
COMBINED FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

For

REED HOUSE, JACKSONS LANE, REED, HERTFORDSHIRE (SG8 8AB)

Job Number: 10-5217
Date: November 2025

NOTICE

This document and its contents have been prepared and are intended solely for David Tait's information and use.

Peter Dann Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

Document history

Job number:			Document ref:			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
A	For Information	DM	DM	JB	IS	20/08/2020
B	For Information	DT	DM	DM	IS	01/09/2023
C	For Information	DT	DM	DM	IS	04/09/2023
D	For Information	DT	DM	DM	IS	08/09/2023
E	For Information	FR	DM	DM	IS	07/05/2024
F	For Planning	FR	DM	DM	IS	26/02/2025
G	For Planning	FR	DM	DM	IS	19/11/2025

Client signoff

Client	David Tait
Project	Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB)
Document title	Combined Flood Risk Assessment & Drainage Strategy
Job no.	10-5217
Copy no.	
Document reference	Combined Flood Risk Assessment & Drainage Strategy

CONTENTS

1	INTRODUCTION	1
2	EXISTING SITE	2
2.1	Site Location	2
2.2	Site Topography.....	2
2.3	Ground Conditions.....	2
2.4	Existing Drainage Regime	3
3	DEVELOPMENT PROPOSALS.....	5
4	FLOOD RISK	6
4.1	Policy & Best Practice	6
4.2	Fluvial Flooding.....	6
4.3	Surface Water Flooding	6
4.4	Groundwater Flooding	7
4.5	Reservoir Flooding.....	7
4.6	Artificial Flooding.....	7
4.7	Flood Vulnerability	8
4.8	Flood Risk Summary	9
5	PROPOSED DRAINAGE STRATEGY	10
5.1	Surface Water Discharge Strategy.....	10
5.2	Runoff Rate & Volume.....	10
5.3	SuDS Strategy	11
5.4	Surface Water Policy & Best Practice	11
5.5	Rainfall Simulation & Climate Change	12
5.6	Surface Water Treatment.....	12
5.7	Exceedence Events	13
5.8	Surface Water Management & Maintenance	14
6	PROPOSED FOUL WATER DRAINAGE	19
7	CONCLUSION.....	20

APPENDICES

Appendix A – Site Location Plan

Appendix B – Topographical Survey

Appendix C – Ground Investigation Information

Appendix D – Existing Drainage Information

Appendix E – Development Masterplan

Appendix F – Fluvial Flooding Information

Appendix G – Surface Water Flooding Information

Appendix H – Reservoir Flooding Information

Appendix I – Historic Flooding Information

Appendix J – Proposed Drainage Strategy & Associated Hydraulic Network Calculations

Appendix K – Half Drain Time And Discharge Volume Flow Calculations

1 INTRODUCTION

Peterdann have been commissioned by David Tait to prepare a Combined Flood Risk Assessment and Drainage Strategy (FRA & DS) to support a planning application at Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB) for 14no. residential units with associated infrastructure and hard and soft landscaping.

The total site red line boundary is 1.461ha and the existing site is occupied by Reed House and associated soft landscaping areas. In total, 0.011ha of the site red line boundary is impermeable area within the existing scenario.

Development proposals generate a total impermeable area of 0.723ha. Thus, there is an increase of 0.712ha in impermeable area when compared to the existing site.

The purpose of this Combined FRA & DS is to demonstrate how development proposals will not lead to an increase in flood risk on or offsite. The strategy has been developed in full accordance with Local and National standards as well as best practice design guidance.

Specifically, this Combined FRA & DS demonstrates proposals will not lead to an increase in;

- Peak runoff rate of storm water runoff leaving the site
- Volume of runoff leaving the site
- Pollution to receiving waters from storm water runoff
- Flood risk to nearby or neighbouring sites

2 EXISTING SITE

2.1 Site Location

The site is located at Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB).

The site is located at grid reference (536391,236490).

Access to the site can be taken from Jackson Lane to the south and The Joint to the north.

The existing site is bounded by Reed House and private properties to the south, The Joint to the north and green fields to the all other directions.

A site location plan is shown in **Appendix A**

2.2 Site Topography

A Topographical Survey of the site was prepared by Ratcliff Land & Engineering Surveys (ref; *Topographical & Level Survey*, dwg no. 4703-1), undertaken during February 2014.

The Topographical Survey shows site levels typically falling southwest at a gradient of around 1 in 60.

The highest point of the site at the northeast corner is ~157.20 Above Ordnance Datum (AOD) and the lowest point of the site, directly to the south adjacent to Jackson Lane is ~153.00 AOD.

A topographical survey of the site is provided in **Appendix B**

2.3 Ground Conditions

An intrusive ground investigation at the site was carried out by Ground Engineering Limited during February 2014. As part of this investigation, 7no trial pits between 0.723 – 2.10m deep were undertaken.

Infiltration tests to BRE 365 were performed in all 7 trial pits. Infiltration rates within all trial pits were measured at 1×10^{-9} m/s except for TPC which recorded a first test result of 5.18×10^{-7} m/s.

General ground make-up comprised of topsoil between 0.30 – 0.35m deep on top of firm, stiff, grey, brown and orange mottled slightly gravelly CLAY present to the bottom of all boreholes.

No groundwater seepages were recorded within any of the boreholes.

Ground Investigation information of the site is provided in **Appendix C**

2.4 Existing Drainage Regime

Surface Water

Review of the topographical survey shows a very shallow depression / ditch along the western boundary of the site. This ditch runs north to south at a gradient of around 1 in 60 and outfalls into a small dense area of vegetation located at the southwest corner of the site. Due to the natural fall of the site topography from east to west, it is believed this existing ditch drains around two thirds of the site area.

2no. private ponds are located to the south of the site, adjacent to Jackson Lane. These are linked together via a 400mm culvert underneath the private drive leading to Reed House.

Based on the CCTV Drainage Survey undertaken by Eyes on Drainage, dated November 2025, the existing pond furthest east outfalls via a 225mm pipe located underneath Jackson Lane into a ditch along the western side of High Street. This ditch, which is partially culverted, runs approximately 410 m south along High Street before discharging into an ordinary watercourse, which continues south to ultimately reach the River Quin.

Using the greenfield runoff rate estimation tool from www.uksuds.com together with a development impervious area of 0.723ha, a maximum greenfield flow rate generated for the 1, 30 and 100 year storm events can be determined as shown in **Table 1**.

Greenfield runoff rate	Existing greenfield runoff rate using SPR of 0.1 (0.723ha) (l/s)	Existing greenfield runoff rate using SPR of 0.4 (0.723ha) (l/s)
1 in 1 year	0.09	2.63
QBAR	0.11	3.02
1 in 30 year	0.26	7.40
1 in 100 year	0.38	10.76

Table 1 - Existing greenfield runoff rates for the 1,30 and 100 year storm event

It should be noted whilst the default Standard Percentage Runoff (SPR) value associated with the Greenfield run off rate calculation is 0.1 (consistent with sandy soils), this has been edited to an SPR of 0.4 (consistent with heavy clay) which based on the intrusive ground investigation results, is a more accurate baseline as to what ground conditions on site are.

An Existing Drainage General Arrangement Plan, the CCTV Drainage Survey report and Greenfield runoff rate estimation calculations are shown in **Appendix B**.

Foul Water

Thames Water asset information shows a 150mm diameter foul water sewer within Jackson Lane conveying flows west to east before conveying flows south down High Street

Thames Water manhole 4302 located where Jackson Lane and High Street connect, records a cover level and invert level of 152.50 and 149.38 AOD respectively.

Please refer to **Appendix D** for existing drainage information.

3 DEVELOPMENT PROPOSALS

Development proposals are for 14no. residential units with associated infrastructure and hard and soft landscaping.

The total site red line boundary is 1.461ha and the existing site is occupied by Reed House and associated soft landscaping areas. In total, 0.011ha of the site red line boundary is impermeable area within the existing scenario.

Development proposals along with retained existing impermeable area, generate a total impermeable area of 0.723ha. Thus, there is an increase of 0.712ha in impermeable area when compared to the existing site.

It is proposed existing Reed House and associated hardstanding is maintained as of existing as part of development proposals.

A masterplan of development proposals is shown in **Appendix E**

4 FLOOD RISK

4.1 Policy & Best Practice

This proposed Flood Risk Assessment has been primarily prepared in accordance with the following best practice drainage documentation;

- North Hertfordshire District Council Strategic Flood Risk Assessment (SFRA, July 2008).
- Department for Communities and Local Government National Planning Policy Framework, 2024.
- Environment Agency (EA) publications and modelling outputs.
- CIRIA 753, 2015: The SuDS Manual; This document provides current best practice and National guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their effective implementation within developments.

4.2 Fluvial Flooding

Review of EA fluvial flood mapping identifies the development to be within the *very low flooding extents* (Flood Zone 1).

Fluvial flood mapping extract is shown in **Appendix F**.

It is believed therefore the site is at *very low risk* of Fluvial flooding.

4.3 Surface Water Flooding

Review of EA surface water flood mapping identifies the site to be located within the very low flood risk extents.

Surface water mapping extract is shown in **Appendix G**.

It is proposed implementation of the SuDS Strategy identified in **Section 5** will sufficiently mitigate surface water flooding.

It is believed therefore the site is at *very low risk* of surface water flooding.

4.4 Groundwater Flooding

An intrusive ground investigation at the site was carried out by Ground Engineering Limited during February 2014. As part of this investigation, 7no trial pits between 0.723 – 2.10m deep were undertaken.

Infiltration tests to BRE 365 were performed in all 7 trial pits. Infiltration rates within all trial pits were measured at 1×10^{-9} m/s except for TPC which recorded a first test result of 5.18×10^{-7} m/s.

General ground make-up comprised of topsoil between 0.30 – 0.35m deep on top of firm, stiff, grey, brown and orange mottled slightly gravelly CLAY present to the bottom of all boreholes. No groundwater seepages were recorded within any of the boreholes.

Review of Hertfordshire Flood Risk Management Viewer shows that the site is not within the areas susceptible to groundwater flooding.

Ground Investigation information and Hertfordshire Flood Risk Management Viewer mapping extract is provided in **Appendix C**.

Given that the site is underlain by clay, typically impermeable to rising groundwater, and no groundwater has been identified during the infiltration testing, the site is not considered to be at risk of groundwater flooding.

It is believed therefore the existing site is at *very low* risk of groundwater flooding.

4.5 Reservoir Flooding

EA Reservoir Flood mapping identifies that flooding from reservoirs is unlikely in this site.

A reservoir flood risk mapping is shown in **Appendix H**.

It is believed therefore the site is at *very low* risk of reservoir flooding.

4.6 Artificial Flooding

Thames Water asset information shows a 150mm diameter foul water sewer within Jackson Lane conveying flows west to east before conveying flows south down High Street.

Thames Water manhole 4302 located where Jackson Lane and High Street connect, records a cover level and invert level of 152.50 and 149.38 AOD respectively.

Please refer to **Appendix D** for existing drainage information.

Given that Thames Water manhole cover levels within Jackson Lane are at least 2.5m lower than the site, it is believed if any surcharging of gravity sewerage was to materialise, flood water would be contained within Jackson Lane.

It is believed therefore the site is at *very low risk* of artificial flooding.

4.7 Flood Vulnerability

Technical guidance to the National Planning Policy Framework (NPPF) 2023, divides land use into five classifications as follows;

- Essential infrastructure e.g essential transport infrastructure and utility infrastructure, wind turbines
- Highly vulnerable e.g caravans, mobile homes and park home intended for permanent residential use.
- More vulnerable e.g hospitals, residential institutions, dwelling houses.
- Less vulnerable e.g shops, land and buildings used for agriculture, non-residential institutions, assembly and leisure.
- Water compatible e.g docks, marinas and wharves, amenity open space, sports grounds (and essential facilities such as changing rooms).

The flood risk vulnerability categorisation for the site is “more vulnerable” development (dwelling houses). “More vulnerable” development is fully permissible within flood Zone 1.

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:

✓ Exception test is not required

X Development should not be permitted

Figure 1 – NPPF Flood Risk Vulnerability & Flood Zone Compatibility

4.8 Flood Risk Summary

A summary of the flood risk posed from each flood source before and after development (with the proposed drainage / flood mitigation measures in place) are provided in **Table 2**;

Type of Flooding	Existing Risk Category	Proposed Risk Category
Fluvial flooding	Very Low Risk	Very Low Risk
Surface Water flooding	Very Low Risk	Very Low Risk
Groundwater flooding	Very Low Risk	Very Low Risk
Reservoir flooding	Very Low Risk	Very Low Risk
Artificial Flooding	Very Low Risk	Very Low Risk

Table 2 – Flood Risk Summary from all sources before and after development

5 PROPOSED DRAINAGE STRATEGY

5.1 Surface Water Discharge Strategy

Part H of the Building Regulations (2010) recommends surface water run-off shall discharge to one of the following, listed in order of priority:

- An adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable,
- A watercourse, or, where that is not reasonably practicable,
- A sewer.

Infiltration

An intrusive ground investigation was carried out by Ground Engineering Limited during February 2014. As part of this investigation, 7no trial pits were undertaken between 0.723 – 2.10m deep and infiltration testing in accordance with BRE 365 performed in all trial pits.

All trial pits failed to drain after their first test and testing was therefore abandoned. The best recorded rate was at TPC which recorded a first test result of 5.18×10^{-7} m/s. This rate would be insufficient in ensuring half drain down times within 24 hours could occur (a requirement within the SuDS Manual). Similarly given infiltration rates at all other trial pits was measured at 1×10^{-9} m/s, attempting to use infiltration drainage would be impractical on this site.

Watercourse

In line with the next preferred disposal mechanism, it is proposed a connection to an existing watercourse to the south of the site is progressed.

5.2 Runoff Rate & Volume

It is proposed all runoff from the proposed development and associated external hardstanding areas (an impermeable area of 0.958ha) is attenuated and discharged at 1.50 l/s for all storm events up to and including the critical 100 year plus 40%cc event.

Flow rates during the 1, 30 and 100 year storm events have been calculated for the existing and proposed scenario as shown in **Table 3**.

Storm Event (Annual Exceedance Probability)	Existing Greenfield Runoff Rates (0.723ha) (l/s)	Proposed Site Runoff Rate (l/s) (0.723ha) (l/s)
1 in 1 year	2.63	1.50
QBAR	3.02	1.50
1 in 30 year	7.40	1.50
1 in 100 year	10.76	1.50

Table 3: Existing and proposed discharge rates.

It is demonstrated the proposed development provides significant betterment in the across all storm thresholds when compared to the existing scenario.

5.3 SuDS Strategy

A variety of SuDS have been used as part of the proposed drainage system as identified below;

- Permeable paving will be used for the access road and all private hardstanding external areas.
- A detention basin will be used as the primary attenuation facility for the site.
- The detention basin In turn will drain to a dry swale system.
- The swale system will discharge to an open attenuation basin located within the south east corner of the site.
- The dwellings will incorporate water butts connected to at least one rainwater downpipe for garden irrigation, with overflow directed into the surface-water network

The proposed drainage general arrangement plans and supporting hydraulic calculations are shown in **Appendix J**.

5.4 Surface Water Policy & Best Practice

This proposed Surface and Foul Water Drainage Strategy has been primarily designed in accordance with the following best practice drainage documentation;

- Hertfordshire LLFA, Summary Guidance for Developers
- Department for Communities and Local Government National Planning Policy Framework, 2019.
- CIRIA 753, 2015: The SuDS Manual; This document provides current best practice National guidance on the planning, design, construction, operation, and maintenance of SuDS to facilitate their effective implementation within developments.
- Environment Agency publications
- Building Regulations Part H (2010); Drainage and Water Disposal.

5.5 Rainfall Simulation & Climate Change

This drainage strategy uses Flood Estimation Handbook (FEH) rainfall data.

An allowance of +40% for climate change corresponding to the 'upper end' of current legislation on climate change published by the EA has been used.

Additionally, a 10% allowance for urban creep has been factored into the residential roof impervious areas of the proposed development.

All attenuation structures have been sized based on the 1 in 100 year critical storm event plus an additional 40% allowance for climate change.

In addition, additional storage volume has been provided to allow for a scenario in which the existing ditch is surcharged for a 6-hour period.

5.6 Surface Water Treatment

The SuDS Manual, 2015 identifies pollution hazard levels of new development based off their proposed land use. In line with the SuDS Manual pollution hazard categorisations, a *low* pollution risk for all development site hardstanding area has been adopted (low traffic roads). A *very low* pollution risk for the roof areas has been adopted.

Table 4 shows the total suspended solids, metals and hydrocarbons associated with low and very low pollution categorizations (as provided within the SuDS Manual).

	Total Suspended Solids (TSS)	Metals	Hydro-carbons
<i>Very Low</i> pollution hazard index	0.2	0.2	0.05
<i>Low</i> pollution hazard index	0.5	0.4	0.4

Table 4 – Total suspended solids, metals and hydrocarbons associated with low and medium pollution categorizations (as provided within the SuDS Manual)

As of the SuDS Manual guidance, conveying run off through different forms of SuDS provides varied mitigation values. On the basis the combined mitigation index value is higher than the initial mitigation values associated with a low pollution risk, the drainage system is deemed to have sufficiently mitigated the pollution hazard posed. In accordance with the SuDS Manual, the combined mitigation index value can be calculated as follow;

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5 \times (\text{mitigation index}_2)$$

All development hardstanding areas will pass through the Type 3 sub-base, a first attenuation basin, swales, and a second attenuation basin prior to discharge. **Table 5** shows the combined mitigation index provided by the various SuDS runoff will pass through prior to being discharged into the ground.

	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Permeable paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Swale	0.5	0.6	0.6
Detention Basin	0.5	0.5	0.6
Total SuDS mitigation index	1.45	1.40	1.60

Table 5 – SuDS Pollution Mitigation provided across proposed development site

It can be confirmed the proposed drainage strategy treats runoff over and above the guidance provided within the SuDS Manual (C753).

5.7 Exceedence Events

Whilst it is a requirement to fully attenuate the 1 in 100 year critical storm event plus an allowance of 40% for climate change onsite, it is also necessary to ensure storms which exceed this severity do not cause unreasonable or unsafe flooding or exacerbate flooding elsewhere.

All proposed finished surface levels will be chosen to ensure exceedance runoff is directed away from building areas and towards areas less vulnerable to flooding such as hard and soft landscaped areas.

Exceedence flow arrows are shown on the drainage strategy layout plan shown in **Appendix J**.

5.8 Surface Water Management & Maintenance

For any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained to ensure its continued performance throughout its lifetime.

It is proposed SuDS features used within this development will be maintained and managed by a private management company.

Table 6, 7, 8, 9, and 10 identify the proposed operation, maintenance requirements and frequencies of the SuDS features used for this development which will be maintained by the private management company to ensure a satisfactory maintenance regime is carried out.

Table 6: Operation and Maintenance Requirements for Geo-cellular Tank

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risk to performance)	Monthly
	For system where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and / or internal forebays	Annually, or as required
Remedial Actions	Repair / rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Table 7: Operation and Maintenance Requirements for Pervious Pavements

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 8: Operation and Maintenance Requirements for Detention Basin

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut the grass	Monthly (during growing season)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start then as required)
	Inspect inlets, outlets, bankside, structures pipework etc for evidence of blockage and damage	Monthly
	Inspect water body for signs of poor water quality	Monthly
	Inspect silt accumulation rates in main body of pond. Undertake contamination testing once some build up has occurred to inform disposal options	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond bas, include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water edge to min of 1m above water level	Annually
	Tidy all dead growth before start of growing season	Annually
Occasional Maintenance	Remove sediment from the main body when pool volume is reduced by 20%	Typically required every 20 -50 years
Remedial Actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair / rehabilitate inlets, outlets and overflows	As required

Table 9: Operation and Maintenance requirement for Swales

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut the grass to retain grass height to 0.1m	Monthly (during growing season)
	Manage other vegetation and remove nuisance planting	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect infiltration surface for ponding, compaction, silt accumulation, record areas where water is ponding for more than 48 hours	Monthly or when required
	Inspect vegetation cover	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Re-level uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil later to improve infiltration performance, break up silt deposits and prevent compactions of the soil surface	As required
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrols residues using safe standard practices	As required

Table 10: Operation and Maintenance requirement for Vortex Flow Control Device

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Visual inspection and removal of debris / silt. If any siltation or debris is observed, it will be removed by hosing down, manual cleaning (subject to sufficient risk assessment taking place)	Visual inspection to be carried out once every month or after a substantial storm event.
Occasional Maintenance	Remove debris and hose down as a matter of course including clearing of sump chamber	Every 6 months
Remedial Work	Operation of flow control including testing as required. If operation is compromised in any way, flow control to be replaced.	As required

6 PROPOSED FOUL WATER DRAINAGE

It is proposed all foul water flows from development proposals will gravitate to the existing Thames Water foul water drainage system.

As of OFWOT guidance (April 2018), a right to connect to the public foul sewer exists.

A predevelopment enquiry confirming Thames Water acceptance of the foul water connection however is shown in **Appendix G**

It is proposed as part of development proposals a “Y” connection to the existing 150mm foul water sewer between TW FW MH 3301 and TW FW MH 4301 is made.

The total foul water flow rate from development proposals can be calculated based on guidance given within Sewers for Adoption Design criteria.

Sewers for Adoption assumes a flow rate of 4000 litres per dwelling per day (l/d/d). Based on this criteria, a peak flow rate of **0.65 l/s** can be calculated

- Peak Flow rate = $(4000 \text{ l/d/d} \times 14) / 86,400 = \mathbf{0.65 \text{ l/s}}$

It is recommended detailed design drawings are provided to TW in due course as part of a S106 application to formally agree the foul water sewerage connection.

7 CONCLUSION

Peterdann have been commissioned by David Tait to prepare a Combined Flood Risk Assessment and Drainage Strategy (FRA & DS) to support a planning application at Reed House, Jacksons Lane, Reed, Hertfordshire (SG8 8AB) for 14no. residential units with associated infrastructure and hard and soft landscaping.

The total site red line boundary is 1.461ha and the existing site is occupied by Reed House and associated soft landscaping areas. In total, 0.011ha of the site red line boundary is impermeable area within the existing scenario.

Development proposals along with retained existing impermeable area, generate a total impermeable area of 0.723ha. Thus, there is an increase of 0.712ha in impermeable area when compared to the existing site.

A summary of the flood risk posed from each flood source before and after development (including with the implemented proposed mitigation measures) are provided below;

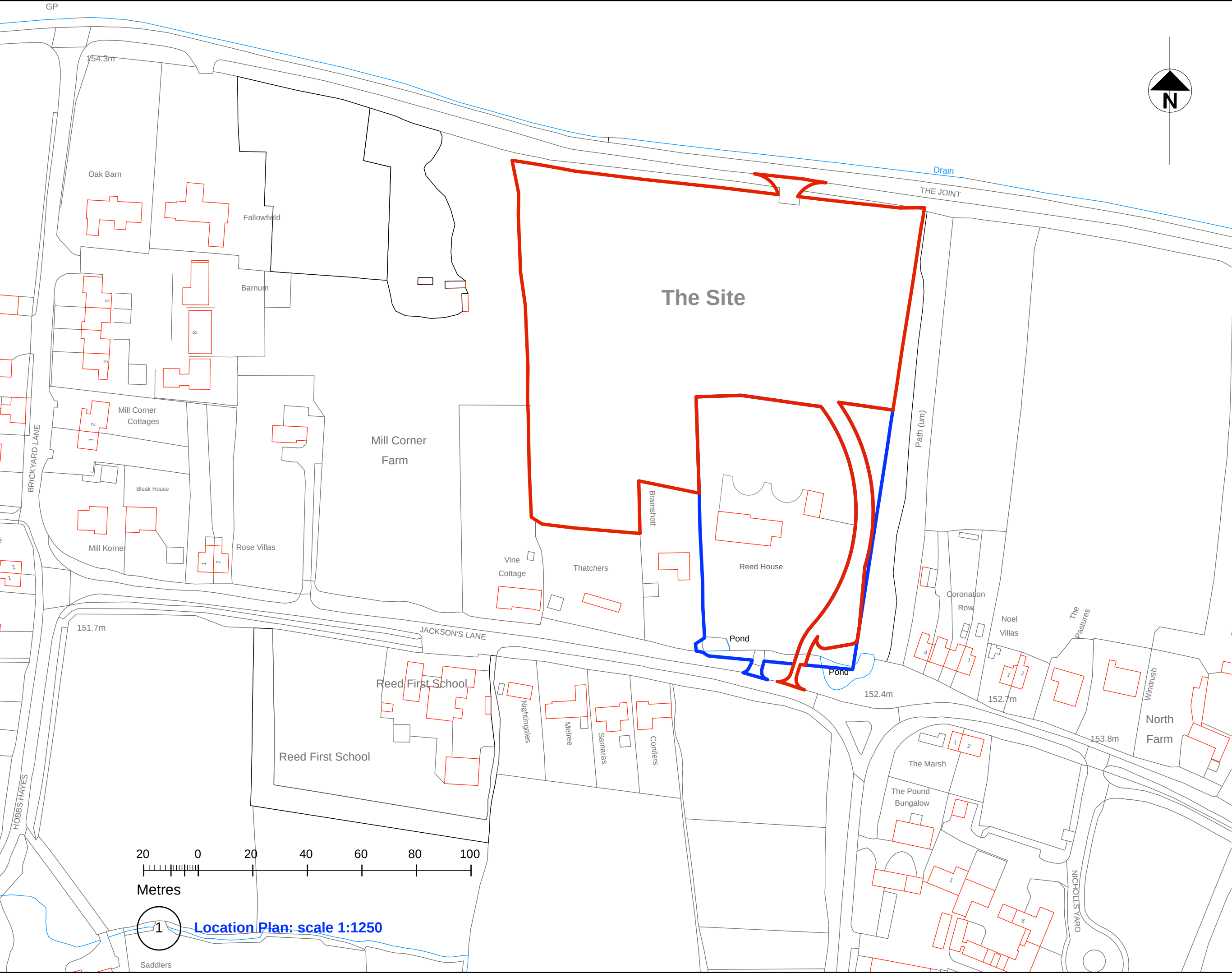
Type of Flooding	Existing Risk Category	Proposed Risk Category
Fluvial flooding	Very Low Risk	Very Low Risk
Surface Water flooding	Very Low Risk	Very Low Risk
Groundwater flooding	Very Low Risk	Very Low Risk
Reservoir flooding	Very Low Risk	Very Low Risk
Artificial Flooding	Very Low Risk	Very Low Risk

Since BRE 365 infiltration testing has ruled out infiltration discharge of surface water, it is proposed the full impermeable area generated from development proposals will utilise a controlled discharge of 1.50 l/s for all storm events up to and including the 100 year plus 40% climate change event. This measure ensures the proposed site drains at a rate lower than the existing greenfield runoff rate.

