, sweeping or surfaces and litter / debris removal.
 - Occasional maintenance: comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the regular tasks.
 - Remedial maintenance: describes the intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised with good design, constructions and regular maintenance activities.
- 6.3. Maintenance regimes are to be reviewed on an annual basis to ensure that the approach adopted is meeting its objectives.
- 6.4. All those responsible for the maintenance operations should adhere to the relevant health and safety legislation for the activities listed within this report (including lone working, if relevant). Method statements and risk assessments should always be completed prior to the undertaking of any works.

Indicative Maintenance & Management Plan

Gravity Drains & Catchpits

- 6.5. Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal. If maintenance is not undertaken for long periods, deposits can become hard-packed and require more effort to remove.

Permeable Surfaces

- 6.6. Permeable surfaces including permeable block paving, porous asphalt, gravel or free draining soils that allow rain to percolate through the surface into underlying drainage layers. They must be protected from silt, sand, compost, mulch, etc. Permeable block paving and porous asphalt can be cleaned by suction brushing.
- 6.7. Regular inspection and maintenance is important for the effective operation of permeable pavements, they should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.
- 6.8. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. In instances where jointing material is lost, this material should be replaced immediately.

- 6.9. Depending on the amount of usage and the environment that the permeable pavement has been exposed to, the laying course material may require either replacement or cleaning after a 25 to 30 year period. This would be evident if the infiltration rate of the paving became prolonged, allowing ponding to develop. If this situation should occur, the uplifting and cleaning (or replacing, depending on the costings of the activity) of the laying course may be considered. The laying course material, jointing and blocks may be reused (once cleaned), to aid in minimising costs.
- 6.10. Inspection and maintenance of the permeable surfaces will be dependent upon the manufacturer's recommendations and installation as per manufacturers details.
- 6.11. The table below gives a summary of the operation and maintenance requirements for permeable paving –

PERMEABLE AND POROUS SURFACES	
Regular Maintenance	Frequency
Brush regularly and remove sweepings from all hard surfaces	Three times a year at end of winter, mid-summer and after autumnal leaf fall, or as required based upon site specific observations or as per manufacturers recommendations
Occasional Tasks	Frequency
Removal of weeds	As required
Stabilise and mow contributing and adjacent areas	As required
Remedial Works	Frequency
Remediate any landscaping which, through vegetation maintenance or soil slip has encroached upon the permeable surface	As required
Remedial work to any depressions, rutting, cracked or broken blocks considered to be detrimental to the structure or that pose a hazard to users	As required
Rehabilitation of surface and upper substructure by sweeping	As required if infiltration performance is reduced
Monitoring	Frequency
Initial Inspection	Monthly for 3 months after installation / regular usage
Inspection for evidence of poor operation and / or weed growth	3 monthly & 48 hours after large storms
Inspection of silt accumulation	Annually
Monitoring of inspection chambers	Annually
Inspection for depressions, ponding or rutting	Annually

Modular Storage

- 6.12. Modular plastic geocellular systems with a high void ratio, that can be used to create a below ground infiltration (soakaway) or storage structure.
- 6.13. Regular inspection and maintenance is required to ensure the effective long-term operation of below ground modular storage systems
- 6.14. Catchpits are installed at the inlet to the tanks to allow for removal of silt / debris as required. The tanks are utilised for the 1:100 year storm event and as such are envisaged to have minimal levels of silt due to the use of permeable paving and gullies within the system.
- 6.15. Inspection and maintenance of the tanks will be dependent upon the manufacturer's recommendations and installation as per manufacturers details.
- 6.16. The table below gives a summary of the operation and maintenance requirements for modular storage –

MODULAR STORAGE	
Regular Maintenance	Frequency
Inspect and identify any areas that are not operating correctly	Monthly for 3 months after installation / regular usage
Debris and silt removal from catchment areas	Monthly
Removal of sediment from pre-treatment structures	Annually or as required
Remedial Works	Frequency
Repair / rehabilitation of inlets, outlets, overflows and vents	As required
Monitoring	Frequency
Inspect / check all inlets, inspection wells, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually and after large storms
Inspection of surface above units for sag points or depressions which may indicate structural failure.	Annually
Survey inside of the tank for sediment build-up and removal as required	Every 5 years or as required

Flow Control Chambers

- 6.17. The flow control chamber proposed for this site is a Hydro Brake which has no moving parts and are self-activating requiring minimal maintenance. The bypass disc is the only manually operated element and is applicable for use in the event of a blockage or issue with the drainage network. It is recommended that the chamber is inspected monthly for three months after installation and bi-annually thereafter to verify the condition and operation of the unit and check for blockages within the chamber or flow control device.

- 6.18. Any silt or debris found during inspections should be removed and cleaned out with the use of a sump vacuum cleaner.
- 6.19. The table below gives a summary of the operation and maintenance requirements for flow control devices –

CONTROL CHAMBERS	
Regular Maintenance	Frequency
Check there is no physical damage and that control is functioning. Ensure bypass arrangements are functional. Remove Debris and silt. Undertake inspection after autumnal leaf fall to ensure functionality of control and that there are no blockages	Monthly
Remedial Works	Frequency
Repair physical damage if required / replace unit is damaged	As required
Monitoring	Frequency
Inspect chamber and flow control units to ensure that they are in good condition and operating as designed.	Annually and after large storms

Blockages & Spillages

Blockage

- 6.20. In the event of a blockage within the drainage network, the key risk is that of flooding to the surrounding area. The extent and location of flooding is dependent upon the location of the blockage and the associated storm event.
- 6.21. In the event of a blockage within the network, the network is to be drained down by use of suction equipment and the blockage removed.
- 6.22. If a blockage does occur and results in flooding, the exceedance flow routes are anticipated to flow in a westerly direction.

Spillages

- 6.23. Due to the nature of the development, the likelihood of a spillage is minimal.
- 6.24. Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency with residual spillage allowed to bio-remediate in the drainage system.
- 6.25. In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s) downstream of the spillage with a bung. Contact the Environment Agency immediately.

Implementation of the management plan & Adoption

6.26. Shared drainage features such as SuDS and flow control chambers are to be maintained in accordance with the details provided in this report. The responsibility for the implementation of the management and maintenance of shared drainage features can only be indicated at this stage.

6.27. There are two viable options for this:

Option 1 – Adoption of the drainage network by the water authority

6.28. This option passes all adoption and maintenance responsibilities to the local water authority (Thames Water) through the adoption of the drainage network under S104.

6.29. Local water authorities can be approached to adopt SuDS following the Ofwat approval of the Sewage Sector Guidance documentation.

Option 2 – Private management company

6.30. This option seeks to have a management company tasked with the maintenance and management of the shared drainage assets.

6.31. There are a number of companies that offer this service however it is not reasonable to appoint a specific company and enter agreement prior to receiving planning permission or before the development is constructed. As such this option is presented at planning stages to show that it is viable to have a management company.

6.32. The form in which a management company is funded is dependent upon the designation of the proposed development. Funding towards the management company will be either via a commuted sum or a resident management fee. These details are to be determined by the developer / client and the associated management company in which they appoint at the relevant stage.

7. PROPOSED FOUL WATER STRATEGY

Existing Drainage

- 7.1. Refer to **Appendix D** for Thames Water Asset mapping. A Public Foul Water Sewer is located to the east of the site in North Street. This 225mm sewer discharges to the north.
- 7.2. An existing private foul water drain is assumed within the existing site, refer to the topographical survey in **Appendix B**, it is assumed that this drain discharges to the Thames Water sewer to the east of the site.

Proposed Strategy

- 7.3. The proposed development will generate new and additional foul flows. In accordance with Sewers for Adoption, the development site will discharge 1.944l/s of foul flow from the 42 dwellings.
- 7.4. It is proposed that connection is made to the Thames Water foul sewer located to the east of the site via a new manhole. Refer to **Appendix F** for an indication of the foul water proposal to serve the site.
- 7.5. A pre development enquiry has been submitted to Thames Water to assess the capacity of the receiving sewer. At the time of issue of this report, a response has not been received.

Adoption

- 7.6. The foul sewer is proposed to be adopted by Thames Water under a S104 agreement in accordance with sewers for adoption. Associated applications and design details will be provided to Thames Water in due course.

8. CONCLUSIONS

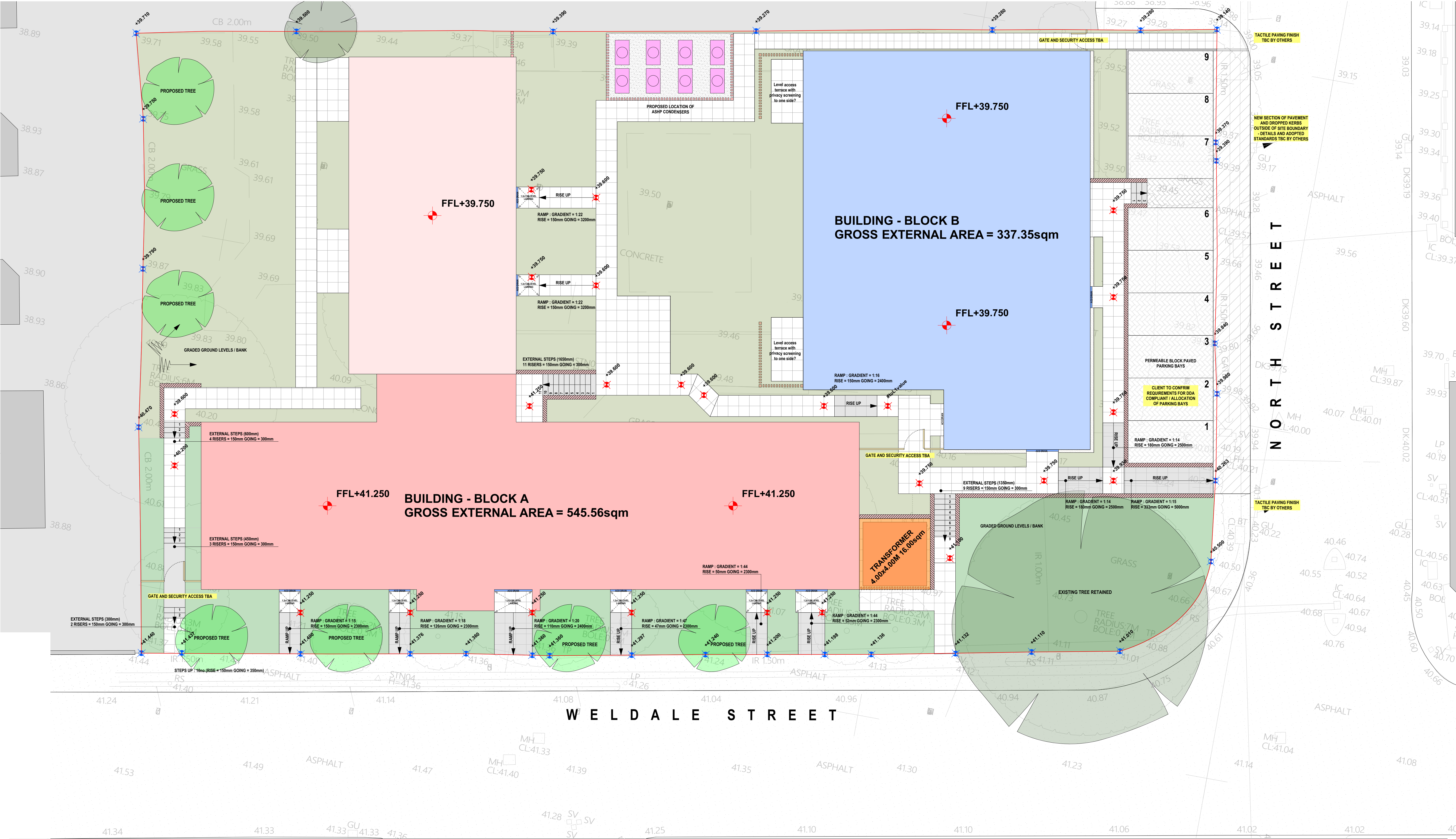
- 8.1. This Drainage Strategy has been prepared in connection with the erection of two buildings to provide 42 dwellings with associated bin and cycle storage, vehicle parking, landscaping and associated works at North Street, Reading. The key conclusions are:
- The site area is 0.212 hectares and classified as a brownfield site.
 - Current Environment Agency flood risk mapping identifies that the site is located in Flood Zone 1
 - Flood risk from all sources has been reviewed.
 - Development proposals are appropriate for the flood zone classifications and flood risk vulnerability.
 - A viable surface water drainage strategy is shown for the site which implements SuDS.
 - Surface water discharge from the site is to be restricted to 2.5l/s for all storm events which provides a significant betterment on existing brownfield runoff rates. This is in accordance with the approved WSP Drainage Strategy Statement.
 - Surface water is proposed to discharge to Thames Water Sewers located in North Street
 - The implementation of a drainage strategy which implements an attenuation tank and permeable paving reduces the surface water flood risk of the site by the effective management and attenuation of surface water flows.
 - Foul drainage is proposed to discharge to the existing Thames Water sewer to the east of the site subject to agreement with Thames Water
- 8.2. The available flood risk information includes: Environment Agency data and interactive Flood Hazard Maps; local flood history data from all sources of flooding; modelled flood data: and flooding information in the SFRA.
- 8.3. In addition to flooding from rivers and the sea, this drainage strategy has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources
- 8.4. The details in this report provide sufficient information to discharge planning condition 5 of planning approval 191695 with Reading Borough Council.
- 8.5. The overall conclusions drawn from this Drainage Strategy are that the development, located in flood zone 1, would be appropriately safe for its lifetime taking account of the vulnerability of its users and the development would not increase flood risk elsewhere.

