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ENVIRONMENT

CP Logistics UK Reading Propco Limited
Land to the North of the A4
Theale
Sustainable Drainage Statement

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Theale
Sustainable Drainage Statement

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					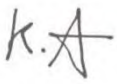
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			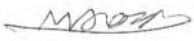		
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			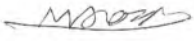	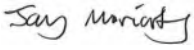	
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			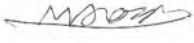	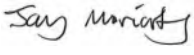	

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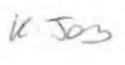
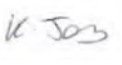
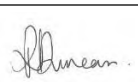
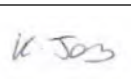
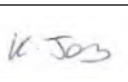
					
P07	September 2023	S8	Rebekah Duncan Meng (Hons)	Kristen Jones MSc (Hons)	Kristen Jones MSc (Hons)
					

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TABLES

APPENDICES

1. INTRODUCTION

1.1 A Sustainable Drainage Statement (SDS) sets out the principles of drainage design for a development and summarises the reasoning behind the chosen design. This includes consideration of national and local guidance, justification of specific flow rates, volumes of attenuated storage, as well as the appropriate level of treatment to be provided to surface water runoff.

1.2 This SDS has been produced by BWB Consulting on behalf of Panattoni UK Developments Ltd in respect of a planning application for the proposed development at Land to the North of the A4, Theale.

1.3 A Flood Risk Assessment has been developed for the site (reference THR-BWB-ZZ-XX-RP-YE-0001_FRA) and this Sustainable Drainage Statement accompanies this overarching document.

1.4 The location of the site is illustrated within **Figure 1**, with contextual information provided within **Table 1.1**.

Table 1.1: Site Details

Site Name	Land to the North of the A4
Location	Theale
NGR (approx.)	SU647714
Application Site Area (ha)	5.43
Development Area (ha)	3.89
Development Type	Commercial
Lead Local Flood Authority	West Berkshire Council
Local Planning Authority	West Berkshire Council
Sewerage Undertaker	Thames Water

Figure 1: Site Location

Sustainable Drainage Guidance

1.5 The LLFA, West Berkshire Council (WBC), have specific SuDS guidance[1] which has been reviewed in the production of this Drainage Strategy. The guidance identifies the purpose of SuDS, aims for the West Berkshire region and specific local policies to be followed.

1.6 The Non-Statutory Technical Standards for Sustainable Drainage Systems[2] as published by DEFRA have also been utilised to inform the strategy.

1.7 In line with the WBC guidance, a 40% uplift has been applied to account for the impact of climate change.

[1] Sustainable Drainage Systems Supplementary Planning Document (West Berkshire Council, December 2018)
[2] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

2. EXISTING CONDITIONS

2.1 The site is currently agricultural and appears to be entirely permeable based on available aerial imagery. A topographic survey of the existing site has been undertaken and has been included as **Appendix 1**. This shows the route of the unnamed ordinary watercourse through the site, from the culvert underneath the M4 to the culvert underneath the A4. The route of the watercourse is illustrated in **Figure 1**.

2.2 The overall site is approximately 5.43ha. The site topographical survey indicates that the existing site is relatively level with a gentle slope in a southerly direction from High Street towards the A4.

2.3 The British Geological Survey (BGS) mapping indicates that the site is underlain by Seaford Chalk Formation – Chalk bedrock. The northeast of the site is expected to be underlain by Langley Silt Member – Clay and Silt superficial deposits. BWB Consulting site investigations recorded groundwater between 0.53m and 1.89m below ground level. The shallow depths of groundwater suggest there is a risk of groundwater emergence. Correspondence with WBC noted that the available information indicates a risk of groundwater flooding to both surface and subsurface assets. This risk would preclude the use of infiltration techniques.

2.4 Due to the existing site conditions, it is assumed that current surface water runoff from the site infiltrates into the ground. In the event of exceedance, it is assumed that excess surface water would enter the existing unnamed watercourse within the site boundary.

Existing Runoff Rates

2.5 An assessment of the equivalent Greenfield surface water runoff rates from the site area have been undertaken and are summarised within **Table 2.1** and detailed in **Appendix 2**.

2.6 The runoff rates have been estimated using the ICP SuDS method, with appropriate prorated adjustments for a site of less than 50ha, as recommended in Interim Code of Practice for Sustainable Drainage[3]. This was undertaken within Micro Drainage, which makes the necessary adjustments for small sites automatically. Due to the site location the urban factor has been adjusted to 0.5 and the QBAR urban value has been used.

Table 2.1: Existing Greenfield Runoff Rates from the Site

Return Period (Yrs.)	Runoff Rate (l/s)
1	29.7
Mean Annual Flow Rate (QBAR Urban)	34.9
30	65.7
100	80.0

[3] The National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage

Existing Runoff Volume

2.7 An assessment of the existing surface water runoff rates from the site area has been made for a 1 in 100-year, 6-hour storm.

2.8 As the existing site is permeable, the runoff volume has been calculated using the Source Control module within Micro Drainage to be 1122m^3, results are included within **Appendix 3**.

3. SURFACE WATER DRAINAGE STRATEGY

3.1 The development proposals are for two warehouse units with first floor office space. Each warehouse is accompanied by a service yard area, car parking spaces and associated landscaping. Based on the site plan included as **Appendix 4**, the total proposed impermeable area is 2.324ha.

Drainage Hierarchy

3.2 The Planning Policy Guidance[4] and the SuDS Manual[5] identify that surface water runoff from a development should be disposed of as high up the following hierarchy as reasonably practicable:

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

3.3 The aim of this is approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

Drainage Discharge Options

Option 1 - Infiltration

3.4 Due to the unfavourable underlying ground conditions and high groundwater levels identified in the Site Investigation, disposal of surface water via infiltration is not feasible in this instance for the entire site.

Option 2 - Existing ditch within site boundary

3.5 BWB contacted National Highways (formally Highways England) to gain permission for the site to discharge into their ditch that runs along the boundary of the site (**Figure 2**) at Greenfield runoff rates. National Highways advised referred to the DfT Circular 2/2013 document paragraph 50 which states "In order to ensure the integrity of the highway drainage systems, no water run off that may arise due to any change of use will be accepted into the highway drainage systems, and there shall be no new connections into those systems from third party development and drainage systems. Where there is already an existing third-party connection the right for connection may be allowed to continue provided that the input of the contributing catchment to the connection remains unaltered."

3.6 As such despite the existing site draining into the existing ditch the proposed flows from the new development flows cannot discharge into this ditch. Refer to correspondence from HE in **Appendix 5**.

[4] Planning Practice Guidance. http://planningguidance.planningportal.gov.uk/.
[5] The SuDS Manual (C753). CIRIA 2015.

Figure 2: Drainage Discharge Option 2

Option 3 – EA Watercourse

3.7 Option 3 proposes that the surface water is pumped to enable discharge into the Environment Agency (EA) Watercourse to the north of the site (**Figure 3**).

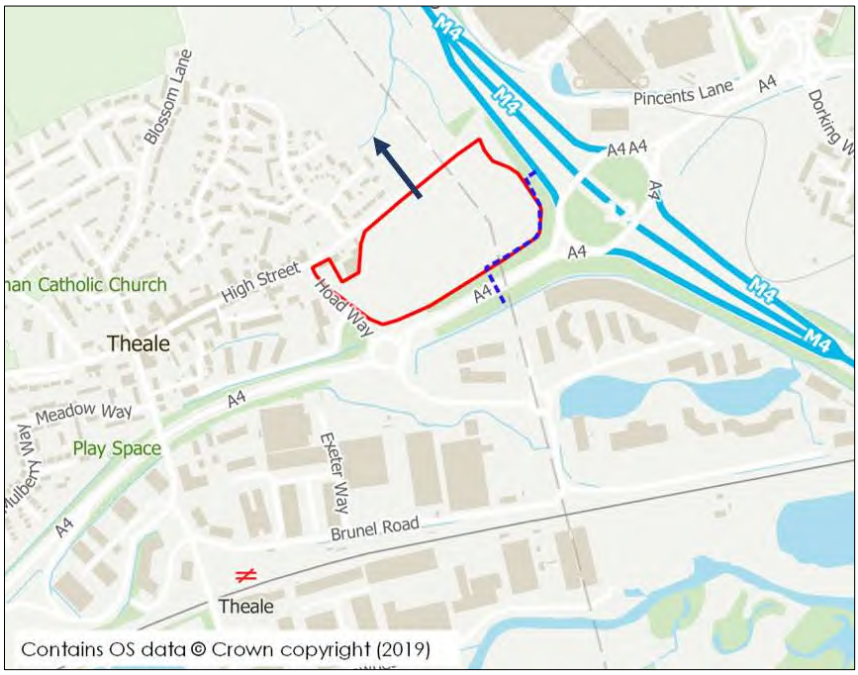


Figure 3: Drainage Discharge Option 3

3.8 This proposal was sent to the EA on 18/11/19 and at the time of writing this report, a formal response from the EA has not been received yet. Refer to the correspondence in **Appendix 6**.

3.9 However following discussions with the neighbouring property owners, it is understood that this permission to run a new rising main through their land would not be granted. Therefore, this option is not feasible.

Option 4 – Existing Thames Water Sewer

3.10 Option 4 (**Figure 4**) aims to utilise the Thames Water (TW) surface water sewer which is located to the north of the site on Rotherfield Close. Discharging into this sewer is subject to TW approval at a restricted discharge rate based on the network capacity. It should be noted that due to site levels, surface water from the development would need to be pumped over a distance of approximately 150m. This would be subject to additional TW approval under a Section 104 (under the Water Industry Act 1991).

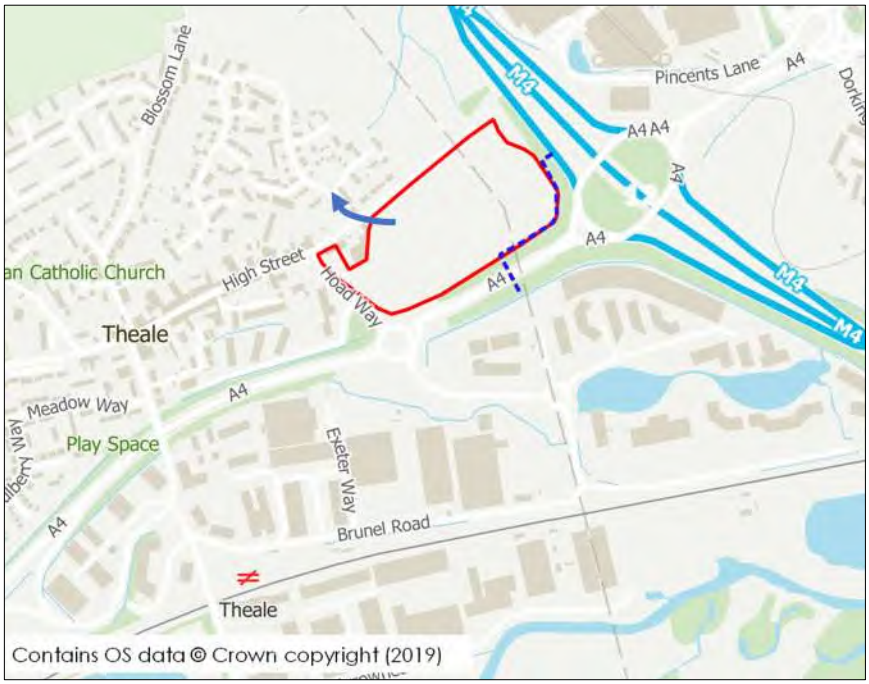


Figure 4: Drainage Discharge Option 4

Summary

3.11 As per the drainage hierarchy, infiltration was first considered to discharge surface water. However, due to ground conditions, this option is not deemed possible. The second and third options to discharge to a watercourse, due to various ownerships and permissions, is not possible either. Therefore, the only option that is deemed viable is to discharge to the existing surface water sewer.

Peak Flow Control

3.12 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems S2-S3[6], runoff from greenfield developments should not exceed the equivalent greenfield rates for the 1 and 100-year return period events.

3.13 The LLFA Guidance states that the peak runoff rate from the development for the 1 in 1-year and 1 in 100-year event shall not exceed the peak greenfield runoff rate for the same event.

3.14 To comply with the peak flow control criterion, surface water discharge would need to be restricted from all rainfall events to the equivalent Greenfield QBAR rate up to the 1 in 100-year plus climate change event. Historic discussions with Thames Water provisionally agreed a discharge rate of 15 l/s (see **Appendix 7**). A new PPSE has been submitted to Thames Water to reconfirm this figure, however at the time of writing a response has not been received.

3.15 In the absence of a formal response from Thames Water the proposed strategy has been developed to suit a pumped discharge rate of 15 l/s. The final discharge rates will need to be agreed with Thames Water but the proposed discharge rates from the development will not exceed the QBAR rates. This is summarised within **Table 3.1**.

Table 3.1: Existing & Proposed Runoff Rates

Return Period (Yr.)	Existing Runoff Rate (l/s)	Proposed Discharge Rate (l/s)
1	29.7	15.0
QBAR	34.9	15.0
30	65.7	
100	80.0	
100 + 40%	-	

Attenuated Storage

3.16 As the development proposals require a restricted runoff rate, it will be necessary to provide attenuated storage to balance the excess volume is a safe manner within the site.

3.17 Sufficient storage for events up to the 1 in 100-year storm with a 40% allowance for climate change will be considered.

[6] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

3.18 After considering, the site constraints and development aspirations it is suggested that the necessary surface water storage volume is found within a combination of a detention basin located in the north and cellular storage located in the service yards.

3.19 A simulation has been run of the strategic pipe network including storage provision using Micro Drainage. Using a restriction of 15.0 l/s and an impermeable area of 2.324ha, the storage provided ensures the network operates effectively up to the design event. There is no flooding to the network in the 30-year event, and minor flooding encountered in the 100 year+40% event. The results are summarised in SW assessment located in **Appendix 8**.

3.20 Should the confirmed discharge rate by Thames Water differ from the 15l/s used the level of attenuation will be affected.

Runoff Volume Control

3.21 The Non-Statutory Technical Standards for Sustainable Drainage Systems S4-S6[7] states that where reasonably practical the runoff volume from a development for the 1 in 100-year 6-hour rainfall event should not exceed the runoff volume prior to development or redevelopment. Additionally, if practicable on previously developed sites, the runoff volume should not exceed the equivalent greenfield runoff volume.

3.22 Where it is not reasonably practicable to constrain the volume of runoff from a development at or below the existing volume, then the runoff must be discharged in a manner that does not adversely affect flood risk, i.e.:

i. The additional runoff volume resulting from the development (the 'long term storage volume') should be discharged separately from the site at a rate of 2L/s/ha or less. Or,

ii. All the runoff volume from the development should be discharged at a rate equivalent to the mean annual flow rate (QBAR) rate under greenfield conditions or less. Or,

iii. All the runoff volume from the development should be discharged at a rate of 2L/s/ha or less.

3.23 An estimate of the post-development runoff volume from the 1 in 100-year 6-hour storm can be derived from the Micro Drainage for both the impermeable and permeable areas.

3.24 The runoff volume for the impermeable areas is derived from the following equation using the average rainfall intensity obtained from MicroDrainage (which can be located in **Appendix 9**.

$$Runoff\ Volume\ (m^3) = Ave.\ Rainfall\ Intensity\ x\ Storm\ Duration\ x\ impemable\ area$$
$$= \frac{11.616}{1000}\ x\ 6\ x\ 23240 = 1618\ m^3$$

[7] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

3.25 The runoff volume for the permeable areas is prorated from the greenfield runoff volume located in **Appendix 3,** which equates to approximately 451m³.

3.26 The existing and post-development runoff volumes are compared within **Table 3.2**.

Table 3.2: Runoff Volume Comparison

Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3)
1,122	1618 + 451 = 2,069	+947

3.27 The 1 in 100-year 6-hour storm runoff volume from the site has been shown to increase as a result of the proposed development. However, as the runoff volume from the development will be discharged at a rate that does not exceed the mean annual flow rate (QBAR) rate under Greenfield conditions, the volume control criteria will be met.

Long Term Storage

3.28 It is proposed to discharge the runoff from the development a rate that does not exceed the mean annual flow rate (QBAR) rate under Greenfield conditions. Therefore, provision for long term storage is not required.

Sustainable Drainage Systems

3.29 A sustainable drainage optioneering exercise has been carried out to confirm what SuDS can be implement across the scheme. For further details refer to **Appendix 10**.

3.30 The proposals include rainwater harvesting tanks, a detention basin, raingardens (filter drain beneath swale), proprietary treatment systems (bypass and full retention separators) and two cellular storage tanks due to the quantum of development proposed. Additionally, a filter drain is included surrounding the proposed warehouse units.

3.31 A surface and foul water detailed proposed drainage layout for the development is shown on BWB Dwg No. THR-BWB-GEN-XX-DR-C-0500_Proposed Drainage Layout, included as **Appendix 11**.