The Drainage strategy proposes permeable paving, detention basins, swales and water butts. These measures ensure run off is treated in accordance with latest guidance and legislation prior to discharge.

Furthermore, this report demonstrates if storm events greater than the 1 in 100 year were to materialise, how exceedance flows could be directed safely away from building areas to less vulnerable soft and hard landscaped areas.

APPENDIX A – SITE LOCATION PLAN



general notes

This drawing must not be scaled except for Planning purposes.
All setting out must be checked out on site.
All levels must be checked on site and refer to Ordinance Datum Newlyn unless alternative given
Any discrepancy between the drawing and site conditions are to be notified to Sapele Design in writing without delay
This drawing must be read in conjunction with the relevant specification clauses
All fixings and weatherings must be checked on site
This drawing must not be used for land transfer purposes.
This drawing must not be used on site unless issued for construction - see status on this drawing.

notes

P1 PLANNING ISSUE28.04.24

client

Mr & Mrs D Tait

project

Reed House
Jackson Lane, REED
Hertfordshire SG8 8AB

title

Master Site Location Plan
Location Plan

scaledate

1:1250April 2018

drawing no.drawn

S1017 - PL01.P1

status

PLANNING ISSUE

drawing status

PL = Planning: P = Preliminary: T = Tender:
C = Construction

Sapele Design Limited

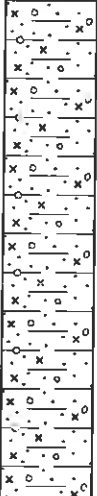
Courtyard Cottage
Manor Farm Barns
Church End
Barley Nr Royston
Hertfordshire SG8 8JW
T : 01763 849154
E: timothy@sapeledesign.co.uk

© 2018 Sapele Design Limited

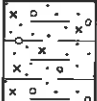
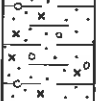
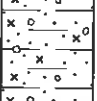
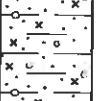
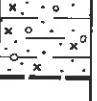
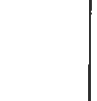
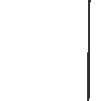
APPENDIX B – TOPOGRAPHICAL SURVEY



APPENDIX C – GROUND INVESTIGATION INFORMATION

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TP1		
			Date: 24/02/14	Pit Size: 1.40m L x 0.60m W x 2.00m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.20	D1			TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30	
0.50	D2						
0.80	D3						
1.00	V1	(67)					
1.20	D4						
1.50	V2	(94)		Firm, becoming stiff below 1.50m depth, grey, brown and orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint. Occasional red brown fine sand pockets from 1.50m depth.		2.00	
1.60	D5						
2.00 2.00	D6 V3	(140+)					
				Pit completed at 2.00m depth			
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to at least 2.00m depth 2. Pit sides stable 3. Pit dry				
					Project No 13206		
					Scale 1:25	Page 1/1	

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON			TRIAL PIT TP2	
			Date: 24/02/14	Pit Size: 1.35m L x 0.60m W x 2.05m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.20	D1		1 √	TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.35	
0.50	D2			Firm, becoming stiff below 1.00m depth, brown, orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to rounded chalk and flint. Occasional red brown fine sand partings from 1.40m depth.			
0.80 0.80	D3 V1	(61)					
1.20 1.20	D4 V2	(90)					
1.60 1.60	D5 V3	(119)					
2.00 2.00	D6 V4	(140+)					
				Pit completed at 2.05m depth		2.05	
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample √ - Water Strike √ - Water Rise √c - Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.30m depth 2. Slight water seepage at 1.90m depth 3. Pit sides stable				
			Project No 13206 Scale 1:25 Page 1/1				

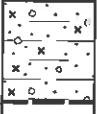
GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TP3	
			Date: 24/02/14	Pit Size: 1.20m L x 0.60m W x 2.10m D.		Ground Level:
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				
0.20	D1			TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.35
0.50	D2			Firm becoming stiff below 1.30m depth, grey brown and orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint. Occasional orange brown fine sand and silt partings below 1.90m depth.		
0.80	D3					
1.00	V1	(67)				
1.20	D4					
1.50	V2	(101)				
1.60	D5					
2.00	D6					
2.00	V3	(126)				2.10
				Pit completed at 2.10m depth		
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.40m depth 2. Pit sides stable 3. Pit dry			
Project No 13206						
Scale Page 1:25 1/1						

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TP4	
Samples and in-situ Tests			Date: 24/02/14	Pit Size: 1.35m L x 0.60m W x 2.00m D.		Ground Level:
Depth m	Type	Result	(Date) Water	Description of Strata	Legend	Depth m
0.20	D1	(67)		TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.35
0.60	D2			Firm, brown, orange brown, grey mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.70
0.90 1.00	D3 V1			Firm becoming stiff below 1.20m depth, grey, orange brown, brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to rounded flint and chalk. Occasional red brown sand and silt partings between 0.90m-1.50m depth.		2.00
1.20	D4	(94)				
1.50	V2					
1.60	D5					
2.00 2.00	D6 V3	(140+)				
				Pit completed at 2.00m depth		

KEY	REMARKS
D - Disturbed Sample	1. Live roots observed to 1.20m depth 2. Pit sides stable 3. Pit dry
B - Bulk Sample	
U - Undisturbed Sample	
R - Root Sample	
W - Water Sample	
J - Jar Sample	
∇ - Water Strike	
∇ - Water Rise	
∇c - Level on completion	
MP - Mackintosh Probe	
P() - Hand Penetrometer	
V - Vane Shear Test	
	Cohesion () kPa
	Cohesion () kPa

Project No 13206	
Scale 1:25	Page 1/1

GROUND ENGINEERING L I M I T E D Tel: 01733-568566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TPA	
Date: 24/02/14			Pit Size: 1.20m L x 0.60m W x 0.60m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.20	D1	(56)		TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30
0.60	D2			Firm, grey, brown, orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.60
0.60	V1			Pit completed at 0.60m depth		
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P() - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.40m depth 2. Pit sides stable 3. Pit dry			
			Project No 13206			
			Scale Page 1:25 1/1			

GROUND ENGINEERING L I M I T E D Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TPB	
Date: 24/02/14			Pit Size: 1.30m L x 0.60m W x 0.65m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				O.D. Level m
0.20	D1			TOPSOIL - Soft, friable, dark brown, slightly sandy, slightly gravelly, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30
0.60 0.60	D2 V1	(61)		Firm, brown, orange brown, grey mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.65
				Pit completed at 0.65m depth		
KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed Sample R - Root Sample W - Water Sample J - Jar Sample  Water Strike  Water Rise  Level on completion MP - Mackintosh Probe P () - Hand Penetrometer Cohesion () kPa V - Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.30m depth 2. Pit sides stable 3. Pit dry			
			Project No 13206			
			Scale 1:25			
			Page 1/1			

GROUND ENGINEERING LIMITED Tel: 01733-566566 www.groundengineering.co.uk			Site: LAND OFF THE JOINT, REED, NEAR ROYSTON		TRIAL PIT TPC	
Date: 24/02/14			Pit Size: 1.55m L x 0.60m W x 0.60m D.		Ground Level:	
Samples and in-situ Tests			(Date) Water	Description of Strata	Legend	Depth m
Depth m	Type	Result				
0.20	D1	(83)		TOPSOIL - Soft, friable, dark brown, slightly gravelly, slightly sandy, silty CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.30
0.60	D2			Firm becoming stiff, grey, brown, orange brown mottled, slightly sandy, slightly gravelly CLAY. Gravel consists of sub-angular to sub-rounded chalk and flint.		0.60
0.60	V1			Pit completed at 0.60m depth		
KEY D = Disturbed Sample B = Bulk Sample U = Undisturbed Sample R = Root Sample W = Water Sample J = Jar Sample  Water Strike  Water Rise  Level on completion MP = Mackintosh Probe P() = Hand Penetrometer Cohesion () kPa V = Vane Shear Test Cohesion () kPa			REMARKS 1. Live roots observed to 0.30m depth 2. Pit sides stable 3. Pit dry			
					Project No 13206	
					Scale 1:25	Page 1/1

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

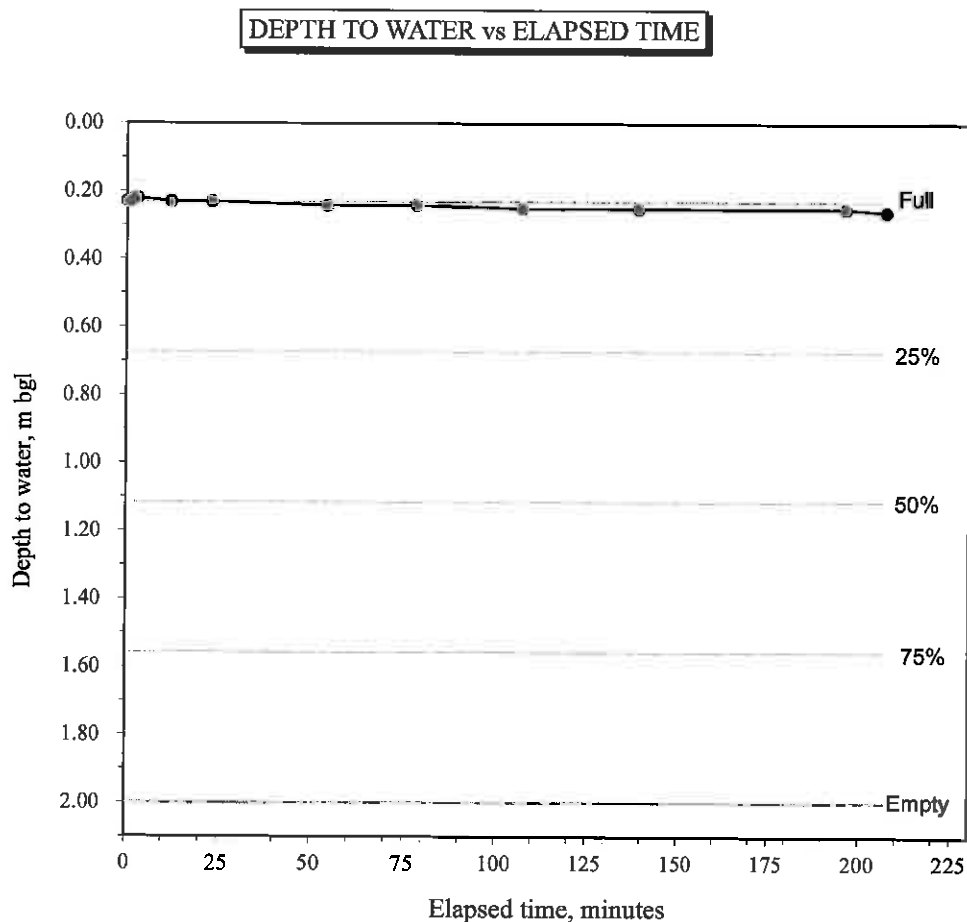
Trial Pit: TP1 FIRST FILLING
Depth: 2.00
Length: 1.40
Width: 0.60

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.23
1	0.23
2	0.22
3	0.22
12	0.23
23	0.23
54	0.24
78	0.24
107	0.25
139	0.25
196	0.25
207	0.26

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.743$$

$$A50 = 4.380$$

$$T75 - T25 = 6141 \quad (\text{extrapolated})$$

Extrapolated Soil Infiltration Rate $f = \underline{4.61E-07} \text{ m/s}$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TP2
Depth: 2.05
Length: 1.35
Width: 0.60

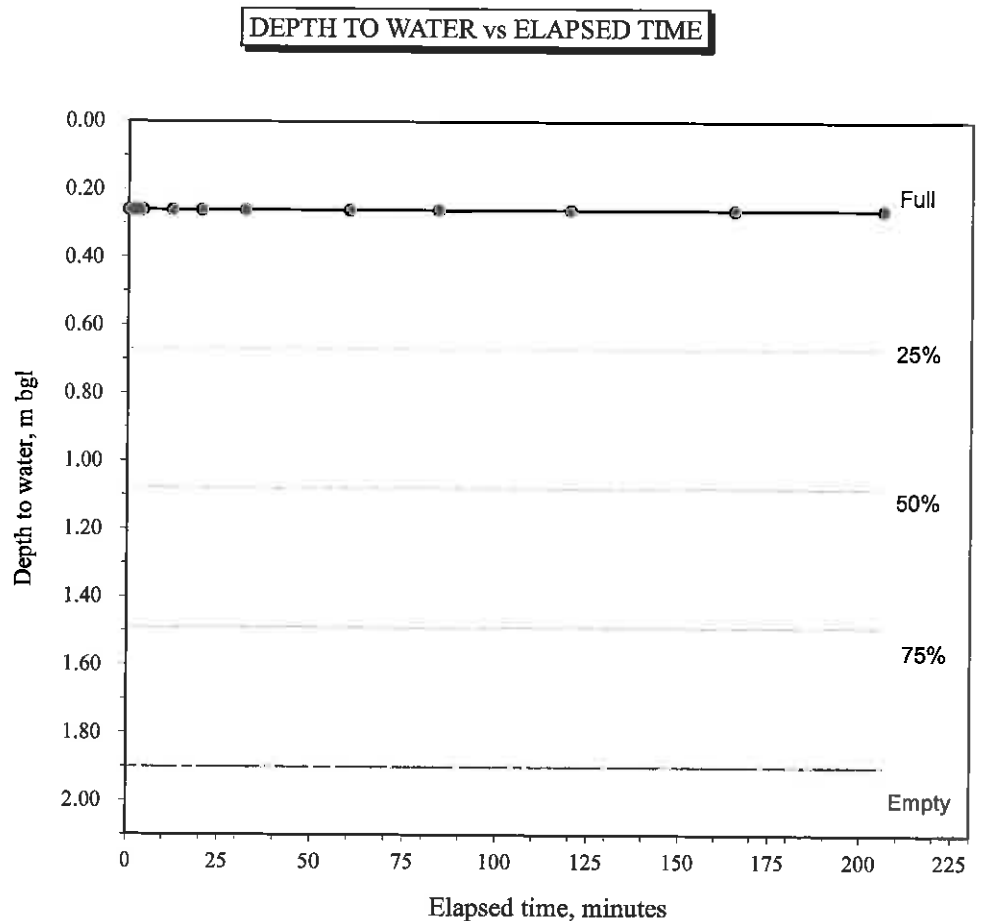
FIRST FILLING

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: 1.90
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.26
1	0.26
2	0.26
3	0.26
4	0.26
12	0.26
20	0.26
32	0.26
60	0.26
84	0.26
120	0.26
165	0.26
206	0.26

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

$V75 - V25 = 0.664$
 $A50 = 4.008$
 $T75 - T25 = >10000$ (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

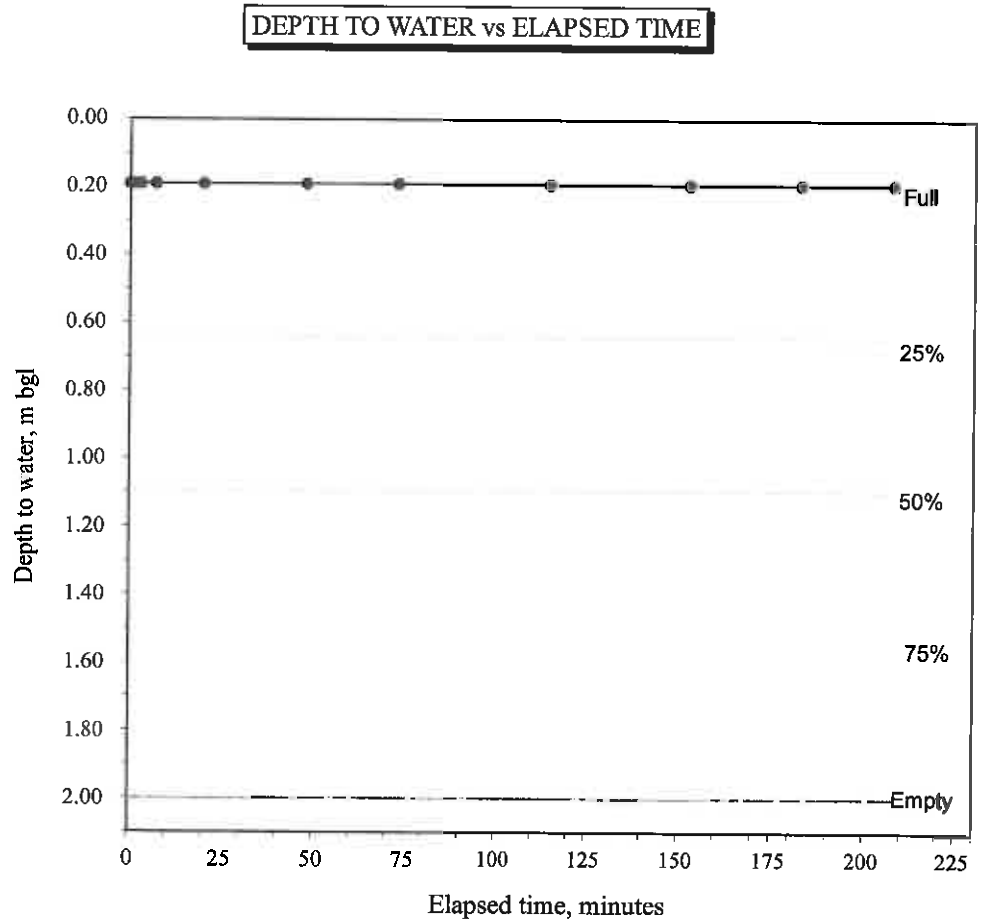
Trial Pit: TP3 FIRST FILLING
Depth: 2.10
Length: 1.20
Width: 0.60

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.19
1	0.19
2	0.19
3	0.19
7	0.19
20	0.19
48	0.19
73	0.19
115	0.19
153	0.19
183	0.19
208	0.19

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

V75-V25 = 0.652
A50 = 3.978
T75-T25 = >10000 (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

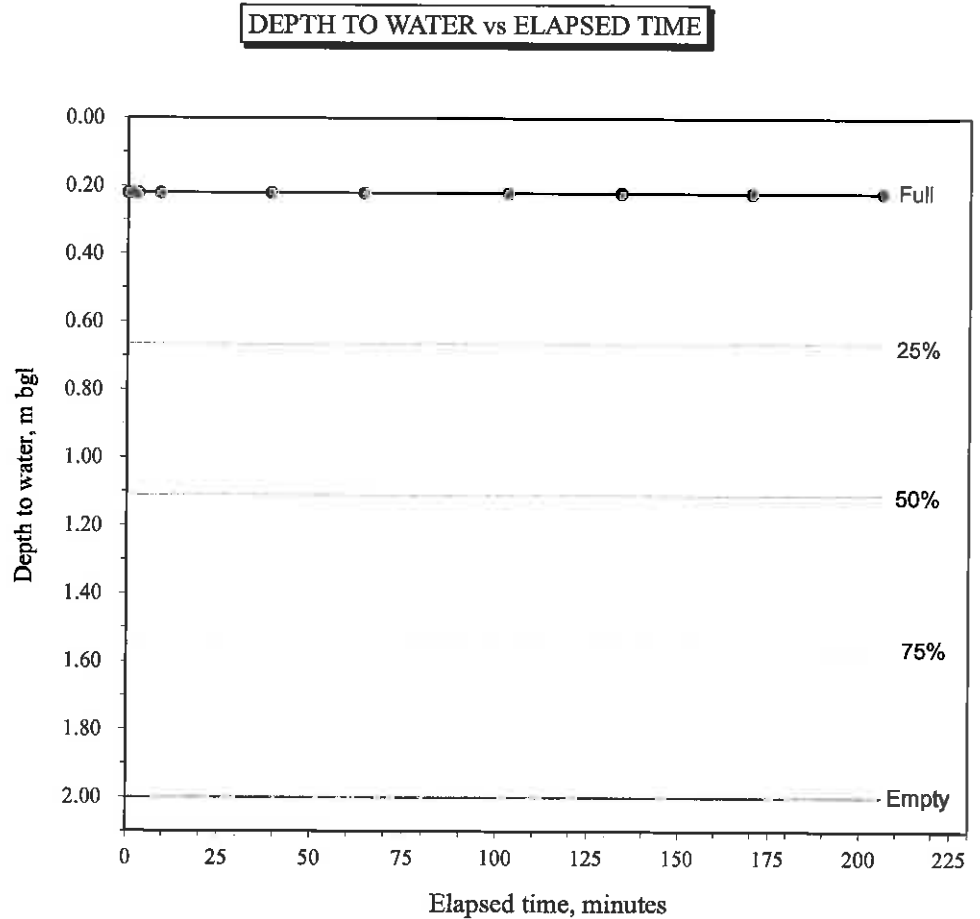
Trial Pit: TP4 FIRST FILLING
Depth: 2.00
Length: 1.35
Width: 0.60

Description of Stratum under test: Stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.22
1	0.22
2	0.22
3	0.22
9	0.22
39	0.22
64	0.22
103	0.22
134	0.22
170	0.22
206	0.22

All dimensions given in metres



$$f = (V_{75} - V_{25}) / A_{50}(T_{75} - T_{25})$$

$V_{75} - V_{25} = 0.721$
 $A_{50} = 4.281$
 $T_{75} - T_{25} = >10000$ (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

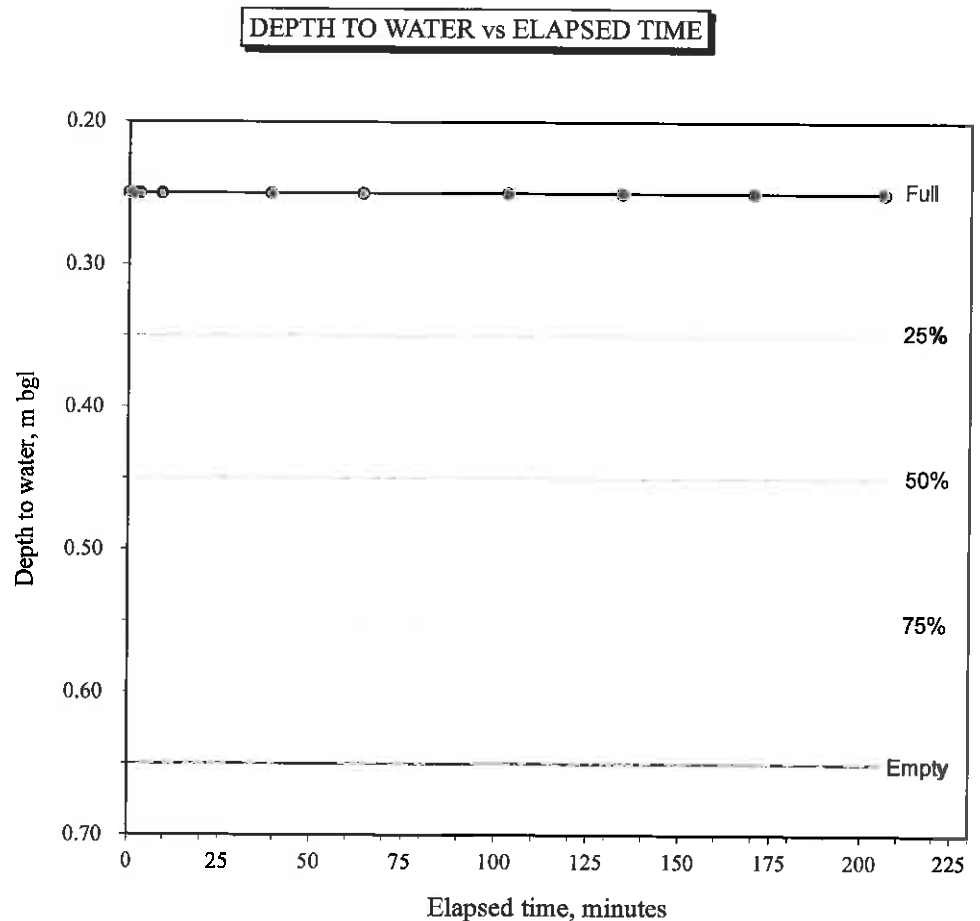
Trial Pit: TPB FIRST FILLING
Depth: 0.65
Length: 1.30
Width: 0.60