APPENDICES

APPENDIX A

READING AFFORDABLE HOUSING SITE NORTH STREET, Reading, RG1 7DA.
W102 - PROPOSED SITE PLAN

BUILDING	Area m2
BUILDING - BLOCK A	545.56
BUILDING - BLOCK B	337.35
SITE AREA	2,119.12



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- ☒ Preliminary
- ☐ Feasibility
- ☐ Planning
- ☐ Building Regulations
- ☐ Tender
- ☐ Construction issue
- ☐ As Built



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2. Do not scale drawing: all dimensions to be checked on site prior to construction and any discrepancies reported to contract administrator

PRELIMINARY ISSUE FOR INFORMATION 11/12/2020

Drawing title: PROPOSED SITE PLAN

Client: READING BOROUGH COUNCIL

Drawn by: RG Checked: TC

Job number: 20.20.022

Project:
READING AFFORDABLE HOUSING SITE
NORTH STREET, Reading, RG1 7DA.

Scale: 1:100 at A1 (1:200 at A3)

Date: NOVEMBER 2020

Drawing no: W102

coombes : everitt architects

APPENDIX B



DO NOT SCALE

NOTES:

1. Levels are related to supplied survey
2. Grid is related to supplied pdf
3. Drainage pipe sizes are estimated from the surface
4. Tree sizes are measured 1m from the ground

KEY

AV	AIR VALVE	OL	OUTSIDE LIGHT
BB	BELISHA BEACON	LV	LOW VOLTAGE
BH	BORERHOLE	MH	MANHOLE COVER
BOL	BOLLARD	MK	MARKER
BM	BENCH MARK	MKE	MARKER ELECTRIC
BS	BUS STOP	MKFH	MARKER FIRE HYDRANT
BT	BRITISH TELECOM COVER	MKSV	MARKER SLUICE VALVE
B-W	BARBED WIRE	MKT	MARKER TELEPHONE
CB	CONTROL BOX	MKW	MARKER WATER
C-B	CLOSE BOARD/ED	NB	NOTICE BOARD
CL	COVER LEVEL	NP	NAME PLATE
CL	CHAIN LINK	PO	POST
CP	CATCH PIT	PP	PETROL PUMP
CPS	CONCRETE PAVING SLABS	P&R	POST & RAIL
CTV	CABLE TV COVER	P&W	POST & WIRE
DP	DISTRIBUTION POST	RE	RODDING EYE
EOT	END OF TRACE	RP	REFLECTOR POST
EP	ELECTRIC POLE	RS	ROAD SIGN
ER	EARTH ROD	SP	SIGN POST
FH	FIRE HYDRANT	STP	STAND PIPE
FHT	FENCE HEIGHT	SV	SLUICE VALVE
FW	FOUL WATER	SW	SURFACE WATER
G	GULLY	ST	STAY
GP	GATE POST	TBM	TEMPORARY BENCH MARK
GAS	GAS VALVE	TCB	TELEPHONE CALL BOX
HH	HEDGE HEIGHT	TL	TRAFFIC LIGHT
HV	HIGH VOLTAGE	TM	TICKET MACHINE
IC	INSPECTION COVER	TP	TELEPHONE POLE
IR	IRON RAILING	UTT	UNABLE TO TRACE
KO	KERB OUTLET	UTL	UNABLE TO LIFT
LP	LAMP POST	WH	WALL HEIGHT
		WM	WATER METER
		WO	WASH OUT
		VT	VENT

LINETYPE MENU

Top Bank	=====	Telephone	=====
Bottom Bank	=====	Low Voltage	=====
Building	=====	Water line	=====
Foliage	=====	Gas line	=====
Hedge	=====	Ducting	=====
Pipe	=====		
Verge	=====	Tree	=====
Wall	=====	Spread/Dia/Height	=====
Kerb	=====	Manhole/	=====
Fence	=====	Inspection cover	=====
Overhead Cable	=====	Unknown	=====
Drop Kerb	=====	General Coms	=====
Depth Burial	+ 0.56m	Foul Water	=====
High Voltage		Surface Water	=====
Fibre Optics		Grid Cross	=====
Cable TV			

Topography & Utility Survey



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Client
Beards Construction

Project
North Street Reading

Title
Topography & Utility Survey 2D

Drawn
TC/JW

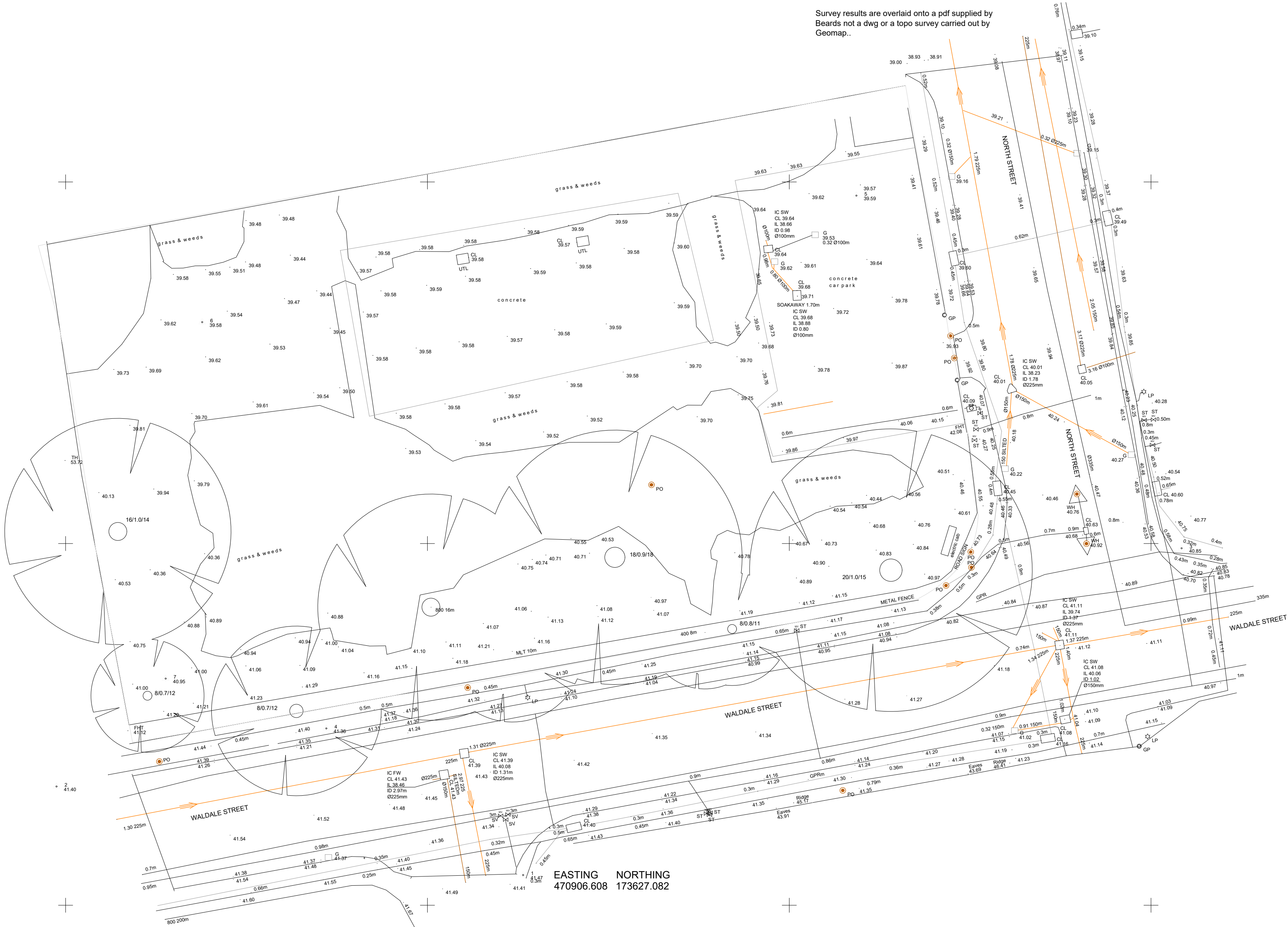
Date:
25/11/2020

Scale (at A1)
1:200

Drg no.
BC-NSR-2511/20

Revision No.
1 of 1

Survey results are overlaid onto a pdf supplied by Beards not a dwg or a topo survey carried out by Geomap.