Residual Risk and Designing for Exceedance

3.32 It is recommended that the final layout uses the proposed road infrastructure to provide drainage exceedance (overland flood flow) routes through the development and towards the attenuation storage for events in excess of the capacity of the drainage system.

3.33 If the capacity of the attenuation is exceeded, flood water will be directed away from buildings and pool within the service yard and car parking areas. For further details refer to exceedance layout in **Appendix 11**.

4. FOUL WATER DRAINAGE

4.1 It is proposed to drain used water from the development separately to surface water.

4.2 There is an existing foul water sewer that runs along the northern boundary of the site, parallel with High Road as identified within the TW sewer records **(Appendix 12)** and site topographical survey.

4.3 Historic correspondence with Thames Water **(Appendix 7)** has identified concern regarding the capacity of the local foul water network to accommodate the anticipated foul water flows from the development. The correspondence notes that hydraulic modelling will be required to assess the impact of the increased foul flows and to identify a potential solution which might include upgrading the sewer network. This modelling will be undertaken at the planning stage and combined with the necessary upgrades which may take up to 20 months after planning is granted. At the time of writing an updated response has not been received from Thames Water

4.4 In the absence of updated advice from Thames Water it is proposed to connect into the existing Thames Water sewer after the necessary upgrades to the sewer network have been completed. It is to be noted that due to site levels, pumping will be required.

4.5 This strategy is shown within drawing THR-BWB-GEN-XX-DR-C-0500_Proposed Drainage Layout, included as **Appendix 11**.

5. MAINTENANCE

5.1 Unless adopted, it is likely that a management company would adopt the SuDS features, and maintenance of these, including vegetation maintenance, trash screen clearing and regular outfall inspections.

5.2 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the site management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.

5.3 It is envisaged that the Operation and Maintenance manual will be developed at the detailed design stage, but some examples are included below.

i. All drainage features should be located in open areas which are readily accessible.
ii. Gullies should be inspected and de-silted at least once a year, where necessary.
iii. Pipes, manholes and silt traps should be inspected and de-silted at least once a year, where necessary.
iv. The surface water attenuation areas will be predominantly dry and the base should be seeded with a wildflower grass seed mix that can tolerate wet ground conditions.
v. Regular inspections of the attenuation basin and cellular storage should be undertaken to remove litter/debris, invasive/colonising vegetation and silt build up as necessary. Inlet and outlet structures to be regularly inspected, with remedial work as required to maintain water flows and prevent silt/vegetation build up.
vi. Vegetation/grass with the attenuation basin should be maintained appropriately to allow establishment and promote habitat formation, without impeding the operation of the inlet and outlet structure.
vii. Pumps should be inspected as per manufacturers guidance, litter/debris and silt build up should be removed as necessary.
viii. Any specialist or proprietary products specified as part of foul water and surface water strategy should have a manufacturer specific maintenance regime which should be included within the Operation and Maintenance Manual.

5.4 A draft copy of the operation and maintenance document that will be finalised ahead of handover can be located in **Appendix 13**.

6. SUMMARY

6.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

6.2 This SDS is intended to support an outline planning application and as such the level of detail included is commensurate and subject to the nature of the proposals.

Table 6.1: Sustainable Drainage Statement Summary

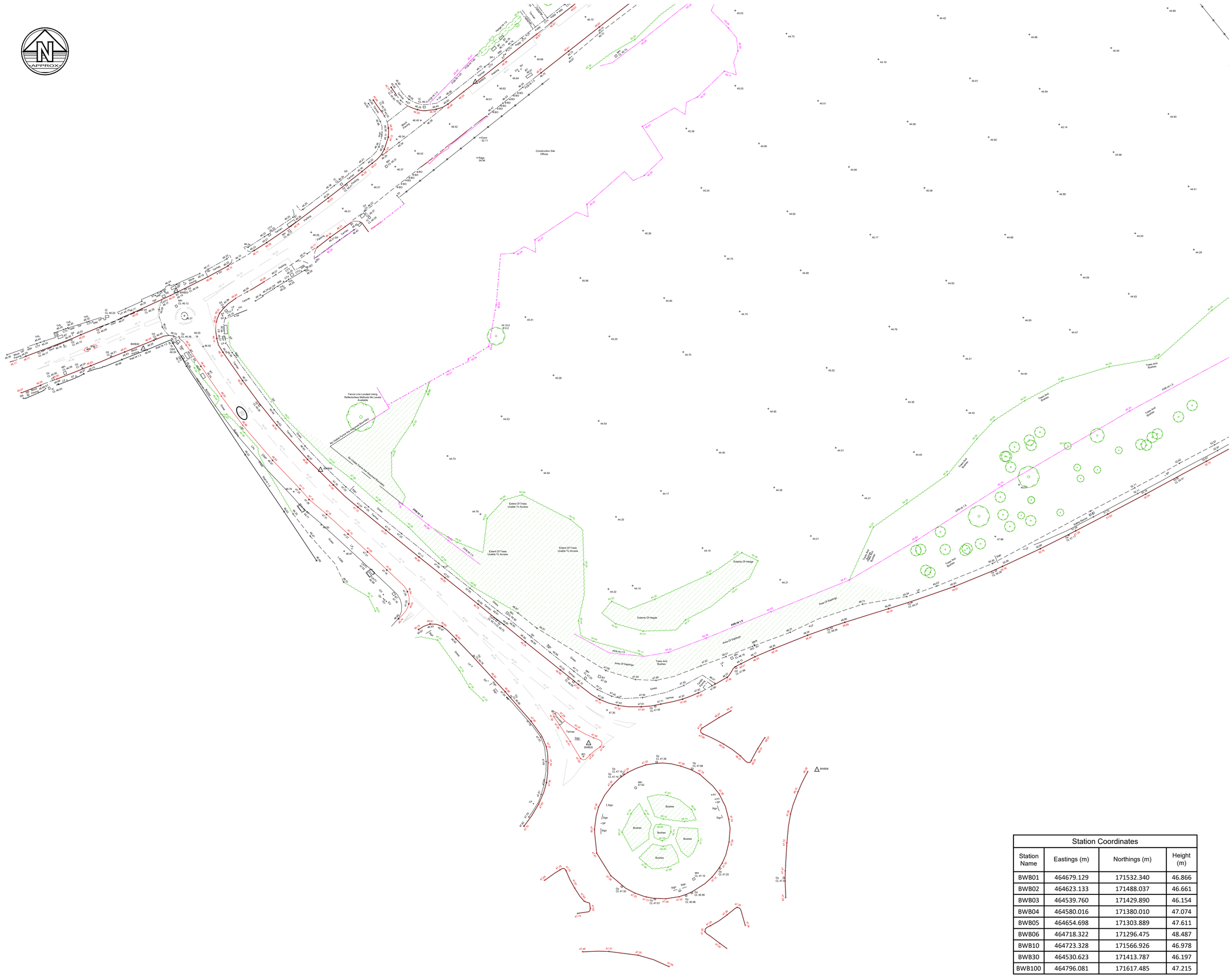
		Existing Site	Proposed Development
Site Area (Ha)		5.68	
Impermeable Area (Ha)		-	2.324
Outfall Location		Watercourse	Thames Water Sewer
Peak Runoff Rate (l/s)	**QBAR**	34.9	15.0
	1 in 30-Year	65.7	15.0
	1 in 100-Year	80.0	15.0
	1 in 100-Year + CC	-	15.0
Infiltration Rate		N/A	N/A
Runoff Volume (100yr RP 6 hour Storm)		1,122m^3	2,069m^3
Volume Control		-	Discharge rate limited to 15.0 l/s (via a pumped system)
Proposed Storage Volume		-	≈2,161m^3 (based on 15.0 l/s discharge rate
Flow Control Type		-	Pump
SuDS Features		-	Filter Drains, Detention Basin, Cellular Storage, Rain Garden, Rainwater harvesting, proprietary treatment systems
Maintenance Responsibility		-	Management Company

6.3 A foul drainage strategy has been developed to incorporate foul water pumps into the existing Thames Water sewer.

6.4 It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

APPENDICES

APPENDIX 1: Topographical Survey

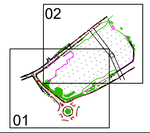


Station Coordinates			
Station Name	Eastings (m)	Northings (m)	Height (m)
BWB01	464679.129	171532.340	46.866
BWB02	464623.133	171488.037	46.661
BWB03	464539.760	171429.890	46.154
BWB04	464580.016	171380.010	47.074
BWB05	464654.698	171303.889	47.611
BWB06	464718.322	171296.475	48.487
BWB10	464723.328	171566.926	46.978
BWB30	464530.623	171413.787	46.197
BWB100	464796.081	171617.485	47.215

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. No scale factor has been applied to this survey, therefore the os coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
6. All coordinates and height data relate to OSGB36(15). Control stations are coordinated by means of GPS receiving real time corrections via OS smart net.
7. All manhole data is collected from ground level therefore discrepancies may occur. More accurate data is only achievable via confined space entry.
8. OS license number: 100022432

Key Plan



Legend

- OS Buildings
- Surveyed Buildings
- Building
- Wall
- Kerb Channel Line
- Top of Kerb
- Edge of Surface
- Top of Bank
- Bottom of Bank
- Canopy / Overhang
- Line Marking
- Centre Line
- Watercourse Centre Line
- Barrier
- Fence
- Gate
- Overhead Powerline
- Overhead Utilities
- Contour Lines
- Inspection Chamber
- Flow direction and pipe diameter (0.25 / 1)
- Station and Name
- BH 1 — Monitoring Borehole
- Tree / Bush / Sapling
- Area of Vegetation/ Extent of Tree Canopy
- Hedge
- Body of Water
- Body of Water from OS
- +50.00 — Spot Level
- Assumed Surface Water Drainage Line
- Surface Water Drainage Line

AP	Anchor Point	FBW	Fence Barbed Wire	LB	Litter Bin
BG	Back Gully	FCB	Fence Closed Board	LP	Lamp Post
BO	Bollard	FCL	Fence Chain Link	MH	Manhole
BS	Bus Stop	FEL	Fence Electric	Mkr	Service Marker
BT	British Telecom	FMP	Fence Metal Panel	PB	Post Box
C	Crest	FMR	Fence Metal Railing	PT	Post
CL	Cover Level	FOB	Fence Open Board	RE	Rodding Eye
CMP	Cable Marker Post	FPW	Fence Post & Wire	SP	Sign Post
		FSP	Fence Steel Palisade	ST	Stop Tap
CCTV	Security Camera	FWM	Fence Wire Mesh	SV	Stop Valve
CTV	Cable TV	FFL	Finished Floor Level	TCB	Telephone Call Box
DC	Drainage Channel	FP	Flagpole	THL	Threshold Level
DK	Drop Kerb	Gas	Gas	TL	Traffic Light
DP	Down Pipe	GV	Gas Valve	TP	Telegraph Post
Elec	Electric	GY	Gully	TS	Traffic Signal
EP	Electricity Post	Ht	Height	UTS	Unable to Survey
ER	Earth Rod	IC	Inspection Chamber	WL	Water Level
FH	Fire Hydrant	IFL	Internal Floor Level	WM	Water Meter
FL	Floodlight	IL	Invert Level (as a reduced level)	WO	Wash Out

Rev	Date	Details of issue / revision	Drw	Rev
P3	14.08.19	Survey Updated Fence lines added	IR	JM

Issues & Revisions

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Client

First Panattoni UK Development Ltd

Project Title

Theale , Reading

Drawing Title

Existing Site Plan

Drawn:	I.Riley		Reviewed:	J.Mathieson
BWB Ref:	NTE2460	Date:	25.09.18	Scale@A1: 1:500

Drawing Status

Information

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
THR-BWB-00-01-DR-G-0001	**S2**	**P3**

Station Coordinates			
Station Name	Eastings (m)	Northings (m)	Height (m)
BWB01	464679.129	171532.340	46.866
BWB02	464623.133	171488.037	46.661
BWB03	464539.760	171429.890	46.154
BWB04	464580.016	171380.010	47.074
BWB05	464654.698	171303.889	47.611
BWB06	464718.322	171296.475	48.487
BWB10	464723.328	171566.926	46.978
BWB30	464530.623	171413.787	46.197
BWB100	464796.081	171617.485	47.215

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in metres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. No scale factor has been applied to this survey, therefore the os coordinates are to be treated as arbitrary. Please refer to survey station information below for on site control establishment.
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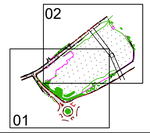

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- Overhead Utilities
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C	Crest	FMR	Fence Metal Railing	PT	Post
CL	Cover Level	FOB	Fence Open Board	RE	Rodding Eye
CMP	Cable Marker Post	FPW	Fence Post & Wire	SP	Sign Post
		FSP	Fence Steel Palisade	ST	Stop Tap
CCTV	Security Camera	FWM	Fence Wire Mesh	SV	Stop Valve
CTV	Cable TV	FFL	Finished Floor Level	TCB	Telephone Call Box
DC	Drainage Channel	FP	Flagpole	THL	Threshold Level
DK	Drop Kerb	Gas	Gas	TL	Traffic Light
DP	Down Pipe	GV	Gas Valve	TP	Telegraph Post
Elec	Electric	GY	Gully	TS	Traffic Signal
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FL	Floodlight	IL	Invert Level (as a reduced level)	WO	Wash Out

Rev	Date	Details of issue / revision	Drw	Rev
P2	07.08.19	Survey Updated (Trees Added)	IR	JM

Issues & Revisions

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- Nottingham | 0115 924 1100

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Client

First Panattoni UK Development Ltd

Project Title

Theale , Reading

Drawing Title

Existing Site Plan

Drawn:	I.Riley	Reviewed:	J.Mathieson
BWB Ref:	NTE2460	Date:	25.09.18
Scale@A1:	1:500		

Drawing Status

Information

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
THR-BWB-00-02-DR-G-0001	S2	P2

Y:\NTE\NTE2460_Theale, Reading\02. Project Delivery\02. SHARED\THR-BWB-00-M2-DR-G-0001-Existing_Site _2D_Model.dwg

APPENDIX 2: Greenfield Runoff Rate

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 700 Urban 0.500
Area (ha) 3.890 Soil 0.450 Region Number Region 6

Results l/s

QBAR Rural 17.1
QBAR Urban 34.9

Q100 years 80.0

Q1 year 29.7
Q30 years 65.7
Q100 years 80.0

APPENDIX 3: Greenfield Runoff Volume

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
FEH Rainfall Version	1999
Site Location	GB 465000 171200 SU 65000 71200
C (1km)	-0.029
D1 (1km)	0.280
D2 (1km)	0.299
D3 (1km)	0.349
E (1km)	0.309
F (1km)	2.560
Areal Reduction Factor	1.00
Area (ha)	3.890
SAAR (mm)	656
CWI	97.080
SPR Host	40.440
URBEXT (1990)	0.1578

Results

Percentage Runoff (%)	41.37
Greenfield Runoff Volume (m^3)	1121.540

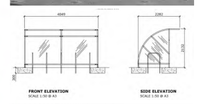
APPENDIX 4: Masterplan

Boundaries

- Red Line Boundary
- NDA
- Security Fence

01 WASTE MANAGEMENT STORE
Concrete base with 2.4m high timber palisade fencing with galvanized structure.

02 BICYCLE STORE
Urban Engineering 'Series A' or similar and approved Polycarbonate transparent sheets with polyester powder coated steel frame.
Colour: White (BS00E55) Shetfield steel cycle racks or similar and approved to accommodate 10 cycles per shelter.



Arrangement and quantity of Cycle Stands within the Cycle Store area in accordance with planning requirements

Refer to site plan for location and positioning.

03 BOUNDARY SECURITY FENCE

Typical Paladin Fencing:
The perimeter of the service yards will be provided with 2.4m high paladin fencing. Post and panels to be black finish. Fences to be suitably set back from vehicular areas to reduce risk of accidental impact. Fencing / landscaping to be co-ordinated such that a maximum gap beneath fence is 100mm.

04 KNEE RAIL FENCING
Made from softwood guaranteed for 25 years.
Galvanised strap for longer life
5 year treatment guarantee
Height 1.20m with planed finish.

05 DOCK APRON RETAINING WALL
External retaining walls to the sides of the dock access will be also of fair faced concrete. Armco barrier galvanised mild steel and handrailing is to be provided adjacent to the retaining wall to level access ramps. The barrier uprights are to be surface fixed to the concrete.

06-07 VEHICLE AND PEDESTRIAN GATES:

To security sensitive areas near the main access road, vehicle gate is to be black steel paladin, 2.4m high to BS 1722-12:2006 (including concrete foundations). Gates to hinge open and be able to be held in the open position by providing bolt sleeves. Posts to be square section powder coated black steel with capped tops, cast in concrete bases.

07 AUTO CANTILEVERED SLIDING GATE

2.4m high Paladin automated sliding Gates.

Rev	Date	Iss. By	App. By	Description
P1	26/07/23		ELF	Revised Layout.
P2	03/08/23		ELF	Access to Unit 1 moved.
P3	04/08/23		ELF	Car Park layout updated.
P4	08/08/23		ELF	Update site layout as per latest comments from Panattoni.
P5	09/08/23		ELF	Issued for Planning
P6	11/09/23		ELF	Updated layout according to the latest landscape and drainage strategy.