Description of Stratum under test: Firm, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.25
1	0.25
2	0.25
3	0.25
9	0.25
39	0.25
64	0.25
103	0.25
134	0.25
170	0.25
206	0.25

All dimensions given in metres



$$f = (V75 - V25) / A50(T75 - T25)$$

$$V75 - V25 = 0.156$$

$$A50 = 1.540$$

$$T75 - T25 = >10000 \quad (\text{extrapolated})$$

Estimated Soil Infiltration Rate $f = \underline{<1.00E-09} \quad \text{m/s}$

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TPA
Depth: 0.60
Length: 1.20
Width: 0.60

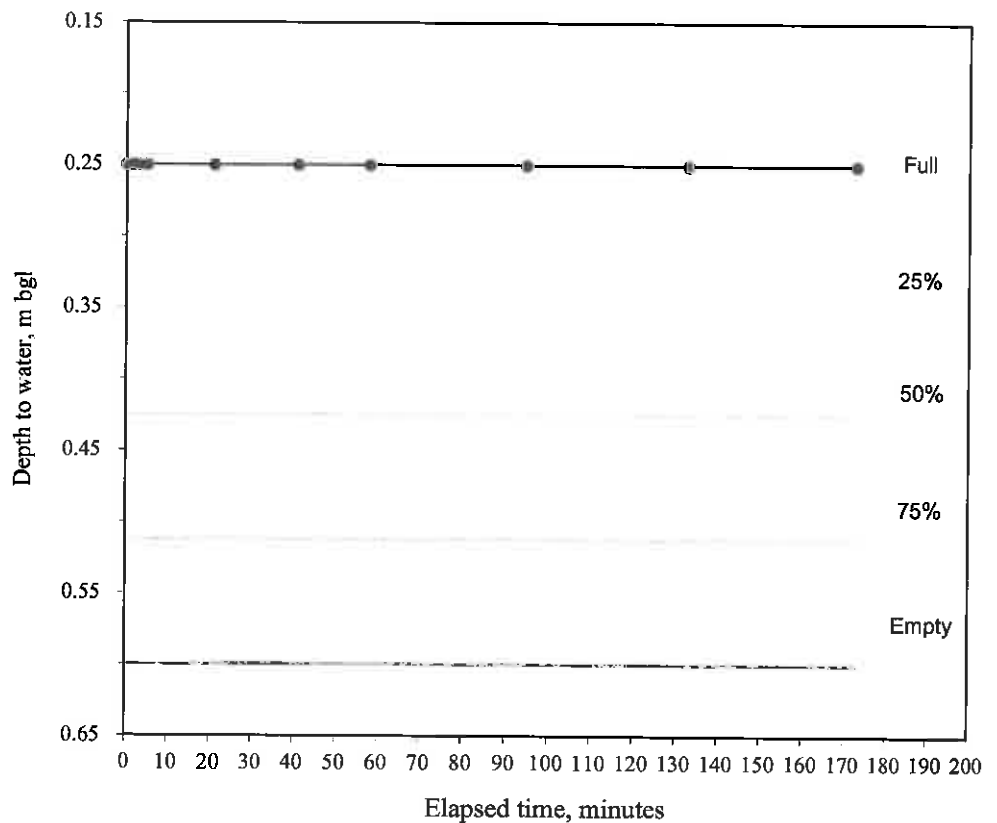
FIRST FILLING

Description of Stratum under test: Firm, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.25
1	0.25
2	0.25
3	0.25
5	0.25
21	0.25
41	0.25
58	0.25
95	0.25
133	0.25
173	0.25

DEPTH TO WATER vs ELAPSED TIME



All dimensions given in metres

$$f = (V_{75} - V_{25}) / A_{50}(T_{75} - T_{25})$$

$V_{75} - V_{25} = 0.126$
 $A_{50} = 1.350$
 $T_{75} - T_{25} = >10000$ (extrapolated)

Estimated Soil Infiltration Rate $f = <1.00E-09$ m/s

SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Land off The Joint, Reed, near Royston
Client: Mr D. Tait

Project No: C13206
Sheet No: 1/1

Trial Pit: TPC
Depth: 0.60
Length: 1.55
Width: 0.60

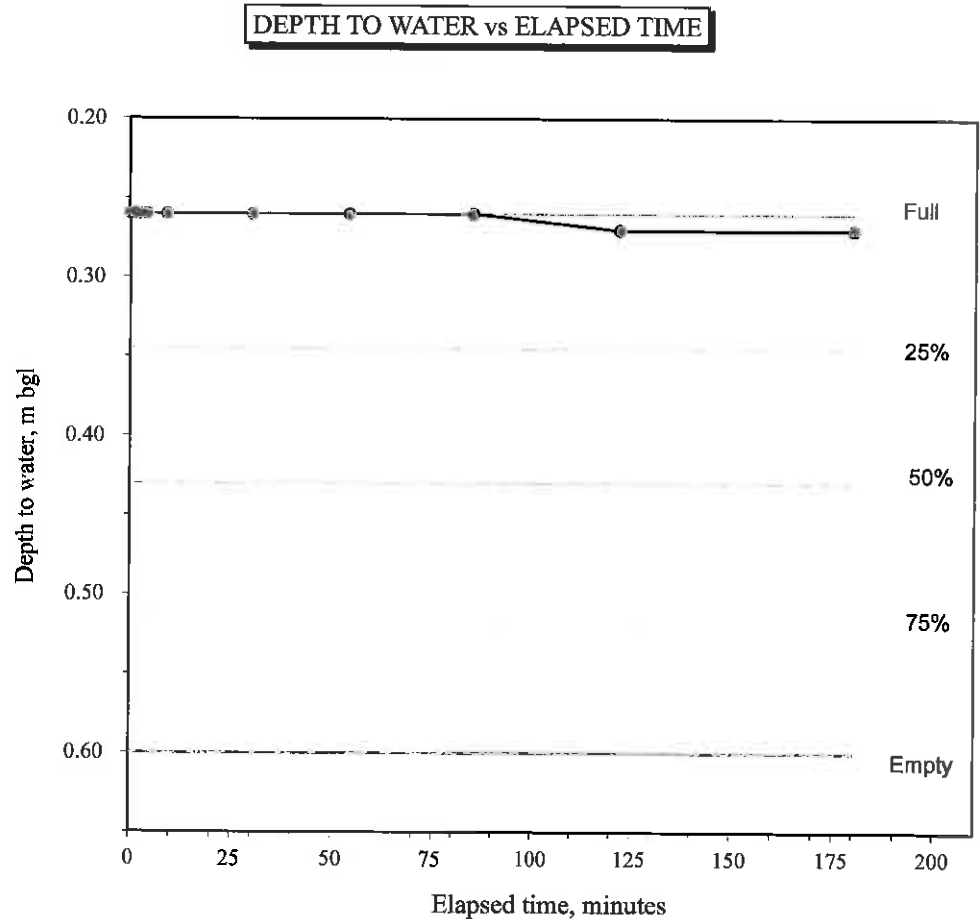
FIRST FILLING

Description of Stratum under test: Firm, becoming stiff, slightly sandy, slightly gravelly CLAY

Depth to water prior to test: Dry
(below ground level)

Elapsed Time mins	Depth to Water m
0	0.26
1	0.26
2	0.26
4	0.26
9	0.26
30	0.26
54	0.26
85	0.26
122	0.27
180	0.27

All dimensions given in metres

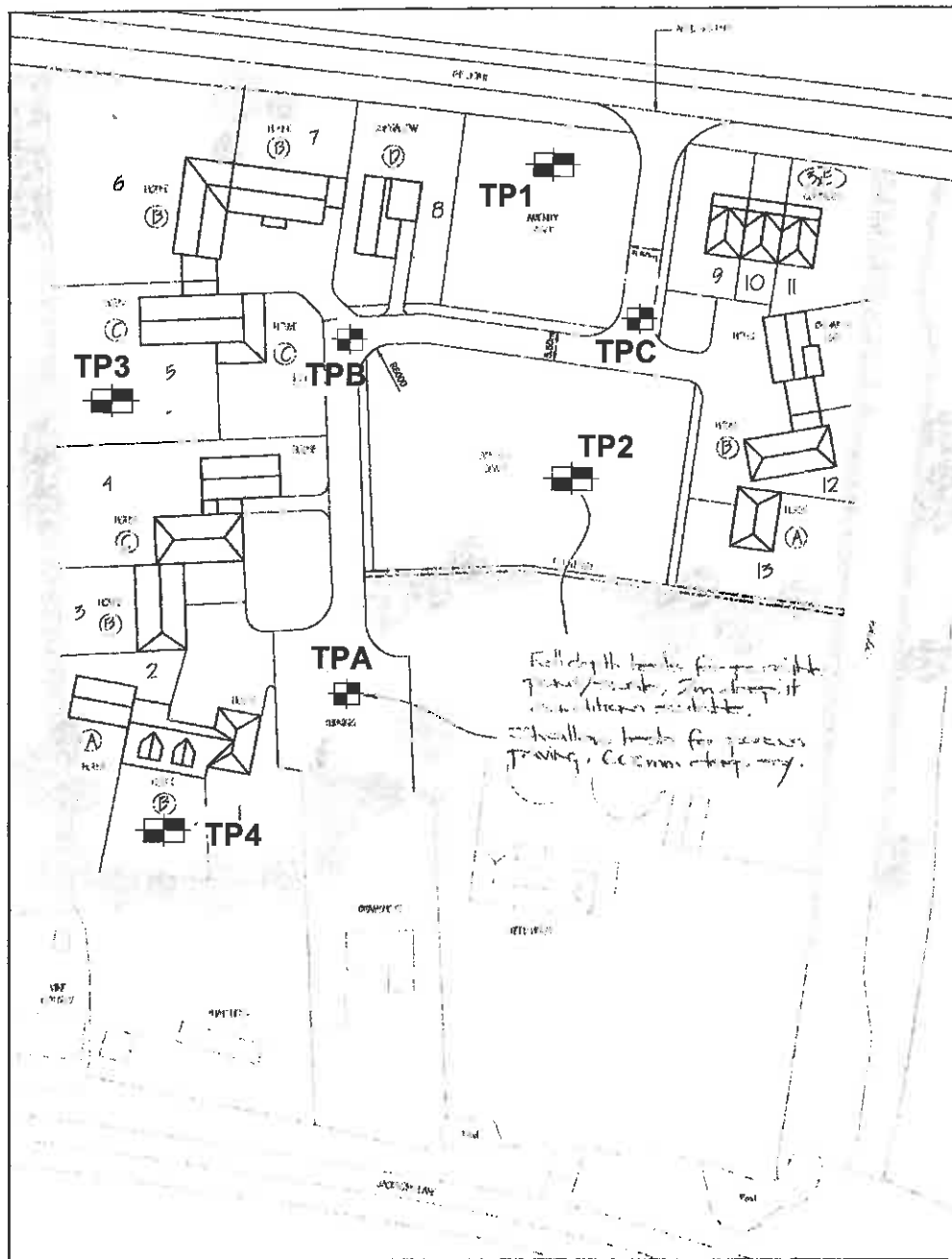


$$f = (V75-V25)/A50(T75-T25)$$
$$V75-V25 = 0.158$$
$$A50 = 1.661$$
$$T75-T25 = 3060 \quad (\text{extrapolated})$$

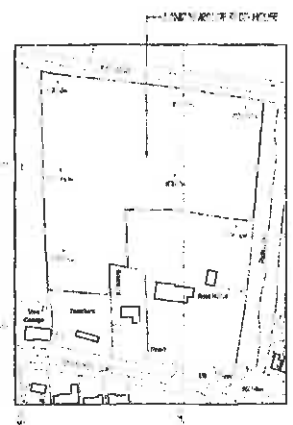
Extrapolated Soil Infiltration Rate $f = \underline{5.18E-07} \text{ m/s}$

Trial Pit Location Plan

Based on the Ordnance Survey sheet with the permission of the Controller of Her Majesty's Stationery Office,
© Crown Copyright. All rights reserved. Licence number AL 100005523.



SITE LOCATION PLAN
(1:500)



LOCATION PLAN
(1:500)

Not To Scale

Project : Land off The Joint, Reed, near Royston

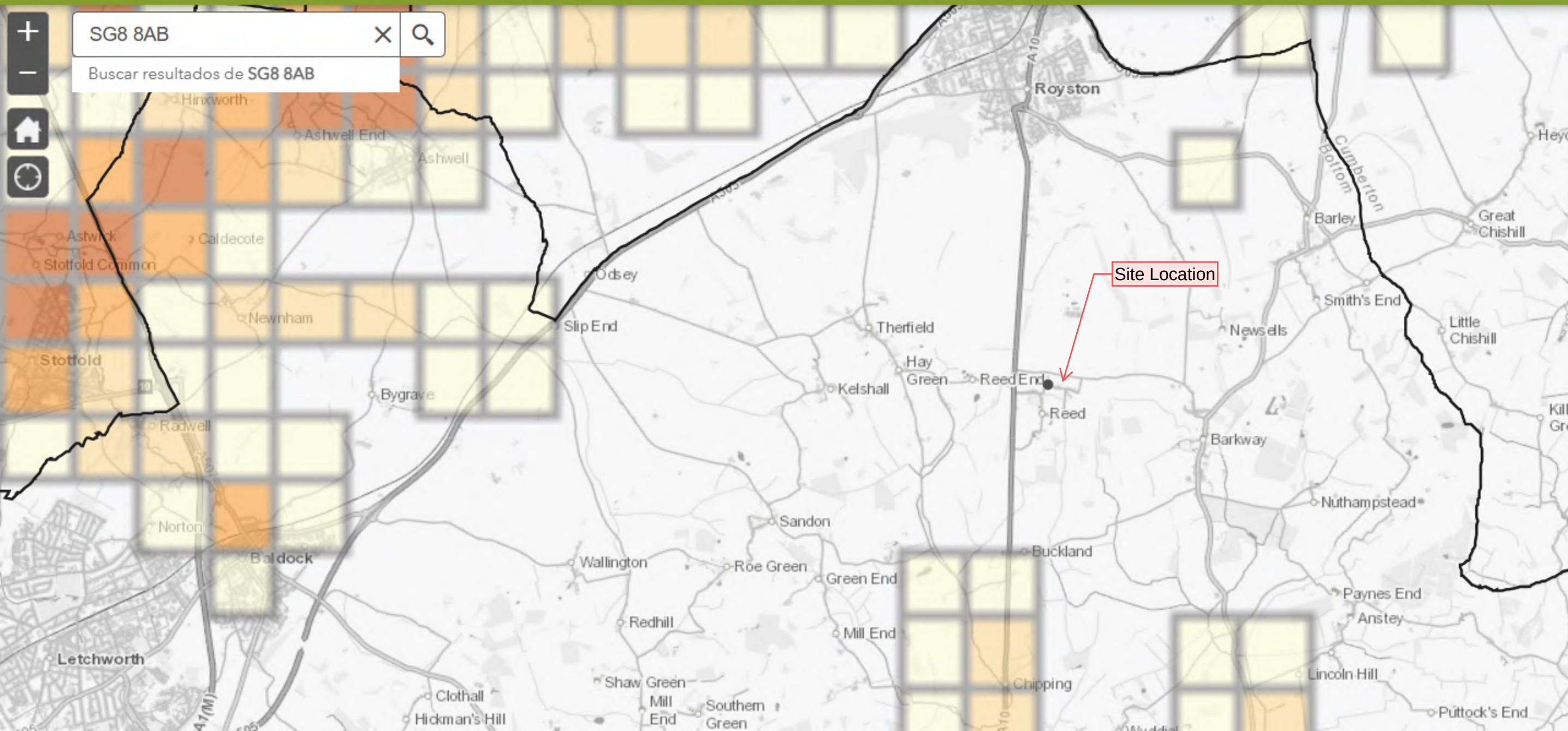
Client : Mr D. Tait

**GROUND
ENGINEERING
LIMITED**

Peterborough

Tel : 01733 566566

Project No.
C13206

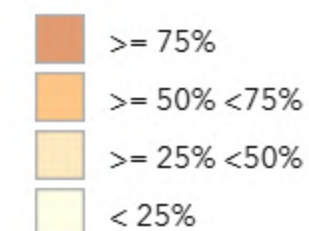


Legend

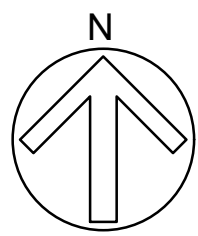
Surface Water and Groundwater Flooding

Risk of Flooding from Groundwater

Areas Susceptible to Groundwater Flooding



APPENDIX D – EXISTING DRAINAGE INFORMATION



EXISTING DRAINAGE LEGEND

- Land under Client's control.
- Site Boundary (1.461ha)
- CWMH
Existing Thames Water Combined Water Drainage (locations / levels as taken from Thames Water asset plan information).
- SWMH
Existing Surface Water drainage
- Surface Fall Direction

EXISTING CATCHMENT LEGEND:

Existing Impermeable Area 0.011 ha

NOTES:

- This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
- All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
- Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
- All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
- The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
- All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
- All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

02	18/11/20	PR	DM	LFA COMMENTS ADDRESSED
01	15/08/20	DT	DM	PLANNING ISSUE
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS



peterdannlimited | newton house
cambridge road | barton | cambridge | CB23 7WJ

t: 01223 264888 www.peterdann.com info@peterdann.com

JOB TITLE

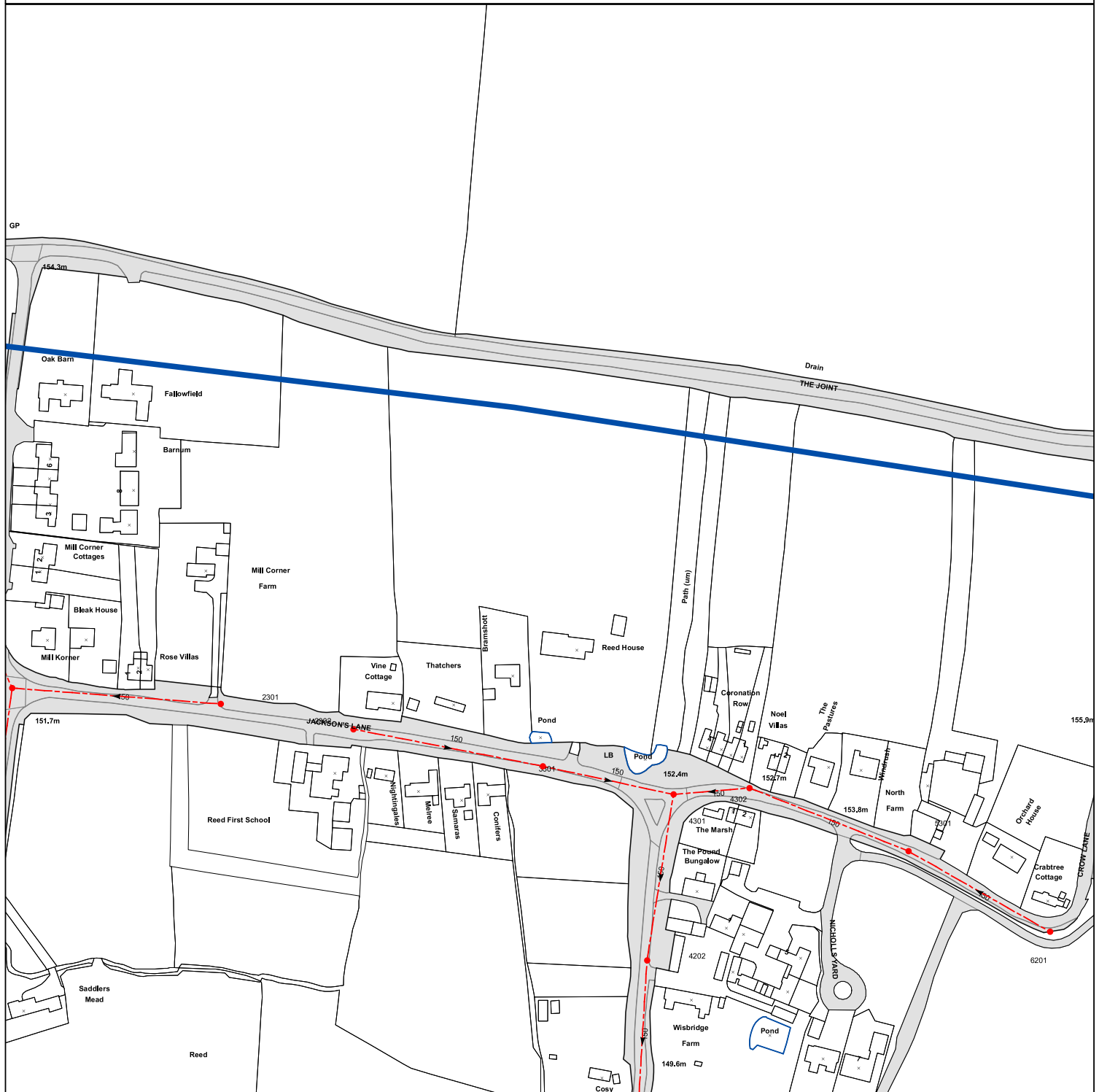
Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Existing Drainage Plan

DATE	DRAWN	CHECKED	SCALE	@A1
Aug 2020	DM	DM	N.T.S	
DRAWING STATUS				STATUS CODE
PLANNING				FOR PLANNING
JOB/DWG No.				REV.
10-5217_C-001				P2

© Peter Dann Ltd. All rights reserved.



0 10 20 40 60 80
Meters

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 before any works are undertaken. Crown copyright Reserved

Scale: 1:1791
Width: 500m
Printed By: annagraj
Print Date: 14/02/2014
Map Centre: 536386,236465
Grid Reference: TL3636SW

Comments:

ALS/ALS Standard/2014_2686751

NB: Level quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no Survey information is available.

REFERENCE	COVER LEVEL	INVERT LEVEL
5301		
1401	151.68	150.45
2302		
4202	150.76	148.65
4302	152.68	151.35

REFERENCE	COVER LEVEL	INVERT LEVEL
6201	154.42	153.05
2301	152.08	151.07
3301		
4301	152.5	149.38



estimation for sites

www.uksubs.com | Greenfield runoff tool

Calculated by:	Dan Martin
Site name:	Reed House
Site location:	SG8 8AB

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.00993° N
Longitude:	0.01424° W
Reference:	1868025507
Date:	Aug 20 2020 09:13

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	1
-----------------------	---

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	619	619
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.15	4.18
1 in 1 year (l/s):	0.13	3.64
1 in 30 years (l/s):	0.36	10.24
1 in 100 year (l/s):	0.52	14.88
1 in 200 years (l/s):	0.61	17.6

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksubs.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksubs.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Project

Project Name: Reed House - Reed
Project Description: CCTV Survey, Trace & Plot
Project Status: Complete
Project Date: 13/11/2025
Inspection Standard: MSCC5 Sewers & Drainage GB (SRM5 Scoring)



EYES ON DRAINAGE

CCTV-Trace-Plot-Map-Repair

Table of Contents

Project Name Reed House - Reed	Project Number	Project Date 13/11/2025
--	-----------------------	-----------------------------------

Project Information	P-1
Scoring Summary	P-3
Project Pictures	P-4
Section Profile	P-9
Section Summary	P-10
Section Item 1: HW1 > Outfall 1 (HW1X)	1
Section Item 2: HW2 > CP1 (HW2X)	13
Section Item 3: CP1 > Outfall 2 (CP1X)	15
Section Item 4: Outfall 3 > CP2 (Outfall 3X)	17
Disclaimer	20

Project Information**Project Name**
Reed House - Reed**Project Number****Project Date**
13/11/2025**Client**

Company: Civilistix Consulting Engineers
Department: Allia Future Business Centre
Street: Market Square
Town or City: Cambridge
Post Code: CB2 3QJ
Phone: 01223 343277
Email: enquiries@civilistix.com

**Site**

Contact: David Tait
Department: Reed House
Street: Jacksons Lane
Town or City: Reed
County: Hertfordshire
Post Code: SG8 8AB

Contractor

Company: Eyes On Drainage Services Ltd
Department: Merrion House
Street: Bines Green
Town or City: Horsham
County: West Sussex
Post Code: RH13 8EH
Phone: 01403 710971
Mobile: 077111 84951
Email: info@eyesondrainage.co.uk



Project Information

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025

Project Drawing, Page 'Reed House - Reed'



Section Inspection - 11/11/2025 - Outfall 3X

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
4	1	11/11/25	12:17	Not Specified	No Rain Or Snow	No	OUTFALL 3X
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
JY		FV73 RZB		P540	Not Specified	Highways Drainage	Not Specified

Section Drawing OUTFALL 3X, Page Outfall 3X



Scoring Summary

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025

Structural Defects

Grade 3: Best practice suggests consideration should be given to repairs in the medium term.