POINT DATA				
POINT NUMBER	EASTING	NORTHING	LEVEL	DESCRIPTION
1	470906.608	173627.082	41.474	STN
2	470874.361	173633.200	41.401	STN
3	470952.108	173649.669	40.846	STN
4	470893.009	173637.213	41.361	STN
5	470929.634	173674.050	39.586	STN
6	470884.431	173665.302	39.580	STN
7	470881.905	173640.659	40.951	STN

* LV denotes electricity cables <1000V, HV denotes electricity cables >1000V - these estimations are usually derived from non intrusive methods and should be verified physically where necessary.
* Cable routes are likely to represent multi cables/ducts following the same line.
* Depths shown in brackets in mm.
* Drainage invert depths taken to bottom of channel mixing chamber.
* Depths to ducts in chambers represent cover, where multiple ducts have been found at different levels, measurements are to top of shallowest and bottom of deepest.
* Drainage/duct levels, depths and pipe sizes at chambers have been gauged from the surface and should be regarded as approximate only.
* A number of technologies have been used to obtain the information detailed on this plan, and whilst every effort has been made to achieve accurate results, crucial dimensions and positions should be checked prior to design or construction.
* The results of this survey should never be regarded as 100 percent accurate or complete. We recommend that hand auger excavation trenches are used to check our findings for both accuracy and completeness.
* No transposing of record information has taken place. Existing drawings should be referred to in conjunction with this plan.
* Information detailed on this plan is only to be used in accordance with our terms and conditions (available upon request).
* For information, some services may have been shown outside of the survey boundary, however, any areas outside of those outlined in our quotation should not be considered as having been fully investigated.

APPENDIX C

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200	BOREHOLE LOG		Hole No. BH101
	Project North Street		Sheet 1 of 2
Job No 70012984	Client Reading Borough Council		Date 15-01-20 16-01-20
Contractor / Driller ADP Group Limited	Method/Plant Used Comacchio 305	Logged By EJ	Co-Ordinates (470955 173682) E 470887.95 N 173667.95
		Ground Level (m) 39.41	

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P Pen (kN/m2)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
0.20-0.40	ES						39.34	0.07	ASPHALT.		TARMAC	
0.40-0.60	ES		0				39.16	0.25	Red brown black slightly clayey gravelly COBBLES of brick and concrete. Gravel is fine to coarse angular to subangular of flint, brick and concrete. (MADE GROUND)		TARMAC	
0.90-1.30	B						39.06	0.35	ASPHALT. Extremely weak.		ALV	
1.30-1.50	ES		0					(1.50)	Black sandy CLAY with fine to coarse gravel sized tiles, glass and metals. (MADE GROUND)		ALV	
1.50-1.95	SPT	1,1,1 1,2,1 N=5 (S)							Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to angular of flint. (ALLUVIUM)		ALV	
1.70-1.80	D		0				37.31	2.10	1.90 - 2.10 Pale brown gravelly sand. Gravel is fine to medium, subangular of chalk		ALV	
2.00-2.45	SPT	1,1,2 2,2,2 N=8 (S)						(0.90)	Loose brown gravelly SAND. Gravel is fine and medium subangular of flint and chalk. (ALLUVIUM)		ALV	
2.20-3.00	B						36.41	3.00	Firm locally stiff pale brown occasionally cream sandy gravelly CLAY. Gravel is fine to coarse angular to subangular of flint and chalk. (ALLUVIUM)		ALV	
2.50-2.60	D								3.50 - 3.60 Slightly clayey sandy GRAVEL		ALV	
3.00	SPT	2,2,3 3,4,4 N=14 (S)						(1.70)	3.60 Gravel chalk fine to coarse subrounded to subangular		ALV	
3.00-4.00	B										SECK	
3.70-3.80	D						34.71	4.70	Cream and black clayey fine to coarse subangular to angular GRAVEL of flint. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
4.00	SPT	1,2,2 2,2,1 N=7 (S)					34.56	4.85	CHALK recovered as clayey matrix with fine to coarse angular to subangular chalk clasts. Clasts are extremely weak to very weak medium-density cream with rare black specks matrix is cream occasional orangish staining on clast surfaces. Flint gravels at 5.0m to 5.3m bgl, singular coarse flint gravel at 6.0m bgl, angular flint gravel from 9.50m to 10.2m potentially broken up cobbles. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
5.00	SPT	2,2,3 3,2,2 N=10 (S)							4.85 - 4.95 Flint cobble		SECK	
6.00-6.10	D								5.00 - 5.50 Orangish staining		SECK	
6.50-6.95	SPT	1,2,2 3,3,3 N=11 (S)									SECK	
7.60-7.70	D							(5.35)			SECK	
8.00-8.45	SPT	1,2,2 3,3,4 N=12 (S)									SECK	
9.30-9.40	D										SECK	

Boring Progress						Water Strikes					
Date	Time	Depth	Casing Dpt	Dia. (mm)	Water Dpt	Date	Time	Strike	Minutes	Standing	Casing
15-01-20	12.40										
15-01-20	16.40	9.50	9.50		8						
16-01-20	07.15	9.50	9.50		5						
16-01-20	15.00										
Chiselling				Water Added							
From	To	Hours	Tool	From	To	General Remarks Hole terminated at 15.5m bgl Handpit terminated at 1.50m bgl					
Scale 1:62.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

17 WSP BH LOG 70012984 - NORTH STREET, READING.GPJ WSPTEMPLATE700.GDT 3/3/20

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200	BOREHOLE LOG			Hole No. BH101	
	Project North Street			Sheet 2 of 2	
Job No 70012984		Client Reading Borough Council			Date 15-01-20 16-01-20
Contractor / Driller ADP Group Limited		Method/Plant Used Comacchio 305	Logged By EJ	Co-Ordinates (470955 173682) E 470887.95 N 173667.95	Ground Level (m) 39.41

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P Pen (kN/m2)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
9.50	SPT	2,3,3 4,3,4 N=14 (S)					29.21	10.20	CHALK recovered as chalk gravel sized clasts and clayey matrix. Gravel is extremely weak to very weak medium-density cream matrix cream and sub-angular. Flint gravel at 11.5m and 12.1m, 12.5m to 13.15m and 15.5m. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated)) 11.50 - 11.70 Orange staining		SECK	
10.50-10.60	D											
11.00-11.45	SPT	5,5,6 8,8,8 N=30 (S)										
11.70-11.80	D											
12.50-12.95	SPT	2,2,9 7,8,9 N=33 (S)						(5.30)			SECK	
13.50-13.60	D											
14.00	SPT	7,7,11 9,15,15 N=50/ 275mm (S)										
14.90-15.00	D											
15.50-15.78	SPT	8,12,13 13,12,12 N=50/ 280mm (S)					23.91	15.50	Borehole terminated at 15.5m bgl		END	

Boring Progress						Water Strikes					
Date	Time	Depth	Casing Dpt	Dia. (mm)	Water Dpt	Date	Time	Strike	Minutes	Standing	Casing
				125							
Chiselling				Water Added		General Remarks Hole terminated at 15.5m bgl Handpit terminated at 1.50m bgl					
From	To	Hours	Tool	From	To						
Scale 1:62.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

17 WSP BH LOG 70012984 - NORTH STREET, READING.GPJ WSPTEMPLATE7 00.GDT 3/3/20

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200	BOREHOLE LOG		Hole No. BH102
	Project North Street		Sheet 1 of 2
Job No 70012984	Client Reading Borough Council		Date 13-01-20 13-01-20
Contractor / Driller ADP Group Limited	Method/Plant Used Comacchio 305	Logged By EJ	Co-Ordinates (470955 173682) E 470907.27 N 173657.24
		Ground Level (m) 39.52	

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P Pen (kN/m2)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
0.00-0.50	B						39.47	0.05	CONCRETE. Paving slab.		CONC	
0.20	D		0									
0.20-0.40	ES						39.02	0.50	Brown sandy gravelly CLAY with occasional rootlets and rare metal fragments. Gravel is fine to coarse of flint, chalk and brick. (MADE GROUND)		CMG	
0.50-1.00	B		0									
0.50	D											
0.60-0.70	ES		0					(1.10)	Soft yellowish brown sandy CLAY. (ALLUVIUM)		ALV	
1.50	SPT	2.4.7 7,6,6 N=26 (S)					37.92	1.60				
								(1.05)	Medium dense to dense pale yellowish brown slightly clayey sandy fine to coarse subangular to rounded GRAVEL of flint. (TAPLOW GRAVELS)		TG	
1.60-2.60	B											
2.00	SPT	5,6,8 8,7,8 N=31 (S)	0				36.87	2.65	2.40 - 2.50 Dark orangish brown			
2.80-2.90	D								CHALK recovered as yellowish cream coloured clayey matrix with fine to coarse subangular to subrounded gravel sized clasts. Clasts are very weak medium-density cream with occasional dark orangish brown staining on fracture surface. Matrix is cream with rare orange staining. Rinded nodular flint cobble at 3.40m bgl. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
3.00-3.45	SPT	2,5,8 7,7,6 N=28 (S)						(1.35)				
3.50-3.60	D						35.52	4.00				
4.00-4.50	SPT	1,2,3 3,2,3 N=11 (S)	0					(1.00)	CHALK recovered clay matrix with fine to coarse subangular gravel sized clasts. Clasts are very weak to weak medium-density cream. Matrix is cream. Nodular rinded flint gravel 4.0m to 4.5m potential cobble broken up. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
4.50-4.60	D						34.52	5.00				
5.00-5.45	SPT	2,2,4 5,5,6 N=20 (S)							CHALK recovered as clay matrix with fine to coarse subangular gravel sized clasts. Clasts are weak none medium and high density cream with rare black specks. Matrix is cream rare orangish brown staining. Rinded nodular flint cobble 7.3m to 7.4m. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))			
6.00-6.10	D											
6.50-6.95	SPT	1,2,3 3,3,6 N=15 (S)						(4.00)			SECK	
7.50-7.60	D								7.30 - 7.50 Orangish brown staining			
8.00-8.45	SPT	2,3,4 4,3,6 N=17 (S)										
8.80-8.90	D						30.52	9.00			SECK	
									CHALK recovered as clay matrix with fine to coarse subangular gravel sized clasts. Gravel is very weak to weak medium-density cream with rare black specks and sub-angular. Rinded nodular flint at 9.50m, 10.2m and 12.0m (cobble). (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))			

Boring Progress						Water Strikes					
Date	Time	Depth	Casing Dpt	Dia. (mm)	Water Dpt	Date	Time	Strike	Minutes	Standing	Casing
13-01-20	06.00										
13-01-20	16.05	2.00	1.50		Dry						
14-01-20	07.15	2.00	1.50		Dry						
15-01-20	12.35										
Chiselling				Water Added		General Remarks Hole terminated at 17.0m bgl Handpit to 1.50m bgl					
From	To	Hours	Tool	From	To						
Scale 1:62.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