Red Line Boundary

Name	Area (Hectares)	Area (Acres)
Site Gross Area	5.43 hectare	13.41 acres
Total Area	5.43 hectare	13.41 acres

Planning Site Area Schedule

Name	Area (Hectares)	Area (Acres)
Net Dev Area Unit 1	0.98 hectare	2.42 acres
Net Dev Area Unit 2	1.04 hectare	2.58 acres
Total Area	2.02 hectare	4.99 acres

UNIT 1 GIA Area Schedule

Name	Area (m²)	Area (ft²)
Unit 1 Escape Stair	24.29 m²	261.48 ft²
Unit 1 GF Core	86.68 m²	933.06 ft²
Unit 1 Mezzanine Office	415.76 m²	4,475.16 ft²
Unit 1 Warehouse	4,029.72 m²	43,375.58 ft²
	4,556.45 m²	49,045.27 ft²

UNIT 2 GIA Area Schedule

Name	Area (m²)	Area (ft²)
Unit 2 Escape Stair	24.29 m²	261.48 ft²
Unit 2 GF Core	86.68 m²	933.06 ft²
Unit 2 Mezzanine Office	415.76 m²	4,475.16 ft²
Unit 2 Warehouse	4,561.56 m²	49,100.20 ft²
	5,088.29 m²	54,769.90 ft²

TOTAL GIA

Name	Area (m²)	Area (ft²)
<varies>	9,644.74 m²	103,815.17 ft²
	9,644.74 m²	103,815.17 ft²

GEA Schedule

Name	Area (m²)	Area (ft²)
<varies>	9,889.97 m²	106,454.73 ft²
Total GEA:	9,889.97 m²	106,454.73 ft²

SCALE 1:1000
0m 50m 100m

PANATTONI

SGP
Architects + Masterplanners

Waterfront House
2a Smith Way
Grove Park
Enderby
Leicester LE19 1SX

t: +44 (0)116 247 0557

www.stephengeorge.co.uk

Theale, Reading

Drawing Name:
Site Plan

Drawing Stage: **Planning**

Status: **S0**

SGP File Ref: 18-095-SGP-ZZ-ZZ-M3-A-00000

SGP Project No	Date	Drawn	Team	Scale	Rev
18-095	26/07/23	ELF	MMS	As indicated @ A1	P6

Drawing Number:
18-095-SGP-ZZ-ZZ-DR-A- 131001
Project Code Originator Volume Level Type Role Number

APPENDIX 5: National Highways Correspondence

Matthew Ross

From: Ginn, Beata <Beata.Ginn@highwaysengland.co.uk>
Sent: 13 November 2019 11:55
To: Jean Benard
Cc: Blake, Patrick; Planning SE
Subject: Response 2019_11_13 - RE: Theale, Reading

Hi Jean,

I was not in the office yesterday, so apologies you were not able to get hold of me.

Unfortunately, no connections to the Highways England drainage system is permitted from the adjacent development, the DfT Circular 2/2013, in the chapter ñPhysical Impact of Development on the Strategic Road Networkò states that:

There may be development proposals that, whilst not within the statutory requirement for a local planning authority to consult the Highways Agency, have the potential for direct or indirect physical impact on the strategic road network or its amenities, or to put users of the road at risk (such as fire hazard; stability of embankments and cuttings; integrity of structures; water run-off; air quality; visibility of traffic signs; etc.). Developers and local authorities are encouraged to identify such potential risks and discuss with the Highways Agency at the earliest opportunity to avoid the possibility of delaying or putting the delivery of their proposals at risk. 50. In order to ensure the integrity of the highway drainage systems, no water run off that may arise due to any change of use will be accepted into the highway drainage systems, and there shall be no new connections into those systems from third party development and drainage systems. Where there is already an existing third party connection the right for connection may be allowed to continue provided that the input of the contributing catchment to the connection remains unaltered.

I remember mentioning it at the meeting held at our offices on 18 October, where it seemed to have been clearly understood by meeting attendees.

Therefore any drainage for the site will need to be carefully designed not to have impact on the M4 drainage.

Regards

Mrs Beata Ginn
Assistant Spatial Planning Manager (Area 3)
Highways England | Bridge House | Walnut Tree Close | Guildford GU1 4LZ
Tel: +44 (0) 300 470 1118 **Mobile:** 0787 204 6392
Web: www.highwaysengland.co.uk

APPENDIX 6: EA Correspondence

Matthew Ross

From:	Matthew Ross
Sent:	18 November 2019 10:23
To:	enquiries_THM@environment-agency.gov.uk
Cc:	Jean Benard
Subject:	THM_135276 - Theale - Potential Watercourse Connection
Attachments:	18-095-M003-Illustrative Masterplan.pdf; PTAU-Conder-SAF-6pp-brochure-181018.pdf

To the attention of Julia Hewitt
Ref: THM_135276

Hi Julia

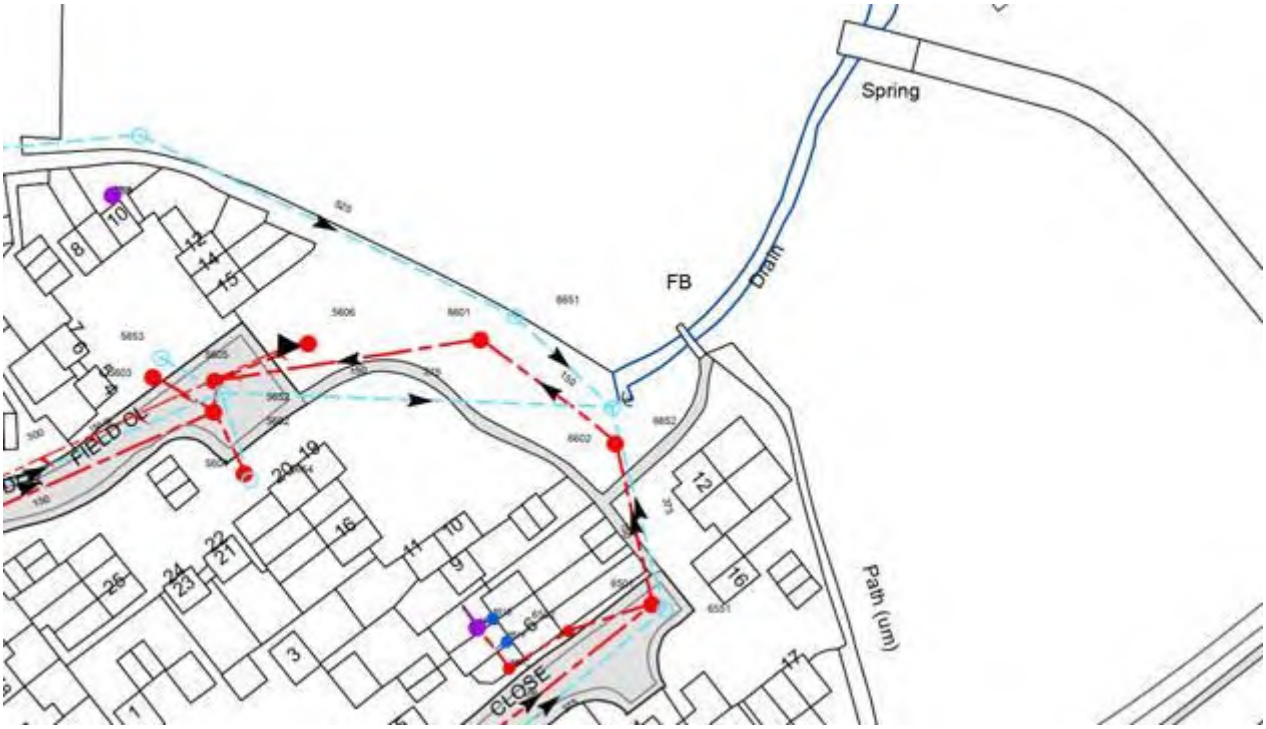
My colleague Rachel Meredith provided me with your contact details and advised you would be the best to contact on this matter.

I am contacting you on behalf of the developers Panattoni who are proposing the development of 3 warehouses on the disused land off Hoad Way, Theale I have attached the proposed Site Plan.

There is a drainage ditch that currently runs through the site which is under Highways England ownership. The HE have stated that under no circumstances can we discharge our drainage into their ditch. So we need to find an alternative connection.

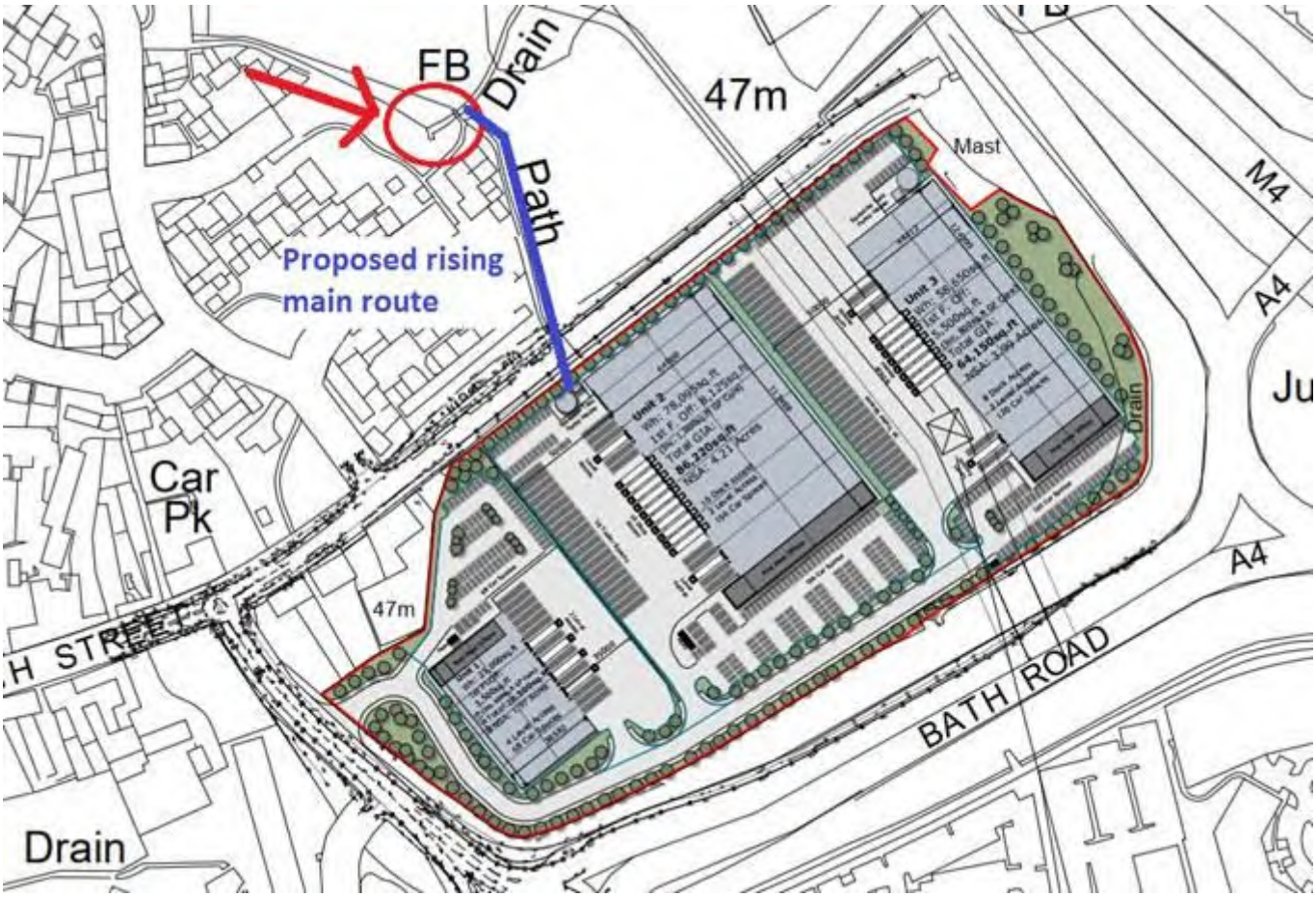
I am under the impression that the Watercourse highlighted in dark blue is under Environmental Agency ownership:

Thames Water Asset location plan shows that a Surface Water sewer currently discharges into this watercourse.



We are proposing to discharge the development at Greenfield runoff rates to match existing conditions:
1 year – 43.4 l/s
30 year – 50.2 l/s
100 year + 40% CC – 50.6 l/s

In terms of Foul water, Thames Water have confirmed there is no capacity in their foul sewer network. Therefore, we are proposing to treat the foul via an Effluent Treatment Plant (I have attached the specification).
The idea would be to discharge a Combined Water (Surface Water and treated Foul) to the watercourse via a Combined Water Pump as shown below. We would provide a Penstock and a Non-return valve prior to the combined Water pump to ensure any contamination couldn't reach the watercourse. We can also provide a sampling chamber for the EA to have access if this is required. The site will contain a mixture of SuDS and Full retention seperators to ensure any water dischagred is complient with EA standards.



We are aware we would need permission to pump across 3rd party land. Can you also confirm whether we would need to apply for a Trade Effluent Discharge agreement?

Please can you confirm this would be acceptable in principle? We are hoping to go to planning as soon as possible and would be grateful if you could respond at your earliest opportunity.

Please let me know if you require any further information.

Thanks in advance for your time on this matter.

Kind regards

Matthew Ross
Engineer | BWB Consulting Limited

11-15 Borough High Street, London SE1 9SE
T 020 7407 3879 **D** 020 3973 9811 **W** www.bwbconsulting.com

APPENDIX 7: Thames Water Correspondence

Miss Rachel Meredith

BWB Consulting Ltd,
5th Floor, Waterfront House,
Station Street,
Nottingham,
Nottinghamshire,
NG2 3DQ

Wastewater pre-planning
Our ref **DS6063561**

31 July 2019

Pre-planning enquiry: Insufficient Capacity

Dear Rachel,

Thank you for providing information on your development.

Site: Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Existing site: Greenfield.
Proposed site: Offices (1,395m2) & Warehouse (15,000m2).
Proposed foul water discharge by pump at 5.5 l/s into manhole SU64716401.
Proposed surface water discharge to nearby watercourse and not to Thames Water Sewer.

We have completed the assessment of the foul water flows based on the information submitted in your application with the purpose of assessing sewerage capacity within the existing Thames Water sewer network.

Foul Water

We've assessed your **foul water** proposals and concluded that our sewerage network will not have enough capacity for your development at this time.

In order to ensure we make the appropriate upgrades – or 'off-site reinforcement' – to serve the remainder of your development, we'll need to carry out modelling work, design a solution and build the necessary improvements. This work is done at our cost.

Once we've begun modelling, we may need to contact you to discuss changing the connection point for capacity reasons. Please note that we'll pay the cost of covering any extra distance if the connection needs to be made at a point further away than the nearest practicable point of at least the same diameter.

How long could modelling and reinforcement take?

Typical timescales for a development of your size are:

Modelling: 8 months
Design: 6 months
Construction: 6 months
Total: 20 months

If the time you're likely to take from planning and construction through to first occupancy is longer than this, we'll be able to carry out the necessary upgrades in time for your development. If it's shorter, please contact me on the number below to discuss the timing of our activities.

What do you need to tell us before we start modelling?

We're responsible for funding any modelling and reinforcement work. We need, though, to spend our customers' money wisely, so we'll only carry out modelling once we're confident that your development will proceed.

In order to have this confidence, we'll need to know that you **own the land and have either outline or full planning permission**. Please email this information to us as soon as you have it.

If you'd like us to start modelling work ahead of this point, we can do this if you agree to underwrite the cost of modelling and design. That means we'll fund the work – but you agree to pay the cost if you don't achieve first occupancy within five years.

If the modelling shows we need to carry out reinforcement work, then before we start construction we'll need you to supply us with notification that you've confirmed your F10 – Notification of construction project - submission to the Health and Safety Executive.

Surface Water

Please note that discharging surface water to the public sewer network should only be considered after all other methods of disposal have been investigated and proven to not be viable. In accordance with the Building Act 2000 Clause H3.3, positive connection to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable.

The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; 3rd Sewers.

Only when it can be proven that soakage into the ground or a connection into an adjacent watercourse is not possible we would then consider a restricted discharge into the public surface water/combined sewer network. As a guide a discharge rate of 5 litres/second/Hectare will be use, in most instances, however more onerous constraints may be imposed to fit local circumstances. The system shall not show signs of flooding above ground for the worst 1 in 30-year storm and shall be tested for exceedance in a 1 in 100-year storm to demonstrate any flooding that may occur will not flood properties.

Thames Water Planning team would ask to see why it is not practicable on the site to restrict to Greenfield run-off rates if they are consulted as part of any planning application.

Please see the attached 'Planning your wastewater' leaflet for additional information.

What do I need to do next?