Grade 4: Best practice suggests consideration should be given to repairs to avoid a potential collapse.

Grade 5: Best practice suggests that this pipe is at risk of collapse at any time. Urgent consideration should be given to repairs to avoid total failure.

Section	PLR	Grade	Description
1	HW1X	4	Multiple defects

Service / Operational Condition

Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.

Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.

Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
1	HW1X	5	Roots, mass at joint, 45% cross-sectional area loss
3	CP1X	4	Settled deposits, coarse, 75% cross-sectional area loss, finish

Abandoned Surveys

Section	PLR	Description
All inspections complete, none are abandoned.		

Information

These scoring summaries are based on the SRM grading from the WRc.

Project Pictures

Project Name
 Reed House - Reed

Project Number

Project Date
 13/11/2025



Outfall 1



Headwall 1



Headwall 2



Headwall 2



CP1



Outfall 2

Project Pictures

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025



Outfall 3



Outfall 3



CP2 Location



Headwall 3



Headwall 3



Headwall 4

Project Pictures

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025



Headwall 4



Headwall 5



Headwall 5



Headwall 6? No pipe visible



Crossover 1, no culvert



Crossover 2, no culvert



Project Pictures

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025



Ditch at footpath entrance at The Joint looking South



Redundant Ditch



Redundant Ditch



CP3



CP4



CP5



Project Pictures

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025



750mm Outfall



750mm Outfall



Location of SWMH & 750mm Outfall

Section Profile

Project Name
Reed House - Reed

Project Number

Project Date
13/11/2025

Circular, 150 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
1	HW1	Outfall 1	11/11/2025	Jacksons Lane	Vitrified clay	56.20 m	56.20 m

Total: 1 Inspection x Circular 150 mm, 0 mm = 56.20 m Total Length and 56.20 m Inspected Length

Circular, 225 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
2	HW2	CP1	11/11/2025	Jacksons Lane	Asbestos cement	12.60 m	12.60 m
3	CP1	Outfall 2	11/11/2025	Jacksons Lane	Asbestos cement	1.10 m	1.10 m
4	Outfall 3	CP2	11/11/2025	Jacksons Lane	Concrete	6.30 m	6.30 m

Total: 3 Inspections x Circular 225 mm, 0 mm = 20.00 m Total Length and 20.00 m Inspected Length

Total: 4 Inspections = 76.20 m Total Length and 76.20 m Inspected Length

Section Summary

Project Name Reed House - Reed	Project Number	Project Date 13/11/2025
--	-----------------------	-----------------------------------

Number of sections	4
Total length of sections	76.20 m
Total length of inspected sections	76.20 m
Total length of not inspected sections	0.00 m
Number of abandoned inspections	0
Number of section inspection photos	62
Number of section inspection videos	5
Number of section inspection scans	0
Number of section inclination measurements	0

PLR:	HW1X	Upstream Node:	HW1
Inspection Direction:	Upstream	Downstream Node:	Outfall 1
Inspected Length:	56.20 m	Dia/Height:	150 mm
Total Length:	56.20 m	Material:	Vitrified clay

No.	m+	Code	Observation
1	0.00	OF	Start node, outfall, reference: Outfall 1
2	0.00	WL	Water level, 0% of the vertical dimension
3	0.00	DES	Settled deposits, fine, 30% cross-sectional area loss, start
4	1.00	DES	Settled deposits, fine, 20% cross-sectional area loss, change
5	2.00	DES	Settled deposits, fine, 10% cross-sectional area loss, change
6	2.50	DES	Settled deposits, fine, 10% cross-sectional area loss, finish
7	4.00	DER	Settled deposits, coarse, 10% cross-sectional area loss
8	5.60	FL	Fracture, longitudinal at 12 o'clock, start
9	6.40	FL	Fracture, longitudinal at 12 o'clock, finish
10	11.20	RFJ	Roots, fine at joint
11	12.20	FMJ	Fractures, multiple at joint from 12 o'clock to 12 o'clock
12	12.40	D	Deformed sewer or drain, 10%
13	12.50	JDL	Joint displaced, large
14	12.50	BJ	Broken pipe at joint from 9 o'clock to 3 o'clock
15	12.60	LL	Line deviates left
16	17.80	FLJ	Fracture, longitudinal at joint at 1 o'clock
17	18.00	CXI	Connection defective, connecting pipe is intruding at 12 o'clock, 150mm dia, intrusion: 25%
18	18.00	FC	Fracture, circumferential from 7 o'clock to 11 o'clock
19	21.50	OJL	Open joint, large
20	21.70	JN	Junction at 3 o'clock, 100mm dia
21	22.00	FL	Fracture, longitudinal at 12 o'clock

Section Summary

Project Name Reed House - Reed	Project Number	Project Date 13/11/2025
--	-----------------------	-----------------------------------

No.	m+	Code	Observation
22	22.00	JDM	Joint displaced, medium
23	22.00	FL	Fracture, longitudinal at 9 o'clock, start
24	22.60	FL	Fracture, longitudinal at 9 o'clock, finish
25	25.50	FL	Fracture, longitudinal at 8 o'clock, start
26	25.50	FL	Fracture, longitudinal at 12 o'clock, start
27	25.50	FLJ	Fracture, longitudinal at joint at 11 o'clock
28	25.50	FL	Fracture, longitudinal at 1 o'clock, start
29	27.50	DER	Settled deposits, coarse, 25% cross-sectional area loss, start
30	27.50	JDL	Joint displaced, large
31	27.50	FL	Fracture, longitudinal at 8 o'clock, finish
32	27.50	FL	Fracture, longitudinal at 12 o'clock, finish
33	27.50	FL	Fracture, longitudinal at 1 o'clock, finish
34	29.10	DER	Settled deposits, coarse, 35% cross-sectional area loss, change
35	29.20	RMJ	Roots, mass at joint, 45% cross-sectional area loss
36	30.60	DER	Settled deposits, coarse, 25% cross-sectional area loss, change
37	31.00	DER	Settled deposits, coarse, 25% cross-sectional area loss, finish
38	38.20	JN	Junction at 2 o'clock, 100mm dia
39	41.80	JDM	Joint displaced, medium
40	43.50	DER	Settled deposits, coarse, 20% cross-sectional area loss, start
41	43.50	JDM	Joint displaced, medium
42	45.30	RFJ	Roots, fine at joint
43	46.40	B	Broken pipe from 12 o'clock to 12 o'clock
44	46.80	JN	Junction at 9 o'clock, 150mm dia
45	46.80	DER	Settled deposits, coarse, 20% cross-sectional area loss, finish
46	47.00	JDM	Joint displaced, medium
47	47.00	RFJ	Roots, fine at joint
48	51.30	FL	Fracture, longitudinal at 9 o'clock, start
49	51.30	FL	Fracture, longitudinal at 3 o'clock, start
50	51.80	FL	Fracture, longitudinal at 9 o'clock, finish
51	51.80	FL	Fracture, longitudinal at 3 o'clock, finish
52	51.80	FC	Fracture, circumferential from 10 o'clock to 4 o'clock
53	54.00	DER	Settled deposits, coarse, 10% cross-sectional area loss
54	54.40	JDL	Joint displaced, large
55	54.40	RFJ	Roots, fine at joint
56	55.50	DER	Settled deposits, coarse, 20% cross-sectional area loss
57	56.20	OFF	Finish node, outfall, reference: HW1

PLR:	HW2X	Upstream Node:	HW2
Inspection Direction:	Downstream	Downstream Node:	CP1
Inspected Length:	12.60 m	Dia/Height:	225 mm
Total Length:	12.60 m	Material:	Asbestos cement

No.	m+	Code	Observation
1	0.00	OF	Start node, outfall, reference: HW2
2	0.00	WL	Water level, 0% of the vertical dimension

Section Summary

Project Name Reed House - Reed	Project Number	Project Date 13/11/2025
--	-----------------------	-----------------------------------

No.	m+	Code	Observation
3	0.00	DES	Settled deposits, fine, 25% cross-sectional area loss, start
4	1.80	DES	Settled deposits, fine, 20% cross-sectional area loss, change
5	12.60	DES	Settled deposits, fine, 20% cross-sectional area loss, finish

PLR:	CP1X	Upstream Node:	CP1
Inspection Direction:	Downstream	Downstream Node:	Outfall 2
Inspected Length:	1.10 m	Dia/Height:	225 mm
Total Length:	1.10 m	Material:	Asbestos cement

No.	m+	Code	Observation
1	0.00	CP	Start node, catchpit, reference: CP1
2	0.00	WL	Water level, 0% of the vertical dimension
3	0.00	DER	Settled deposits, coarse, 75% cross-sectional area loss, start
4	1.10	DER	Settled deposits, coarse, 75% cross-sectional area loss, finish
5	1.10	OFF	Finish node, outfall, reference: Outfall 2

PLR:	Outfall 3X	Upstream Node:	Outfall 3
Inspection Direction:	Downstream	Downstream Node:	CP2
Inspected Length:	6.30 m	Dia/Height:	225 mm
Total Length:	6.30 m	Material:	Concrete

No.	m+	Code	Observation
1	0.00	MH	Start node, manhole, reference: Outfall 3
2	0.00	WL	Water level, 0% of the vertical dimension
3	6.30	CPF	Finish node, catchpit, reference: CP2, Buried, unable to access

Section Inspection - 11/11/2025 - HW1X

Item No. 1	Insp. No. 1	Date 11/11/25	Time 12:02	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned No	PLR HW1X
Operator JY		Vehicle FV73 RZB		Camera P540	Preset Length Not Specified	Legal Status Highways Drainage	Alternative ID Not Specified

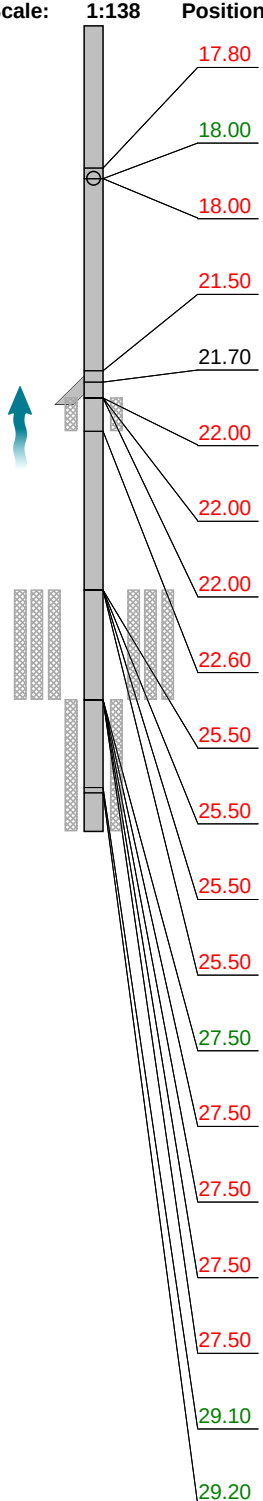
Town or Village:	Reed	Inspection Direction:	Upstream	Upstream Node:	HW1
Road:	Jacksons Lane	Inspected Length:	56.20 m	Upstream Pipe Depth:	
Location:	Verge	Total Length:	56.20 m	Downstream Node:	OUTFALL 1
Surface Type:	Grass	Joint Length:		Downstream Pipe Depth:	
Use:	Culverted watercourse	Pipe Shape:	Circular		
Type of Pipe:	Gravity drain/sewer	Dia/Height:	150 mm		
Flow Control:	No flow control	Material:	Vitrified clay		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:
Recommendations:

Scale: 1:138	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m Outfall 1						
	0.00	OF	Start node, outfall, reference: Outfall 1	00:00:00	1	
	0.00	WL	Water level, 0% of the vertical dimension	00:00:21		
	0.00	S01	DES Settled deposits, fine, 30% cross-sectional area loss, start	00:00:21	2, 3	
	1.00	C01	DES Settled deposits, fine, 20% cross-sectional area loss, change	00:13:55	4	
	2.00	C01	DES Settled deposits, fine, 10% cross-sectional area loss, change	00:13:55	5	
	2.50	F01	DES Settled deposits, fine, 10% cross-sectional area loss, finish	00:13:55	6	4
	4.00	DER	Settled deposits, coarse, 10% cross-sectional area loss	00:13:51	7	3
	5.60	S11	FL Fracture, longitudinal at 12 o'clock, start	00:13:35	8	
	6.40	F11	FL Fracture, longitudinal at 12 o'clock, finish	00:13:35	9	3 / 2
	11.20	RFJ	Roots, fine at joint	00:13:17	10	2
	12.20	FMJ	Fractures, multiple at joint from 12 o'clock to 12 o'clock	00:13:10	11	4 / 2
	12.40	D	Deformed sewer or drain, 10%	00:13:01	12, 13	4 / 3
	12.50	JDL	Joint displaced, large	00:12:48	14	1 / 4
	12.50	BJ	Broken pipe at joint from 9 o'clock to 3 o'clock	00:12:54	15	4
	12.60	LL	Line deviates left	00:12:42	16	

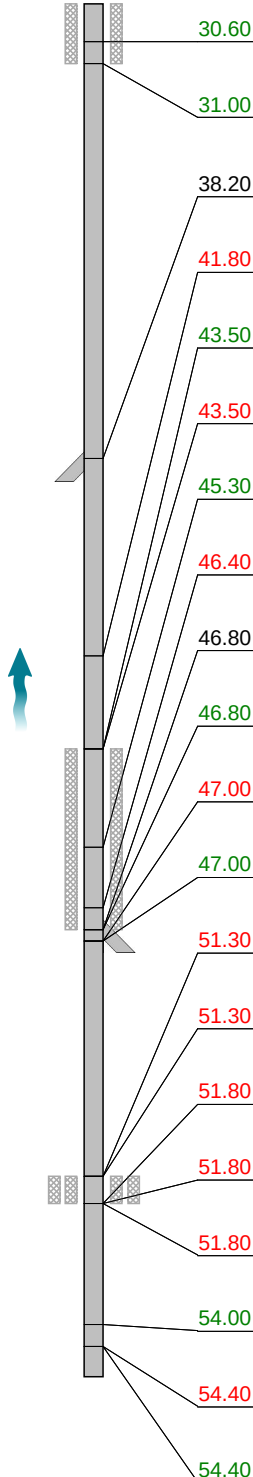
Section Inspection - 11/11/2025 - HW1X

Item No. 1	Insp. No. 1	Date 11/11/25	Time 12:02	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned No	PLR HW1X
Operator JY		Vehicle FV73 RZB		Camera P540	Preset Length Not Specified	Legal Status Highways Drainage	Alternative ID Not Specified

Scale:	1:138	Position [m]	Code	Observation	MPEG	Photo	Grade	
		17.80	FLJ	Fracture, longitudinal at joint at 1 o'clock	00:12:17	17	3 / 2	
		18.00	CXI	Connection defective, connecting pipe is intruding at 12 o'clock, 150mm dia, intrusion: 25%	00:12:12	18	4	
		18.00	FC	Fracture, circumferential from 7 o'clock to 11 o'clock	00:12:12		3 / 2	
		21.50	OJL	Open joint, large	00:11:54	19	1	
		21.70	JN	Junction at 3 o'clock, 100mm dia	00:11:51	20		
		22.00	FL	Fracture, longitudinal at 12 o'clock	00:11:39		3 / 2	
		22.00	JDM	Joint displaced, medium	00:11:43		1 / 3	
		22.00	S10	FL	Fracture, longitudinal at 9 o'clock, start	00:11:43	21	
		22.60	F10	FL	Fracture, longitudinal at 9 o'clock, finish	00:11:37	22	3 / 2
		25.50	S08	FL	Fracture, longitudinal at 8 o'clock, start	00:11:13		
		25.50	S06	FL	Fracture, longitudinal at 12 o'clock, start	00:11:21	23	
		25.50	FLJ	Fracture, longitudinal at joint at 11 o'clock	00:11:21	24	3 / 2	
		25.50	S09	FL	Fracture, longitudinal at 1 o'clock, start	00:11:21	25	
		27.50	S05	DER	Settled deposits, coarse, 25% cross-sectional area loss, start	00:10:53	26	
		27.50	JDL	Joint displaced, large	00:10:58	27	1 / 4	
		27.50	F08	FL	Fracture, longitudinal at 8 o'clock, finish	00:11:00		3 / 2
		27.50	F06	FL	Fracture, longitudinal at 12 o'clock, finish	00:11:00		3 / 2
		27.50	F09	FL	Fracture, longitudinal at 1 o'clock, finish	00:11:01	28	3 / 2
		29.10	C05	DER	Settled deposits, coarse, 35% cross-sectional area loss, change	00:10:35	29	
		29.20	RMJ	Roots, mass at joint, 45% cross-sectional area loss	00:10:40	30	5	

Section Inspection - 11/11/2025 - HW1X

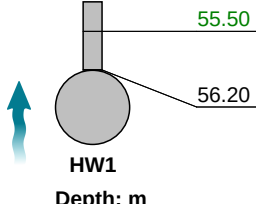
Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
1	1	11/11/25	12:02	Not Specified	No Rain Or Snow	No	HW1X
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
JY		FV73 RZB		P540	Not Specified	Highways Drainage	Not Specified

Scale:	1:138	Position [m]	Code	Observation	MPEG	Photo	Grade		
		30.60	C05	DER	Settled deposits, coarse, 25% cross-sectional area loss, change	00:10:22	31		
		31.00	F05	DER	Settled deposits, coarse, 25% cross-sectional area loss, finish	00:10:17	32	4	
		38.20	JN	Junction at 2 o'clock, 100mm dia	00:09:49	33			
		41.80	JDM	Joint displaced, medium	00:09:34	34	1 / 3		
		43.50	S04	DER	Settled deposits, coarse, 20% cross-sectional area loss, start	00:09:18	35		
		43.50	JDM	Joint displaced, medium	00:09:20			1 / 3	
		45.30	RFJ	Roots, fine at joint	00:09:06	36	2		
		46.40	B	Broken pipe from 12 o'clock to 12 o'clock	00:08:56	37	4		
		46.80	JN	Junction at 9 o'clock, 150mm dia	00:08:44	38			
		46.80	F04	DER	Settled deposits, coarse, 20% cross-sectional area loss, finish	00:08:49	39	4	
		47.00	JDM	Joint displaced, medium	00:08:41	40	1 / 3		
		47.00	RFJ	Roots, fine at joint	00:08:41			2	
		51.30	S03	FL	Fracture, longitudinal at 9 o'clock, start	00:08:03			
		51.30	S02	FL	Fracture, longitudinal at 3 o'clock, start	00:08:03	41		
		51.80	F03	FL	Fracture, longitudinal at 9 o'clock, finish	00:08:08	42	3 / 2	
		51.80	F02	FL	Fracture, longitudinal at 3 o'clock, finish	00:08:08			3 / 2
		51.80	FC	Fracture, circumferential from 10 o'clock to 4 o'clock	00:08:08	43	3 / 2		
		54.00	DER	Settled deposits, coarse, 10% cross-sectional area loss	00:07:52	44	3		
		54.40	JDL	Joint displaced, large	00:07:49	45	1 / 4		
		54.40	RFJ	Roots, fine at joint	00:07:49			2	

Section Inspection - 11/11/2025 - HW1X

Item No.	Insp. No.	Date	Time	Client's Job Ref	Weather	Pre Cleaned	PLR
1	1	11/11/25	12:02	Not Specified	No Rain Or Snow	No	HW1X
Operator		Vehicle		Camera	Preset Length	Legal Status	Alternative ID
JY		FV73 RZB		P540	Not Specified	Highways Drainage	Not Specified

Scale:	1:138	Position [m]	Code	Observation	MPEG	Photo	Grade
		55.50	DER	Settled deposits, coarse, 20% cross-sectional area loss	00:07:34	46	4
		56.20	OFF	Finish node, outfall, reference: HW1	00:07:17	47, 48	



Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
24	160.0	16.6	932.0	4.0	33	15.0	2.2	124.0	5.0



Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



7, 00:13:51, 4.00 m
Settled deposits, coarse, 10% cross-sectional area loss



8, 00:13:35, 5.60 m
Fracture, longitudinal at 12 o'clock, start



9, 00:13:35, 6.40 m
Fracture, longitudinal at 12 o'clock, finish



10, 00:13:17, 11.20 m
Roots, fine at joint



11, 00:13:10, 12.20 m
Fractures, multiple at joint from 12 o'clock to 12 o'clock



12, 00:13:01, 12.40 m
Deformed sewer or drain, 10%



Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



13, 00:13:01, 12.40 m
Deformed sewer or drain, 10%



14, 00:12:48, 12.50 m
Joint displaced, large



15, 00:12:54, 12.50 m
Broken pipe at joint from 9 o'clock to 3 o'clock



16, 00:12:42, 12.60 m
Line deviates left



17, 00:12:17, 17.80 m
Fracture, longitudinal at joint at 1 o'clock



18, 00:12:12, 18.00 m
Connection defective, connecting pipe is intruding at 12 o'clock, 150mm dia, intrusion: 25%



Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



19, 00:11:54, 21.50 m
Open joint, large



20, 00:11:51, 21.70 m
Junction at 3 o'clock, 100mm dia



21, 00:11:43, 22.00 m
Fracture, longitudinal at 9 o'clock, start



22, 00:11:37, 22.60 m
Fracture, longitudinal at 9 o'clock, finish



23, 00:11:21, 25.50 m
Fracture, longitudinal at 12 o'clock, start



24, 00:11:21, 25.50 m
Fracture, longitudinal at joint at 11 o'clock



Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



31, 00:10:22, 30.60 m
Settled deposits, coarse, 25% cross-sectional area loss, change



32, 00:10:17, 31.00 m
Settled deposits, coarse, 25% cross-sectional area loss, finish



33, 00:09:49, 38.20 m
Junction at 2 o'clock, 100mm dia



34, 00:09:34, 41.80 m
Joint displaced, medium



35, 00:09:18, 43.50 m
Settled deposits, coarse, 20% cross-sectional area loss, start



36, 00:09:06, 45.30 m
Roots, fine at joint

Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



37, 00:08:56, 46.40 m
Broken pipe from 12 o'clock to 12 o'clock



38, 00:08:44, 46.80 m
Junction at 9 o'clock, 150mm dia



39, 00:08:49, 46.80 m
Settled deposits, coarse, 20% cross-sectional area loss, finish



40, 00:08:41, 47.00 m
Joint displaced, medium



41, 00:08:03, 51.30 m
Fracture, longitudinal at 3 o'clock, start



42, 00:08:08, 51.80 m
Fracture, longitudinal at 9 o'clock, finish

Section Pictures - 11/11/2025 - HW1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
1	Upstream	HW1X		



43, 00:08:08, 51.80 m
Fracture, circumferential from 10 o'clock to 4 o'clock



44, 00:07:52, 54.00 m
Settled deposits, coarse, 10% cross-sectional area loss



45, 00:07:49, 54.40 m
Joint displaced, large



46, 00:07:34, 55.50 m
Settled deposits, coarse, 20% cross-sectional area loss



47, 00:07:17, 56.20 m
Finish node, outfall, reference: HW1



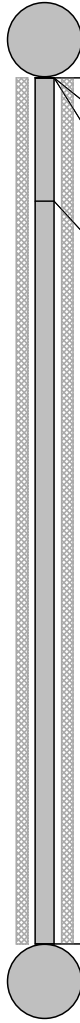
48, 00:07:17, 56.20 m
Finish node, outfall, reference: HW1

Section Inspection - 11/11/2025 - HW2X

Item No. 2	Insp. No. 1	Date 11/11/25	Time 12:12	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned No	PLR HW2X
Operator JY		Vehicle FV73 RZB		Camera P540	Preset Length Not Specified	Legal Status Highways Drainage	Alternative ID Not Specified

Town or Village:	Reed	Inspection Direction:	Downstream	Upstream Node:	HW2
Road:	Jacksons Lane	Inspected Length:	12.60 m	Upstream Pipe Depth:	
Location:	Verge	Total Length:	12.60 m	Downstream Node:	CP1
Surface Type:	Asphalt Highway	Joint Length:		Downstream Pipe Depth:	0.760 m
Use:	Culverted watercourse	Pipe Shape:	Circular		
Type of Pipe:	Gravity drain/sewer	Dia/Height:	225 mm		
Flow Control:	No flow control	Material:	Asbestos cement		
Year Constructed:	Not Specified	Lining Type:	No Lining		
Inspection Purpose:	Routine inspection	Lining Material:	No Lining		

Comments:
Recommendations:

Scale: 1:110	Position [m]	Code	Observation	MPEG	Photo	Grade																																			
Depth: m HW2  <table border="1"> <tbody> <tr> <td>0.00</td><td>OF</td><td></td><td>Start node, outfall, reference: HW2</td><td>00:00:00</td><td>1</td><td></td></tr> <tr> <td>0.00</td><td>WL</td><td></td><td>Water level, 0% of the vertical dimension</td><td>00:00:09</td><td></td><td></td></tr> <tr> <td>0.00</td><td>S01</td><td>DES</td><td>Settled deposits, fine, 25% cross-sectional area loss, start</td><td>00:00:09</td><td>2, 3</td><td></td></tr> <tr> <td>1.80</td><td>C01</td><td>DES</td><td>Settled deposits, fine, 20% cross-sectional area loss, change</td><td>00:00:29</td><td>4</td><td></td></tr> <tr> <td>12.60</td><td>F01</td><td>DES</td><td>Settled deposits, fine, 20% cross-sectional area loss, finish</td><td>00:01:19</td><td>5, 6</td><td></td></tr> </tbody> </table>							0.00	OF		Start node, outfall, reference: HW2	00:00:00	1		0.00	WL		Water level, 0% of the vertical dimension	00:00:09			0.00	S01	DES	Settled deposits, fine, 25% cross-sectional area loss, start	00:00:09	2, 3		1.80	C01	DES	Settled deposits, fine, 20% cross-sectional area loss, change	00:00:29	4		12.60	F01	DES	Settled deposits, fine, 20% cross-sectional area loss, finish	00:01:19	5, 6	
0.00	OF		Start node, outfall, reference: HW2	00:00:00	1																																				
0.00	WL		Water level, 0% of the vertical dimension	00:00:09																																					
0.00	S01	DES	Settled deposits, fine, 25% cross-sectional area loss, start	00:00:09	2, 3																																				
1.80	C01	DES	Settled deposits, fine, 20% cross-sectional area loss, change	00:00:29	4																																				
12.60	F01	DES	Settled deposits, fine, 20% cross-sectional area loss, finish	00:01:19	5, 6																																				
CP1 Depth: 0.76 m																																									

Construction Features

Structural Defects

Miscellaneous Features

Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0



Section Pictures - 11/11/2025 - HW2X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
2	Downstream	HW2X		



1, 00:00:00, 0.00 m
Start node, outfall, reference: HW2



2, 00:00:09, 0.00 m
Settled deposits, fine, 25% cross-sectional area loss, start



3, 00:00:09, 0.00 m
Settled deposits, fine, 25% cross-sectional area loss, start



4, 00:00:29, 1.80 m
Settled deposits, fine, 20% cross-sectional area loss, change



5, 00:01:19, 12.60 m
Settled deposits, fine, 20% cross-sectional area loss, finish



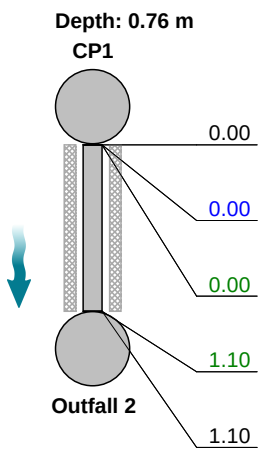
6, 00:01:19, 12.60 m
Settled deposits, fine, 20% cross-sectional area loss, finish

Section Inspection - 11/11/2025 - CP1X

Item No. 3	Insp. No. 1	Date 11/11/25	Time 12:15	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned No	PLR CP1X
Operator JY		Vehicle FV73 RZB		Camera P540	Preset Length Not Specified	Legal Status Highways Drainage	Alternative ID Not Specified

Town or Village:	Reed	Inspection Direction:	Downstream	Upstream Node:	CP1
Road:	Jacksons Lane	Inspected Length:	1.10 m	Upstream Pipe Depth:	0.760 m
Location:	Verge	Total Length:	1.10 m	Downstream Node:	OUTFALL 2
Surface Type:	Grass	Joint Length:		Downstream Pipe Depth:	
Use:	Culverted watercourse			Pipe Shape:	Circular
Type of Pipe:	Gravity drain/sewer			Dia/Height:	225 mm
Flow Control:	No flow control			Material:	Asbestos cement
Year Constructed:	Not Specified			Lining Type:	No Lining
Inspection Purpose:	Routine inspection			Lining Material:	No Lining

Comments:
Recommendations:

Scale:	1:50	Position [m]	Code	Observation	MPEG	Photo	Grade
							
		0.00	CP	Start node, catchpit, reference: CP1	00:00:00		
		0.00	WL	Water level, 0% of the vertical dimension	00:00:35		
		0.00	S01	DER Settled deposits, coarse, 75% cross-sectional area loss, start	00:00:35	1, 2	
		1.10	F01	DER Settled deposits, coarse, 75% cross-sectional area loss, finish	00:00:00		4
		1.10	OFF	Finish node, outfall, reference: Outfall 2	00:00:19	3, 4	
Depth: m							

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	1	8.0	14.5	16.0	5.0



Section Pictures - 11/11/2025 - CP1X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
3	Downstream	CP1X		



1, 00:00:35, 0.00 m
Settled deposits, coarse, 75% cross-sectional area loss, start



2, 00:00:35, 0.00 m
Settled deposits, coarse, 75% cross-sectional area loss, start



3, 00:00:19, 1.10 m
Finish node, outfall, reference: Outfall 2



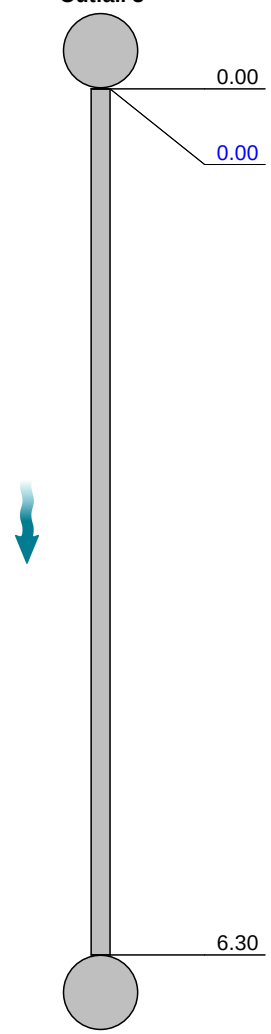
4, 00:00:19, 1.10 m
Finish node, outfall, reference: Outfall 2

Section Inspection - 11/11/2025 - Outfall 3X

Item No. 4	Insp. No. 1	Date 11/11/25	Time 12:17	Client's Job Ref Not Specified	Weather No Rain Or Snow	Pre Cleaned No	PLR OUTFALL 3X
Operator JY		Vehicle FV73 RZB		Camera P540	Preset Length Not Specified	Legal Status Highways Drainage	Alternative ID Not Specified

Town or Village:	Reed	Inspection Direction:	Downstream	Upstream Node:	OUTFALL 3
Road:	Jacksons Lane	Inspected Length:	6.30 m	Upstream Pipe Depth:	
Location:	Verge	Total Length:	6.30 m	Downstream Node:	CP2
Surface Type:	Grass	Joint Length:		Downstream Pipe Depth:	
Use:	Culverted watercourse			Pipe Shape:	Circular
Type of Pipe:	Gravity drain/sewer			Dia/Height:	225 mm
Flow Control:	No flow control			Material:	Concrete
Year Constructed:	Not Specified			Lining Type:	No Lining
Inspection Purpose:	Routine inspection			Lining Material:	No Lining

Comments:
Recommendations:

Scale:	1:55	Position [m]	Code	Observation	MPEG	Photo	Grade
Depth: m Outfall 3							
		0.00	MH	Start node, manhole, reference: Outfall 3	00:00:00	1	
		0.00	WL	Water level, 0% of the vertical dimension	00:00:00	2	
							
		6.30	CPF	Finish node, catchpit, reference: CP2: Buried, unable to access	00:00:36	3, 4	
CP2 Depth: m							

Construction Features
Structural Defects
Miscellaneous Features
Service & Operational Observations

STR No. Def	STR Peak	STR Mean	STR Total	STR Grade	SER No. Def	SER Peak	SER Mean	SER Total	SER Grade
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0



Section Pictures - 11/11/2025 - Outfall 3X

Item No.	Inspection Direction	PLR	Client's Job Ref	Contractor's Job Ref
4	Downstream	OUTFALL 3X		



1, 00:00:00, 0.00 m
Start node, manhole, reference: Outfall 3



2, 00:00:00, 0.00 m
Water level, 0% of the vertical dimension



3, 00:00:36, 6.30 m
Finish node, catchpit, reference: CP2, Buried, unable to access



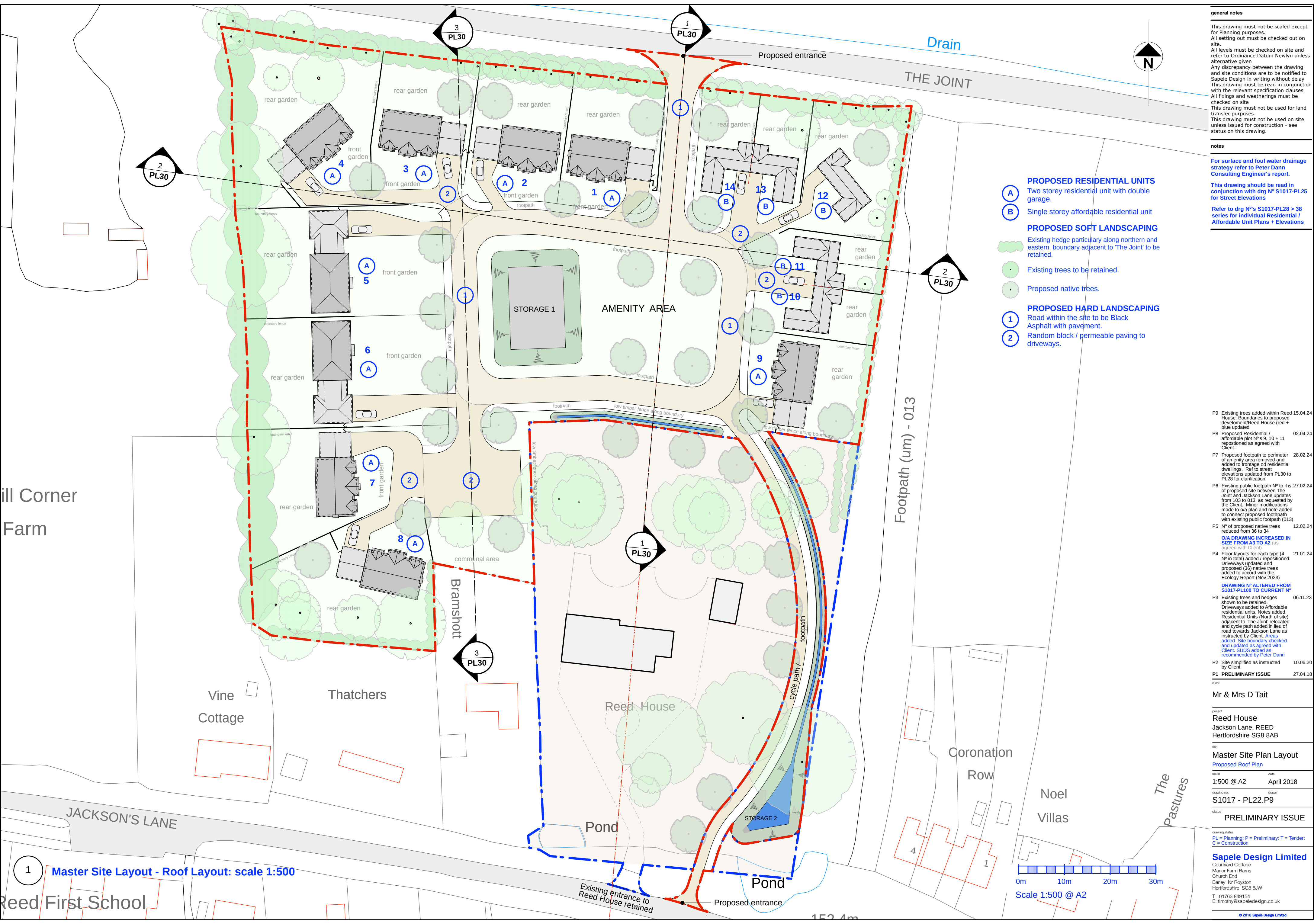
4, 00:00:36, 6.30 m
Finish node, catchpit, reference: CP2, Buried, unable to access

Disclaimer

Although every effort has been made to produce a thorough and precise report, Eyes On Drainage Services Ltd cannot be held liable for any discrepancies or omissions.

Furthermore Eyes On Drainage Services Ltd cannot be held responsible for any actions taken based on the information supplied within this report.

APPENDIX E – DEVELOPMENT MASTERPLAN



general notes

This drawing must not be scaled except for Planning purposes.
All setting out must be checked out on site.
All levels must be checked on site and refer to Ordinance Datum Newlyn unless alternative given.
Any discrepancy between the drawing and site conditions are to be notified to Sapele Design in writing without delay.
This drawing must be read in conjunction with the relevant specification clauses.
All fixings and weatherings must be checked on site.
This drawing must not be used for land transfer purposes.
This drawing must not be used on site unless issued for construction - see status on this drawing.

notes

For surface and foul water drainage strategy refer to Peter Dann Consulting Engineer's report.

This drawing should be read in conjunction with drg N° S1017-PL25 for Street Elevations

Refer to drg N°s S1017-PL28 > 38 series for individual Residential / Affordable Unit Plans + Elevations

P9

Existing trees added within Reed 15.04.24
House. Boundaries to proposed development/Reed House (red + blue updated)

02.04.24

P8

Proposed Residential / affordable plot N°s 9, 10 + 11 repositioned as agreed with Client.

28.02.24

P7

Proposed footpath to perimeter of amenity area removed and added to frontage of residential dwellings. Ref to street elevations updated from PL30 to PL28 for clarification

27.02.24

P6

Existing public footpath N° to rhs of proposed site between The Joint and Jackson Lane updates from 103 to 013, as requested by the Client. Minor modifications made to o/a plan and note added to connect proposed footpath with existing public footpath (013)

12.02.24

P5

N° of proposed native trees reduced from 36 to 34
O/A DRAWING INCREASED IN SIZE FROM A3 TO A2 (as agreed with Client)

21.01.24

P4

Floor layouts for each type (4 N° in total) added / repositioned. Driveways updated and proposed (35) native trees added to accord with the Ecology Report (Nov 2023)

06.11.23

P3

Existing trees and hedges shown to be retained. Driveways added to Affordable residential units. Notes added. Residential Units (North of site) adjacent to 'The Joint' relocated and cycle path added in lieu of road towards Jackson Lane as instructed by Client. Areas added. Site boundary checked and updated as agreed with Client. SUDS added as recommended by Peter Dann

10.06.20

P2

Site simplified as instructed by Client

27.04.18

P1

PRELIMINARY ISSUE

client

Mr & Mrs D Tait

project

Reed House
Jackson Lane, REED
Hertfordshire SG8 8AB

title

Master Site Plan Layout
Proposed Roof Plan

scale

1:500 @ A2

date

April 2018

drawing no.

S1017 - PL22.P9

status

PRELIMINARY ISSUE

drawing status

PL = Planning; P = Preliminary; T = Tender;
C = Construction

Sapele Design Limited
Courtyard Cottage
Manor Farm Barns
Church End
Barley Nr Royston
Hertfordshire SG8 8JW
T: 01763 849154
E: timothy@sapeledesign.co.uk

© 2018 Sapele Design Limited

APPENDIX F – FLUVIAL FLOODING INFORMATION

Rivers and sea map

Yearly chance of flooding

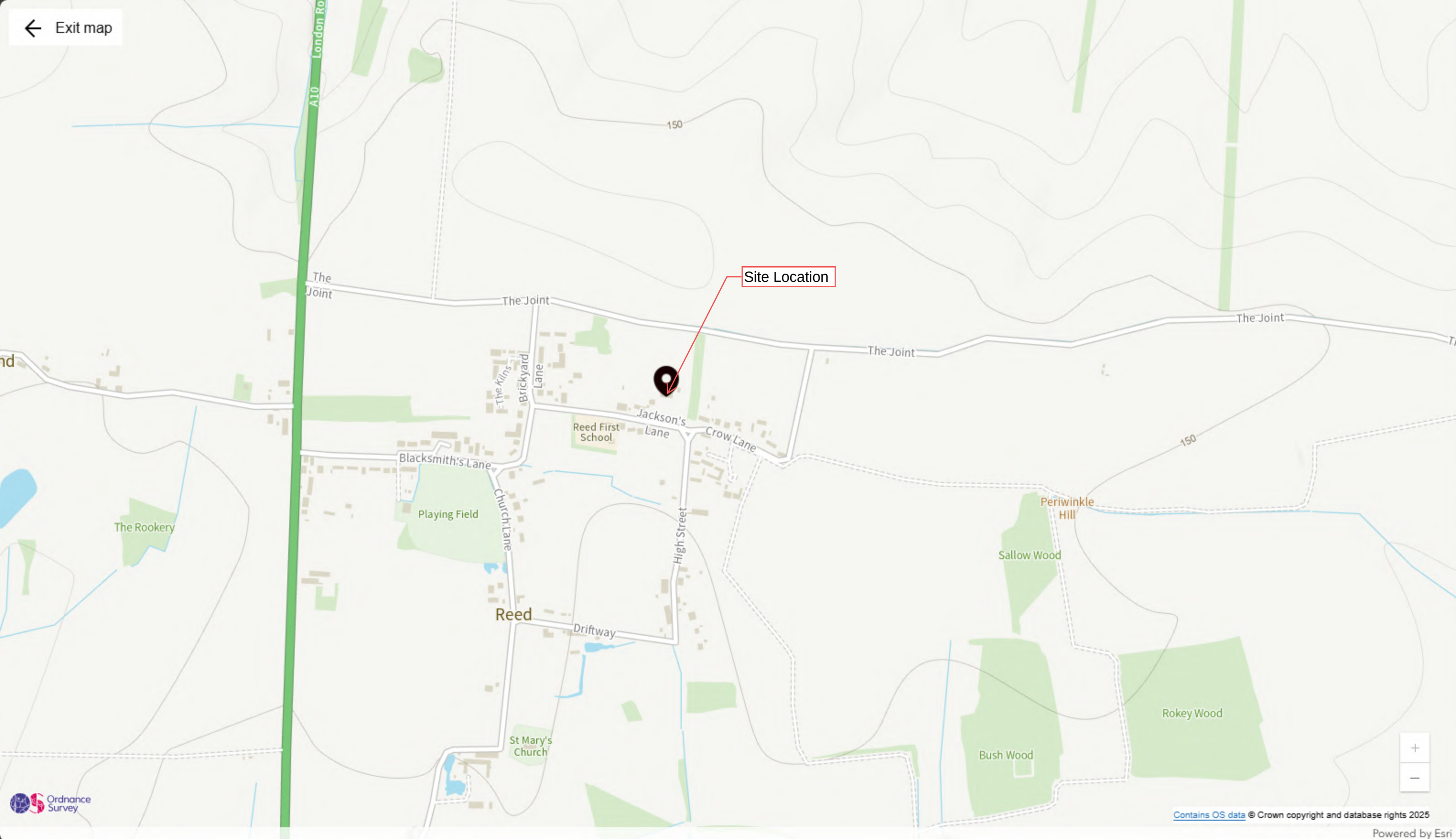
- Flood area (extent)
- High chance
 - Medium chance
 - Low chance
 - Very low chance

Yearly chance of flooding between 2036 and 2069

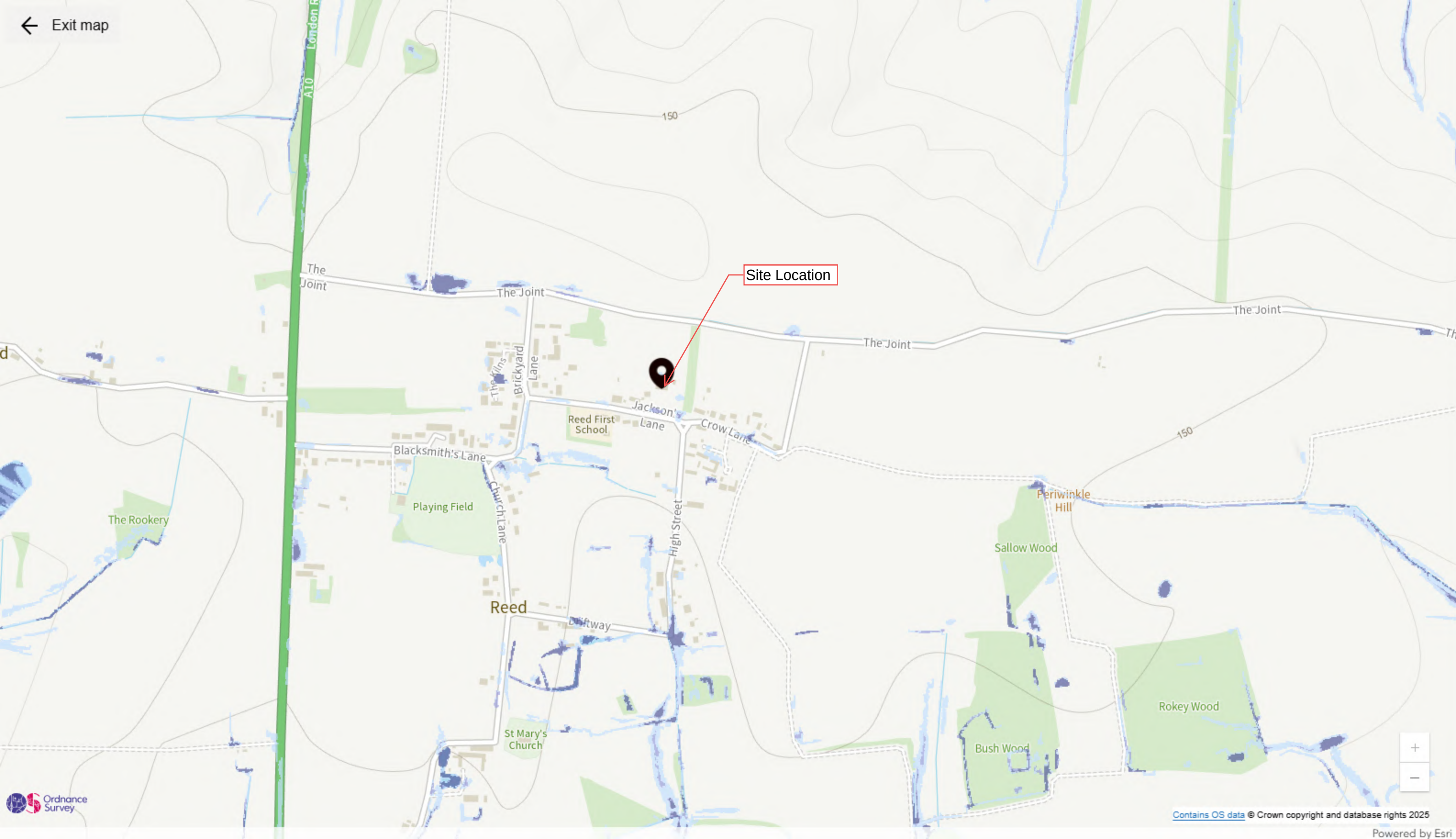
- Flood area (extent)

Map details

- ☒ Show flooding
- ☒ Selected address



APPENDIX G – SURFACE WATER FLOODING INFORMATION



Surface water map

Yearly chance of flooding

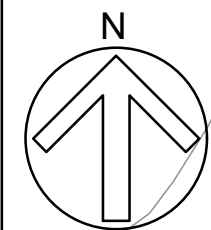
-  Flood area (extent)
 -  High chance
 -  Medium chance
 -  Low chance

Yearly chance of flooding between 2040 and 2060

-  Flood area (extent)

Map details

- ☒ Show flooding
- ☒  Selected address



SURFACE WATER FLOODING EXTENT LEGEND



Surface Water Flooding Extent
Based on EA Defra Risk of Flooding from Surface Water
mapping

NOTES:

1. This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
2. All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
3. Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
4. All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
5. The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
6. All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
7. All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

PI	18/11/25	FR	DM	PLANNING ISSUE
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS



peterdannlimited | newtonhouse
cambridge road | barton | cambridge | CB23 7WJ

t: 01223 264888 www.peterdann.com info@peterdann.com

JOB TITLE
**Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)**

DRAWING TITLE
EA Surface Water Flooding Extent

DATE Oct 2025	DRAWN FR	CHECKED DM	SCALE N.T.S	@A1 STATUS CODE FOR PLANNING
DRAWING STATUS PLANNING	JOB/ORG No. 10-5217_C-006			REV. P1

© Peter Dann Ltd. All rights reserved.