17 WSP BH LOG 70012984 - NORTH STREET, READING.GPJ WSPTEMPLATE7 00.GDT 3/3/20

17 WSP BH LOG 70012984 - NORTH STREET, READING.GPJ WSPTEMPLATE7 00.GDT 3/3/20

WSP WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200		BOREHOLE LOG					Hole No. BH102					
		Project North Street					Sheet 2 of 2					
Job No 70012984		Client Reading Borough Council					Date 13-01-20 13-01-20					
Contractor / Driller ADP Group Limited		Method/Plant Used Comacchio 305		Logged By EJ		Co-Ordinates (470955 173682) E 470907.27 N 173657.24		Ground Level (m) 39.52				
SAMPLES & TESTS							STRATA				Install / Backfill	
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P Pen (kN/m2)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
9.50-9.95	SPT	4,6,7 7,7,7 N=28 (S)							CHALK recovered as clay matrix with fine to coarse subangular gravel sized clasts. Gravel is very weak to weak medium-density cream with rare black specks and sub-angular. Rinded nodular flint at 9.50m, 10.2m and 12.0m (cobble). (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated)) (<i>continued</i>)		SECK	
10.50-10.60	D							(3.80)				
11.00-11.45	SPT	3,5,5 7,8,6 N=26 (S)										
12.20-12.30	D											
12.50-12.95	SPT	4,6,7 7,7,7 N=28 (S)					26.72	12.80				
								(1.20)	CHALK recovered as clay matrix with fine to coarse angular gravel sized clasts. Clasts are very weak to weak medium and high density cream. Matrix is cream rare pale orange staining. Rinded flint at 13.60m bgl. (Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
13.70-13.80	D						25.52	14.00				
14.00-14.45	SPT	4,6,7 9,11,9 N=36 (S)							CHALK recovered as clay matri with gravel sized clasts. Gravel is extremely weak to very weak medium-density cream and sub-angular. Flint at 14.00m bgl, 15.10m bgl, 16.40m bgl and 16.90m bgl. Matrix is cream with rare orange staining.(Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))			
14.60-14.70	D								14.70 - 14.90 Rare orange / brown staining			
								(3.00)			SECK	
15.50-15.95	SPT	5,6,7 8,9,12 N=36 (S)										
16.00-16.10	D								16.60 - 16.70 Weak high density chalk			
17.00-17.50	SPT	8,8,9 8,17,12 N=46 (S)					22.52	17.00	Borehole terminated at 17.0m bgl		END	
		</										

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200		BOREHOLE LOG		Hole No. BH103	
Project North Street		Sheet 1 of 2			
Job No 70012984		Client Reading Borough Council		Date 20-01-20 20-01-20	
Contractor / Driller ADP Group Limited		Method/Plant Used Comacchio 305		Logged By EJ	
Co-Ordinates (470955 173682) E 470916.42 N 173671.27		Ground Level (m) 39.55			

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P Pen (kN/m2)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
							39.35	0.20	Reinforced CONCRETE.		CONC	
							39.20	0.35	Red and brown sandy fine to coarse subangular to subrounded GRAVEL of flint. With concrete and cobble size bricks. (MADE GROUND)		GMG	
0.40-0.50	ES		0					(0.75)	Very dark grey gravelly CLAY with numerous brick and tile fragments. Gravel is fine to coarse angular to subrounded of flint. (MADE GROUND)		CMG	
0.50-1.00	B						38.45	1.10	Dark brown sandy slightly gravelly CLAY. Gravel is fine to coarse angular to subrounded of flint. Reworked natural. (MADE GROUND)		CMG	
1.10-1.40	D		0				38.15	1.40	Soft brown gravelly slightly sandy CLAY. Gravel is medium and coarse angular to subangular of flint. (ALLUVIUM)		ALV	
1.40-1.90	B		0					(0.50)	Medium density yellowish cream clayey gravelly fine to coarse SAND. Gravel is fine to coarse angular of flint and sub angular to sub rounded of chalk. (ALLUVIUM)		ALV	
1.50-1.60	ES						37.65	1.90	Stiff locally firm cream and yellowish brown gravelly slightly sandy CLAY. Gravel is fine to coarse subangular to subrounded of chalk and rare angular to sub angular of flint. Chalk clasts high density very weak, matrix cream with rare black speckles. (ALLUVIUM)		ALV	
1.50-1.95	SPT	1,2,1 2,2,3 N=8 (S)						(0.90)	Firm pale brown gravelly sandy CLAY. Gravel is fine and medium angular to subrounded of flint and chalk. (ALLUVIUM)		ALV	
1.70-1.80	D		0					(1.10)	Medium dense pale brown clayey sandy fine to coarse angular to subangular GRAVEL of flint with rare fine chalk. (ALLUVIUM)		ALV	
2.00	SPT	2,2,3 3,3,3 N=12 (S)					36.75	2.80	CHALK recovered as clay matrix with fine to coarse subangular gravel sized clasts. Clasts are very weak none low and medium density cream with rare black specks. Matrix is cream. Rinded flint cobble at 6.30 bgl.(Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
2.60-2.70	D							(1.20)	CHALK recovered as clay matrix with fine to coarse subangular gravel sized clasts. Clasts are very weak medium-density cream with occasional black specks. Matrix is cream. Rinded flint cobble at 8.30m bgl. flint gravel at 8.70m bgl. rinded nodular flint cobble at 9.30m bgl. Occasional orange staining.(Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated))		SECK	
2.80-3.90	B							(1.30)	8.00 - 8.30 No recovery		SECK	
3.00-3.45	SPT	3,3,3 3,3,3 N=12 (S)	0				35.65	3.90				
3.50-3.60	D											
4.00-4.45	SPT	1,1,2 2,3,2 N=9 (S)										
4.50-4.60	D						34.45	5.10				
5.00	SPT	2,2,3 4,4,3 N=14 (S)						(0.80)				
5.10-5.90	B						33.65	5.90				
6.10-6.20	D											
6.50	SPT	2,3,3 2,2,1 N=8 (S)					31.55	8.00				
8.00-8.45	SPT	3,2,3 3,2,3 N=11 (S)						(1.30)				
9.00-9.10	D						30.25	9.30				

Boring Progress						Water Strikes					
Date	Time	Depth	Casing Dpt	Dia. (mm)	Water Dpt	Date	Time	Strike	Minutes	Standing	Casing
20-01-20	06.10					20-01-20		3.20	20	2.95	
21-01-20	16.35										
Chiselling			Water Added			General Remarks Hole terminated at 15.50m bgl Handpit terminated at 1.50m bgl					
From	To	Hours	Tool	From	To						
Scale 1:62.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

17 WSP BH LOG 70012984 - NORTH STREET, READING.GPJ WSPTEMPLATE7 00.GDT 3/3/20

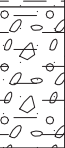
 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200	BOREHOLE LOG			Hole No. BH103	
	Project North Street			Sheet 2 of 2	
Job No 70012984		Client Reading Borough Council			Date 20-01-20 20-01-20
Contractor / Driller ADP Group Limited		Method/Plant Used Comacchio 305	Logged By EJ	Co-Ordinates (470955 173682) E 470916.42 N 173671.27	Ground Level (m) 39.55

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m2)	P Pen (kN/m2)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
9.50-9.95	SPT	3,4,4 5,4,4 N=17 (S)							CHALK recovered as clay matrix with gravel sized clasts. Gravel is very weak none low and medium density cream and sub-angular. Broken rinded flint cobble at 14.70m and 11.40m, angular flint gravel at 15.50m, rare flint. 9.90m rinded nodular flint and at 13.20, at 10.70m. Matrix cream.(Seaford Chalk Formation And Newhaven Chalk Formation (undifferentiated)) (continued) 11.00 - 11.20 No recovery		SECK	
10.50-10.60	D											
11.00-11.45	SPT	4,4,5 5,6,5 N=21 (S)										
11.90-12.00	D											
12.50-12.95	SPT	5,6,6 6,6,7 N=25 (S)						(6.20)				
13.40-13.50	D								14.00 - 14.70 No recovery		SECK	
14.00-14.45	SPT	5,6,7 8,7,11 N=33 (S)										
15.20-15.30	D											
15.50	SPT	17,8,23 17,10 N=50/ 180mm (S)					24.05	15.50	Borehole terminated at 15.5m bgl		END	

Boring Progress						Water Strikes					
Date	Time	Depth	Casing Dpt	Dia. (mm)	Water Dpt	Date	Time	Strike	Minutes	Standing	Casing
20-01-20	17.00	14.00	14.00	125	7						
21-01-20	07.15	14.00	14.00		7						
Chiselling				Water Added		General Remarks					
From	To	Hours	Tool	From	To						
						Hole terminated at 15.50m bgl Handpit terminated at 1.50m bgl					
Scale 1:62.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

17 WSP BH LOG 70012984 - NORTH STREET, READING.GPJ WSPTEMPLATE7 00.GDT 3/3/20

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200	WINDOW SAMPLE LOG		Hole No. WS101	
	Project North Street		Sheet 1 of 1	
Job No 70012984	Client Reading Borough Council		Date 16-01-20 17-01-20	
Contractor / Driller ADP Group Limited	Method/Plant Used Comacchio 305	Logged By EJ	Co-Ordinates (470955 173682) E 470883.71 N 173656.00	Ground Level (m) 39.93

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kNm ²)	P Pen (kNm ²)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
0.20-0.40	ES	.	0					(0.50)	Soft very dark brown slightly sandy slightly gravelly CLAY with numerous rootlets occasional brick fragments. Gravel is fine to coarse subangular to subrounded of flint. (MADE GROUND)		CMG	
0.50-1.00	B	.	0				39.43	0.50	Soft to firm brown sandy CLAY with occasional rootlets. (ALLUVIUM)		ALV	
0.60	D	.	0									
1.50-2.30	B (S)	2.2.1 4.4.3 N=12.	0					(1.80)				
2.00	(S)	2.7.6 6.7.8 N=27.					37.63	2.30	Cream and pale brown slightly clayey slightly sandy GRAVEL. Gravel fine to coarse subrounded to subangular flint and chalk. (ALLUVIUM)		ALV	
2.30-3.00	B	.	0					(0.70)				
							36.93	3.00	Borehole terminated at 3m bgl to complete downhole permeability test		END	
3.00	(S)	3.2.2 1.1.1 N=5.										