If you are satisfied with the points above, then you should compare your own timeline with the typical timescales we have suggested for our activities. If the time you're likely to take from planning and construction through to first occupancy is **more** than the total time we're likely to take, we'll be able to carry out the necessary upgrades in time for your development.

If it's **less** than this, you might want to ask us to start modelling earlier – in which case we'll require you to underwrite the cost, as noted above.

If you've any further questions, please contact me on 020 3577 7608

Yours sincerely

Zaid Kazi

Development Engineer
Developer Services – Sewer Adoptions Team
Thames Water

Rebekah Duncan

From: Matthew Ross
Sent: 24 July 2023 15:08
To: Rebekah Duncan
Subject: FW: RE: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

FYI

Kind regards

Matthew Ross
Associate | BWB Consulting Limited

11-15 Borough High Street, London SE1 9SE
T 020 7407 3879 **M** 0746 9280 462 **W** www.bwbconsulting.com

---

From: DEVELOPER.SERVICES@THAMESWATER.CO.U <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
Sent: Wednesday, February 26, 2020 8:21 AM
To: Matthew Ross <Matthew.Ross@bwb-consulting.com>
Cc: zaid.kazi@thameswater.co.uk
Subject: RE: RE: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Morning Matthew,

I have received a response from the Asset planners, and they have principally approved the restricted discharge rate of 15.0 l/s (Pumped) to our Thames Water Sewer Network.

The same will be notified to you through the planning application that has been made to the Local Authority.

Many Thanks

Kind Regards

Zaid Kazi

Adoptions Engineer
Developer Services - Sewer Adoptions Team
Thames Water
Tel No: 020 3577 7608

Original Text

From: "DEVELOPER.SERVICES@THAMESWATER.CO.U" <DEVELOPER.SERVICES@THAMESWATER.CO.UK>
To: matthew.ross@bwb-consulting.com
CC: zaid.kazi@thameswater.co.uk <zaid.kazi@thameswater.co.uk>
Sent: 12.02.20 14:29:49
Subject: RE: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Dear Matthew,

Thank you for your email.

Please refer my responses in below highlights.

Many Thanks

Kind Regards

Zaid Kazi

Adoption Engineer
Developer Services - Sewer Adoptions Team
Tel No: 020 3577 7608

Original Text

From: Matthew Ross <Matthew.Ross@bwb-consulting.com>
To: Zaid Kazi <Zaid.Kazi@thameswater.co.uk>
CC: Developer Services <developer.services@thameswater.co.uk>
Sent: 10.02.20 09:25:28
Subject: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Hi Zaid

Following your below email please find attached the requested information.

1. Infiltration tests haven't been carried out however, the Local Authority said it won't be feasible due to ground water flooding and the Phase 2 report states the water table is close to the surface and therefore infiltration will not be feasible, see attached email and report extract.
2. See attached email correspondence with the Local Authority
3. I have attached the Proposed Drainage Layout for the Site

Thank you for your providing the revised drainage strategy inclusive of the surface water discharge to Thames Water network. I will have to run this through with our planners and seek their approval.
As confirmed earlier, the total impermeable of the site is 4.33ha.

Also, I would request you to please provide me the planning reference number once the planning application is been made to local authority.

Please note, I am on my annual leave next week and will only be able to respond to you on my return.

The development consists of 3 medium size warehouses and has a design life of 25 years. The proposal is to pump surface water from a package pump station to the Thames Water sewer via a rising main. Is this something TW would look at adopting via Section 104 application or would the rising main & package pump station need to remain private?
The pumping station within the whole site (commercial area) comes under single curtilage category and hence won't be adopted by Thames Water.

Kind regards

Matthew Ross
Engineer | BWB Consulting Limited

From: Zaid Kazi <Zaid.Kazi@thameswater.co.uk>
Sent: 10 January 2020 07:45
To: Matthew Ross <Matthew.Ross@bwbconsulting.com>
Cc: Developer Services <developer.services@thameswater.co.uk>
Subject: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Dear Matthew,

Thank you for your email.

As discussed over the phone, Thames Water does not support the disposal of surface water flows to Thames Water Foul sewer network.

If the surface flows are to be discharged to the Thames Water surface sewer network, we would like you to provide us with the following documents:

1) Infiltration test reports confirming that soakaways are not feasible.
2) Confirmation letter or email correspondence from the Local Authority / LLFA accepting your proposal in principle; stating surface water flows can be discharged to Thames Water sewer network and not to the nearby watercourse (due to crossing of the third party land). This is to ensure that we have covered the various stages of surface water hierarchy; 1) soakaways, 2) watercourse & 3) Public sewer network.
3) Once the above are provided, we would like you to then present us with the surface water drainage plan implementing various SUDS plan on site. The restricted flow rate should be discharged to the surface water sewer network which is slightly to the North of the site (junction between Rother Field Close & Woodfield Way). Below Screenshot for your information.

Should you have any queries or require any clarification to the above, please feel free to contact me.

Many Thanks

Kind Regards

Zaid Kazi
Developer Services – Adoptions Engineer, Sewer Adoptions Team
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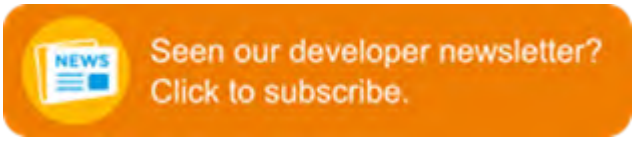
Clearwater Court, Vastern Road, Reading, RG1 8DB
Find us online at developers.thameswater.co.uk



From: Matthew Ross <Matthew.Ross@bwbconsulting.com>
Sent: 07 January 2020 14:03
To: Zaid Kazi <Zaid.Kazi@thameswater.co.uk>
Cc: Developer Services <developer.services@thameswater.co.uk>
Subject: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Hi Zaid

Happy New Year.

In regards to the site below, we were initially planning on discharging surface water to a local watercourse. This has been blocked by Highways England as the watercourse is under their ownership, they referred to the DfT Circular 2/2013 document paragraph 50 which states "In order to ensure the integrity of the highway drainage systems, no water run off that may arise due to any change of use will be accepted into the highway drainage systems, and there shall be no new connections into those systems from third party development and drainage systems. Where there is already an existing third-party connection the right for connection may be allowed to continue provided that the input of the contributing catchment to the connection remains unaltered".

There is a watercourse to the north of the site under Environment Agency ownership however, we would require permission to cross third party land to get there. The third party land owner has confirmed we do not have permission to cross their land.

Infiltration is not possible due to the ground conditions and the proximity of the watercourse.

The nearest Thames Water surface water sewer is approximately 150m away from the site would and would require pumping through third part land including residential areas to make a connection.

Therefore we believe we have exhausted all other options for discharging surface water. The only possibility would be to discharge surface water to the Thames Water foul sewer.

I appreciate the points made below regarding upgrading/modelling works only begin once the job has planning etc. but, in principle, assuming the sewer reinforcement works go ahead, would Thames Water accept the surface water of the site discharging into their foul sewer? If not, is there any solution Thames Water can offer?

Kind regards

Matthew Ross
Engineer | BWB Consulting Limited

11-15 Borough High Street, London SE1 9SE
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From: Zaid Kazi <Zaid.Kazi@thameswater.co.uk>
Sent: 13 December 2019 08:20
To: Matthew Ross <Matthew.Ross@bwbconsulting.com>
Cc: Developer Services <developer.services@thameswater.co.uk>
Subject: RE: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Dear Matthew,

Thank you for your email.

As stated in the letter; the modelling works, the necessary upgrades or any offsite reinforcement works will be carried out by us (Thames Water) at our own cost with no charges to the customer.

However, for us to start the above works you will have to provide us with the following details.

1) The outline or full planning permission reference number made to Local Authority.
2) The developer's details who will be constructing the site.
3) The building programme such as construction start and end date along with the first occupancy date in MMYYYY. If site consists of multiple phases, please provide the details accordingly.

Once we have the confidence of the site proceeding further with the development, we will then utilise our resources to carry out the above works and will ensure sufficient capacity is available in our network to meet the demands of your site.

Should you have any queries to the above, please feel free to contact me at the undersign.

Many Thanks

Kind Regards

Zaid Kazi
Developer Services – Adoptions Engineer, Sewer Adoptions Team
Office: 0203 5777 608
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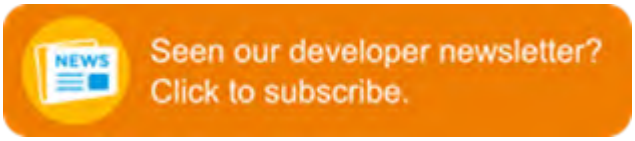
Find us online at developers.thameswater.co.uk



From: Matthew Ross <Matthew.Ross@bwbconsulting.com>
Sent: 10 December 2019 15:54
To: Zaid Kazi <Zaid.Kazi@thameswater.co.uk>
Subject: TW Ref: DS6063561 - Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR

Wastewater Pre-Planning
TW Ref: DS6063561

Hi Zaid

In July this year we undertook a Pre-Planning Sewer Enquiry for the Site; Land to the East of Hoad Way, Theale, Hoad Way, Theale - RG7 5AR.

You came back explaining there was insufficient capacity within the Foul Network System and stated this would take approximately 20 months to upgrade. Your response is attached. Our Client is wanting to progress this option but requires a costing for the upgrading of the sewer, please can you provide this?

Kind regards

Matthew Ross
Engineer | BWB Consulting Limited

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APPENDIX 8: Surface Water Assessment

TRANSPORT AND INFRASTRUCTURE

CP Logistics UK Reading Propco Limited
Theale
Reading

Surface Water Drainage Design

www.bwbconsulting.com

Project Number:	NTE2460
Project Name:	Theale, Reading
Client:	CP Logistics UK Reading Propco Limited
Document Title:	Surface Water Drainage Design
Phase / Unit Reference:	2 Unit Masterplam
Revision:	P02
Stage:	Planning
Prepared by:	Rebekah Duncan
Date:	08/09/2023
Authorised by:	Kristen Jones
Date:	08/09/2023
File Ref:	THR-BWB-DDG-xx-CA-D-0001-SW Assessment

Contents: **Page:**

Project Number:	NTE2460	Page	1
Project Name:	Theale, Reading	Rev.	P02
Plot Reference / Zone:	2 Unit Masterplam	Stage	Planning
Client:	CP Logistics UK Reading Propco Limited	Date	08/09/2023
File Ref:	THR-BWB-DDG-xx-CA-D-0001-SW Assessment	Prepared by	Rebekah Duncan
Document Title:	Surface Water Drainage Design	Authorised by	Kristen Jones

Introduction

Existing Site :

Greenfield development.

It is assumed that current surface water runoff from the site infiltrates into the ground. In the event of exceedance, it is assumed that excess surface water would enter the existing National Highways watercourse within the site boundary

Proposed Development :

Two thirds of the site will be developed and 2 commerical units with associated access road, service yard and car parking will be erected

Design Assumptions :

Discharge location will follow the hierarchy strategy which is briefly:
Step 1: to ground by infiltration. The sub-surface ground conditions and ground water levels have been found to be unfavourable and as such, infiltration SuDS are currently not considered viable as a method of surface water disposal.
Step 2: to an adjacent watercourse. The nearest watercourse to the Site is along the southern boundary but this has been identifeied as a National Highways ditch and they have advised that we cannot connect into it, as such is not not considered viable as a method of surface water disposal. The nearest EA watercourse would require crossing of 3rd party land, we have been advised that the 3rd party has rejected any proposals to cross their land as such is not not considered viable as a method of surface water disposal.
Step 3: to the surface water sewers within / adjacent to the site. The site will discharge to the existing surface water drainage via a rising main into the existing Thames Water Sewer in Rotherfield Close.
Step 4: to the combined sewers within / adjacent to the site. As Step 3 can be achieved, discharge to public combined sewers is not necessary.

The current advice from Thames Water (email 26/02/2020) advises that a discharge rate of 15l/s/ha can be used for the whole site, as only 2/3rd's of the development is proposed to come forward at this time it is proposed that the pump and rising main installed are designed to match this discharge rate (15l/s) to prevent any future requirements to upgrade the rising main beneath the public highway. The third unit will need to be designed to attenuate itself and will be allowed a pass though flow of 5l/s which will be accounted in the microdrainage modelling for the network.

Based on a 75 year lifespan for the development, Table 2 of the gov.uk guidance a *the* climate change allowances below have been considered.
The design is being progressed using both FSR & FEH. The relevant data is below:

Climate change (30 yr)	*35* %
Climate change (100 yr)	*40* %
Nearest postcode	RG7 5AQ
Easting	464718
Northing	171432
Gird Reference	SU647714
FSR Rainfall Data used for 15 and 30 minute storm durations:	
M5-60	*18.600* mm
Ratio R	*0.4*
Soil	*0.45*
SAAR	*700* mm
Region	*6*
FEH Data (1999):	
C (1km)	*-0.029*
D1 (1km)	*0.280*
D2 (1km)	*0.299*
D3 (1km)	*0.349*
E (1km)	*0.309*
F (1km)	*2.560*
FEH1999 XML Rainfall file used for 60 minute and greater storm durations	

Project Number:	NTE2460	Page	2
Project Name:	Theale, Reading	Rev.	P02
Plot Reference / Zone:	2 Unit Masterplam	Stage	Planning
Client:	CP Logistics UK Reading Propco Limited	Date	08/09/2023
File Ref:	THR-BWB-DDG-xx-CA-D-0001-SW Assessment	Prepared by	Rebekah Duncan
Document Title:	Surface Water Drainage Design	Authorised by	Kristen Jones

Impermeable Areas Assessment

Total Site Area

Based on the masterplan	Total area		=	5.430 ha
	Undeveloped Area		≈	1.540 ha
	Development Area		≈	3.890 ha

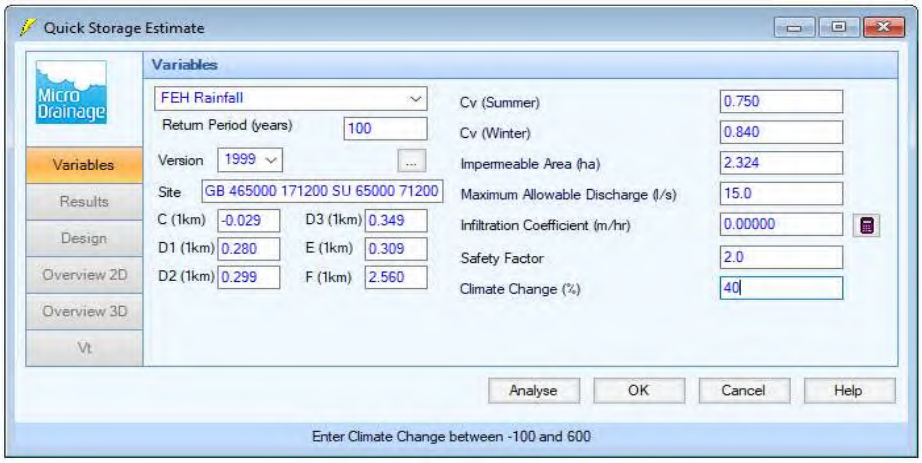
Pre-development conditions (development area):

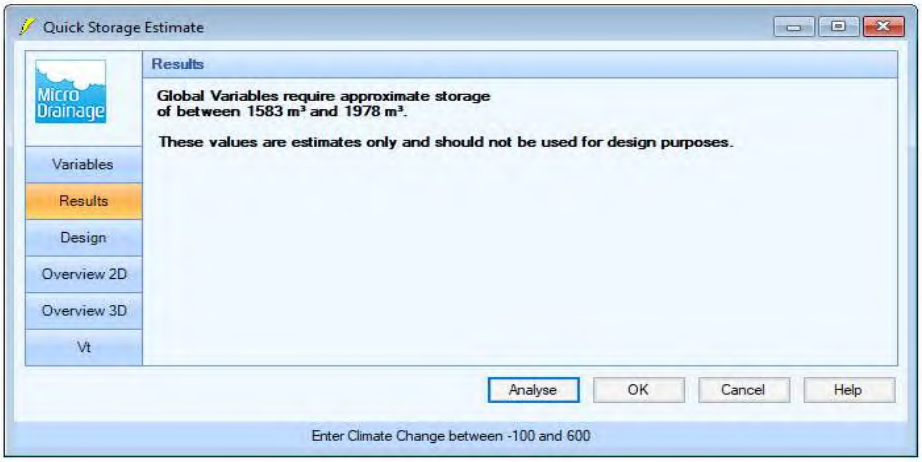
	Impermeable area	Aex	=	0.000 ha
	Premeable area	Apex	=	3.890 ha

Post-development Conditions (development area):