APPENDIX H – RESERVOIR FLOODING INFORMATION

← Exit map

 Surface water

 Rivers and the sea

Reservoirs map

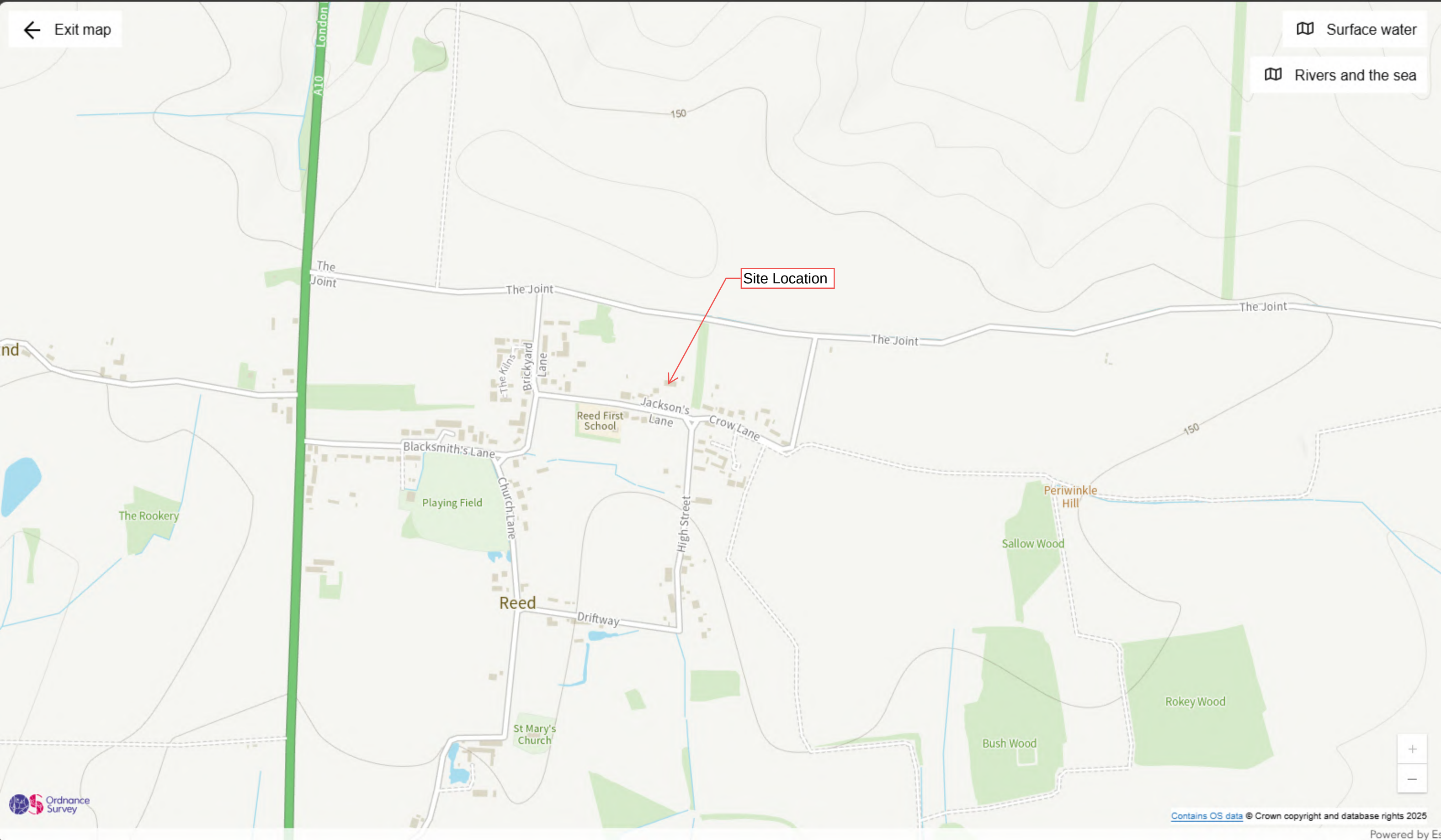
☒ Extent

 When river levels are normal

 When there is also flooding from rivers

Map details

☒ Show flooding

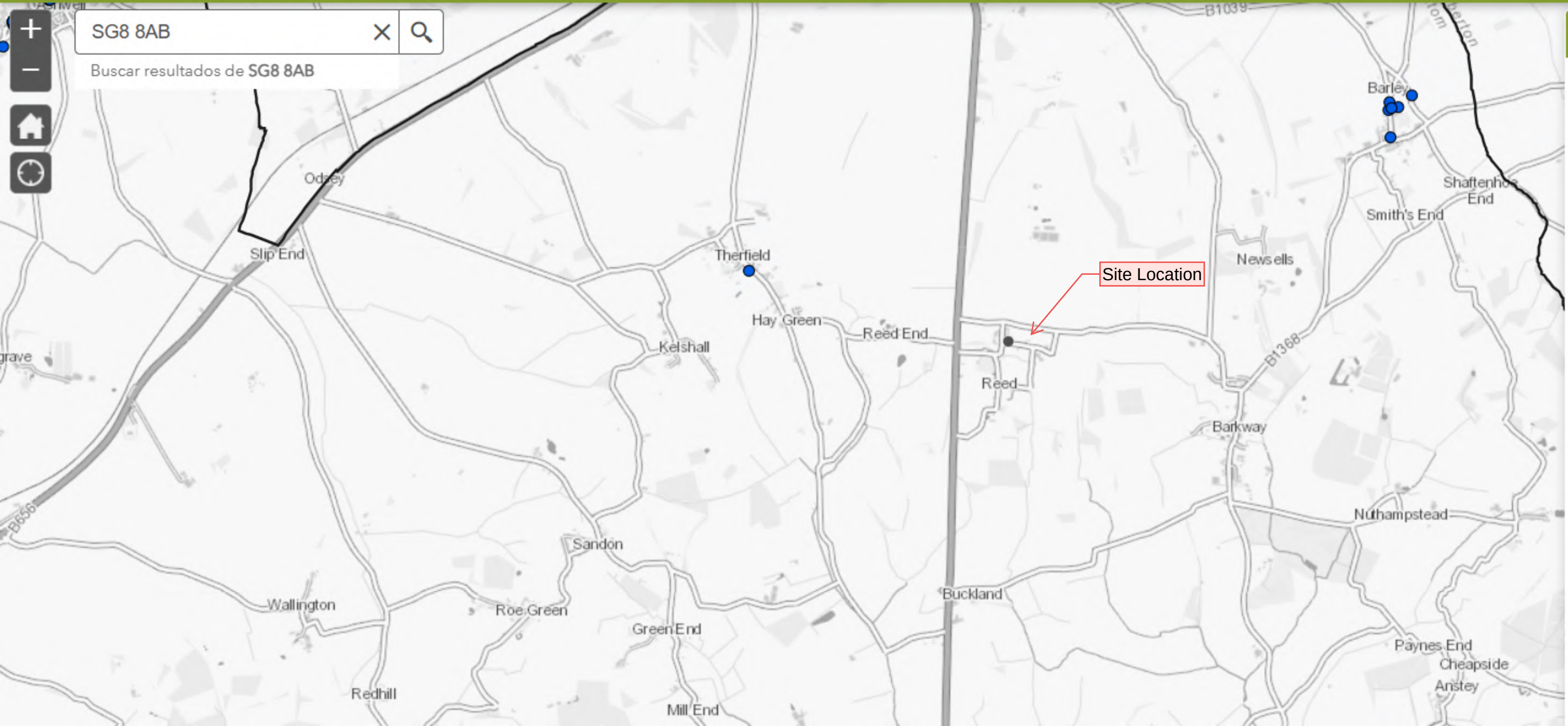


[Contains OS data](#) © Crown copyright and database rights 2025

Powered by Esri

APPENDIX I – HISTORIC FLOODING INCIDENT MAPPING

Maps and Geographic Information



Legend

HCC Flood Incident Record



**APPENDIX J – PROPOSED DRAINAGE STRATEGY & ASSOCIATED HYDRAULIC
NETWORK CALCULATIONS**



EXISTING DRAINAGE LEGEND

- CWMH
- Existing Thames Water Combined Water Drainage (locations / levels as taken from Thames Water asset plan information).
- SWMH
- Existing Surface Water drainage

DRAINAGE LEGEND

- Land under Client's control.
- Site Boundary (1.461ha)
- SWMH
- Proposed Surface Water Drainage (For pipe diameter, refer to Causeway FLOW calculations).
- FWMH
- Proposed Foul Water Drainage (Pipe diameter to be 150ø)
- Proposed pre-cast concrete headwall
- Proposed Permeable paving construction
- Proposed 2.50m wide dry swale.
- Exceedence Flow Arrow (Storm Events greater than the 100yr + 40% climate change event)
- Indicates cover level is indicative and subject to detailed hard-standing design

NOTES:

- This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
- All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
- Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
- All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
- The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
- All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
- All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

DS	19/11/23	FR	DM	LFA COMMENTS ADDRESSED
DS	19/11/23	FR	DM	MASTER PLAN DRAINAGE LAYOUT REVISED
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS



peterdannlimited | newtonhouse
cambridge road | barton | cambridge | CB23 7WJ

t: 01223 284888 www.peterdann.com info@peterdann.com

JOB TITLE

Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Proposed Drainage Strategy
(Sheet 1 of 3)

DATE Aug 2020

DRAWN DM

CHECKED DM

SCALE 1:250

@A1

DRAWING STATUS

PLANNING

STATUS CODE

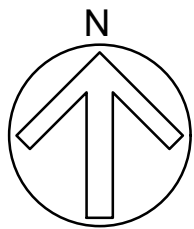
FOR PLANNING

JOB/ORG No.

10-5217_C-002

REV.

P3



NOTES:

1. This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
2. All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
3. Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
4. All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
5. The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
6. All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
7. All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

DS	19/11/23	FR	DM	LFA COMMENTS ADDRESSED
DS	19/05/23	FR	DM	MASTERPLAN DRAINAGE LAYOUT REVISED
PL	15/05/23	DT	DM	PLANNING ISSUE
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS



peterdann limited | newton house
cambridge road | barton | cambridge | CB23 7WJ

t: 01223 284888 www.peterdann.com info@peterdann.com

JOB TITLE

Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Proposed Drainage Strategy
(Sheet 2 of 3)

DATE Aug 2020 DRAWN DM CHECKED DM SCALE 1:250

DRAWING STATUS

PLANNING

JOB/ORG No.

10-5217_C-003

@A1

STATUS CODE

FOR PLANNING

REV.

P3

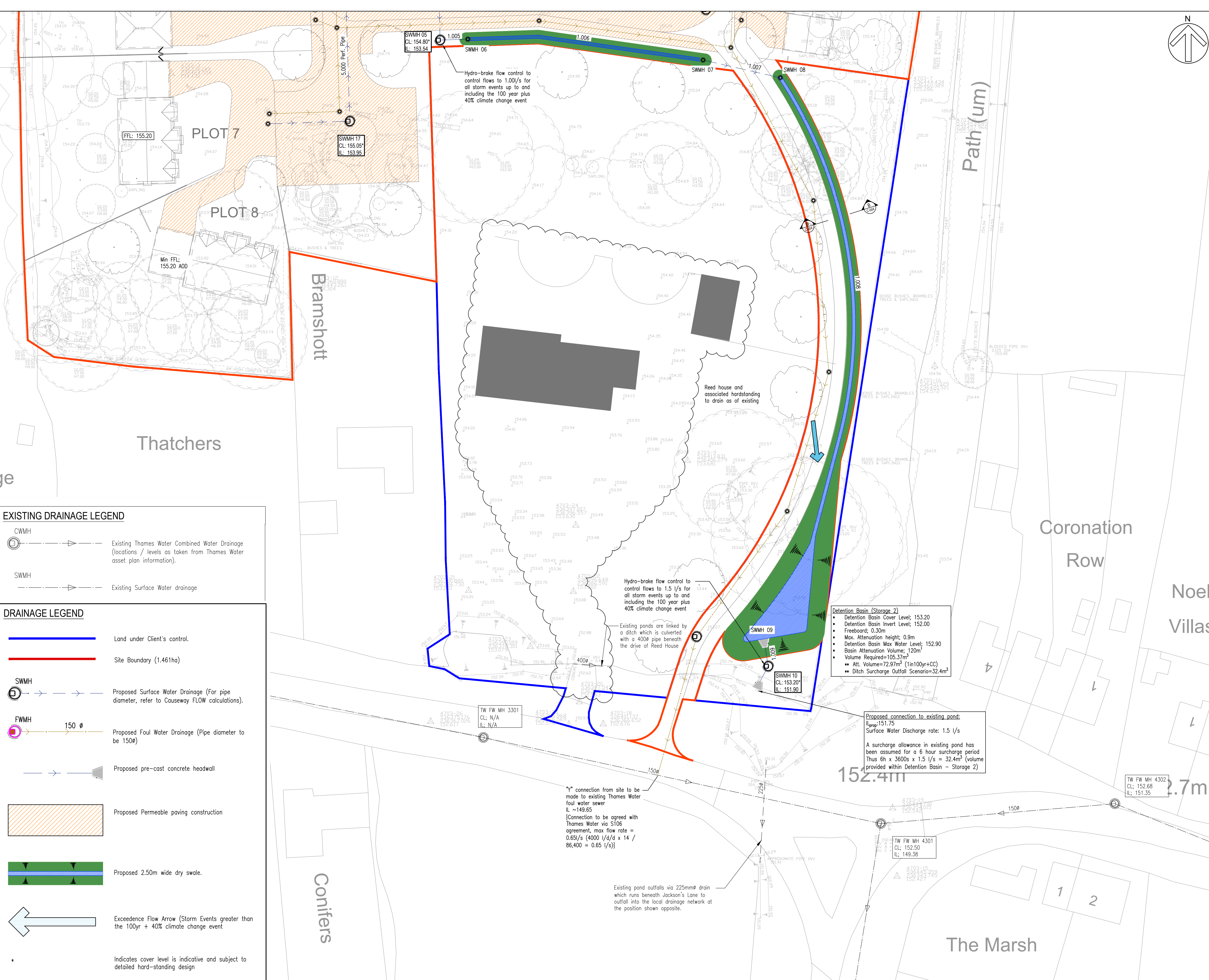
© Peter Dann Ltd. All rights reserved.

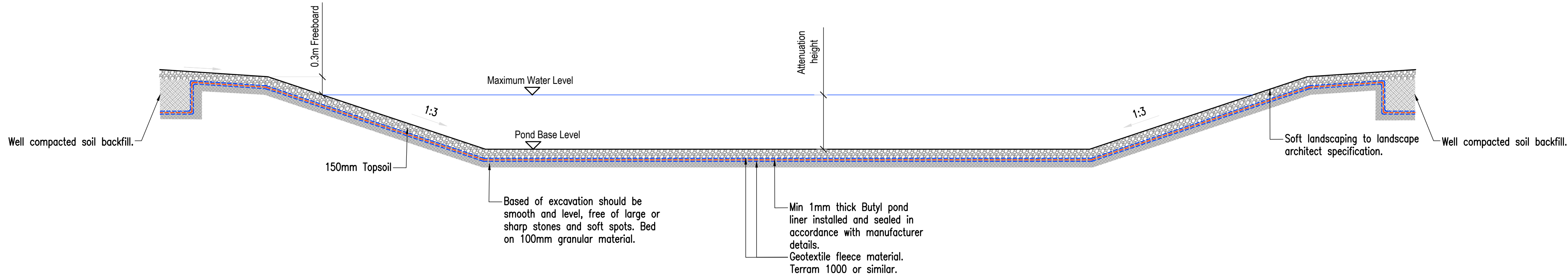
EXISTING DRAINAGE LEGEND

- CWMH
Existing Thames Water Combined Water Drainage (locations / levels as taken from Thames Water asset plan information).
- SWMH
Existing Surface Water drainage

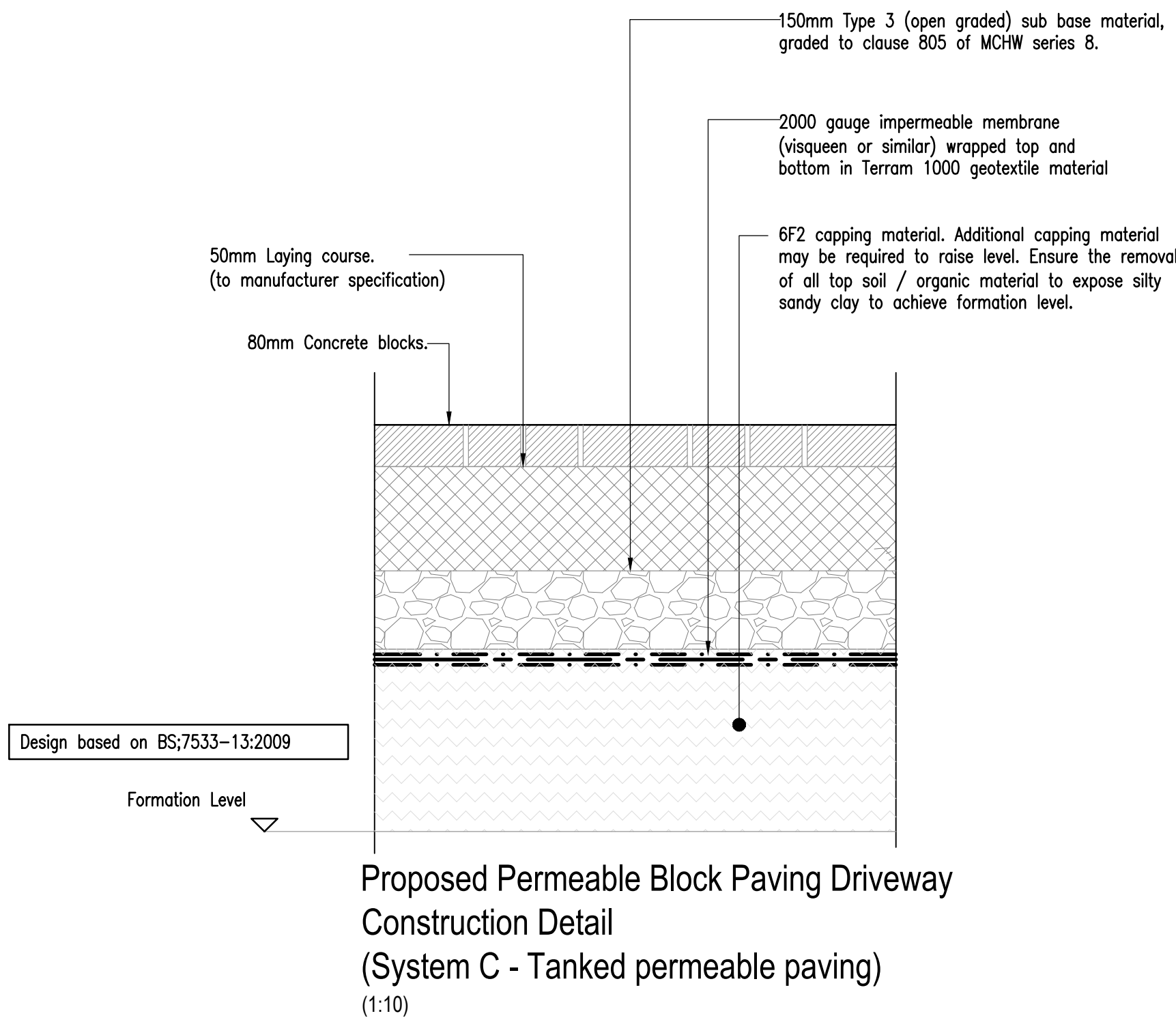
DRAINAGE LEGEND

- Land under Client's control.
- Site Boundary (1.461ha)
- SWMH
Proposed Surface Water Drainage (For pipe diameter, refer to Causeway FLOW calculations).
- FWMH
Proposed Foul Water Drainage (Pipe diameter to be 150ø)
- Proposed pre-cast concrete headwall
- Proposed Permeable paving construction
- Proposed 2.50m wide dry swale.
- Exceedence Flow Arrow (Storm Events greater than the 100yr + 40% climate change event)
- * Indicates cover level is indicative and subject to detailed hard-standing design

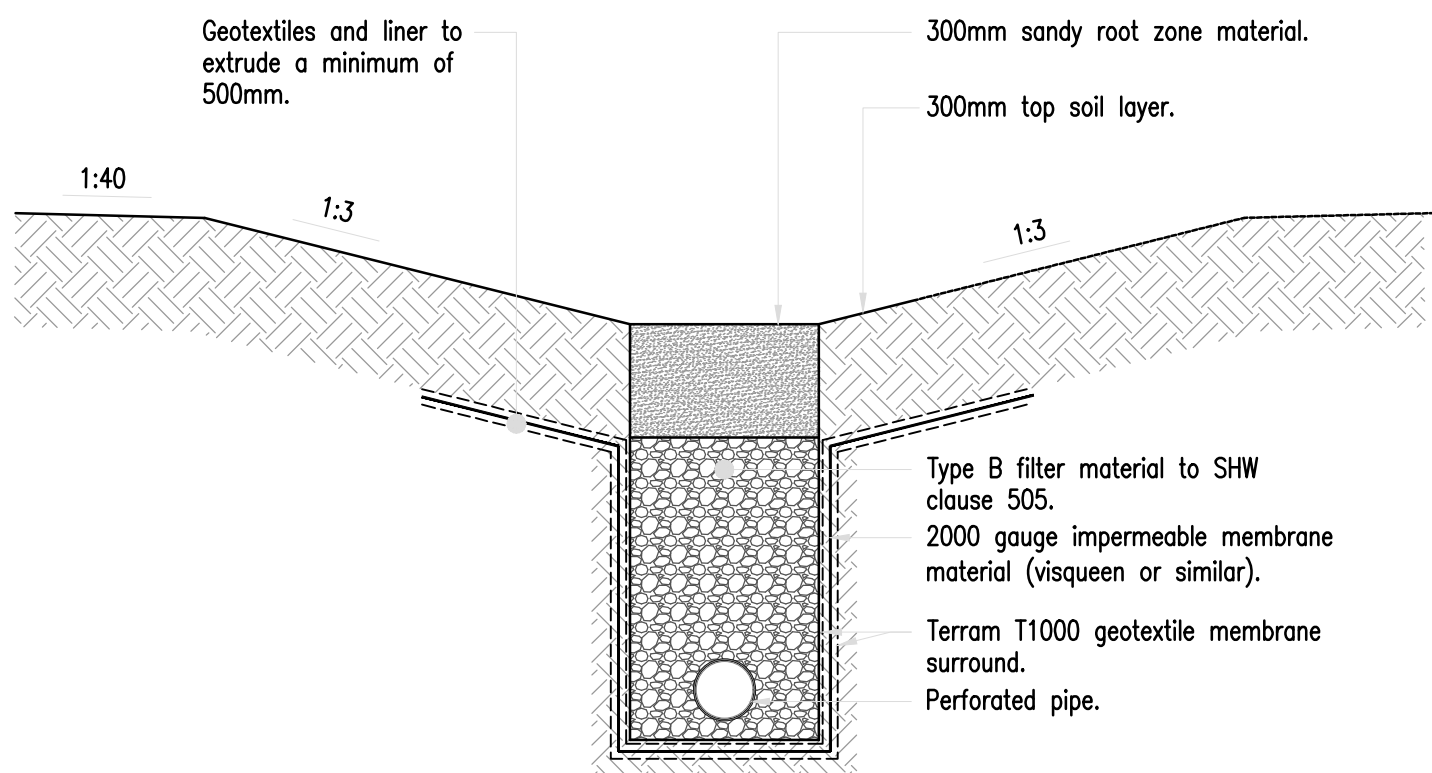




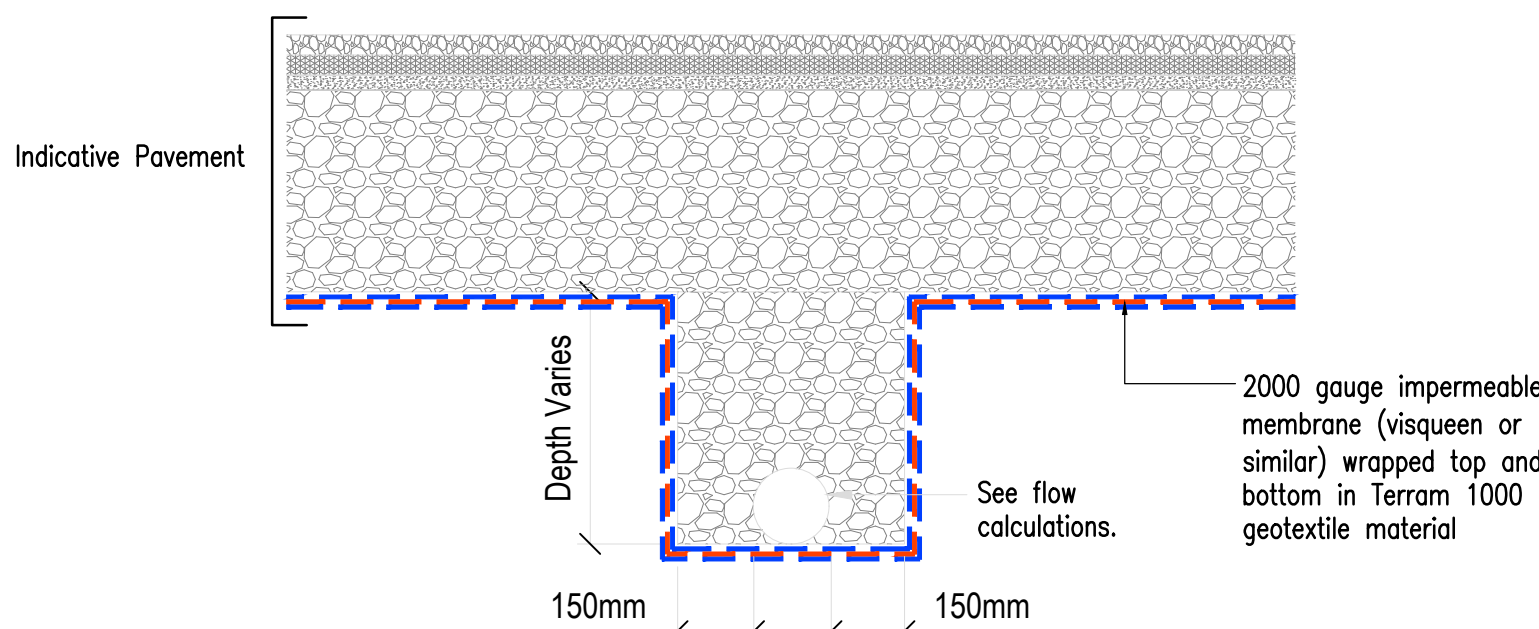
Section A-A - Typical Attenuation Basin Detail
(1:50)