Hole Diameter			Recovery			Water Strikes					
Depth	Diameter (mm)	Remarks	Core Top (m)	Core Base (m)	% Recovery	Date	Time	Strike	Minutes	Standing	Casing
3.00	102	102									
						General Remarks Hole terminated at 3.0m bgl to complete downhole permeability test Handpit terminated at 1.50m bgl At start of shift water at 2.70m bgl					
Scale 1:37.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200		WINDOW SAMPLE LOG		Hole No. WS102	
				Sheet 1 of 1	
Job No 70012984		Client Reading Borough Council		Date 17-01-20 17-01-20	
Contractor / Driller ADP Group Limited		Method/Plant Used Comacchio 305		Logged By EJ	
				Co-Ordinates (470955 173682) E 470905.51 N 173666.17	
				Ground Level (m) 39.54	

SAMPLES & TESTS							STRATA					Install Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kN/m ²)	P.Pen (kN/m ²)	Water	Elev. (m)	Depth (Thickness)	Description	Legend	Geology	Dia. mm
0.25-0.75	B	.					39.50	0.04	CONCRETE		CONC	
0.35-0.45	ES	.					39.35	0.19	CONCRETE		CONC	
0.40		.					39.29	0.25	CONCRETE		CONC	
0.50	D	.	0						Brown fine subangular GRAVEL of flint. (MADE GROUND)		GMG	
									Very soft very dark grey very gravelly CLAY with occasional fine and medium gravel sized brick fragments. Gravel fine to medium subangular of flint. (MADE GROUND)			
									0.25 Red brick (cobble sized)			
											CMG	
1.30		.	0									
1.40-1.50	ES	.							1.30 - 1.50 Coal fragments			
1.50	D (S)	1,1,4 5,5,6 N=20.	0									
1.50-1.95	SPT (S)	1,1,4 5,5,6 N=20.	0									
2.00	(S)	1,1,2 2,2,2 N=8.	0				37.54	2.00	1.80 Bone fragment			
									Firm brown gravelly sandy CLAY. Gravel fine and medium subangular of flint. (ALLUVIUM)		ALV	
3.00	(S)	1,1,2 2,2,3 N=9.	0									
							35.94	3.60				
3.80-4.00	D	.							Pale brown slightly clayey gravelly SAND. Gravel fine to coarse subrounded to angular of flint. (ALLUVIUM)		ALV	
4.00-4.45	SPT (S)	1,4,3 3,2,3 N=11.					35.54	4.00	Borehole terminated at 4.0m bgl due to collapse of borehole		END	

Hole Diameter			Recovery			Water Strikes					
Depth	Diameter (mm)	Remarks	Core Top (m)	Core Base (m)	% Recovery	Date	Time	Strike	Minutes	Standing	Casing
4.00	102	102									
						General Remarks Hole terminated at 4.0m bgl due to collapse Handpit terminated at 1.50m bgl At end of borehole water standing at 2.70m bgl					
Scale 1:37.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									

 WSP 1 Queens Street Bristol BS2 0HQ Telephone: 0117 930 6200	WINDOW SAMPLE LOG		Hole No. WS103	
	Project North Street		Sheet 1 of 1	
Job No 70012984	Client Reading Borough Council		Date 17-01-20 17-01-20	
Contractor / Driller ADP Group Limited	Method/Plant Used Comacchio 305	Logged By EJ	Co-Ordinates (470955 173682) E 470920.92 N 173659.65	Ground Level (m) 39.73

SAMPLES & TESTS							STRATA					Install / Backfill
Depth	Type	Test Result	PID (ppmV)	HSV (kNm ²)	P Pen (kNm ²)	Water	Elev. (m)	Depth (Thick-ness)	Description	Legend	Geology	Dia. mm
0.30-0.40	ES	.	0				39.54	0.19	ASPHALT.		TARMAC	
							39.48	0.25	CONCRETE.		CONC	
							39.43	0.30	0.19 Re bar		CMG	
0.50	D	.					(0.30)		Stiff brown gravelly CLAY with rare cobble size bricks. Gravel is fine to coarse angular to subangular of flint concrete and brick. (MADE GROUND)		CMG	
0.70-1.20	B	.					39.13	0.60				
							(0.70)		Brown and cream gravelly CLAY with rare brick fragments. Gravel is fine and medium angular to subangular of flint and chalk. (MADE GROUND)		ALV	
									Soft brown sandy slightly gravelly CLAY. Gravel is fine and medium subangular of flint. (ALLUVIUM)			
1.20-1.30	ES	.	0				38.43	1.30				
							(0.30)		Brown very gravelly CLAY. Gravel is fine to coarse angular to subangular of flint. (ALLUVIUM)		ALV	
1.50	(S)	1,1,1 1,2,2 N=6.					38.13	1.60				
1.70-1.80	D	.					(0.30)		Loose brown slightly clayey sandy fine to coarse angular to subrounded GRAVEL of flint. (ALLUVIUM)		ALV	
							37.83	1.90				
2.00-3.00	B (S)	2,4,3 4,5,3 N=15.							Medium density pale brown slightly clayey sandy fine to coarse angular to subrounded GRAVEL of flint and rare chalk. (ALLUVIUM)			
							(1.10)		2.45 - 2.55 Chalk gravel very clayey and cream		ALV	
							36.73	3.00	2.90 - 3.00 Very clayey and cream			
									Borehole terminated at 3.0m bgl		END	

Hole Diameter			Recovery			Water Strikes					
Depth	Diameter (mm)	Remarks	Core Top (m)	Core Base (m)	% Recovery	Date	Time	Strike	Minutes	Standing	Casing
3.00	102	102									
						General Remarks Hole terminated at 3.00m bgl to ensure a monitoring well could be installed within the gravels Hole dry					
Scale 1:37.5		Notes: All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.									



Project: North Street
Code: 70012984
Client:

Downhole permeability TEST

TEST DATA

Pit reference	WS101
Pit depth (m)	2.18
Hand Pit Diameter(m)	0.34
Borehole Diameter (m)	0.10
Area of hand pit (m2)	0.09
Area of borehole (m2)	0.08
Depth to standing water (m)	0.81

Test 1

Time (min)	Depth (m)
0.0	0.81
0.5	0.88
1.0	0.90
1.5	0.92
2.0	0.95
2.5	0.96
3.0	0.98
4.0	1.01
5.0	1.04
6.5	1.08
7.0	1.09
8.0	1.12
9.0	1.13
11.0	1.17
15.0	1.23
21.5	1.30
32.5	1.40
45.5	1.51
59.0	1.63
71.0	1.71
79.0	1.75
90.0	1.80
105.0	1.85
114.0	1.88
129.0	1.91
148.0	1.95
160.0	1.96
171.0	1.97
193.0	2.00
212.0	2.01

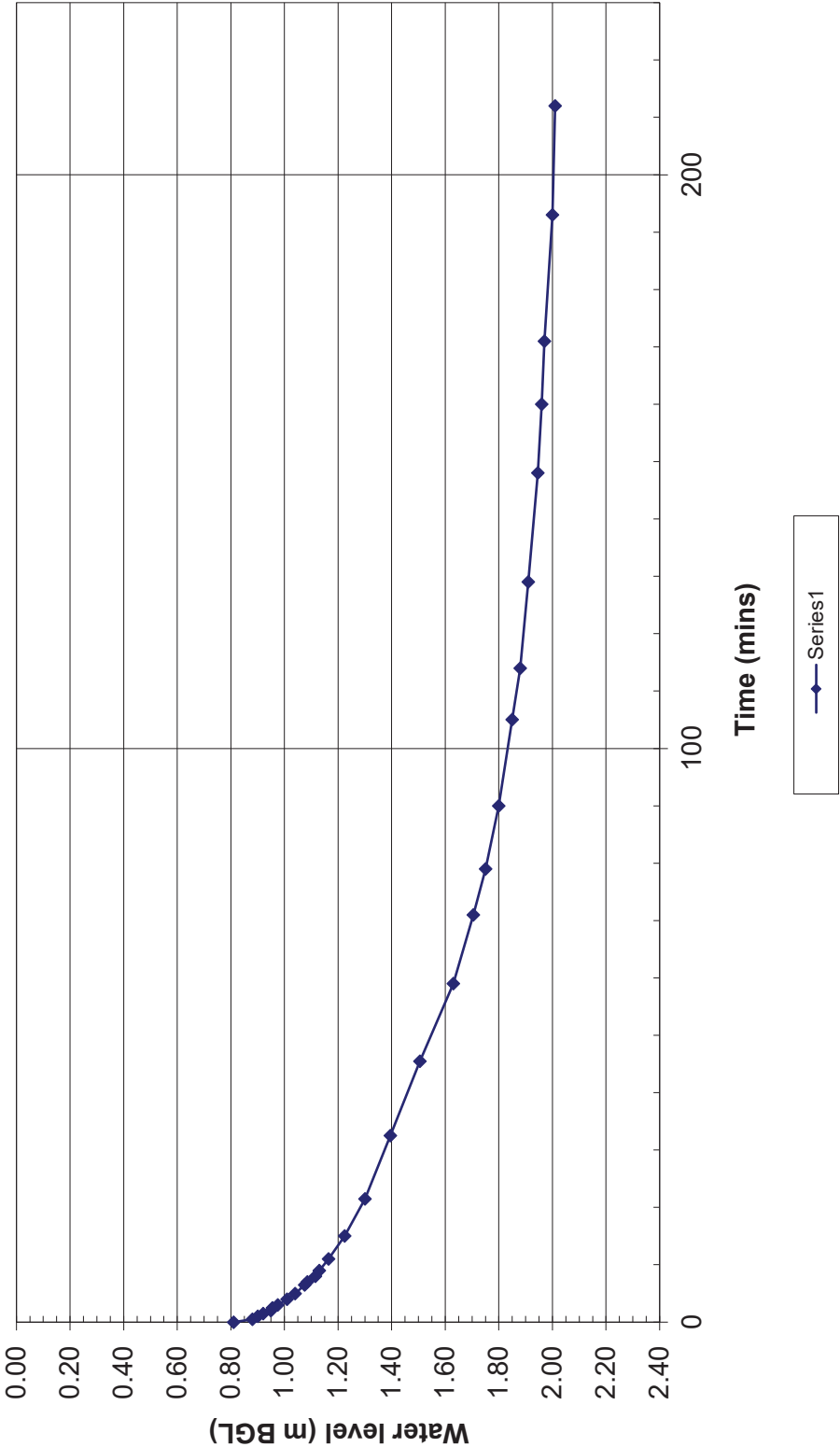
Max. depth (m)	2.18
Effective depth (m)	0.81
Effective drop (m)	1.37
75% effective depth (m)	1.84
50% effective depth (m)	1.50
25% effective depth (m)	1.15
t75 (min)	103.00
t50 (min)	45.00
t25 (min)	10.00
Vp 75-25	0.06
ap 50	0.2179009
tp 75-25	93.00

Soil infiltration rate (m/s)	4.83E-05		
Soil infiltration rate (mm/hr)	1.74E+02		

Notes:

1	Blue cells require input data
2	Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
3	First line of table must be depth at time = 0 sec

WS101





Project: North Street
Code: 70012984

Downhole Permeability TEST

TEST DATA

Pit reference	WS103
Pit depth (m)	3.00
Borehole diameter (m)	0.05
Pit area m ²	0.001963495
Pit perimeter m	0.157079633
Depth to standing water (m)	0.98

Test 1

Time (min)	Depth (m)
0.0	0.98
0.3	1.12
0.7	1.24
1.0	1.41
1.3	1.63
1.7	1.73
2.0	1.84
2.5	1.95
3.0	2.04
3.5	2.11
4.0	2.16
4.5	2.19
5.0	2.23
5.5	2.27
6.0	2.30
6.5	2.33
7.0	2.35
8.0	2.40
9.5	2.45
10.0	2.46
11.0	2.49
12.2	2.51
14.0	2.53
15.0	2.55
16.0	2.56
17.0	2.58
18.0	2.59
19.5	2.61
20.0	2.61
25.0	2.67
29.0	2.71
36.0	2.74
49.0	2.77
61.0	2.79