	Impermeable area	Ap	=	2.324 ha
	Premeable area	App	=	1.566 ha

100 Year Plus Climate Change Event - Attenuation Requirements





WinDes Network Information

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 465000 171200 SU 65000 71200
C (1km)	-0.029
D1 (1km)	0.280
D2 (1km)	0.299
D3 (1km)	0.349
E (1km)	0.309
F (1km)	2.560
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	19.981	0.273	73.2	0.052	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	30.342	0.348	87.2	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	19.236	0.217	88.6	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	17.179	0.172	99.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	31.377	0.301	104.2	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	20.164	0.125	161.3	0.091	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	11.282	0.068	165.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.22	44.869	0.052	0.0	0.0	0.0	1.53	60.8	7.0
1.001	50.00	5.58	44.596	0.080	0.0	0.0	0.0	1.40	55.7	10.8
1.002	50.00	5.81	44.248	0.125	0.0	0.0	0.0	1.39	55.2	16.9
1.003	50.00	6.03	44.031	0.125	0.0	0.0	0.0	1.31	52.0	16.9
1.004	50.00	6.44	43.859	0.161	0.0	0.0	0.0	1.28	50.9	21.8
2.000	50.00	5.33	43.683	0.091	0.0	0.0	0.0	1.03	40.8	12.3
1.005	50.00	6.62	43.558	0.252	0.0	0.0	0.0	1.01	40.2	34.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	29.603	0.122	242.6	0.160	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	19.122	0.120	159.4	0.068	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	22.648	0.142	159.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	12.330	0.112	110.1	0.250	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.003	7.313	0.018	406.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	33.214	0.011	3019.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	27.496	0.055	499.9	0.106	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	25.074	0.051	491.6	0.211	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.010	23.969	0.076	315.4	0.137	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.011	13.178	0.027	488.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.000	69.846	0.281	248.6	0.074	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	16.286	0.062	262.7	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.002	19.663	0.164	119.9	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.003	5.226	0.070	74.7	0.105	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.004	35.736	0.050	714.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	19.122	0.130	147.1	0.067	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	23.056	0.060	384.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.002	12.330	0.120	102.8	0.260	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.003	21.124	0.025	845.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.005	4.437	0.009	493.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.006	19.435	0.040	485.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	50.00	7.00	43.265	0.412	0.0	0.0	0.0	1.30	206.9	55.8
3.000	50.00	5.31	43.760	0.068	0.0	0.0	0.0	1.03	41.1	9.2
3.001	50.00	5.67	43.640	0.068	0.0	0.0	0.0	1.03	41.1	9.2
3.002	50.00	5.78	43.273	0.318	0.0	0.0	0.0	1.94	308.1	43.1
3.003	50.00	5.90	43.161	0.318	0.0	0.0	0.0	1.00	159.4	43.1
1.007	50.00	8.54	43.143	0.730	0.0	0.0	0.0	0.36	57.3«	98.9
1.008	50.00	9.00	43.132	0.836	0.0	0.0	0.0	0.99	215.4	113.2
1.009	50.00	9.41	43.077	1.047	0.0	0.0	0.0	1.00	217.2	141.8
1.010	50.00	9.73	43.026	1.184	0.0	0.0	0.0	1.26	271.9	160.3
1.011	50.00	9.95	42.950	1.184	0.0	0.0	0.0	1.01	218.0	160.3
4.000	50.00	6.17	44.122	0.074	0.0	0.0	0.0	0.99	70.2	10.0
4.001	50.00	6.45	43.841	0.116	0.0	0.0	0.0	0.97	68.2	15.7
4.002	50.00	6.68	43.779	0.167	0.0	0.0	0.0	1.43	101.4	22.6
4.003	50.00	6.73	43.615	0.272	0.0	0.0	0.0	1.82	128.8	36.8
4.004	50.00	7.76	43.545	0.272	0.0	0.0	0.0	0.58	41.0	36.8
5.000	50.00	5.30	43.830	0.067	0.0	0.0	0.0	1.08	42.8	9.1
5.001	50.00	5.67	43.700	0.067	0.0	0.0	0.0	1.03	164.0	9.1
5.002	50.00	5.77	43.640	0.327	0.0	0.0	0.0	2.01	319.0	44.3
5.003	50.00	6.28	43.520	0.327	0.0	0.0	0.0	0.69	110.0	44.3
4.005	50.00	7.83	43.495	0.599	0.0	0.0	0.0	1.00	216.9	81.1
4.006	50.00	8.15	43.486	0.599	0.0	0.0	0.0	1.01	218.5	81.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.007	27.316	0.055	496.7	0.119	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.008	27.366	0.055	497.6	0.238	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.009	8.890	0.018	493.9	0.119	0.00	0.0	0.600	o	525	Pipe/Conduit	
6.000	6.567	0.067	98.0	0.000	5.00	5.0	0.600	o	150	Pipe/Conduit	
4.010	79.441	0.173	460.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.011	78.151	0.222	352.0	0.065	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.012	10.000	0.075	133.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.007	50.00	8.61	43.446	0.718	0.0	0.0	0.0	1.00	216.1	97.2
4.008	50.00	9.06	43.391	0.956	0.0	0.0	0.0	1.00	215.9	129.5
4.009	50.00	9.21	43.336	1.075	0.0	0.0	0.0	1.00	216.7	145.6
6.000	50.00	5.11	43.385	0.000	5.0	0.0	0.0	1.02	17.9	5.0
4.010	50.00	10.49	43.318	1.075	5.0	0.0	0.0	1.04	224.6	150.6
4.011	50.00	11.58	43.145	1.140	5.0	0.0	0.0	1.19	257.2	159.4
1.012	50.00	11.67	42.923	2.324	5.0	0.0	0.0	1.94	419.6	319.7

5th Floor, Waterfront House
35 Station Street
Nottingham, NG2 3DQ

Date 08/09/2023 11:24 | Designed by Rebekah.Duncan
File NTE2460 - Theale - Surface | Checked by
Innovyze | Network 2020.1

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
101	45.994	1.125	Open Manhole	1200	1.000	44.869	225				
102	45.721	1.125	Open Manhole	1200	1.001	44.596	225	1.000	44.596	225	
103	45.373	1.125	Open Manhole	1200	1.002	44.248	225	1.001	44.248	225	
104	45.156	1.125	Open Manhole	1200	1.003	44.031	225	1.002	44.031	225	
105	45.203	1.344	Open Manhole	1200	1.004	43.859	225	1.003	43.859	225	
106	45.108	1.425	Open Manhole	1200	2.000	43.683	225				
107	45.225	1.667	Open Manhole	1200	1.005	43.558	225	1.004	43.558	225	
								2.000	43.558	225	
109	45.263	1.998	Open Manhole	1350	1.006	43.265	450	1.005	43.490	225	
Dock	44.550	0.790	Open Manhole	450 x 450	3.000	43.760	225				
111	45.216	1.576	Open Manhole	1200	3.001	43.640	225	3.000	43.640	225	
112	45.215	1.942	Open Manhole	1350	3.002	43.273	450	3.001	43.498	225	
113	45.215	2.054	Open Manhole	1350	3.003	43.161	450	3.002	43.161	450	
Tank	45.172	2.029	Open Manhole	1350	1.007	43.143	450	1.006	43.143	450	
								3.003	43.143	450	
114	45.817	2.685	Open Manhole	1500	1.008	43.132	525	1.007	43.132	450	
115	45.817	2.740	Open Manhole	1500	1.009	43.077	525	1.008	43.077	525	
116	45.818	2.792	Open Manhole	1500	1.010	43.026	525	1.009	43.026	525	
Headwall	44.750	1.800	Open Manhole	1500	1.011	42.950	525	1.010	42.950	525	
201	45.355	1.233	Open Manhole	1200	4.000	44.122	300				
202	45.737	1.896	Open Manhole	1200	4.001	43.841	300	4.000	43.841	300	
203	46.183	2.404	Open Manhole	1200	4.002	43.779	300	4.001	43.779	300	
206	46.091	2.476	Open Manhole	1200	4.003	43.615	300	4.002	43.615	300	
Tank Inlet	45.896	2.351	Open Manhole	1200	4.004	43.545	300	4.003	43.545	300	
Dock 2	44.585	0.755	Open Manhole	450 x 450	5.000	43.830	225				
207	45.216	1.516	Open Manhole	1350	5.001	43.700	450	5.000	43.700	225	
208	45.216	1.576	Open Manhole	1350	5.002	43.640	450	5.001	43.640	450	
209	45.216	1.696	Open Manhole	1350	5.003	43.520	450	5.002	43.520	450	
Tank 2	45.252	1.757	Open Manhole	1500	4.005	43.495	525	4.004	43.495	300	
								5.003	43.495	450	
210	45.414	1.928	Open Manhole	1500	4.006	43.486	525	4.005	43.486	525	
211	45.860	2.414	Open Manhole	1500	4.007	43.446	525	4.006	43.446	525	
212	45.813	2.422	Open Manhole	1500	4.008	43.391	525	4.007	43.391	525	
213	45.830	2.494	Open Manhole	1500	4.009	43.336	525	4.008	43.336	525	
Stub	44.808	1.423	Open Manhole	1200	6.000	43.385	150				
214	44.859	1.541	Open Manhole	1500	4.010	43.318	525	4.009	43.318	525	
								6.000	43.318	150	
Headwall 2	44.750	1.605	Open Manhole	1500	4.011	43.145	525	4.010	43.145	525	
PPS	44.750	1.827	Open Manhole	1500	1.012	42.923	525	1.011	42.923	525	
								4.011	42.923	525	
	44.750	1.902	Open Manhole	1200		OUTFALL		1.012	42.848	525	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
101	464619.034	171389.382	464619.034	171389.382	Required	
102	464634.023	171376.168	464634.023	171376.168	Required	
103	464650.268	171350.542	464650.268	171350.542	Required	
104	464665.937	171339.384	464665.937	171339.384	Required	
105	464683.097	171340.177	464683.097	171340.177	Required	
106	464728.940	171363.649	464728.940	171363.649	Required	
107	464710.569	171355.337	464710.569	171355.337	Required	
109	464706.473	171365.849	464706.473	171365.849	Required	
Dock	464734.904	171435.851	464734.904	171435.851	Required	
111	464746.817	171420.895	464746.817	171420.895	Required	
112	464729.102	171406.785	464729.102	171406.785	Required	
113	464719.457	171399.103	464719.457	171399.103	Required	
Tank	464713.737	171394.547	464713.737	171394.547	Required	
114	464682.301	171405.268	464682.301	171405.268	Required	
115	464665.204	171426.829	464665.204	171426.829	Required	
116	464649.633	171446.455	464649.633	171446.455	Required	
Headwall	464651.390	171470.360	464651.390	171470.360	Required	
201	464779.496	171393.184	464779.496	171393.184	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
202	464838.897	171429.926	464838.897	171429.926	Required	
203	464832.238	171444.789	464832.238	171444.789	Required	
206	464846.719	171458.142	464846.719	171458.142	Required	
Tank Inlet	464843.464	171462.230	464843.464	171462.230	Required	
Dock 2	464775.077	171467.847	464775.077	171467.847	Required	
207	464786.994	171452.890	464786.994	171452.890	Required	
208	464805.026	171467.258	464805.026	171467.258	Required	
209	464814.670	171474.940	464814.670	171474.940	Required	
Tank 2	464825.461	171493.100	464825.461	171493.100	Required	
210	464828.932	171495.864	464828.932	171495.864	Required	
211	464816.823	171511.065	464816.823	171511.065	Required	
212	464799.802	171532.430	464799.802	171532.430	Required	
213	464782.751	171553.834	464782.751	171553.834	Required	
Stub	464782.680	171564.425	464782.680	171564.425	Required	
214	464777.211	171560.788	464777.211	171560.788	Required	
Headwall 2	464710.167	171518.173	464710.167	171518.173	Required	
PPS	464642.125	171479.731	464642.125	171479.731	Required	
	464635.738	171487.426			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	101	45.994	44.869	0.900	Open Manhole	1200
1.001	o	225	102	45.721	44.596	0.900	Open Manhole	1200
1.002	o	225	103	45.373	44.248	0.900	Open Manhole	1200
1.003	o	225	104	45.156	44.031	0.900	Open Manhole	1200
1.004	o	225	105	45.203	43.859	1.119	Open Manhole	1200
2.000	o	225	106	45.108	43.683	1.200	Open Manhole	1200
1.005	o	225	107	45.225	43.558	1.442	Open Manhole	1200
1.006	o	450	109	45.263	43.265	1.548	Open Manhole	1350
3.000	o	225	Dock	44.550	43.760	0.565	Open Manhole	450 x 450
3.001	o	225	111	45.216	43.640	1.351	Open Manhole	1200
3.002	o	450	112	45.215	43.273	1.492	Open Manhole	1350
3.003	o	450	113	45.215	43.161	1.604	Open Manhole	1350
1.007	o	450	Tank	45.172	43.143	1.579	Open Manhole	1350
1.008	o	525	114	45.817	43.132	2.160	Open Manhole	1500
1.009	o	525	115	45.817	43.077	2.215	Open Manhole	1500
1.010	o	525	116	45.818	43.026	2.267	Open Manhole	1500
1.011	o	525	Headwall	44.750	42.950	1.275	Open Manhole	1500
4.000	o	300	201	45.355	44.122	0.933	Open Manhole	1200
4.001	o	300	202	45.737	43.841	1.596	Open Manhole	1200
4.002	o	300	203	46.183	43.779	2.104	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.981	73.2	102	45.721	44.596	0.900	Open Manhole	1200
1.001	30.342	87.2	103	45.373	44.248	0.900	Open Manhole	1200
1.002	19.236	88.6	104	45.156	44.031	0.900	Open Manhole	1200
1.003	17.179	99.9	105	45.203	43.859	1.119	Open Manhole	1200
1.004	31.377	104.2	107	45.225	43.558	1.442	Open Manhole	1200
2.000	20.164	161.3	107	45.225	43.558	1.442	Open Manhole	1200
1.005	11.282	165.9	109	45.263	43.490	1.548	Open Manhole	1350
1.006	29.603	242.6	Tank	45.172	43.143	1.579	Open Manhole	1350
3.000	19.122	159.4	111	45.216	43.640	1.351	Open Manhole	1200
3.001	22.648	159.5	112	45.215	43.498	1.492	Open Manhole	1350
3.002	12.330	110.1	113	45.215	43.161	1.604	Open Manhole	1350
3.003	7.313	406.3	Tank	45.172	43.143	1.579	Open Manhole	1350
1.007	33.214	3019.5	114	45.817	43.132	2.235	Open Manhole	1500
1.008	27.496	499.9	115	45.817	43.077	2.215	Open Manhole	1500
1.009	25.074	491.6	116	45.818	43.026	2.267	Open Manhole	1500
1.010	23.969	315.4	Headwall	44.750	42.950	1.275	Open Manhole	1500
1.011	13.178	488.1	PPS	44.750	42.923	1.302	Open Manhole	1500
4.000	69.846	248.6	202	45.737	43.841	1.596	Open Manhole	1200
4.001	16.286	262.7	203	46.183	43.779	2.104	Open Manhole	1200
4.002	19.663	119.9	206	46.091	43.615	2.176	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.003	o	300	206	46.091	43.615	2.176	Open Manhole	1200
4.004	o	300	Tank Inlet	45.896	43.545	2.051	Open Manhole	1200
5.000	o	225	Dock 2	44.585	43.830	0.530	Open Manhole	450 x 450
5.001	o	450	207	45.216	43.700	1.066	Open Manhole	1350
5.002	o	450	208	45.216	43.640	1.126	Open Manhole	1350
5.003	o	450	209	45.216	43.520	1.246	Open Manhole	1350
4.005	o	525	Tank 2	45.252	43.495	1.232	Open Manhole	1500
4.006	o	525	210	45.414	43.486	1.403	Open Manhole	1500
4.007	o	525	211	45.860	43.446	1.889	Open Manhole	1500
4.008	o	525	212	45.813	43.391	1.897	Open Manhole	1500
4.009	o	525	213	45.830	43.336	1.969	Open Manhole	1500
6.000	o	150	Stub	44.808	43.385	1.273	Open Manhole	1200
4.010	o	525	214	44.859	43.318	1.016	Open Manhole	1500
4.011	o	525	Headwall 2	44.750	43.145	1.080	Open Manhole	1500
1.012	o	525	PPS	44.750	42.923	1.302	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.003	5.226	74.7	Tank Inlet	45.896	43.545	2.051	Open Manhole	1200
4.004	35.736	714.7	Tank 2	45.252	43.495	1.457	Open Manhole	1500
5.000	19.122	147.1	207	45.216	43.700	1.291	Open Manhole	1350
5.001	23.056	384.3	208	45.216	43.640	1.126	Open Manhole	1350
5.002	12.330	102.8	209	45.216	43.520	1.246	Open Manhole	1350
5.003	21.124	845.0	Tank 2	45.252	43.495	1.307	Open Manhole	1500
4.005	4.437	493.0	210	45.414	43.486	1.403	Open Manhole	1500
4.006	19.435	485.9	211	45.860	43.446	1.889	Open Manhole	1500
4.007	27.316	496.7	212	45.813	43.391	1.897	Open Manhole	1500
4.008	27.366	497.6	213	45.830	43.336	1.969	Open Manhole	1500
4.009	8.890	493.9	214	44.859	43.318	1.016	Open Manhole	1500
6.000	6.567	98.0	214	44.859	43.318	1.391	Open Manhole	1500
4.010	79.441	460.0	Headwall 2	44.750	43.145	1.080	Open Manhole	1500
4.011	78.151	352.0	PPS	44.750	42.923	1.302	Open Manhole	1500
1.012	10.000	133.3		44.750	42.848	1.377	Open Manhole	1200