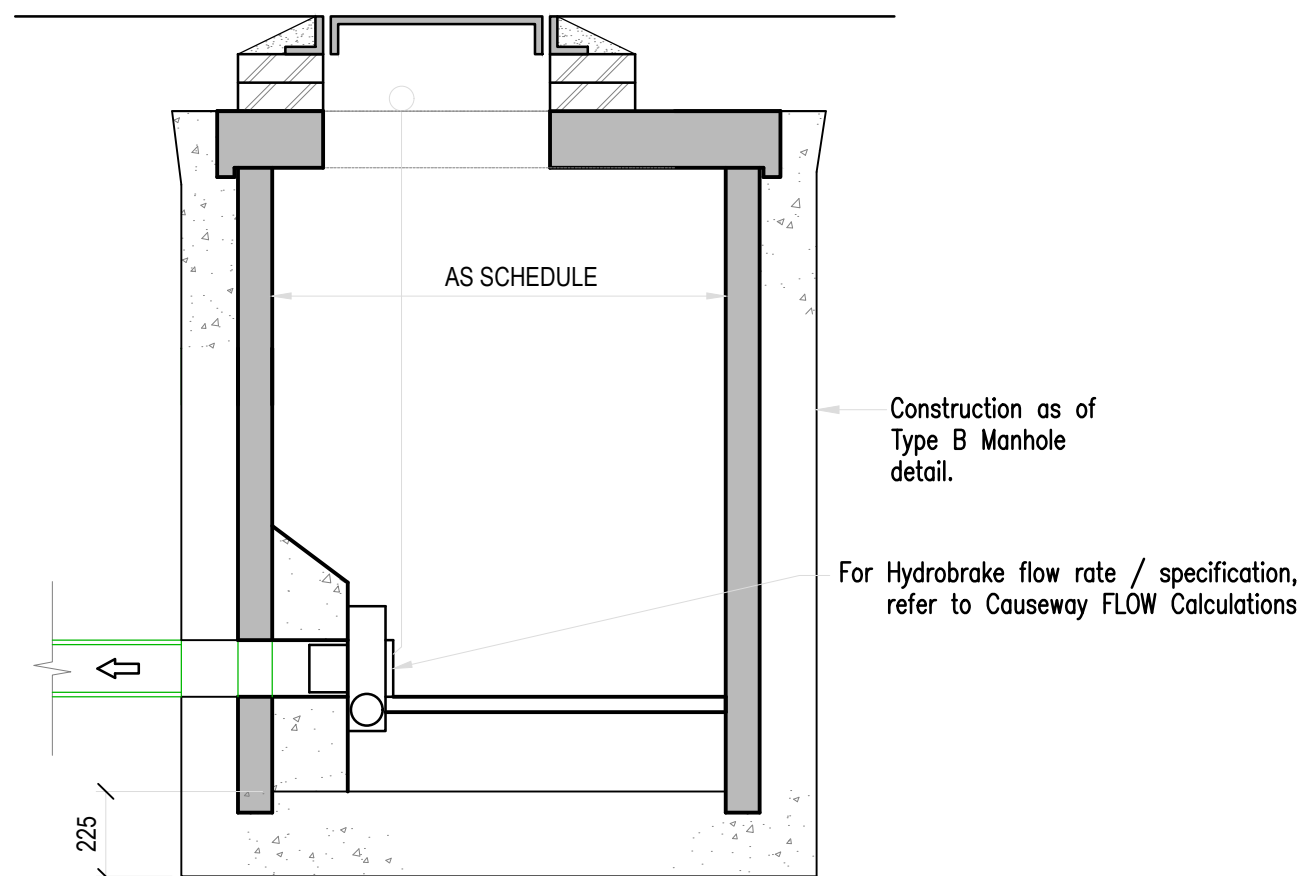
Proposed Permeable Block Paving Driveway
Construction Detail
(System C - Tanked permeable paving)
(1:10)



Section B-B - Typical Dry Swale Detail
(1:20)



Section C-C - Typical Sub-Formation Drainage Arrangement (1:15)



Control Chamber (1:20)
(Max depth from cover level to soffit of pipe of 3.0m)
Manhole construction shall comply with 'Design and Construction Guidance for
foul and surface water sewers'

NOTES:

1. This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
2. All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
3. Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
4. All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
5. The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
6. All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
7. All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

REV	DATE	OWN	CHK	DESCRIPTION
P2	18/11/22	PL	DM	LFA COMMENTS ADDRESSED
P1	15/08/22	DT	DM	PLANNING ISSUE

AMENDMENTS



peterdannlimited | newtonhouse
cambridge road | barton | cambridge | CB23 7WJ

t: 01223 264888 www.peterdann.com info@peterdann.com

JOB TITLE

Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

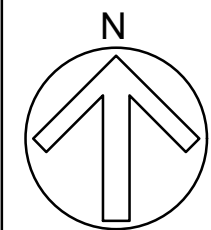
Proposed Drainage Strategy
(Sheet 3 of 3)

DATE: Aug 2020
DRAWN: DM
CHECKED: DM
SCALE: As shown

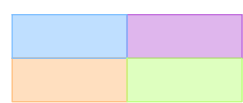
DRAWING STATUS: PLANNING
STATUS CODE: FOR PLANNING

JOB/DRG No.: 10-5217_C-004
REV.: P2

© Peter Dann Ltd. All rights reserved.



CATCHMENT PLAN LEGEND



Proposed Impermeable Area = 0.723 ha

NOTES:

1. This drawing is to be read in conjunction with all Peter Dann Consulting Engineers, Architects, MEP Engineers and Specialists drawings along with all relevant specifications.
2. All gridlines, building lines, etc. are to be set out in accordance with the relevant Architects drawings. Any discrepancies between the information given by the Engineer and that provided by others must be referred to the Architect before work proceeds.
3. Dimensions are NOT to be scaled from this drawing. If in doubt ask. Dimensions marked * are subject to confirmation by site measurement before construction commences.
4. All proprietary fixings shall be installed in accordance with the manufacturer's recommendations.
5. The Contractor shall comply with the health and safety requirements as set out by the CDM Regulations, THE HEALTH AND SAFETY EXECUTIVE.
6. All works are to be undertaken in accordance with the Building Regulations and latest relevant British Standards.
7. All construction products are to be CE marked in accordance with the Construction Products Regulation (EU) No. 305/2011.



CDM 2015

CONSTRUCTION - It is considered that the proposed works are within the scope of a competent contractor and as such no unusual hazards have been identified, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

LIFETIME/USAGE - The building has no exceptional structural features that present a hazard to potential users, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

DECOMMISSIONING/DEMOLITION - There are no unusual structural aspects to this building that require highlighting in the event that the building is demolished, with the exception of the following:-

- ** (Assessed & completed by PDL Project Manager)

RECORD INFORMATION - The record drawings / operating manual for the building should be thoroughly studied and its implications assessed by the demolition contractor.

DS	19/11/23	FR	DM	LFA COMMENTS ADDRESSED
DS	19/09/23	FR	DM	MASTERPLAN DRAINAGE LAYOUT REVISED
DS	15/09/23	DT	DM	PLANNING ISSUE
REV	DATE	DWN	CHK	DESCRIPTION

AMENDMENTS



peterdannlimited | newtonhouse
cambridge road | barton | cambridge | CB23 7WJ

t: 01223 264888 www.peterdann.com info@peterdann.com

JOB TITLE

Reed House, Jacksons Lane
Reed, Hertfordshire (SG8 8AB)

DRAWING TITLE

Proposed Drainage Catchment Plan

DATE Aug 2020

DRAWN DM

CHECKED DM

SCALE N.T.S

@A1

DRAWING STATUS

STATUS CODE

PLANNING

FOR PLANNING

JOB/DWG No.

REV.

10-5217_C-005

P3

© Peter Dann Ltd. All rights reserved.

Nodes							
Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWMH 01	0.047	4.00	156.100	1200	536345.903	236545.387	0.900
SWMH 02	0.027	4.00	157.000	1200	536408.082	236536.922	2.505
SWMH 03			156.100	1200	536404.091	236507.932	1.975
SWMH 04	0.020	4.00	156.000	1200	536381.570	236510.998	2.110
STORAGE 1	0.154	4.00	155.200	1200	536376.329	236485.327	1.500
SWMH 05			154.800	1200	536376.595	236469.538	1.258
SWMH 06			154.800	1200	536380.149	236469.662	1.294
SWMH 07	0.008	4.00	155.000	1200	536416.593	236466.444	1.759
SWMH 08			155.000	1200	536427.493	236464.309	1.995
STORAGE 2	0.088	4.00	153.200	1200	536425.306	236379.441	1.200
SWMH 10			153.200	1200	536425.976	236375.332	1.300
SWMH 11	0.023	4.00	157.000	1200	536447.281	236531.586	2.000
SWMH 13	0.042	4.00	155.000	1200	536416.608	236474.134	1.120
SWMH 14	0.031	4.00	155.200	1200	536384.088	236476.748	1.450
SWMH 15	0.051	4.00	156.200	1200	536416.663	236506.221	1.500
SWMH 16	0.092	4.00	155.800	1200	536363.059	236510.408	1.700
SWMH 17	0.051	4.00	155.050	1200	536363.003	236457.341	1.100
SWMH 18	0.089	4.00	155.200	1200	536362.114	236484.999	1.400

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SWMH 01	SWMH 02	62.753	0.600	155.200	154.570	0.630	99.6	225	4.80	92.7
1.001	SWMH 02	SWMH 03	29.263	0.600	154.495	154.200	0.295	99.2	225	5.17	89.0
1.002	SWMH 03	SWMH 04	22.729	0.600	154.125	153.890	0.235	96.7	300	5.41	86.8
1.003	SWMH 04	STORAGE 1	26.201	0.600	153.890	153.700	0.190	137.9	300	5.73	84.6
1.004	STORAGE 1	SWMH 05	15.791	0.600	153.700	153.542	0.158	99.9	150	6.00	83.5
1.005	SWMH 05	SWMH 06	3.556	0.600	153.542	153.506	0.036	98.8	150	6.05	83.2
1.006	SWMH 06	SWMH 07	39.741	0.600	153.506	153.241	0.265	150.0	150	6.86	80.2
1.007	SWMH 07	SWMH 08	16.144	0.600	153.241	153.080	0.161	100.3	150	7.13	79.1
1.008	SWMH 08	STORAGE 2	85.835	0.600	153.005	152.000	1.005	85.4	225	8.14	73.6
1.009	STORAGE 2	SWMH 10	3.893	0.600	152.000	151.900	0.100	38.9	150	8.18	73.3
2.000	SWMH 11	SWMH 02	39.561	0.600	155.000	154.570	0.430	92.0	150	4.63	93.8
3.000	SWMH 13	SWMH 14	24.901	0.600	153.880	153.750	0.130	191.5	225	4.44	95.8
3.001	SWMH 14	STORAGE 1	8.244	0.600	153.750	153.700	0.050	164.9	225	4.58	94.3
6.000	SWMH 15	SWMH 03	16.944	0.600	154.700	154.200	0.500	33.9	225	4.13	92.0
4.000	SWMH 16	SWMH 04	18.520	0.600	154.100	153.965	0.135	137.2	225	4.28	96.7
5.000	SWMH 17	SWMH 18	27.672	0.600	153.950	153.800	0.150	184.5	225	4.48	95.4
5.001	SWMH 18	STORAGE 1	14.219	0.600	153.800	153.700	0.100	142.2	225	4.70	94.8

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	1500	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m ³ /ha)	0.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	10	0
2	0	10	0
30	0	10	0
30	35	10	0
100	0	10	0
100	40	10	0
1000	0	10	0

Node STORAGE 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	153.700	Product Number	CTL-SHE-0045-1000-1200-1000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node STORAGE 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	152.000	Product Number	CTL-SHE-0059-1500-0900-1500
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

Node STORAGE 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	153.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	331.0	0.0	1.200	642.0	0.0

Node STORAGE 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	152.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	65.0	0.0	0.900	200.0	0.0

Results for 1 year +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	10	155.242	0.042	4.2	0.0472	0.0000	OK
15 minute winter	SWMH 02	11	154.555	0.060	8.2	0.0682	0.0000	OK
15 minute winter	SWMH 03	10	154.191	0.066	12.3	0.0746	0.0000	OK
15 minute summer	SWMH 04	10	154.006	0.116	21.8	0.1307	0.0000	OK
960 minute winter	STORAGE 1	930	153.981	0.281	5.9	103.3958	0.0000	SURCHARGED
180 minute winter	SWMH 05	132	153.564	0.022	0.7	0.0246	0.0000	OK
180 minute winter	SWMH 06	152	153.530	0.024	0.7	0.0267	0.0000	OK
120 minute summer	SWMH 07	64	153.266	0.025	1.1	0.0282	0.0000	OK
120 minute summer	SWMH 08	66	153.026	0.021	1.0	0.0238	0.0000	OK
480 minute winter	STORAGE 2	344	152.128	0.127	2.2	9.6487	0.0000	OK
15 minute summer	SWMH 10	1	151.900	0.000	0.6	0.0000	0.0000	OK
15 minute winter	SWMH 11	10	155.033	0.033	2.0	0.0371	0.0000	OK
960 minute winter	SWMH 13	930	153.981	0.101	0.4	0.1138	0.0000	OK
960 minute winter	SWMH 14	930	153.981	0.231	0.7	0.2608	0.0000	SURCHARGED
15 minute winter	SWMH 15	10	154.735	0.035	4.5	0.0395	0.0000	OK
15 minute winter	SWMH 16	10	154.167	0.067	8.1	0.0759	0.0000	OK
15 minute winter	SWMH 17	10	154.002	0.052	4.5	0.0585	0.0000	OK
960 minute winter	SWMH 18	930	153.981	0.181	1.3	0.2043	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	3.9	0.774	0.074	0.3146	
15 minute winter	SWMH 02	1.001	SWMH 03	8.0	0.948	0.153	0.2465	
15 minute winter	SWMH 03	1.002	SWMH 04	12.2	0.709	0.108	0.4102	
15 minute summer	SWMH 04	1.003	STORAGE 1	22.0	1.686	0.233	0.3745	
960 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	0.7				
180 minute winter	SWMH 05	1.005	SWMH 06	0.7	0.453	0.042	0.0060	
180 minute winter	SWMH 06	1.006	SWMH 07	0.7	0.455	0.052	0.0694	
120 minute summer	SWMH 07	1.007	SWMH 08	1.0	0.546	0.058	0.0307	
120 minute summer	SWMH 08	1.008	STORAGE 2	1.0	0.222	0.018	0.6802	
480 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.3				95.2
15 minute winter	SWMH 11	2.000	SWMH 02	1.9	0.677	0.103	0.1117	
960 minute winter	SWMH 13	3.000	SWMH 14	0.4	0.223	0.011	0.7089	
960 minute winter	SWMH 14	3.001	STORAGE 1	0.6	0.329	0.016	0.3279	
15 minute winter	SWMH 15	6.000	SWMH 03	4.5	1.171	0.050	0.0651	
15 minute winter	SWMH 16	4.000	SWMH 04	8.1	0.838	0.183	0.1791	
15 minute winter	SWMH 17	5.000	SWMH 18	4.5	0.413	0.118	0.3090	
960 minute winter	SWMH 18	5.001	STORAGE 1	1.3	0.487	0.029	0.5257	

Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	10	155.255	0.055	7.0	0.0619	0.0000	OK
15 minute winter	SWMH 02	10	154.576	0.081	13.9	0.0912	0.0000	OK
15 minute winter	SWMH 03	10	154.212	0.087	21.2	0.0982	0.0000	OK
960 minute winter	SWMH 04	930	154.082	0.192	3.4	0.2172	0.0000	OK
960 minute winter	STORAGE 1	930	154.082	0.382	7.9	145.8136	0.0000	SURCHARGED
180 minute winter	SWMH 05	100	153.564	0.022	0.7	0.0246	0.0000	OK
120 minute winter	SWMH 06	468	153.530	0.024	0.7	0.0267	0.0000	OK
30 minute winter	SWMH 07	19	153.270	0.029	1.5	0.0329	0.0000	OK
30 minute winter	SWMH 08	21	153.029	0.024	1.4	0.0274	0.0000	OK
360 minute winter	STORAGE 2	272	152.173	0.173	3.3	13.7175	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	1.0	0.0000	0.0000	OK
15 minute winter	SWMH 11	10	155.043	0.043	3.4	0.0491	0.0000	OK
960 minute winter	SWMH 13	930	154.082	0.202	0.5	0.2285	0.0000	OK
960 minute winter	SWMH 14	930	154.082	0.332	0.9	0.3756	0.0000	SURCHARGED
15 minute winter	SWMH 15	10	154.745	0.045	7.6	0.0513	0.0000	OK
15 minute summer	SWMH 16	10	154.190	0.089	13.7	0.1012	0.0000	OK
960 minute winter	SWMH 17	930	154.082	0.132	0.7	0.1494	0.0000	OK
960 minute winter	SWMH 18	930	154.082	0.282	1.8	0.3190	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	6.6	0.903	0.128	0.4622	
15 minute winter	SWMH 02	1.001	SWMH 03	13.6	1.096	0.260	0.3646	
15 minute winter	SWMH 03	1.002	SWMH 04	21.0	0.846	0.186	0.5837	
960 minute winter	SWMH 04	1.003	STORAGE 1	3.4	0.533	0.036	1.5465	
960 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	0.7				
180 minute winter	SWMH 05	1.005	SWMH 06	0.7	0.454	0.042	0.0060	
120 minute winter	SWMH 06	1.006	SWMH 07	0.7	0.455	0.052	0.0748	
30 minute winter	SWMH 07	1.007	SWMH 08	1.4	0.598	0.080	0.0382	
30 minute winter	SWMH 08	1.008	STORAGE 2	1.4	0.246	0.024	0.7243	
360 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				95.7
15 minute winter	SWMH 11	2.000	SWMH 02	3.3	0.791	0.178	0.1652	
960 minute winter	SWMH 13	3.000	SWMH 14	0.5	0.223	0.013	0.9634	
960 minute winter	SWMH 14	3.001	STORAGE 1	0.8	0.408	0.020	0.3279	
15 minute winter	SWMH 15	6.000	SWMH 03	7.6	1.360	0.085	0.0947	
15 minute summer	SWMH 16	4.000	SWMH 04	13.7	0.964	0.309	0.2636	
960 minute winter	SWMH 17	5.000	SWMH 18	0.7	0.245	0.018	0.8853	
960 minute winter	SWMH 18	5.001	STORAGE 1	1.7	0.500	0.039	0.5655	

Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	10	155.297	0.097	20.1	0.1101	0.0000	OK
15 minute winter	SWMH 02	10	154.652	0.157	41.0	0.1774	0.0000	OK
1440 minute winter	SWMH 03	1410	154.446	0.321	2.6	0.3633	0.0000	SURCHARGED
1440 minute winter	SWMH 04	1410	154.446	0.556	4.7	0.6291	0.0000	SURCHARGED
1440 minute winter	STORAGE 1	1410	154.446	0.746	11.0	320.0196	0.0000	SURCHARGED
1440 minute winter	SWMH 05	1410	153.565	0.023	0.8	0.0257	0.0000	OK
1440 minute winter	SWMH 06	1410	153.531	0.025	0.8	0.0278	0.0000	OK
15 minute winter	SWMH 07	10	153.290	0.049	4.0	0.0554	0.0000	OK
15 minute winter	SWMH 08	11	153.044	0.039	3.9	0.0442	0.0000	OK
360 minute winter	STORAGE 2	352	152.370	0.370	6.3	34.7727	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	1.4	0.0000	0.0000	OK
15 minute summer	SWMH 11	10	155.079	0.079	9.8	0.0892	0.0000	OK
1440 minute winter	SWMH 13	1410	154.446	0.566	0.8	0.6404	0.0000	SURCHARGED
1440 minute winter	SWMH 14	1410	154.446	0.696	1.4	0.7875	0.0000	SURCHARGED
15 minute winter	SWMH 15	9	154.779	0.079	21.8	0.0892	0.0000	OK
1440 minute winter	SWMH 16	1410	154.446	0.346	1.7	0.3916	0.0000	SURCHARGED
1440 minute winter	SWMH 17	1410	154.446	0.496	0.9	0.5613	0.0000	SURCHARGED
1440 minute winter	SWMH 18	1410	154.446	0.646	2.4	0.7309	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	19.7	1.216	0.378	1.0161	
15 minute winter	SWMH 02	1.001	SWMH 03	40.1	1.417	0.768	0.8318	
1440 minute winter	SWMH 03	1.002	SWMH 04	2.6	0.454	0.023	1.6006	
1440 minute winter	SWMH 04	1.003	STORAGE 1	4.5	0.542	0.047	1.8451	
1440 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	0.8				
1440 minute winter	SWMH 05	1.005	SWMH 06	0.8	0.458	0.046	0.0063	
1440 minute winter	SWMH 06	1.006	SWMH 07	0.8	0.467	0.056	0.0696	
15 minute winter	SWMH 07	1.007	SWMH 08	3.9	0.791	0.217	0.0788	
15 minute winter	SWMH 08	1.008	STORAGE 2	3.7	0.283	0.066	1.6548	
360 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				124.5
15 minute summer	SWMH 11	2.000	SWMH 02	9.8	1.030	0.530	0.3773	
1440 minute winter	SWMH 13	3.000	SWMH 14	0.8	0.163	0.021	0.9903	
1440 minute winter	SWMH 14	3.001	STORAGE 1	1.3	0.428	0.033	0.3279	
15 minute winter	SWMH 15	6.000	SWMH 03	21.8	1.787	0.243	0.2156	
1440 minute winter	SWMH 16	4.000	SWMH 04	1.7	0.507	0.038	0.7366	
1440 minute winter	SWMH 17	5.000	SWMH 18	0.9	0.207	0.023	1.1005	
1440 minute winter	SWMH 18	5.001	STORAGE 1	2.4	0.521	0.055	0.5655	