Max. depth (m) 3.00

Effective depth (m) 0.98

Effective drop (m) 2.02

75% effective depth (m) 2.50

50% effective depth (m) 1.99

25% effective depth (m) 1.49

t75 (min) 11.60

t50 (min) 2.75

t25 (min) 1.15

Vp 75-25 0.001983

ap 50 0.158650429

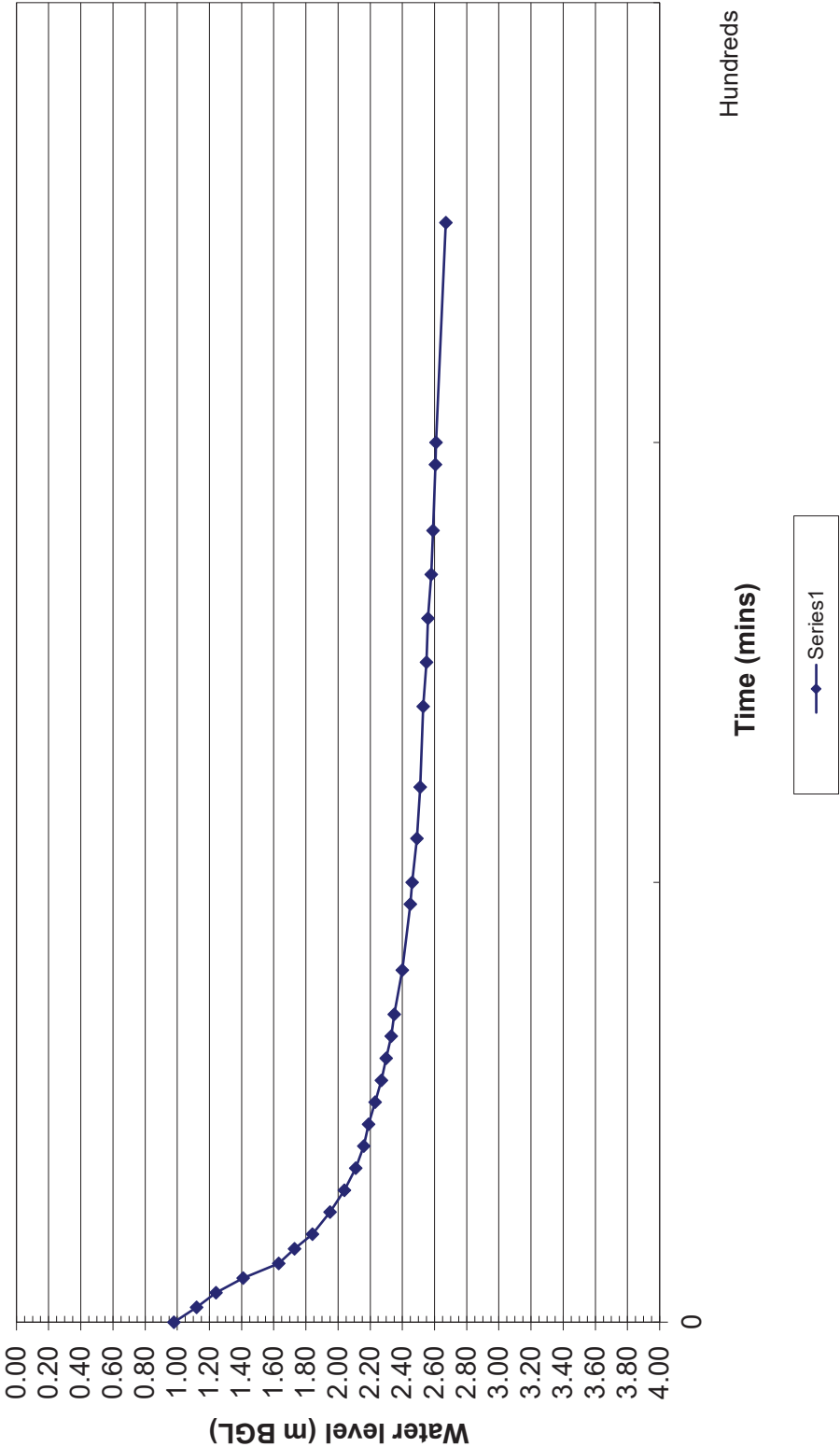
tp 75-25 10.45

Soil infiltration rate (m/s)	1.99E-05		
Soil infiltration rate (mm/hr)	7.18E+01		

Notes:

- Blue cells require input data
- Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
- First line of table must be depth at time = 0 sec

WS103



APPENDIX D

Asset Location Search Sewer Map - ALS/ALS Standard/2017_3628702



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 470911,173657

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

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
1751	n/a	n/a
1701	n/a	n/a
181B	38.5	36.63
1652	39.44	38.24
161A	n/a	n/a
1551	43.35	41.1
1402	44.41	41.28
141A	n/a	n/a
041E	n/a	n/a
041D	44.55	41.55
041C	44.5	41.5
041F	n/a	n/a
0451	43.06	42.02
0455	n/a	n/a
1453	43.69	41.86
1406	43.44	40.66
051G	n/a	n/a
051E	n/a	n/a
051F	n/a	n/a
951A	n/a	n/a
0551	36.74	34.98
1554	44.25	41.29
051C	n/a	n/a
051D	n/a	n/a
051A	44.6	41.03
9558	n/a	n/a
051B	44.07	40.63
9552	45.24	43.87
051H	n/a	n/a
1553	44.31	41.19
0555	44.07	42.09
1502	44.36	40.65
0558	44.6	41.79
9553	45.29	44.09
9559	n/a	n/a
0450	44.05	42.34
941D	n/a	n/a
941C	n/a	n/a
0462	n/a	n/a
1403	44.18	40.97
0403	44.24	41.02
0402	45.02	42.4
1404	44.11	40.93
1451	44.08	42.22
041G	n/a	n/a
041H	n/a	n/a
9403	44.2	41.3
9455	44.15	42.77
0475	n/a	n/a
041A	44.13	42.03
041B	44.5	41.84
0452	39.56	38.63
9402	44.35	41.7
9454	44.32	42.95
941A	n/a	n/a
941B	n/a	n/a
9453	44.4	43.06
9401	44.4	42.22
9452	44.36	43.14
7452	41.71	40.08
7402	41.47	38.28
7451	41.45	39.85
8451	42.54	41.01
7403	41.94	n/a
9451	44.41	43.25
8503	42.44	39.34
75JJ	n/a	n/a
8552	42.72	41.2
75JK	n/a	n/a
851D	n/a	n/a
8553	43.73	41.78
851C	n/a	n/a
8554	43.89	42.48
9566	n/a	n/a
8501	41.62	38.82
9554	44.65	43.23
7551	40.83	39.32
6551	40.75	39.46
851B	n/a	n/a
7552	40.8	38.39
7501	40.72	37.37
851A	n/a	n/a
7502	40.18	36.78
6652	38.51	36.42
6602	38.37	35.62
6601	38.49	35.58
6654	39.26	37.12
6604	39.23	36.23
6651	38.33	36.45
7553	40.02	38.9
76KJ	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
76JN	n/a	n/a
761A	n/a	n/a
771A	n/a	n/a
771B	n/a	n/a
7752	37.9	36.95
7751	38.03	36.43
76HL	n/a	n/a
7503	40.18	37.44
7554	40.12	39.27
761B	n/a	n/a
76FN	n/a	n/a
8752	n/a	37.17
8603	39.82	37.24
8602	41.18	38.42
8601	41.49	38.8
8751	37.91	37.04
9605	41.39	38.43
9655	41.34	40.04
9601	41.73	39.71
9654	41.81	40.38
7405	43.21	n/a
741A	n/a	n/a
741B	n/a	n/a
641A	n/a	n/a
741D	n/a	n/a
741C	n/a	n/a
7463	n/a	n/a
7464	n/a	n/a
7462	n/a	n/a
7401	42.06	38.84
7404	42.75	39.79
7465	n/a	n/a
9753	37.91	37.03
9701	38.07	35.13
9852	38.74	36.52
9755	38.48	36.64
9756	38.37	36.66
9754	38	36.98
9757	38.16	36.64
0751	38.24	37.06
0752	38.31	36.94
0760	38.44	36.9
1755	38.72	37.59
1754	38.43	37.53
1753	38.55	36.84
1862	38.34	34.4
1863	38.36	34.4
1761	n/a	36.29
0556	n/a	n/a
9560	43.88	40.72
0559	n/a	n/a
1556	n/a	n/a
0560	41.48	40.26
1555	n/a	n/a
0561	n/a	n/a
0651	42.03	39.38
1654	43.17	39.14
1657	42.13	39.43
1604	43.33	38.57
1656	n/a	n/a
1605	42.88	38.69
1606	n/a	n/a
1662	n/a	n/a
9651	41.04	39.67
1603	41.07	37.47
1653	39.51	38.65
06NL	n/a	n/a
9652	39.98	38.18
9604	39.96	36.78
1602	39.48	37.13
1601	39.77	36.86
1651	39.73	37.99
1702	39.32	36.22
1752	39.25	37.63
9752	37.99	37.13
9851	38.71	36.32
1801	38.37	36.13
1851	38.4	n/a
0802	n/a	n/a
0801	n/a	n/a
0851	n/a	n/a
0803	n/a	n/a
7753	38.18	36.67
7754	38.13	35.41

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



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

	Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Trunk Surface Water
	Trunk Foul
	Storm Relief
	Trunk Combined
	Bio-solids (Sludge)
	Vent Pipe
	Proposed Thames Surface Water Sewer
	Proposed Thames Surface Water Sewer
	Gallery
	Foul Rising Main
	Surface Water Rising Main
	Sludge Rising Main
	Vacuum

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans. as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.

Sewer Fittings

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

	Air Valve
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

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

	Control Valve
	Drop Pipe
	Ancillary
	Weir

End Items

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

	Outfall
	Undefined End
	Inlet

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Other Symbols

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

	Public/Private Pumping Station
	Change of characteristic indicator (C.O.C.I.)
	Invert Level
	Summit

Areas

Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

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

	Foul Sewer
	Combined Sewer
	Culverted Watercourse
	Surface Water Sewer
	Gully
	Proposed
	Abandoned Sewer

APPENDIX E

SDS Consulting		Page 1
Unit 16 Shrivenham Hundred Business ... Swindon SN6 8TZ	5332 North Street Reading ICP SuDS	
Date 26/01/2021 09:54 File	Designed by MTD Checked by	
XP Solutions Source Control 2017.1		