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012		44.750	42.848	0.000	1200	0

Online Controls for Storm

Pump Manhole: PPS, DS/PN: 1.012, Volume (m³): 22.3

Invert Level (m) 42.923

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	15.0000	0.700	15.0000	1.300	15.0000	1.900	15.0000	2.500	15.0000
0.200	15.0000	0.800	15.0000	1.400	15.0000	2.000	15.0000	2.600	15.0000
0.300	15.0000	0.900	15.0000	1.500	15.0000	2.100	15.0000	2.700	15.0000
0.400	15.0000	1.000	15.0000	1.600	15.0000	2.200	15.0000	2.800	15.0000
0.500	15.0000	1.100	15.0000	1.700	15.0000	2.300	15.0000	2.900	15.0000
0.600	15.0000	1.200	15.0000	1.800	15.0000	2.400	15.0000	3.000	15.0000

Storage Structures for Storm

Cellular Storage Manhole: Tank, DS/PN: 1.007

Invert Level (m) 43.143 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	625.0	625.0	1.000	625.0	725.0	1.001	0.0	725.1

Cellular Storage Manhole: Tank 2, DS/PN: 4.005

Invert Level (m) 43.495 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	707.0	707.0	0.500	707.0	760.2	0.501	0.0	760.2

Tank or Pond Manhole: PPS, DS/PN: 1.012

Invert Level (m) 42.950

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.4	0.400	296.5	0.800	487.9	1.200	668.4	1.600	898.0
0.050	56.4	0.450	319.9	0.850	512.4	1.250	714.1	1.650	924.8
0.100	120.4	0.500	343.5	0.900	537.2	1.300	739.9	1.700	951.8
0.150	181.6	0.550	367.2	0.950	562.0	1.350	765.9	1.750	978.9
0.200	204.3	0.600	391.1	1.000	587.0	1.400	792.0	1.800	1006.7
0.250	227.1	0.650	415.1	1.050	612.1	1.450	818.3	1.801	0.0
0.300	250.1	0.700	439.2	1.100	637.4	1.500	844.7		
0.350	273.2	0.750	463.5	1.150	662.8	1.550	871.3		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FEH Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 465000 171200 SU 65000 71200	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 35, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	101	60 minute 2 year Summer I+0%	45.994	44.915	-0.179	0.000	0.09		0.047
1.001	102	60 minute 2 year Summer I+0%	45.721	44.654	-0.167	0.000	0.15		0.085
1.002	103	60 minute 2 year Summer I+0%	45.373	44.322	-0.151	0.000	0.24		0.120
1.003	104	60 minute 2 year Summer I+0%	45.156	44.108	-0.148	0.000	0.26		0.125
1.004	105	60 minute 2 year Summer I+0%	45.203	43.946	-0.138	0.000	0.32		0.147
2.000	106	60 minute 2 year Summer I+0%	45.108	43.758	-0.150	0.000	0.24		0.079
1.005	107	60 minute 2 year Summer I+0%	45.225	43.697	-0.086	0.000	0.70		0.552
1.006	109	360 minute 2 year Winter I+0%	45.263	43.408	-0.307	0.000	0.06		0.197
3.000	Dock	60 minute 2 year Summer I+0%	44.550	43.824	-0.161	0.000	0.18		0.012
3.001	111	60 minute 2 year Summer I+0%	45.216	43.704	-0.161	0.000	0.18		0.131
3.002	112	360 minute 2 year Winter I+0%	45.215	43.408	-0.315	0.000	0.04		0.186
3.003	113	360 minute 2 year Winter I+0%	45.215	43.408	-0.203	0.000	0.08		1.031
1.007	Tank	360 minute 2 year Winter I+0%	45.172	43.407	-0.186	0.000	0.07		159.675
1.008	114	360 minute 2 year Winter I+0%	45.817	43.407	-0.250	0.000	0.04		3.003
1.009	115	360 minute 2 year Winter I+0%	45.817	43.406	-0.196	0.000	0.06		3.504
1.010	116	360 minute 2 year Winter I+0%	45.818	43.405	-0.146	0.000	0.06		3.928
1.011	Headwall	360 minute 2 year Winter I+0%	44.750	43.404	-0.071	0.000	0.10		4.692
4.000	201	60 minute 2 year Summer I+0%	45.355	44.188	-0.234	0.000	0.11		0.069
4.001	202	60 minute 2 year Summer I+0%	45.737	43.929	-0.212	0.000	0.19		0.267
4.002	203	60 minute 2 year Summer I+0%	46.183	43.863	-0.216	0.000	0.18		0.239
4.003	206	60 minute 2 year Summer I+0%	46.091	43.742	-0.173	0.000	0.38		0.321
4.004	Tank Inlet	60 minute 2 year Summer I+0%	45.896	43.723	-0.122	0.000	0.65		0.325
5.000	Dock 2	60 minute 2 year Summer I+0%	44.585	43.892	-0.163	0.000	0.17		0.012
5.001	207	60 minute 2 year Summer I+0%	45.216	43.789	-0.361	0.000	0.05		0.206
5.002	208	60 minute 2 year Summer I+0%	45.216	43.767	-0.323	0.000	0.15		0.607
5.003	209	60 minute 2 year Summer I+0%	45.216	43.736	-0.234	0.000	0.47		0.825
4.005	Tank 2	180 minute 2 year Winter I+0%	45.252	43.599	-0.421	0.000	0.06		70.666
4.006	210	180 minute 2 year Winter I+0%	45.414	43.592	-0.419	0.000	0.07		0.212
4.007	211	60 minute 2 year Summer I+0%	45.860	43.586	-0.385	0.000	0.05		0.689

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	101	5.2	OK
1.001	102	7.7	OK
1.002	103	11.8	OK
1.003	104	11.9	OK
1.004	105	15.1	OK
2.000	106	9.0	OK
1.005	107	23.8	OK
1.006	109	10.6	OK
3.000	Dock	6.7	OK
3.001	111	6.7	OK
3.002	112	8.2	OK
3.003	113	8.1	OK
1.007	Tank	5.1	OK
1.008	114	6.3	OK
1.009	115	10.9	OK
1.010	116	13.5	OK
1.011	Headwall	12.6	OK
4.000	201	7.1	OK
4.001	202	10.9	OK
4.002	203	15.5	OK
4.003	206	24.9	OK
4.004	Tank Inlet	24.7	OK
5.000	Dock 2	6.6	OK
5.001	207	6.5	OK
5.002	208	29.8	OK
5.003	209	29.7	OK
4.005	Tank 2	10.1	OK
4.006	210	10.1	OK
4.007	211	8.9	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
4.008	212	60 minute 2 year Summer I+0%	45.813	43.578	-0.338	0.000	0.17		1.435
4.009	213	60 minute 2 year Summer I+0%	45.830	43.544	-0.317	0.000	0.33		1.696
6.000	Stub	60 minute 2 year Summer I+0%	44.808	43.495	-0.040	0.000	0.34		0.119
4.010	214	60 minute 2 year Summer I+0%	44.859	43.482	-0.361	0.000	0.21		0.606
4.011	Headwall 2	360 minute 2 year Winter I+0%	44.750	43.413	-0.257	0.000	0.10		5.598
1.012	PPS	360 minute 2 year Winter I+0%	44.750	43.404	-0.044	0.000	0.06		104.255

PN	US/MH Name	Pipe Flow (l/s)	Status
4.008	212	29.6	OK
4.009	213	39.8	OK
6.000	Stub	5.1	OK
4.010	214	43.8	OK
4.011	Headwall 2	23.7	OK
1.012	PPS	15.0	OK

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model		FEH Data Type	Catchment
FEH Rainfall Version		2013 Cv (Summer)	0.750
Site Location	GB 465000 171200 SU 65000 71200	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 35, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	101	60 minute 30 year Summer I+35%	45.994	44.952	-0.142	0.000	0.30		0.089
1.001	102	60 minute 30 year Summer I+35%	45.721	44.707	-0.114	0.000	0.49		0.181
1.002	103	60 minute 30 year Summer I+35%	45.373	44.483	0.010	0.000	0.77		0.654
1.003	104	60 minute 30 year Summer I+35%	45.156	44.369	0.113	0.000	0.75		1.000
1.004	105	60 minute 30 year Summer I+35%	45.203	44.258	0.174	0.000	0.93		1.078
2.000	106	60 minute 30 year Summer I+35%	45.108	44.083	0.175	0.000	0.73		0.447
1.005	107	60 minute 30 year Summer I+35%	45.225	43.996	0.213	0.000	2.06		2.359
1.006	109	480 minute 30 year Winter I+35%	45.263	43.848	0.133	0.000	0.12		1.224
3.000	Dock	60 minute 30 year Summer I+35%	44.550	43.883	-0.102	0.000	0.58		0.024
3.001	111	480 minute 30 year Winter I+35%	45.216	43.848	-0.017	0.000	0.09		0.707
3.002	112	480 minute 30 year Winter I+35%	45.215	43.847	0.124	0.000	0.08		1.638
3.003	113	480 minute 30 year Winter I+35%	45.215	43.847	0.236	0.000	0.16		2.721
1.007	Tank	480 minute 30 year Winter I+35%	45.172	43.847	0.254	0.000	0.06		424.370
1.008	114	480 minute 30 year Winter I+35%	45.817	43.846	0.189	0.000	0.04		6.308
1.009	115	480 minute 30 year Winter I+35%	45.817	43.845	0.243	0.000	0.07		6.976
1.010	116	480 minute 30 year Winter I+35%	45.818	43.844	0.293	0.000	0.08		6.540
1.011	Headwall	480 minute 30 year Winter I+35%	44.750	43.843	0.368	0.000	0.14		6.433
4.000	201	60 minute 30 year Summer I+35%	45.355	44.268	-0.154	0.000	0.33		0.160
4.001	202	60 minute 30 year Summer I+35%	45.737	44.234	0.093	0.000	0.52		4.261
4.002	203	60 minute 30 year Summer I+35%	46.183	44.172	0.093	0.000	0.47		1.497
4.003	206	60 minute 30 year Summer I+35%	46.091	44.056	0.141	0.000	1.09		1.777
4.004	Tank Inlet	60 minute 30 year Summer I+35%	45.896	43.964	0.119	0.000	1.86		0.753
5.000	Dock 2	60 minute 30 year Summer I+35%	44.585	44.130	0.075	0.000	0.54		0.060
5.001	207	60 minute 30 year Summer I+35%	45.216	44.067	-0.083	0.000	0.15		1.234
5.002	208	60 minute 30 year Summer I+35%	45.216	44.031	-0.059	0.000	0.52		3.342
5.003	209	60 minute 30 year Summer I+35%	45.216	43.970	0.000	0.000	1.58		2.178
4.005	Tank 2	240 minute 30 year Winter I+35%	45.252	43.882	-0.138	0.000	0.09		265.634
4.006	210	180 minute 30 year Winter I+35%	45.414	43.883	-0.128	0.000	0.09		1.125
4.007	211	240 minute 30 year Winter I+35%	45.860	43.881	-0.090	0.000	0.14		3.717

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	101	16.3	OK
1.001	102	25.2	OK
1.002	103	38.2	SURCHARGED
1.003	104	34.7	SURCHARGED
1.004	105	44.2	SURCHARGED
2.000	106	27.1	SURCHARGED
1.005	107	70.5	SURCHARGED
1.006	109	20.5	SURCHARGED
3.000	Dock	21.3	OK
3.001	111	3.4	OK
3.002	112	15.6	SURCHARGED
3.003	113	15.1	SURCHARGED
1.007	Tank	4.6	SURCHARGED
1.008	114	6.7	SURCHARGED
1.009	115	11.9	SURCHARGED
1.010	116	17.5	SURCHARGED
1.011	Headwall	17.4	SURCHARGED
4.000	201	22.1	OK
4.001	202	30.1	SURCHARGED
4.002	203	41.7	SURCHARGED
4.003	206	71.9	SURCHARGED
4.004	Tank Inlet	70.4	SURCHARGED
5.000	Dock 2	20.8	SURCHARGED
5.001	207	21.0	OK
5.002	208	102.4	OK
5.003	209	100.3	OK
4.005	Tank 2	15.4	OK
4.006	210	14.2	OK
4.007	211	24.9	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
4.008	212	240 minute 30 year Winter I+35%	45.813	43.874	-0.042	0.000	0.25		5.643
4.009	213	480 minute 30 year Winter I+35%	45.830	43.861	0.000	0.000	0.29		6.084
6.000	Stub	480 minute 30 year Winter I+35%	44.808	43.864	0.329	0.000	0.34		0.536
4.010	214	480 minute 30 year Winter I+35%	44.859	43.852	0.009	0.000	0.19		2.515
4.011	Headwall 2	480 minute 30 year Winter I+35%	44.750	43.847	0.177	0.000	0.16		18.087
1.012	PPS	480 minute 30 year Winter I+35%	44.750	43.842	0.394	0.000	0.06		296.647

PN	US/MH Name	Pipe Flow (l/s)	Status
4.008	212	44.6	OK
4.009	213	34.5	OK
6.000	Stub	5.1	SURCHARGED
4.010	214	38.9	SURCHARGED
4.011	Headwall 2	37.8	SURCHARGED
1.012	PPS	15.0	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 465000 171200 SU 65000 71200	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 35, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	101	60 minute 100 year Summer I+40%	45.994	45.007	-0.087	0.000	0.40		0.150
1.001	102	60 minute 100 year Summer I+40%	45.721	44.968	0.147	0.000	0.58		1.053
1.002	103	60 minute 100 year Summer I+40%	45.373	44.874	0.401	0.000	0.85		1.861
1.003	104	60 minute 100 year Summer I+40%	45.156	44.710	0.454	0.000	0.94		1.480
1.004	105	60 minute 100 year Summer I+40%	45.203	44.567	0.483	0.000	1.15		1.430
2.000	106	60 minute 100 year Summer I+40%	45.108	44.290	0.382	0.000	0.98		0.681
1.005	107	60 minute 100 year Summer I+40%	45.225	44.173	0.390	0.000	2.62		2.644
1.006	109	600 minute 100 year Winter I+40%	45.263	44.080	0.365	0.000	0.13		1.557
3.000	Dock	600 minute 100 year Winter I+40%	44.550	44.081	0.096	0.000	0.10		0.064
3.001	111	600 minute 100 year Winter I+40%	45.216	44.080	0.215	0.000	0.10		1.220
3.002	112	600 minute 100 year Winter I+40%	45.215	44.079	0.356	0.000	0.09		1.997
3.003	113	600 minute 100 year Winter I+40%	45.215	44.079	0.468	0.000	0.17		3.053
1.007	Tank	600 minute 100 year Winter I+40%	45.172	44.079	0.486	0.000	0.07		562.483
1.008	114	600 minute 100 year Winter I+40%	45.817	44.078	0.421	0.000	0.04		6.719
1.009	115	600 minute 100 year Winter I+40%	45.817	44.077	0.475	0.000	0.08		7.386
1.010	116	600 minute 100 year Winter I+40%	45.818	44.076	0.525	0.000	0.10		6.950
1.011	Headwall	600 minute 100 year Winter I+40%	44.750	44.075	0.600	0.000	0.17		6.843
4.000	201	60 minute 100 year Summer I+40%	45.355	44.584	0.162	0.000	0.41		0.517
4.001	202	60 minute 100 year Summer I+40%	45.737	44.495	0.354	0.000	0.74		5.586
4.002	203	60 minute 100 year Summer I+40%	46.183	44.416	0.337	0.000	0.69		1.781
4.003	206	60 minute 100 year Summer I+40%	46.091	44.297	0.382	0.000	1.51		2.070
4.004	Tank Inlet	60 minute 100 year Summer I+40%	45.896	44.133	0.288	0.000	2.61		0.944
5.000	Dock 2	60 minute 100 year Summer I+40%	44.585	44.244	0.189	0.000	0.73		0.083
5.001	207	60 minute 100 year Summer I+40%	45.216	44.150	0.000	0.000	0.20		1.361
5.002	208	60 minute 100 year Summer I+40%	45.216	44.101	0.011	0.000	0.71		3.851
5.003	209	480 minute 100 year Winter I+40%	45.216	44.090	0.120	0.000	0.32		2.541
4.005	Tank 2	600 minute 100 year Winter I+40%	45.252	44.089	0.069	0.000	0.08		342.651
4.006	210	600 minute 100 year Winter I+40%	45.414	44.089	0.078	0.000	0.08		1.689
4.007	211	600 minute 100 year Winter I+40%	45.860	44.088	0.117	0.000	0.10		5.001