Results for 30 year +35% CC +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWMH 01	10	155.315	0.115	27.1	0.1305	0.0000	OK
15 minute winter	SWMH 02	11	154.838	0.343	56.3	0.3881	0.0000	SURCHARGED
2160 minute winter	SWMH 03	2100	154.675	0.550	2.6	0.6217	0.0000	SURCHARGED
2160 minute winter	SWMH 04	2100	154.675	0.785	4.3	0.8875	0.0000	SURCHARGED
2160 minute winter	STORAGE 1	2100	154.675	0.975	10.4	446.8427	0.0000	SURCHARGED
2160 minute winter	SWMH 05	2100	153.566	0.024	0.9	0.0273	0.0000	OK
2160 minute winter	SWMH 06	2100	153.532	0.026	0.9	0.0295	0.0000	OK
15 minute winter	SWMH 07	10	153.298	0.057	5.3	0.0648	0.0000	OK
15 minute winter	SWMH 08	11	153.050	0.045	5.1	0.0509	0.0000	OK
480 minute winter	STORAGE 2	472	152.507	0.507	6.7	52.8525	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	1.4	0.0000	0.0000	OK
15 minute summer	SWMH 11	10	155.094	0.094	13.3	0.1062	0.0000	OK
2160 minute winter	SWMH 13	2100	154.675	0.795	0.7	0.8988	0.0000	SURCHARGED
2160 minute winter	SWMH 14	2100	154.675	0.925	1.2	1.0458	0.0000	SURCHARGED
15 minute summer	SWMH 15	9	154.789	0.089	29.4	0.1005	0.0000	OK
2160 minute winter	SWMH 16	2100	154.675	0.575	1.6	0.6500	0.0000	SURCHARGED
2160 minute winter	SWMH 17	2100	154.675	0.725	0.9	0.8197	0.0000	SURCHARGED
2160 minute winter	SWMH 18	2100	154.675	0.875	2.4	0.9893	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH 01	1.000	SWMH 02	27.6	1.252	0.531	1.8226	
15 minute winter	SWMH 02	1.001	SWMH 03	49.5	1.405	0.948	1.1638	
2160 minute winter	SWMH 03	1.002	SWMH 04	2.5	0.392	0.022	1.6006	
2160 minute winter	SWMH 04	1.003	STORAGE 1	4.3	0.494	0.045	1.8451	
2160 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	0.9				
2160 minute winter	SWMH 05	1.005	SWMH 06	0.9	0.472	0.051	0.0069	
2160 minute winter	SWMH 06	1.006	SWMH 07	0.9	0.482	0.063	0.0754	
15 minute winter	SWMH 07	1.007	SWMH 08	5.1	0.854	0.290	0.0973	
15 minute winter	SWMH 08	1.008	STORAGE 2	5.0	0.291	0.089	1.9069	
480 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				156.8
15 minute summer	SWMH 11	2.000	SWMH 02	13.3	1.026	0.720	0.5776	
2160 minute winter	SWMH 13	3.000	SWMH 14	0.7	0.163	0.018	0.9903	
2160 minute winter	SWMH 14	3.001	STORAGE 1	1.2	0.328	0.029	0.3279	
15 minute summer	SWMH 15	6.000	SWMH 03	29.7	1.811	0.332	0.4590	
2160 minute winter	SWMH 16	4.000	SWMH 04	1.6	0.459	0.035	0.7366	
2160 minute winter	SWMH 17	5.000	SWMH 18	0.9	0.190	0.023	1.1005	
2160 minute winter	SWMH 18	5.001	STORAGE 1	2.4	0.412	0.054	0.5655	

Results for 100 year +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	SWMH 01	10	155.312	0.112	25.4	0.1270	0.0000	OK
15 minute winter	SWMH 02	11	154.743	0.248	52.8	0.2809	0.0000	SURCHARGED
1440 minute winter	SWMH 03	1410	154.600	0.475	3.2	0.5376	0.0000	SURCHARGED
1440 minute winter	SWMH 04	1410	154.600	0.710	5.5	0.8034	0.0000	SURCHARGED
1440 minute winter	STORAGE 1	1410	154.600	0.900	13.3	404.0733	0.0000	SURCHARGED
1440 minute winter	SWMH 05	1410	153.566	0.024	0.9	0.0268	0.0000	OK
1440 minute winter	SWMH 06	1440	153.532	0.026	0.9	0.0290	0.0000	OK
15 minute winter	SWMH 07	10	153.296	0.055	5.0	0.0626	0.0000	OK
15 minute winter	SWMH 08	11	153.049	0.044	4.8	0.0494	0.0000	OK
480 minute winter	STORAGE 2	472	152.463	0.463	6.2	46.6846	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	1.4	0.0000	0.0000	OK
15 minute winter	SWMH 11	10	155.090	0.090	12.5	0.1019	0.0000	OK
1440 minute winter	SWMH 13	1410	154.600	0.720	0.9	0.8147	0.0000	SURCHARGED
1440 minute winter	SWMH 14	1410	154.600	0.850	1.6	0.9617	0.0000	SURCHARGED
15 minute summer	SWMH 15	9	154.789	0.089	27.6	0.1003	0.0000	OK
1440 minute winter	SWMH 16	1410	154.600	0.500	2.0	0.5659	0.0000	SURCHARGED
1440 minute winter	SWMH 17	1410	154.600	0.650	1.1	0.7355	0.0000	SURCHARGED
1440 minute winter	SWMH 18	1410	154.600	0.800	3.1	0.9052	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	SWMH 01	1.000	SWMH 02	25.5	1.259	0.489	1.4884	
15 minute winter	SWMH 02	1.001	SWMH 03	51.0	1.420	0.977	1.1638	
1440 minute winter	SWMH 03	1.002	SWMH 04	3.2	0.449	0.028	1.6006	
1440 minute winter	SWMH 04	1.003	STORAGE 1	5.3	0.615	0.056	1.8451	
1440 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	0.9				
1440 minute winter	SWMH 05	1.005	SWMH 06	0.9	0.468	0.049	0.0067	
1440 minute winter	SWMH 06	1.006	SWMH 07	0.9	0.477	0.061	0.0739	
15 minute winter	SWMH 07	1.007	SWMH 08	4.8	0.840	0.273	0.0929	
15 minute winter	SWMH 08	1.008	STORAGE 2	4.7	0.291	0.083	1.8687	
480 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				152.2
15 minute winter	SWMH 11	2.000	SWMH 02	12.5	1.024	0.676	0.5467	
1440 minute winter	SWMH 13	3.000	SWMH 14	0.9	0.223	0.023	0.9903	
1440 minute winter	SWMH 14	3.001	STORAGE 1	1.5	0.418	0.038	0.3279	
15 minute summer	SWMH 15	6.000	SWMH 03	27.6	1.781	0.308	0.4536	
1440 minute winter	SWMH 16	4.000	SWMH 04	1.9	0.507	0.044	0.7366	
1440 minute winter	SWMH 17	5.000	SWMH 18	1.1	0.208	0.028	1.1005	
1440 minute winter	SWMH 18	5.001	STORAGE 1	3.0	0.512	0.070	0.5655	

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	11	155.442	0.242	35.6	0.2732	0.0000	SURCHARGED
15 minute winter	SWMH 02	11	155.298	0.803	70.1	0.9083	0.0000	SURCHARGED
15 minute winter	SWMH 03	11	154.910	0.785	87.8	0.8878	0.0000	SURCHARGED
2880 minute winter	SWMH 04	2820	154.900	1.010	4.4	1.1419	0.0000	SURCHARGED
2880 minute winter	STORAGE 1	2820	154.900	1.200	10.5	584.8954	0.0000	SURCHARGED
2880 minute winter	SWMH 05	2820	153.567	0.025	1.0	0.0287	0.0000	OK
2880 minute winter	SWMH 06	2820	153.533	0.027	1.0	0.0309	0.0000	OK
15 minute winter	SWMH 07	10	153.308	0.066	6.8	0.0752	0.0000	OK
15 minute winter	SWMH 08	11	153.056	0.051	6.7	0.0581	0.0000	OK
600 minute winter	STORAGE 2	600	152.640	0.640	7.1	72.9759	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	1.4	0.0000	0.0000	OK
15 minute winter	SWMH 11	11	155.567	0.567	17.4	0.6408	0.0000	SURCHARGED
2880 minute winter	SWMH 13	2820	154.900	1.020	0.7	1.1532	0.0000	FLOOD RISK
2880 minute winter	SWMH 14	2820	154.900	1.150	1.2	1.3002	0.0000	SURCHARGED
15 minute winter	SWMH 15	11	154.997	0.297	38.7	0.3361	0.0000	SURCHARGED
15 minute winter	SWMH 16	10	155.073	0.973	69.7	1.1007	0.0000	SURCHARGED
2880 minute winter	SWMH 17	2820	154.900	0.950	0.9	1.0740	0.0000	FLOOD RISK
2880 minute winter	SWMH 18	2820	154.900	1.100	2.4	1.2436	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	34.4	1.256	0.661	2.4958	
15 minute winter	SWMH 02	1.001	SWMH 03	57.8	1.455	1.108	1.1638	
15 minute winter	SWMH 03	1.002	SWMH 04	87.7	1.246	0.776	1.6006	
2880 minute winter	SWMH 04	1.003	STORAGE 1	4.4	0.467	0.046	1.8451	
2880 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	1.0				
2880 minute winter	SWMH 05	1.005	SWMH 06	1.0	0.485	0.056	0.0074	
2880 minute winter	SWMH 06	1.006	SWMH 07	1.0	0.496	0.069	0.0807	
15 minute winter	SWMH 07	1.007	SWMH 08	6.7	0.914	0.377	0.1182	
15 minute winter	SWMH 08	1.008	STORAGE 2	6.5	0.300	0.116	1.9989	
600 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				152.0
15 minute winter	SWMH 11	2.000	SWMH 02	15.2	1.040	0.819	0.6965	
2880 minute winter	SWMH 13	3.000	SWMH 14	0.7	0.163	0.018	0.9903	
2880 minute winter	SWMH 14	3.001	STORAGE 1	1.2	0.349	0.029	0.3279	
15 minute winter	SWMH 15	6.000	SWMH 03	36.5	1.816	0.408	0.6739	
15 minute winter	SWMH 16	4.000	SWMH 04	67.7	1.701	1.527	0.7366	
2880 minute winter	SWMH 17	5.000	SWMH 18	0.9	0.190	0.023	1.1005	
2880 minute winter	SWMH 18	5.001	STORAGE 1	2.4	0.361	0.054	0.5655	

Results for 1000 year +10% A Critical Storm Duration. Lowest mass balance: 99.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWMH 01	11	155.840	0.640	38.6	0.7242	0.0000	FLOOD RISK
15 minute winter	SWMH 02	11	155.587	1.092	70.4	1.2346	0.0000	SURCHARGED
15 minute winter	SWMH 03	11	155.097	0.972	95.9	1.0997	0.0000	SURCHARGED
600 minute winter	SWMH 04	555	155.008	1.118	21.0	1.2645	0.0000	SURCHARGED
600 minute winter	STORAGE 1	555	155.008	1.308	50.5	654.3967	0.0000	FLOOD RISK
600 minute winter	SWMH 05	555	153.568	0.026	1.0	0.0293	0.0000	OK
2160 minute winter	SWMH 06	1740	153.534	0.028	1.0	0.0314	0.0000	OK
15 minute winter	SWMH 07	10	153.310	0.069	7.3	0.0784	0.0000	OK
15 minute winter	SWMH 08	11	153.058	0.053	7.2	0.0602	0.0000	OK
720 minute winter	STORAGE 2	720	152.771	0.771	7.7	95.5399	0.0000	SURCHARGED
15 minute summer	SWMH 10	1	151.900	0.000	1.4	0.0000	0.0000	OK
15 minute winter	SWMH 11	12	155.837	0.837	18.9	0.9462	0.0000	SURCHARGED
1440 minute winter	SWMH 13	1020	155.000	1.120	6.5	1.2667	91.4026	FLOOD
600 minute winter	SWMH 14	555	155.006	1.256	7.0	1.4200	0.0000	FLOOD RISK
15 minute winter	SWMH 15	11	155.195	0.495	41.9	0.5601	0.0000	SURCHARGED
15 minute winter	SWMH 16	11	155.246	1.146	75.7	1.2965	0.0000	SURCHARGED
15 minute winter	SWMH 17	10	155.046	1.096	41.9	1.2395	0.0000	FLOOD RISK
600 minute winter	SWMH 18	555	155.008	1.208	11.4	1.3662	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWMH 01	1.000	SWMH 02	36.7	1.278	0.704	2.4958	
15 minute winter	SWMH 02	1.001	SWMH 03	62.1	1.561	1.190	1.1638	
15 minute winter	SWMH 03	1.002	SWMH 04	95.8	1.361	0.848	1.6006	
600 minute winter	SWMH 04	1.003	STORAGE 1	20.9	0.893	0.221	1.8451	
600 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	1.0				
600 minute winter	SWMH 05	1.005	SWMH 06	1.0	0.494	0.058	0.0076	
2160 minute winter	SWMH 06	1.006	SWMH 07	1.0	0.501	0.072	0.0848	
15 minute winter	SWMH 07	1.007	SWMH 08	7.2	0.931	0.406	0.1248	
15 minute winter	SWMH 08	1.008	STORAGE 2	7.0	0.299	0.124	2.0143	
720 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				171.2
15 minute winter	SWMH 11	2.000	SWMH 02	15.3	1.034	0.827	0.6965	
1440 minute winter	SWMH 13	3.000	SWMH 14	-6.0	0.243	-0.161	0.9903	
600 minute winter	SWMH 14	3.001	STORAGE 1	-6.6	0.572	-0.164	0.3279	
15 minute winter	SWMH 15	6.000	SWMH 03	38.7	1.851	0.432	0.6739	
15 minute winter	SWMH 16	4.000	SWMH 04	72.6	1.825	1.638	0.7366	
15 minute winter	SWMH 17	5.000	SWMH 18	39.4	0.990	1.033	1.1005	
600 minute winter	SWMH 18	5.001	STORAGE 1	11.3	0.767	0.260	0.5655	

APPENDIX K – HALF DRAIN TIME AND DISCHARGE VOLUMES FLOW CALCULATIONS

Storm Durations

360

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	0	0	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.723	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.437
CWI	93.778	Runoff Volume (m ³)	212

Node STORAGE 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	153.700	Product Number	CTL-SHE-0045-1000-1200-1000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node STORAGE 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	152.000	Product Number	CTL-SHE-0059-1500-0900-1500
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

Node STORAGE 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	153.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	712

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	331.0	0.0	1.200	642.0	0.0

Node STORAGE 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	152.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	65.0	0.0	0.900	200.0	0.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.87%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	SWMH 01	184	155.244	0.043	4.3	0.0492	0.0000	OK
360 minute summer	SWMH 02	184	154.558	0.063	8.7	0.0713	0.0000	OK
360 minute winter	SWMH 03	368	154.458	0.333	9.8	0.3762	0.0000	SURCHARGED
360 minute winter	SWMH 04	368	154.458	0.568	17.2	0.6420	0.0000	SURCHARGED
360 minute winter	STORAGE 1	368	154.458	0.758	39.9	326.0204	0.0000	SURCHARGED
360 minute winter	SWMH 05	368	153.565	0.023	0.8	0.0258	0.0000	OK
360 minute winter	SWMH 06	368	153.531	0.025	0.8	0.0279	0.0000	OK
360 minute summer	SWMH 07	184	153.270	0.029	1.4	0.0324	0.0000	OK
360 minute summer	SWMH 08	184	153.029	0.024	1.4	0.0273	0.0000	OK
360 minute winter	STORAGE 2	352	152.419	0.419	6.9	40.9118	0.0000	SURCHARGED
360 minute summer	SWMH 10	8	151.900	0.000	1.4	0.0000	0.0000	OK
360 minute summer	SWMH 11	184	155.034	0.034	2.1	0.0386	0.0000	OK
360 minute winter	SWMH 13	368	154.458	0.578	2.8	0.6533	0.0000	SURCHARGED
360 minute winter	SWMH 14	368	154.458	0.708	4.7	0.8003	0.0000	SURCHARGED
360 minute summer	SWMH 15	184	154.735	0.035	4.6	0.0399	0.0000	OK
360 minute winter	SWMH 16	368	154.458	0.358	6.1	0.4044	0.0000	SURCHARGED
360 minute winter	SWMH 17	360	154.458	0.508	3.4	0.5740	0.0000	SURCHARGED
360 minute winter	SWMH 18	368	154.458	0.658	9.0	0.7438	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute summer	SWMH 01	1.000	SWMH 02	4.2	0.793	0.081	0.3343	
360 minute summer	SWMH 02	1.001	SWMH 03	8.6	0.966	0.165	0.5328	
360 minute winter	SWMH 03	1.002	SWMH 04	9.8	0.691	0.086	1.6006	
360 minute winter	SWMH 04	1.003	STORAGE 1	16.4	0.914	0.173	1.8451	
360 minute winter	STORAGE 1	Hydro-Brake®	SWMH 05	0.8				
360 minute winter	SWMH 05	1.005	SWMH 06	0.8	0.462	0.046	0.0064	
360 minute winter	SWMH 06	1.006	SWMH 07	0.8	0.467	0.057	0.0752	
360 minute summer	SWMH 07	1.007	SWMH 08	1.4	0.592	0.077	0.0374	
360 minute summer	SWMH 08	1.008	STORAGE 2	1.4	0.266	0.024	1.8045	
360 minute winter	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				134.5
360 minute summer	SWMH 11	2.000	SWMH 02	2.1	0.693	0.112	0.1181	
360 minute winter	SWMH 13	3.000	SWMH 14	2.7	0.283	0.072	0.9903	
360 minute winter	SWMH 14	3.001	STORAGE 1	4.6	0.587	0.114	0.3279	
360 minute summer	SWMH 15	6.000	SWMH 03	4.6	1.177	0.051	0.3005	
360 minute winter	SWMH 16	4.000	SWMH 04	6.1	0.736	0.138	0.7366	
360 minute winter	SWMH 17	5.000	SWMH 18	3.2	0.328	0.083	1.1005	
360 minute winter	SWMH 18	5.001	STORAGE 1	8.8	0.756	0.203	0.5655	

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWMH 01	0.047	4.00	156.100	1200	536345.903	236545.387	0.900
SWMH 02	0.027	4.00	157.000	1200	536408.082	236536.922	2.505
SWMH 03			156.100	1200	536404.091	236507.932	1.975
SWMH 04	0.020	4.00	156.000	1200	536381.570	236510.998	2.110
STORAGE 1	0.154	4.00	155.200	1200	536376.329	236485.327	1.500
SWMH 05			154.800	1200	536376.595	236469.538	1.258
SWMH 06			154.800	1200	536380.149	236469.662	1.294
SWMH 07	0.008	4.00	155.000	1200	536416.593	236466.444	1.759
SWMH 08			155.000	1200	536427.493	236464.309	1.995
STORAGE 2	0.088	4.00	153.200	1200	536425.306	236379.441	1.200
SWMH 10			153.200	1200	536425.976	236375.332	1.300
SWMH 11	0.023	4.00	157.000	1200	536447.281	236531.586	2.000
SWMH 13	0.042	4.00	155.000	1200	536416.608	236474.134	1.120
SWMH 14	0.031	4.00	155.200	1200	536384.088	236476.748	1.450
SWMH 15	0.051	4.00	156.200	1200	536416.663	236506.221	1.500
SWMH 16	0.092	4.00	155.800	1200	536363.059	236510.408	1.700
SWMH 17	0.051	4.00	155.050	1200	536363.003	236457.341	1.100
SWMH 18	0.089	4.00	155.200	1200	536362.114	236484.999	1.400

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SWMH 01	SWMH 02	62.753	0.600	155.200	154.570	0.630	99.6	225	4.80	92.7
1.001	SWMH 02	SWMH 03	29.263	0.600	154.495	154.200	0.295	99.2	225	5.17	89.0
1.002	SWMH 03	SWMH 04	22.729	0.600	154.125	153.890	0.235	96.7	300	5.41	86.8
1.003	SWMH 04	STORAGE 1	26.201	0.600	153.890	153.700	0.190	137.9	300	5.73	84.6
1.004	STORAGE 1	SWMH 05	15.791	0.600	153.700	153.542	0.158	99.9	150	6.00	83.5
1.005	SWMH 05	SWMH 06	3.556	0.600	153.542	153.506	0.036	98.8	150	6.05	83.2
1.006	SWMH 06	SWMH 07	39.741	0.600	153.506	153.241	0.265	150.0	150	6.86	80.2
1.007	SWMH 07	SWMH 08	16.144	0.600	153.241	153.080	0.161	100.3	150	7.13	79.1
1.008	SWMH 08	STORAGE 2	85.835	0.600	153.005	152.000	1.005	85.4	225	8.14	73.6
1.009	STORAGE 2	SWMH 10	3.893	0.600	152.000	151.900	0.100	38.9	150	8.18	73.3
2.000	SWMH 11	SWMH 02	39.561	0.600	155.000	154.570	0.430	92.0	150	4.63	93.8
3.000	SWMH 13	SWMH 14	24.901	0.600	153.880	153.750	0.130	191.5	225	4.44	95.8
3.001	SWMH 14	STORAGE 1	8.244	0.600	153.750	153.700	0.050	164.9	225	4.58	94.3
6.000	SWMH 15	SWMH 03	16.944	0.600	154.700	154.200	0.500	33.9	225	4.13	92.0
4.000	SWMH 16	SWMH 04	18.520	0.600	154.100	153.965	0.135	137.2	225	4.28	96.7
5.000	SWMH 17	SWMH 18	27.672	0.600	153.950	153.800	0.150	184.5	225	4.48	95.4
5.001	SWMH 18	STORAGE 1	14.219	0.600	153.800	153.700	0.100	142.2	225	4.70	94.8

Simulation Settings

Rainfall Methodology	FEH-22	Drain Down Time (mins)	1500
Rainfall Events	Consecutive	Additional Storage (m ³ /ha)	0.0
Winter CV	0.840	Starting Level (m)	
Additional Area (A %)	0	Check Discharge Rate(s)	x
Additional Flow (Q %)	0	Check Discharge Volume	✓
Analysis Speed	Normal	100 year 360 minute (m ³)	212
Skip Steady State	x		

Time Offset (mins)	Duration (mins)	Return Period (years)	Climate Change (CC %)	Time Offset (mins)	Duration (mins)	Return Period (years)	Climate Change (CC %)
0	1440	30	35	1440	1440	10	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.723	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.437
CWI	93.778	Runoff Volume (m ³)	212

Node STORAGE 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	153.700	Product Number	CTL-SHE-0045-1000-1200-1000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node STORAGE 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	152.000	Product Number	CTL-SHE-0059-1500-0900-1500
Design Depth (m)	0.900	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.5	Min Node Diameter (mm)	1200

Node STORAGE 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	153.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	331.0	0.0	1.200	642.0	0.0

Node STORAGE 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	152.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	65.0	0.0	0.900	200.0	0.0

Results for Consecutive Rainfall Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440-1440	SWMH 01	720	155.222	0.022	1.0	0.0245	0.0000	OK
1440-1440	SWMH 02	4290	154.824	0.329	2.1	0.3722	0.0000	SURCHARGED
1440-1440	SWMH 03	4290	154.824	0.699	3.2	0.7907	0.0000	SURCHARGED
1440-1440	SWMH 04	4290	154.824	0.934	5.4	1.0565	0.0000	SURCHARGED
1440-1440	STORAGE 1	4290	154.824	1.124	13.3	537.0912	0.0000	SURCHARGED
1440-1440	SWMH 05	4290	153.567	0.025	1.0	0.0283	0.0000	OK
1440-1440	SWMH 06	4290	153.533	0.027	1.0	0.0304	0.0000	OK
1440-1440	SWMH 07	3840	153.266	0.025	1.1	0.0285	0.0000	OK
1440-1440	SWMH 08	3840	153.026	0.021	1.1	0.0242	0.0000	OK
1440-1440	STORAGE 2	1080	152.368	0.368	2.8	34.5371	0.0000	SURCHARGED
1440-1440	SWMH 10	30	151.900	0.000	1.4	0.0000	0.0000	OK
1440-1440	SWMH 11	690	155.017	0.017	0.5	0.0193	0.0000	OK
1440-1440	SWMH 13	4290	154.824	0.944	0.9	1.0678	0.0000	FLOOD RISK
1440-1440	SWMH 14	4290	154.824	1.074	1.6	1.2148	0.0000	SURCHARGED
1440-1440	SWMH 15	4290	154.824	0.124	1.1	0.1404	0.0000	OK
1440-1440	SWMH 16	4290	154.824	0.724	2.0	0.8190	0.0000	SURCHARGED
1440-1440	SWMH 17	4290	154.824	0.874	1.1	0.9886	0.0000	FLOOD RISK
1440-1440	SWMH 18	4290	154.824	1.024	3.1	1.1583	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440-1440	SWMH 01	1.000	SWMH 02	1.0	0.516	0.019	1.2676	
1440-1440	SWMH 02	1.001	SWMH 03	2.1	0.644	0.040	1.1638	
1440-1440	SWMH 03	1.002	SWMH 04	3.2	0.449	0.028	1.6006	
1440-1440	SWMH 04	1.003	STORAGE 1	5.3	0.615	0.056	1.8451	
1440-1440	STORAGE 1	Hydro-Brake®	SWMH 05	1.0				
1440-1440	SWMH 05	1.005	SWMH 06	1.0	0.481	0.055	0.0072	
1440-1440	SWMH 06	1.006	SWMH 07	1.0	0.491	0.067	0.0801	
1440-1440	SWMH 07	1.007	SWMH 08	1.1	0.549	0.060	0.0311	
1440-1440	SWMH 08	1.008	STORAGE 2	1.1	0.191	0.019	1.7886	
1440-1440	STORAGE 2	Hydro-Brake®	SWMH 10	1.4				405.9
1440-1440	SWMH 11	2.000	SWMH 02	0.5	0.455	0.027	0.3634	
1440-1440	SWMH 13	3.000	SWMH 14	0.9	0.223	0.023	0.9903	
1440-1440	SWMH 14	3.001	STORAGE 1	1.5	0.418	0.038	0.3279	
1440-1440	SWMH 15	6.000	SWMH 03	1.1	0.769	0.012	0.5270	
1440-1440	SWMH 16	4.000	SWMH 04	1.9	0.507	0.043	0.7366	
1440-1440	SWMH 17	5.000	SWMH 18	1.1	0.208	0.028	1.1005	
1440-1440	SWMH 18	5.001	STORAGE 1	3.0	0.512	0.070	0.5655	