ICP SUDS Mean Annual Flood

Input

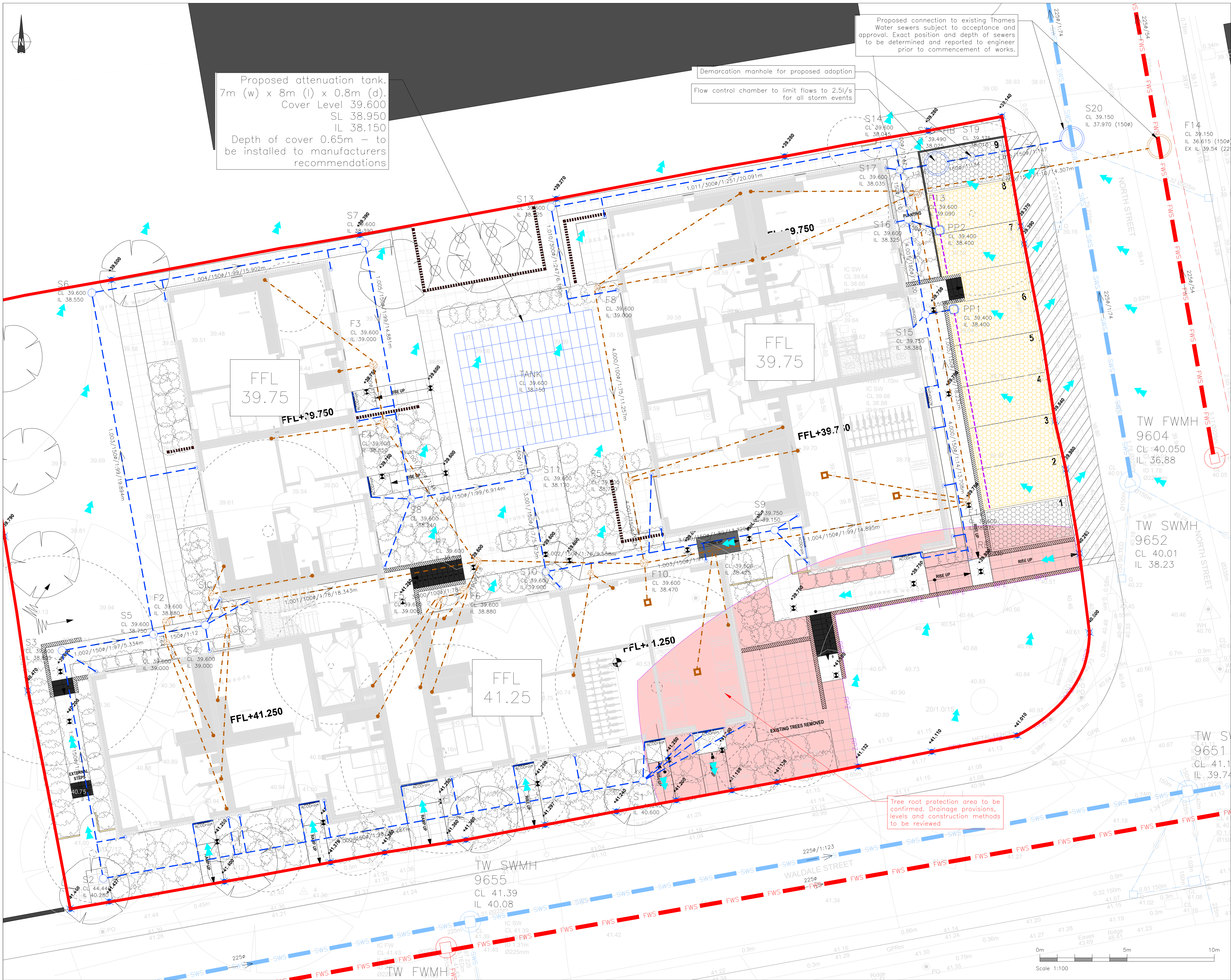
Return Period (years)	100	Soil	0.150
Area (ha)	0.212	Urban	0.000
SAAR (mm)	642	Region Number	Region 6

Results 1/s

QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.2
Q1 year	0.1
Q30 years	0.2
Q100 years	0.2

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APPENDIX F



- NOTES:
1. Drawing for information only
 2. Do not scale from this drawing
 3. Refer to Everitt architects drawing 20.20.022 'Proposed Site Plan' for site plan.
 4. Refer to GeoMap drawing BC-NSR-2511/20 entitled 'Topographical & Utility Survey 2D for the topographical survey.'
 5. This drawing is intended to provide an indication of the drainage requirements for the site and is not to be used as a final design solution.
 6. Existing drainage is indicative
 7. Cover levels are to be reviewed against proposed site levels

- KEY:
- Existing Drainage
- Existing Thames Water Foul Water Sewer
 - Existing Thames Water Surface Water Sewer
- Proposed Drainage
- Foul Water Drain
 - Surface Water Drain
 - Permeable paving outlet
 - PPG8
 - Proposed tanked permeable paving - Surface type TBC
 - Non permeable paving - surface type to match permeable paving
 - Exceedance Route Arrow

Rev	Date	Description	Initials	Check
Job Title				
NORTH STREET READING				
Drawing Title				
DRAINAGE STRATEGY				
Drawing No.				
5332-C-001				
Status				
For Planning				
Not for Construction				
Job Number	5332	Date	JAN 2021	
Scale	1:100 @ A1			
Drawn By	MTD	Checked By	LB	

APPENDIX G

SDS Consulting		Page 1
Unit 16 Shrivenham Hundred Business ... Swindon SN6 8TZ	5332 North Street Reading SW DD REV 1.0 JAN 2021	
Date 26/01/2021 10:45 File 5332 SW REV1.0 DD.MDX	Designed by MTD Checked by	
XP Solutions	Network 2017.1.1	

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)	30	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	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

Network Design Table for Storm

« - Indicates pipe capacity < flow

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
1.000	31.441	0.320	98.3	0.017	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	13.279	1.475	9.0	0.001	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	5.334	0.055	97.0	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	3.007	0.250	12.0	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	19.894	0.200	99.5	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	15.902	0.160	99.4	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	14.881	0.150	99.2	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	6.914	0.070	98.8	0.008	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)
1.000	50.00	5.52	40.600	0.017	0.0	0.0	0.0	1.01	17.9	2.3
1.001	50.00	5.58	40.280	0.019	0.0	0.0	0.0	3.38	59.7	2.5
1.002	50.00	5.67	38.805	0.021	0.0	0.0	0.0	1.02	18.0	2.9
2.000	50.00	5.02	39.000	0.007	0.0	0.0	0.0	2.92	51.6	0.9
1.003	50.00	6.00	38.750	0.033	0.0	0.0	0.0	1.01	17.8	4.4
1.004	50.00	6.26	38.550	0.036	0.0	0.0	0.0	1.01	17.8	4.9
1.005	50.00	6.51	38.390	0.041	0.0	0.0	0.0	1.01	17.8	5.5
1.006	50.00	6.62	38.240	0.048	0.0	0.0	0.0	1.01	17.9	6.6

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Shrivenham Hundred Business ...
Swindon SN6 8TZ

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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
3.000	13.329	0.150	88.9	0.016	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	5.473	0.830	6.6	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	1.852	0.018	102.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.008	4.604	0.001	4604.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	3.601	0.001	3601.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.010	6.180	0.025	247.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.011	20.091	0.080	251.1	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.012	1.475	0.010	147.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	13.708	0.950	14.4	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	1.658	0.020	82.9	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	5.514	0.055	100.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.000	1.893	0.075	25.2	0.004	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	2.888	0.290	10.0	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.013	2.161	0.010	216.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.014	2.006	0.015	133.7	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)
3.000	50.00	5.21	39.150	0.016	0.0	0.0	0.0	1.07	18.9	2.1
3.001	50.00	5.23	39.000	0.020	0.0	0.0	0.0	3.95	69.8	2.7
1.007	50.00	6.65	38.170	0.068	0.0	0.0	0.0	0.99	17.5	9.2
1.008	50.00	7.20	38.152	0.068	0.0	0.0	0.0	0.14	2.5«	9.2
1.009	50.00	7.44	38.151	0.068	0.0	0.0	0.0	0.25	17.9	9.2
1.010	50.00	7.54	38.150	0.068	0.0	0.0	0.0	1.00	70.4	9.2
1.011	50.00	7.88	38.125	0.078	0.0	0.0	0.0	0.99	69.8	10.6
1.012	50.00	7.90	38.045	0.078	0.0	0.0	0.0	1.29	91.4	10.6
4.000	50.00	5.09	39.330	0.006	0.0	0.0	0.0	2.67	47.1	0.9
5.000	50.00	5.03	38.400	0.007	0.0	0.0	0.0	1.10	19.5	0.9
4.001	50.00	5.18	38.380	0.013	0.0	0.0	0.0	1.00	17.7	1.8
6.000	50.00	5.02	38.400	0.004	0.0	0.0	0.0	2.01	35.6	0.6
4.002	50.00	5.19	38.325	0.022	0.0	0.0	0.0	3.21	56.8	2.9
1.013	50.00	7.94	38.035	0.100	0.0	0.0	0.0	1.07	75.3	13.5
1.014	50.00	7.97	38.025	0.100	0.0	0.0	0.0	0.87	15.3	13.5

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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
1.015	5.869	0.040	146.7	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)
1.015	50.00	8.09	38.010	0.100	0.0	0.0	0.0	0.83	14.6	13.5

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.017	0.017	0.017
1.001	User	-	100	0.001	0.001	0.001
1.002	User	-	100	0.003	0.003	0.003
2.000	User	-	100	0.005	0.005	0.005
	User	-	100	0.002	0.002	0.007
1.003	User	-	100	0.005	0.005	0.005
1.004	User	-	100	0.004	0.004	0.004
1.005	User	-	100	0.004	0.004	0.004
1.006	User	-	100	0.008	0.008	0.008
3.000	User	-	100	0.016	0.016	0.016
3.001	User	-	100	0.004	0.004	0.004
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
1.011	User	-	100	0.010	0.010	0.010
1.012	-	-	100	0.000	0.000	0.000
4.000	User	-	100	0.006	0.006	0.006
5.000	User	-	100	0.007	0.007	0.007
4.001	-	-	100	0.000	0.000	0.000
6.000	User	-	100	0.004	0.004	0.004
4.002	User	-	100	0.004	0.004	0.004
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.100	0.100	0.100

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)
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1.015	S20	39.150	37.970	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

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<u>Simulation Criteria for Storm</u>		
Rainfall Model	FSR	Profile Type Summer
Return Period (years)	30	Cv (Summer) 0.750
Region England and Wales		Cv (Winter) 0.840
M5-60 (mm)	20.000	Storm Duration (mins) 30
Ratio R	0.400	
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S18-HB, DS/PN: 1.014, Volume (m³): 1.7

Unit Reference	MD-SHE-0075-2500-1000-2500
Design Head (m)	1.000
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	38.025
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.5
Flush-Flo™	0.307	2.5
Kick-Flo®	0.627	2.0
Mean Flow over Head Range	-	2.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.1	1.200	2.7	3.000	4.1	7.000	6.2
0.200	2.4	1.400	2.9	3.500	4.5	7.500	6.4
0.300	2.5	1.600	3.1	4.000	4.7	8.000	6.6
0.400	2.5	1.800	3.3	4.500	5.0	8.500	6.8
0.500	2.4	2.000	3.4	5.000	5.3	9.000	7.0
0.600	2.1	2.200	3.6	5.500	5.5	9.500	7.1
0.800	2.3	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.9	6.500	6.0		

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Storage Structures for Storm

Cellular Storage Manhole: TANK, DS/PN: 1.009

Invert Level (m) 38.151 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	49.0	49.0	0.801	0.0	71.4
0.800	49.0	71.4			

Porous Car Park Manhole: PP1, DS/PN: 5.000

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 4.8
 Membrane Percolation (mm/hr) 1000 Length (m) 12.0
 Max Percolation (l/s) 16.0 Slope (1:X) 0.0
 Safety Factor 2.0 Depression Storage (mm) 5
 Porosity 0.30 Evaporation (mm/day) 3
 Invert Level (m) 38.950 Cap Volume Depth (m) 0.300

Porous Car Park Manhole: PP2, DS/PN: 6.000

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 4.8
 Membrane Percolation (mm/hr) 1000 Length (m) 7.2
 Max Percolation (l/s) 9.6 Slope (1:X) 0.0
 Safety Factor 2.0 Depression Storage (mm) 5
 Porosity 0.30 Evaporation (mm/day) 3
 Invert Level (m) 38.950 Cap Volume Depth (m) 0.300