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	101	21.9	OK
1.001	102	30.4	SURCHARGED
1.002	103	42.6	SURCHARGED
1.003	104	43.5	SURCHARGED
1.004	105	54.8	SURCHARGED
2.000	106	36.2	SURCHARGED
1.005	107	89.4	SURCHARGED
1.006	109	22.3	SURCHARGED
3.000	Dock	3.7	SURCHARGED
3.001	111	3.7	SURCHARGED
3.002	112	17.0	SURCHARGED
3.003	113	17.0	SURCHARGED
1.007	Tank	4.9	SURCHARGED
1.008	114	6.3	SURCHARGED
1.009	115	14.8	SURCHARGED
1.010	116	21.1	SURCHARGED
1.011	Headwall	20.9	SURCHARGED
4.000	201	27.7	SURCHARGED
4.001	202	42.7	SURCHARGED
4.002	203	61.1	SURCHARGED
4.003	206	100.1	SURCHARGED
4.004	Tank Inlet	98.7	SURCHARGED
5.000	Dock 2	28.2	SURCHARGED
5.001	207	27.8	OK
5.002	208	137.7	SURCHARGED
5.003	209	20.4	SURCHARGED
4.005	Tank 2	12.9	SURCHARGED
4.006	210	12.8	SURCHARGED
4.007	211	17.7	SURCHARGED

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
4.008	212	600 minute 100 year Winter I+40%	45.813	44.086	0.170	0.000	0.15		6.807
4.009	213	600 minute 100 year Winter I+40%	45.830	44.084	0.223	0.000	0.26		6.913
6.000	Stub	600 minute 100 year Winter I+40%	44.808	44.096	0.561	0.000	0.33		0.798
4.010	214	600 minute 100 year Winter I+40%	44.859	44.083	0.240	0.000	0.17		3.036
4.011	Headwall 2	600 minute 100 year Winter I+40%	44.750	44.078	0.408	0.000	0.15		18.513
1.012	PPS	600 minute 100 year Winter I+40%	44.750	44.074	0.626	0.000	0.06		434.090

PN	US/MH Name	Pipe Flow (l/s)	Status
4.008	212	27.4	SURCHARGED
4.009	213	31.5	SURCHARGED
6.000	Stub	5.1	SURCHARGED
4.010	214	35.9	SURCHARGED
4.011	Headwall 2	35.0	SURCHARGED
1.012	PPS	15.0	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	1999
Site Location	GB 465000 171200 SU 65000 71200
C (1km)	-0.029
D1 (1km)	0.280
D2 (1km)	0.299
D3 (1km)	0.349
E (1km)	0.309
F (1km)	2.560
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	19.981	0.273	73.2	0.052	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	30.342	0.348	87.2	0.028	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	19.236	0.217	88.6	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	17.179	0.172	99.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	31.377	0.301	104.2	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	20.164	0.125	161.3	0.091	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	11.282	0.068	165.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.22	44.869	0.052	0.0	0.0	0.0	1.53	60.8	7.0
1.001	50.00	5.58	44.596	0.080	0.0	0.0	0.0	1.40	55.7	10.8
1.002	50.00	5.81	44.248	0.125	0.0	0.0	0.0	1.39	55.2	16.9
1.003	50.00	6.03	44.031	0.125	0.0	0.0	0.0	1.31	52.0	16.9
1.004	50.00	6.44	43.859	0.161	0.0	0.0	0.0	1.28	50.9	21.8
2.000	50.00	5.33	43.683	0.091	0.0	0.0	0.0	1.03	40.8	12.3
1.005	50.00	6.62	43.558	0.252	0.0	0.0	0.0	1.01	40.2	34.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	29.603	0.122	242.6	0.160	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	19.122	0.120	159.4	0.068	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	22.648	0.142	159.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.002	12.330	0.112	110.1	0.250	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.003	7.313	0.018	406.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	33.214	0.011	3019.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.008	27.496	0.055	499.9	0.106	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	25.074	0.051	491.6	0.211	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.010	23.969	0.076	315.4	0.137	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.011	13.178	0.027	488.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.000	69.846	0.281	248.6	0.074	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	16.286	0.062	262.7	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.002	19.663	0.164	119.9	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.003	5.226	0.070	74.7	0.105	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.004	35.736	0.050	714.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	19.122	0.130	147.1	0.067	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	23.056	0.060	384.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.002	12.330	0.120	102.8	0.260	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.003	21.124	0.025	845.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.005	4.437	0.009	493.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.006	19.435	0.040	485.9	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	50.00	7.00	43.265	0.412	0.0	0.0	0.0	1.30	206.9	55.8
3.000	50.00	5.31	43.760	0.068	0.0	0.0	0.0	1.03	41.1	9.2
3.001	50.00	5.67	43.640	0.068	0.0	0.0	0.0	1.03	41.1	9.2
3.002	50.00	5.78	43.273	0.318	0.0	0.0	0.0	1.94	308.1	43.1
3.003	50.00	5.90	43.161	0.318	0.0	0.0	0.0	1.00	159.4	43.1
1.007	50.00	8.54	43.143	0.730	0.0	0.0	0.0	0.36	57.3«	98.9
1.008	50.00	9.00	43.132	0.836	0.0	0.0	0.0	0.99	215.4	113.2
1.009	50.00	9.41	43.077	1.047	0.0	0.0	0.0	1.00	217.2	141.8
1.010	50.00	9.73	43.026	1.184	0.0	0.0	0.0	1.26	271.9	160.3
1.011	50.00	9.95	42.950	1.184	0.0	0.0	0.0	1.01	218.0	160.3
4.000	50.00	6.17	44.122	0.074	0.0	0.0	0.0	0.99	70.2	10.0
4.001	50.00	6.45	43.841	0.116	0.0	0.0	0.0	0.97	68.2	15.7
4.002	50.00	6.68	43.779	0.167	0.0	0.0	0.0	1.43	101.4	22.6
4.003	50.00	6.73	43.615	0.272	0.0	0.0	0.0	1.82	128.8	36.8
4.004	50.00	7.76	43.545	0.272	0.0	0.0	0.0	0.58	41.0	36.8
5.000	50.00	5.30	43.830	0.067	0.0	0.0	0.0	1.08	42.8	9.1
5.001	50.00	5.67	43.700	0.067	0.0	0.0	0.0	1.03	164.0	9.1
5.002	50.00	5.77	43.640	0.327	0.0	0.0	0.0	2.01	319.0	44.3
5.003	50.00	6.28	43.520	0.327	0.0	0.0	0.0	0.69	110.0	44.3
4.005	50.00	7.83	43.495	0.599	0.0	0.0	0.0	1.00	216.9	81.1
4.006	50.00	8.15	43.486	0.599	0.0	0.0	0.0	1.01	218.5	81.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
4.007	27.316	0.055	496.7	0.119	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.008	27.366	0.055	497.6	0.238	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.009	8.890	0.018	493.9	0.119	0.00	0.0	0.600	o	525	Pipe/Conduit	
6.000	6.567	0.067	98.0	0.000	5.00	5.0	0.600	o	150	Pipe/Conduit	
4.010	79.441	0.173	460.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
4.011	78.151	0.222	352.0	0.065	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.012	10.000	0.075	133.3	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.007	50.00	8.61	43.446	0.718	0.0	0.0	0.0	1.00	216.1	97.2
4.008	50.00	9.06	43.391	0.956	0.0	0.0	0.0	1.00	215.9	129.5
4.009	50.00	9.21	43.336	1.075	0.0	0.0	0.0	1.00	216.7	145.6
6.000	50.00	5.11	43.385	0.000	5.0	0.0	0.0	1.02	17.9	5.0
4.010	50.00	10.49	43.318	1.075	5.0	0.0	0.0	1.04	224.6	150.6
4.011	50.00	11.58	43.145	1.140	5.0	0.0	0.0	1.19	257.2	159.4
1.012	50.00	11.67	42.923	2.324	5.0	0.0	0.0	1.94	419.6	319.7

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
101	45.994	1.125	Open Manhole	1200	1.000	44.869	225				
102	45.721	1.125	Open Manhole	1200	1.001	44.596	225	1.000	44.596	225	
103	45.373	1.125	Open Manhole	1200	1.002	44.248	225	1.001	44.248	225	
104	45.156	1.125	Open Manhole	1200	1.003	44.031	225	1.002	44.031	225	
105	45.203	1.344	Open Manhole	1200	1.004	43.859	225	1.003	43.859	225	
106	45.108	1.425	Open Manhole	1200	2.000	43.683	225				
107	45.225	1.667	Open Manhole	1200	1.005	43.558	225	1.004	43.558	225	
								2.000	43.558	225	
109	45.263	1.998	Open Manhole	1350	1.006	43.265	450	1.005	43.490	225	
Dock	44.550	0.790	Open Manhole	450 x 450	3.000	43.760	225				
111	45.216	1.576	Open Manhole	1200	3.001	43.640	225	3.000	43.640	225	
112	45.215	1.942	Open Manhole	1350	3.002	43.273	450	3.001	43.498	225	
113	45.215	2.054	Open Manhole	1350	3.003	43.161	450	3.002	43.161	450	
Tank	45.172	2.029	Open Manhole	1350	1.007	43.143	450	1.006	43.143	450	
								3.003	43.143	450	
114	45.817	2.685	Open Manhole	1500	1.008	43.132	525	1.007	43.132	450	
115	45.817	2.740	Open Manhole	1500	1.009	43.077	525	1.008	43.077	525	
116	45.818	2.792	Open Manhole	1500	1.010	43.026	525	1.009	43.026	525	
Headwall	44.750	1.800	Open Manhole	1500	1.011	42.950	525	1.010	42.950	525	
201	45.355	1.233	Open Manhole	1200	4.000	44.122	300				
202	45.737	1.896	Open Manhole	1200	4.001	43.841	300	4.000	43.841	300	
203	46.183	2.404	Open Manhole	1200	4.002	43.779	300	4.001	43.779	300	
206	46.091	2.476	Open Manhole	1200	4.003	43.615	300	4.002	43.615	300	
Tank Inlet	45.896	2.351	Open Manhole	1200	4.004	43.545	300	4.003	43.545	300	
Dock 2	44.585	0.755	Open Manhole	450 x 450	5.000	43.830	225				
207	45.216	1.516	Open Manhole	1350	5.001	43.700	450	5.000	43.700	225	
208	45.216	1.576	Open Manhole	1350	5.002	43.640	450	5.001	43.640	450	
209	45.216	1.696	Open Manhole	1350	5.003	43.520	450	5.002	43.520	450	
Tank 2	45.252	1.757	Open Manhole	1500	4.005	43.495	525	4.004	43.495	300	
								5.003	43.495	450	
210	45.414	1.928	Open Manhole	1500	4.006	43.486	525	4.005	43.486	525	
211	45.860	2.414	Open Manhole	1500	4.007	43.446	525	4.006	43.446	525	
212	45.813	2.422	Open Manhole	1500	4.008	43.391	525	4.007	43.391	525	
213	45.830	2.494	Open Manhole	1500	4.009	43.336	525	4.008	43.336	525	
Stub	44.808	1.423	Open Manhole	1200	6.000	43.385	150				
214	44.859	1.541	Open Manhole	1500	4.010	43.318	525	4.009	43.318	525	
								6.000	43.318	150	
Headwall 2	44.750	1.605	Open Manhole	1500	4.011	43.145	525	4.010	43.145	525	
PPS	44.750	1.827	Open Manhole	1500	1.012	42.923	525	1.011	42.923	525	
								4.011	42.923	525	
	44.750	1.902	Open Manhole	1200		OUTFALL		1.012	42.848	525	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
101	464619.034	171389.382	464619.034	171389.382	Required	
102	464634.023	171376.168	464634.023	171376.168	Required	
103	464650.268	171350.542	464650.268	171350.542	Required	
104	464665.937	171339.384	464665.937	171339.384	Required	
105	464683.097	171340.177	464683.097	171340.177	Required	
106	464728.940	171363.649	464728.940	171363.649	Required	
107	464710.569	171355.337	464710.569	171355.337	Required	
109	464706.473	171365.849	464706.473	171365.849	Required	
Dock	464734.904	171435.851	464734.904	171435.851	Required	
111	464746.817	171420.895	464746.817	171420.895	Required	
112	464729.102	171406.785	464729.102	171406.785	Required	
113	464719.457	171399.103	464719.457	171399.103	Required	
Tank	464713.737	171394.547	464713.737	171394.547	Required	
114	464682.301	171405.268	464682.301	171405.268	Required	
115	464665.204	171426.829	464665.204	171426.829	Required	
116	464649.633	171446.455	464649.633	171446.455	Required	
Headwall	464651.390	171470.360	464651.390	171470.360	Required	
201	464779.496	171393.184	464779.496	171393.184	Required	

Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
202	464838.897	171429.926	464838.897	171429.926	Required	
203	464832.238	171444.789	464832.238	171444.789	Required	
206	464846.719	171458.142	464846.719	171458.142	Required	
Tank Inlet	464843.464	171462.230	464843.464	171462.230	Required	
Dock 2	464775.077	171467.847	464775.077	171467.847	Required	
207	464786.994	171452.890	464786.994	171452.890	Required	
208	464805.026	171467.258	464805.026	171467.258	Required	
209	464814.670	171474.940	464814.670	171474.940	Required	
Tank 2	464825.461	171493.100	464825.461	171493.100	Required	
210	464828.932	171495.864	464828.932	171495.864	Required	
211	464816.823	171511.065	464816.823	171511.065	Required	
212	464799.802	171532.430	464799.802	171532.430	Required	
213	464782.751	171553.834	464782.751	171553.834	Required	
Stub	464782.680	171564.425	464782.680	171564.425	Required	
214	464777.211	171560.788	464777.211	171560.788	Required	
Headwall 2	464710.167	171518.173	464710.167	171518.173	Required	
PPS	464642.125	171479.731	464642.125	171479.731	Required	
	464635.738	171487.426			No Entry	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	101	45.994	44.869	0.900	Open Manhole	1200
1.001	o	225	102	45.721	44.596	0.900	Open Manhole	1200
1.002	o	225	103	45.373	44.248	0.900	Open Manhole	1200
1.003	o	225	104	45.156	44.031	0.900	Open Manhole	1200
1.004	o	225	105	45.203	43.859	1.119	Open Manhole	1200
2.000	o	225	106	45.108	43.683	1.200	Open Manhole	1200
1.005	o	225	107	45.225	43.558	1.442	Open Manhole	1200
1.006	o	450	109	45.263	43.265	1.548	Open Manhole	1350
3.000	o	225	Dock	44.550	43.760	0.565	Open Manhole	450 x 450
3.001	o	225	111	45.216	43.640	1.351	Open Manhole	1200
3.002	o	450	112	45.215	43.273	1.492	Open Manhole	1350
3.003	o	450	113	45.215	43.161	1.604	Open Manhole	1350
1.007	o	450	Tank	45.172	43.143	1.579	Open Manhole	1350
1.008	o	525	114	45.817	43.132	2.160	Open Manhole	1500
1.009	o	525	115	45.817	43.077	2.215	Open Manhole	1500
1.010	o	525	116	45.818	43.026	2.267	Open Manhole	1500
1.011	o	525	Headwall	44.750	42.950	1.275	Open Manhole	1500
4.000	o	300	201	45.355	44.122	0.933	Open Manhole	1200
4.001	o	300	202	45.737	43.841	1.596	Open Manhole	1200
4.002	o	300	203	46.183	43.779	2.104	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.981	73.2	102	45.721	44.596	0.900	Open Manhole	1200
1.001	30.342	87.2	103	45.373	44.248	0.900	Open Manhole	1200
1.002	19.236	88.6	104	45.156	44.031	0.900	Open Manhole	1200
1.003	17.179	99.9	105	45.203	43.859	1.119	Open Manhole	1200
1.004	31.377	104.2	107	45.225	43.558	1.442	Open Manhole	1200
2.000	20.164	161.3	107	45.225	43.558	1.442	Open Manhole	1200
1.005	11.282	165.9	109	45.263	43.490	1.548	Open Manhole	1350
1.006	29.603	242.6	Tank	45.172	43.143	1.579	Open Manhole	1350
3.000	19.122	159.4	111	45.216	43.640	1.351	Open Manhole	1200
3.001	22.648	159.5	112	45.215	43.498	1.492	Open Manhole	1350
3.002	12.330	110.1	113	45.215	43.161	1.604	Open Manhole	1350
3.003	7.313	406.3	Tank	45.172	43.143	1.579	Open Manhole	1350
1.007	33.214	3019.5	114	45.817	43.132	2.235	Open Manhole	1500
1.008	27.496	499.9	115	45.817	43.077	2.215	Open Manhole	1500
1.009	25.074	491.6	116	45.818	43.026	2.267	Open Manhole	1500
1.010	23.969	315.4	Headwall	44.750	42.950	1.275	Open Manhole	1500
1.011	13.178	488.1	PPS	44.750	42.923	1.302	Open Manhole	1500
4.000	69.846	248.6	202	45.737	43.841	1.596	Open Manhole	1200
4.001	16.286	262.7	203	46.183	43.779	2.104	Open Manhole	1200
4.002	19.663	119.9	206	46.091	43.615	2.176	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.003	o	300	206	46.091	43.615	2.176	Open Manhole	1200
4.004	o	300	Tank Inlet	45.896	43.545	2.051	Open Manhole	1200
5.000	o	225	Dock 2	44.585	43.830	0.530	Open Manhole	450 x 450
5.001	o	450	207	45.216	43.700	1.066	Open Manhole	1350
5.002	o	450	208	45.216	43.640	1.126	Open Manhole	1350
5.003	o	450	209	45.216	43.520	1.246	Open Manhole	1350
4.005	o	525	Tank 2	45.252	43.495	1.232	Open Manhole	1500
4.006	o	525	210	45.414	43.486	1.403	Open Manhole	1500
4.007	o	525	211	45.860	43.446	1.889	Open Manhole	1500
4.008	o	525	212	45.813	43.391	1.897	Open Manhole	1500
4.009	o	525	213	45.830	43.336	1.969	Open Manhole	1500
6.000	o	150	Stub	44.808	43.385	1.273	Open Manhole	1200
4.010	o	525	214	44.859	43.318	1.016	Open Manhole	1500
4.011	o	525	Headwall 2	44.750	43.145	1.080	Open Manhole	1500
1.012	o	525	PPS	44.750	42.923	1.302	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.003	5.226	74.7	Tank Inlet	45.896	43.545	2.051	Open Manhole	1200
4.004	35.736	714.7	Tank 2	45.252	43.495	1.457	Open Manhole	1500
5.000	19.122	147.1	207	45.216	43.700	1.291	Open Manhole	1350
5.001	23.056	384.3	208	45.216	43.640	1.126	Open Manhole	1350
5.002	12.330	102.8	209	45.216	43.520	1.246	Open Manhole	1350
5.003	21.124	845.0	Tank 2	45.252	43.495	1.307	Open Manhole	1500
4.005	4.437	493.0	210	45.414	43.486	1.403	Open Manhole	1500
4.006	19.435	485.9	211	45.860	43.446	1.889	Open Manhole	1500
4.007	27.316	496.7	212	45.813	43.391	1.897	Open Manhole	1500
4.008	27.366	497.6	213	45.830	43.336	1.969	Open Manhole	1500
4.009	8.890	493.9	214	44.859	43.318	1.016	Open Manhole	1500
6.000	6.567	98.0	214	44.859	43.318	1.391	Open Manhole	1500
4.010	79.441	460.0	Headwall 2	44.750	43.145	1.080	Open Manhole	1500
4.011	78.151	352.0	PPS	44.750	42.923	1.302	Open Manhole	1500
1.012	10.000	133.3		44.750	42.848	1.377	Open Manhole	1200