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1 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 Coefficient 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 Storage Structures 3
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
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
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 10, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	1	+0%					40.637
1.001	S2	15 Winter	1	+0%					40.301
1.002	S3	15 Winter	1	+0%	100/15 Summer				38.850
2.000	S4	15 Winter	1	+0%	100/15 Summer				39.017
1.003	S5	15 Winter	1	+0%	100/15 Summer				38.802
1.004	S6	15 Winter	1	+0%	30/15 Summer				38.604
1.005	S7	15 Winter	1	+0%	30/15 Summer				38.448
1.006	S8	15 Winter	1	+0%	30/15 Summer				38.306
3.000	S9	15 Winter	1	+0%					39.185
3.001	S10	15 Winter	1	+0%					39.021
1.007	S11	15 Winter	1	+0%	30/15 Summer				38.271
1.008	J1	15 Winter	1	+0%					38.253
1.009	TANK	60 Winter	1	+0%	30/30 Winter				38.238
1.010	J2	60 Winter	1	+0%					38.239
1.011	S13	60 Winter	1	+0%	30/30 Winter				38.239
1.012	S14	60 Winter	1	+0%	30/15 Summer				38.237
4.000	RE	15 Winter	1	+0%					39.345
5.000	PP1	15 Winter	1	+0%	30/60 Winter				38.431
4.001	S15	15 Summer	1	+0%	30/60 Winter				38.412

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

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
1.000	S1	-0.113	0.000	0.14		2.3	OK	
1.001	S2	-0.129	0.000	0.05		2.5	OK	
1.002	S3	-0.105	0.000	0.20		2.9	OK	
2.000	S4	-0.133	0.000	0.03		0.9	OK	
1.003	S5	-0.098	0.000	0.26		4.3	OK	
1.004	S6	-0.096	0.000	0.28		4.7	OK	
1.005	S7	-0.092	0.000	0.31		5.1	OK	
1.006	S8	-0.084	0.000	0.39		6.0	OK	
3.000	S9	-0.115	0.000	0.13		2.2	OK	
3.001	S10	-0.129	0.000	0.05		2.6	OK	
1.007	S11	-0.049	0.000	0.78		8.5	OK	
1.008	J1	-0.049	0.000	0.79		8.6	OK*	
1.009	TANK	-0.213	0.000	0.04		2.0	OK	
1.010	J2	-0.211	0.000	0.03		2.0	OK*	
1.011	S13	-0.186	0.000	0.04		2.3	OK	
1.012	S14	-0.108	0.000	0.05		2.6	OK	
4.000	RE	-0.135	0.000	0.02		0.9	OK	
5.000	PP1	-0.119	0.000	0.07		0.8	OK	
4.001	S15	-0.118	0.000	0.08		1.1	OK	

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

US/MH		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water
PN	Name								Level (m)
6.000	PP2	15	Winter	1	+0%	30/60	Winter		38.419
4.002	S16	30	Winter	1	+0%	30/60	Winter		38.351
1.013	S17	60	Winter	1	+0%	30/15	Summer		38.237
1.014	S18-HB	60	Winter	1	+0%	1/15	Summer		38.237
1.015	S19	60	Winter	1	+0%				38.054

		Surcharged		Flooded		Pipe			
US/MH		Depth	Volume	Flow /	Overflow	Pipe		Level	
PN	Name	(m)	(m³)	Cap.	(l/s)	(l/s)	Status	Exceeded	
6.000	PP2	-0.131	0.000	0.03		0.5	OK		
4.002	S16	-0.124	0.000	0.07		2.3	OK		
1.013	S17	-0.098	0.000	0.05		2.6	OK		
1.014	S18-HB	0.062	0.000	0.21		2.3	SURCHARGED		
1.015	S19	-0.106	0.000	0.19		2.3	OK		

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30 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 Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
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
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440	Summer and Winter
Return Period(s) (years)	1, 30, 100	
Climate Change (%)	0, 10, 40	

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	30	+10%					40.664
1.001	S2	15 Winter	30	+10%					40.316
1.002	S3	15 Winter	30	+10%	100/15 Summer				38.903
2.000	S4	15 Winter	30	+10%	100/15 Summer				39.028
1.003	S5	15 Winter	30	+10%	100/15 Summer				38.887
1.004	S6	15 Winter	30	+10%	30/15 Summer				38.800
1.005	S7	15 Winter	30	+10%	30/15 Summer				38.716
1.006	S8	15 Winter	30	+10%	30/15 Summer				38.620
3.000	S9	15 Winter	30	+10%					39.210
3.001	S10	15 Winter	30	+10%					39.036
1.007	S11	15 Winter	30	+10%	30/15 Summer				38.545
1.008	J1	30 Winter	30	+10%					38.302
1.009	TANK	120 Winter	30	+10%	30/30 Winter				38.505
1.010	J2	30 Winter	30	+10%					38.450
1.011	S13	60 Winter	30	+10%	30/30 Winter				38.574
1.012	S14	60 Winter	30	+10%	30/15 Summer				38.612
4.000	RE	15 Winter	30	+10%					39.353
5.000	PP1	120 Winter	30	+10%	30/60 Winter				38.578
4.001	S15	60 Winter	30	+10%	30/60 Winter				38.576

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

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
1.000	S1	-0.086	0.000	0.37		6.3	OK	
1.001	S2	-0.114	0.000	0.13		6.8	OK	
1.002	S3	-0.052	0.000	0.53		7.8	OK	
2.000	S4	-0.122	0.000	0.08		2.5	OK	
1.003	S5	-0.013	0.000	0.70		11.8	OK	
1.004	S6	0.100	0.000	0.74		12.2	SURCHARGED	
1.005	S7	0.176	0.000	0.82		13.5	SURCHARGED	
1.006	S8	0.230	0.000	1.01		15.3	SURCHARGED	
3.000	S9	-0.090	0.000	0.34		5.8	OK	
3.001	S10	-0.114	0.000	0.13		7.4	OK	
1.007	S11	0.225	0.000	2.00		21.7	SURCHARGED	
1.008	J1	0.000	0.000	1.68		18.3	SURCHARGED*	
1.009	TANK	0.054	0.000	0.34		16.9	SURCHARGED	
1.010	J2	0.000	0.000	0.09		5.7	SURCHARGED*	
1.011	S13	0.149	0.000	0.17		10.5	SURCHARGED	
1.012	S14	0.267	0.000	0.15		8.6	SURCHARGED	
4.000	RE	-0.127	0.000	0.06		2.4	OK	
5.000	PP1	0.028	0.000	0.11		1.2	SURCHARGED	
4.001	S15	0.046	0.000	0.18		2.6	SURCHARGED	

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

US/MH		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water
PN	Name								Level (m)
6.000	PP2	120	Winter	30	+10%	30/60	Winter		38.593
4.002	S16	120	Winter	30	+10%	30/60	Winter		38.590
1.013	S17	60	Winter	30	+10%	30/15	Summer		38.614
1.014	S18-HB	120	Winter	30	+10%	1/15	Summer		38.618
1.015	S19	60	Winter	30	+10%				38.056

US/MH		Surcharged		Flooded		Pipe		Level	
PN	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Exceeded	
6.000	PP2	0.043	0.000	0.06		1.1	SURCHARGED		
4.002	S16	0.115	0.000	0.15		5.1	SURCHARGED		
1.013	S17	0.279	0.000	0.13		6.8	SURCHARGED		
1.014	S18-HB	0.443	0.000	0.23		2.5	SURCHARGED		
1.015	S19	-0.104	0.000	0.20		2.5	OK		

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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 Coefficient	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 Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
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
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 10, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	100	+40%					40.686
1.001	S2	15 Winter	100	+40%					40.327
1.002	S3	15 Winter	100	+40%	100/15 Summer				39.596
2.000	S4	15 Summer	100	+40%	100/15 Summer				39.588
1.003	S5	15 Summer	100	+40%	100/15 Summer				39.582
1.004	S6	15 Winter	100	+40%	30/15 Summer				39.452
1.005	S7	15 Winter	100	+40%	30/15 Summer				39.297
1.006	S8	15 Winter	100	+40%	30/15 Summer				39.095
3.000	S9	15 Winter	100	+40%					39.231
3.001	S10	15 Winter	100	+40%					39.047
1.007	S11	15 Winter	100	+40%	30/15 Summer				38.933
1.008	J1	60 Winter	100	+40%					38.302
1.009	TANK	120 Winter	100	+40%	30/30 Winter				38.891
1.010	J2	30 Winter	100	+40%					38.450
1.011	S13	120 Winter	100	+40%	30/30 Winter				38.924
1.012	S14	120 Winter	100	+40%	30/15 Summer				38.974
4.000	RE	15 Winter	100	+40%					39.361
5.000	PP1	120 Winter	100	+40%	30/60 Winter				38.954
4.001	S15	120 Winter	100	+40%	30/60 Winter				38.966

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

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)					
1.000	S1	-0.064	0.000	0.60		10.4	OK	
1.001	S2	-0.103	0.000	0.21		11.3	OK	
1.002	S3	0.641	0.000	0.84		12.4	FLOOD RISK	
2.000	S4	0.438	0.000	0.11		3.3	FLOOD RISK	
1.003	S5	0.682	0.000	0.95		15.9	FLOOD RISK	
1.004	S6	0.752	0.000	1.07		17.6	FLOOD RISK	
1.005	S7	0.757	0.000	1.13		18.7	SURCHARGED	
1.006	S8	0.705	0.000	1.46		22.2	SURCHARGED	
3.000	S9	-0.069	0.000	0.56		9.7	OK	
3.001	S10	-0.103	0.000	0.22		12.3	OK	
1.007	S11	0.613	0.000	3.10		33.6	SURCHARGED	
1.008	J1	0.000	0.000	1.79		19.4	SURCHARGED*	
1.009	TANK	0.440	0.000	0.40		19.8	SURCHARGED	
1.010	J2	0.000	0.000	0.29		17.8	SURCHARGED*	
1.011	S13	0.499	0.000	0.21		12.9	SURCHARGED	
1.012	S14	0.629	0.000	0.21		11.5	SURCHARGED	
4.000	RE	-0.119	0.000	0.09		4.0	OK	
5.000	PP1	0.404	0.000	0.24		2.6	SURCHARGED	
4.001	S15	0.436	0.000	0.33		4.8	SURCHARGED	

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

US/MH		Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water
PN	Name								Level (m)
6.000	PP2	120	Winter	100	+40%	30/60	Winter		38.959
4.002	S16	120	Winter	100	+40%	30/60	Winter		38.969
1.013	S17	120	Winter	100	+40%	30/15	Summer		38.993
1.014	S18-HB	120	Winter	100	+40%	1/15	Summer		39.009
1.015	S19	360	Summer	100	+40%				38.056

		Surcharged		Flooded		Pipe			
US/MH		Depth	Volume	Flow /	Overflow	Pipe		Level	
PN	Name	(m)	(m³)	Cap.	(l/s)	(l/s)	Status	Exceeded	
6.000	PP2	0.409	0.000	0.15		2.6	SURCHARGED		
4.002	S16	0.494	0.000	0.23		7.8	SURCHARGED		
1.013	S17	0.658	0.000	0.19		10.3	SURCHARGED		
1.014	S18-HB	0.834	0.000	0.23		2.5	SURCHARGED		
1.015	S19	-0.104	0.000	0.20		2.5	OK		