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012		44.750	42.848	0.000	1200	0

Online Controls for Storm

Pump Manhole: PPS, DS/PN: 1.012, Volume (m³): 22.3

Invert Level (m) 42.923

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	15.0000	0.700	15.0000	1.300	15.0000	1.900	15.0000	2.500	15.0000
0.200	15.0000	0.800	15.0000	1.400	15.0000	2.000	15.0000	2.600	15.0000
0.300	15.0000	0.900	15.0000	1.500	15.0000	2.100	15.0000	2.700	15.0000
0.400	15.0000	1.000	15.0000	1.600	15.0000	2.200	15.0000	2.800	15.0000
0.500	15.0000	1.100	15.0000	1.700	15.0000	2.300	15.0000	2.900	15.0000
0.600	15.0000	1.200	15.0000	1.800	15.0000	2.400	15.0000	3.000	15.0000

Storage Structures for Storm

Cellular Storage Manhole: Tank, DS/PN: 1.007

Invert Level (m) 43.143 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	625.0	625.0	1.000	625.0	725.0	1.001	0.0	725.1

Cellular Storage Manhole: Tank 2, DS/PN: 4.005

Invert Level (m) 43.495 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	707.0	707.0	0.500	707.0	760.2	0.501	0.0	760.2

Tank or Pond Manhole: PPS, DS/PN: 1.012

Invert Level (m) 42.950

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.4	0.400	296.5	0.800	487.9	1.200	668.4	1.600	898.0
0.050	56.4	0.450	319.9	0.850	512.4	1.250	714.1	1.650	924.8
0.100	120.4	0.500	343.5	0.900	537.2	1.300	739.9	1.700	951.8
0.150	181.6	0.550	367.2	0.950	562.0	1.350	765.9	1.750	978.9
0.200	204.3	0.600	391.1	1.000	587.0	1.400	792.0	1.800	1006.7
0.250	227.1	0.650	415.1	1.050	612.1	1.450	818.3	1.801	0.0
0.300	250.1	0.700	439.2	1.100	637.4	1.500	844.7		
0.350	273.2	0.750	463.5	1.150	662.8	1.550	871.3		

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.600
Region	England and Wales	Ratio R	0.400
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 35, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	101	15 minute 1 year Winter I+0%	45.994	44.921	-0.173	0.000	0.12		0.054
1.001	102	15 minute 1 year Winter I+0%	45.721	44.662	-0.159	0.000	0.19		0.099
1.002	103	15 minute 1 year Winter I+0%	45.373	44.331	-0.142	0.000	0.29		0.136
1.003	104	15 minute 1 year Winter I+0%	45.156	44.117	-0.139	0.000	0.32		0.141
1.004	105	15 minute 1 year Winter I+0%	45.203	43.956	-0.128	0.000	0.38		0.165
2.000	106	15 minute 1 year Winter I+0%	45.108	43.770	-0.138	0.000	0.31		0.093
1.005	107	15 minute 1 year Winter I+0%	45.225	43.720	-0.063	0.000	0.86		0.728
1.006	109	15 minute 1 year Winter I+0%	45.263	43.421	-0.294	0.000	0.26		0.216
3.000	Dock	15 minute 1 year Winter I+0%	44.550	43.834	-0.151	0.000	0.23		0.014
3.001	111	15 minute 1 year Winter I+0%	45.216	43.714	-0.151	0.000	0.23		0.153
3.002	112	15 minute 1 year Winter I+0%	45.215	43.406	-0.317	0.000	0.19		0.184
3.003	113	15 minute 1 year Winter I+0%	45.215	43.350	-0.261	0.000	0.37		0.690
1.007	Tank	30 minute 1 year Winter I+0%	45.172	43.241	-0.352	0.000	0.03		58.710
1.008	114	15 minute 1 year Winter I+0%	45.817	43.250	-0.407	0.000	0.03		0.725
1.009	115	15 minute 1 year Winter I+0%	45.817	43.243	-0.359	0.000	0.15		1.193
1.010	116	30 minute 1 year Winter I+0%	45.818	43.241	-0.310	0.000	0.16		1.671
1.011	Headwall	30 minute 1 year Winter I+0%	44.750	43.241	-0.234	0.000	0.28		2.601
4.000	201	15 minute 1 year Winter I+0%	45.355	44.197	-0.225	0.000	0.13		0.080
4.001	202	15 minute 1 year Winter I+0%	45.737	43.939	-0.202	0.000	0.23		0.298
4.002	203	15 minute 1 year Winter I+0%	46.183	43.872	-0.207	0.000	0.21		0.267
4.003	206	15 minute 1 year Winter I+0%	46.091	43.759	-0.156	0.000	0.44		0.406
4.004	Tank Inlet	15 minute 1 year Winter I+0%	45.896	43.743	-0.102	0.000	0.76		0.371
5.000	Dock 2	15 minute 1 year Winter I+0%	44.585	43.902	-0.153	0.000	0.22		0.014
5.001	207	15 minute 1 year Winter I+0%	45.216	43.804	-0.346	0.000	0.06		0.242
5.002	208	15 minute 1 year Winter I+0%	45.216	43.785	-0.305	0.000	0.18		0.781
5.003	209	15 minute 1 year Winter I+0%	45.216	43.759	-0.211	0.000	0.55		0.966
4.005	Tank 2	30 minute 1 year Winter I+0%	45.252	43.560	-0.460	0.000	0.03		44.492
4.006	210	15 minute 1 year Winter I+0%	45.414	43.584	-0.427	0.000	0.02		0.194
4.007	211	15 minute 1 year Winter I+0%	45.860	43.599	-0.372	0.000	0.05		0.794
4.008	212	15 minute 1 year Winter I+0%	45.813	43.591	-0.325	0.000	0.19		1.589
4.009	213	15 minute 1 year Winter I+0%	45.830	43.557	-0.304	0.000	0.37		1.891

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	101	6.7	OK
1.001	102	9.7	OK
1.002	103	14.6	OK
1.003	104	14.6	OK
1.004	105	18.1	OK
2.000	106	11.5	OK
1.005	107	29.3	OK
1.006	109	45.7	OK
3.000	Dock	8.6	OK
3.001	111	8.8	OK
3.002	112	35.8	OK
3.003	113	35.9	OK
1.007	Tank	2.1	OK
1.008	114	5.9	OK
1.009	115	27.2	OK
1.010	116	35.5	OK
1.011	Headwall	33.8	OK
4.000	201	8.9	OK
4.001	202	13.2	OK
4.002	203	18.4	OK
4.003	206	29.0	OK
4.004	Tank Inlet	28.8	OK
5.000	Dock 2	8.5	OK
5.001	207	8.4	OK
5.002	208	35.2	OK
5.003	209	35.0	OK
4.005	Tank 2	4.7	OK
4.006	210	2.6	OK
4.007	211	9.7	OK
4.008	212	33.1	OK
4.009	213	44.5	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
6.000	Stub	15 minute 1 year Winter I+0%	44.808	43.503	-0.032	0.000	0.35		0.128
4.010	214	15 minute 1 year Winter I+0%	44.859	43.491	-0.352	0.000	0.23		0.650
4.011	Headwall 2	15 minute 1 year Winter I+0%	44.750	43.310	-0.360	0.000	0.21		2.195
1.012	PPS	30 minute 1 year Winter I+0%	44.750	43.241	-0.207	0.000	0.06		50.668

PN	US/MH Name	Pipe Flow (l/s)	Status
6.000	Stub	5.3	OK
4.010	214	47.5	OK
4.011	Headwall 2	50.1	OK
1.012	PPS	15.0	OK

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.600
Region	England and Wales	Ratio R	0.400
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 35, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	101	15 minute 30 year Winter I+35%	45.994	44.969	-0.125	0.000	0.40		0.107
1.001	102	15 minute 30 year Winter I+35%	45.721	44.854	0.033	0.000	0.64		0.671
1.002	103	15 minute 30 year Winter I+35%	45.373	44.763	0.290	0.000	0.86		1.709
1.003	104	15 minute 30 year Winter I+35%	45.156	44.615	0.359	0.000	0.90		1.372
1.004	105	15 minute 30 year Winter I+35%	45.203	44.490	0.406	0.000	1.08		1.344
2.000	106	15 minute 30 year Winter I+35%	45.108	44.251	0.343	0.000	0.95		0.637
1.005	107	15 minute 30 year Winter I+35%	45.225	44.136	0.353	0.000	2.50		2.601
1.006	109	15 minute 30 year Winter I+35%	45.263	43.585	-0.130	0.000	0.83		0.536
3.000	Dock	15 minute 30 year Winter I+35%	44.550	43.912	-0.073	0.000	0.77		0.030
3.001	111	15 minute 30 year Winter I+35%	45.216	43.797	-0.068	0.000	0.75		0.467
3.002	112	15 minute 30 year Winter I+35%	45.215	43.721	-0.002	0.000	0.72		1.181
3.003	113	30 minute 30 year Summer I+35%	45.215	43.611	0.000	0.000	1.20		2.192
1.007	Tank	30 minute 30 year Winter I+35%	45.172	43.516	-0.077	0.000	0.00		225.956
1.008	114	30 minute 30 year Winter I+35%	45.817	43.542	-0.115	0.000	0.04		5.016
1.009	115	30 minute 30 year Winter I+35%	45.817	43.570	-0.032	0.000	0.41		5.813
1.010	116	30 minute 30 year Winter I+35%	45.818	43.551	0.000	0.000	0.52		5.626
1.011	Headwall	30 minute 30 year Winter I+35%	44.750	43.543	0.068	0.000	0.90		5.838
4.000	201	15 minute 30 year Winter I+35%	45.355	44.447	0.025	0.000	0.40		0.361
4.001	202	15 minute 30 year Winter I+35%	45.737	44.376	0.235	0.000	0.68		5.366
4.002	203	15 minute 30 year Winter I+35%	46.183	44.313	0.234	0.000	0.60		1.664
4.003	206	15 minute 30 year Winter I+35%	46.091	44.196	0.281	0.000	1.31		1.957
4.004	Tank Inlet	15 minute 30 year Winter I+35%	45.896	44.061	0.216	0.000	2.26		0.862
5.000	Dock 2	15 minute 30 year Winter I+35%	44.585	44.245	0.190	0.000	0.72		0.083
5.001	207	15 minute 30 year Winter I+35%	45.216	44.150	0.000	0.000	0.20		1.361
5.002	208	15 minute 30 year Winter I+35%	45.216	44.105	0.015	0.000	0.69		3.876
5.003	209	15 minute 30 year Winter I+35%	45.216	43.983	0.013	0.000	2.12		2.236
4.005	Tank 2	30 minute 30 year Winter I+35%	45.252	43.720	-0.300	0.000	0.18		154.247
4.006	210	15 minute 30 year Winter I+35%	45.414	43.795	-0.216	0.000	0.20		0.837
4.007	211	15 minute 30 year Winter I+35%	45.860	43.946	-0.025	0.000	0.17		4.341
4.008	212	15 minute 30 year Summer I+35%	45.813	43.916	0.000	0.000	0.57		6.074
4.009	213	15 minute 30 year Summer I+35%	45.830	43.861	0.000	0.000	1.24		6.084

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	101	22.2	OK
1.001	102	33.3	SURCHARGED
1.002	103	43.1	SURCHARGED
1.003	104	41.7	SURCHARGED
1.004	105	51.4	SURCHARGED
2.000	106	35.3	SURCHARGED
1.005	107	85.4	SURCHARGED
1.006	109	146.6	OK
3.000	Dock	28.6	OK
3.001	111	28.2	OK
3.002	112	136.3	OK
3.003	113	116.6	OK
1.007	Tank	0.0	OK
1.008	114	7.6	OK
1.009	115	72.4	OK
1.010	116	114.0	OK
1.011	Headwall	109.6	SURCHARGED
4.000	201	26.7	SURCHARGED
4.001	202	39.4	SURCHARGED
4.002	203	53.2	SURCHARGED
4.003	206	87.0	SURCHARGED
4.004	Tank Inlet	85.6	SURCHARGED
5.000	Dock 2	27.8	SURCHARGED
5.001	207	27.3	OK
5.002	208	133.8	SURCHARGED
5.003	209	134.5	SURCHARGED
4.005	Tank 2	28.9	OK
4.006	210	31.1	OK
4.007	211	30.6	OK
4.008	212	101.7	OK
4.009	213	148.3	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
6.000	Stub	30 minute 30 year Winter I+35%	44.808	43.695	0.160	0.000	0.34		0.344
4.010	214	30 minute 30 year Winter I+35%	44.859	43.682	-0.161	0.000	0.61		1.693
4.011	Headwall 2	30 minute 30 year Winter I+35%	44.750	43.634	-0.036	0.000	0.54		14.388
1.012	PPS	30 minute 30 year Winter I+35%	44.750	43.546	0.098	0.000	0.06		159.086

PN	US/MH Name	Pipe Flow (l/s)	Status
6.000	Stub	5.2	SURCHARGED
4.010	214	126.2	OK
4.011	Headwall 2	128.8	OK
1.012	PPS	15.0	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.600 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 35, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
1.000	101	15 minute 100 year Winter I+40%	45.994	45.471	0.377	0.000	0.49		0.675
1.001	102	15 minute 100 year Winter I+40%	45.721	45.419	0.598	0.000	0.67		1.672
1.002	103	15 minute 100 year Winter I+40%	45.373	45.279	0.806	0.000	0.97		2.320
1.003	104	15 minute 100 year Winter I+40%	45.156	45.064	0.808	0.000	1.08		1.880
1.004	105	15 minute 100 year Winter I+40%	45.203	44.872	0.788	0.000	1.30		1.775
2.000	106	15 minute 100 year Winter I+40%	45.108	44.578	0.670	0.000	1.25		1.007
1.005	107	15 minute 100 year Winter I+40%	45.225	44.374	0.591	0.000	3.11		2.871
1.006	109	15 minute 100 year Winter I+40%	45.263	43.721	0.006	0.000	1.05		0.975
3.000	Dock	15 minute 100 year Winter I+40%	44.550	44.056	0.071	0.000	1.02		0.059
3.001	111	15 minute 100 year Winter I+40%	45.216	43.929	0.064	0.000	1.05		0.993
3.002	112	15 minute 100 year Winter I+40%	45.215	43.797	0.074	0.000	0.97		1.522
3.003	113	15 minute 100 year Winter I+40%	45.215	43.681	0.070	0.000	1.86		2.456
1.007	Tank	30 minute 100 year Winter I+40%	45.172	43.640	0.047	0.000	0.00		300.875
1.008	114	30 minute 100 year Winter I+40%	45.817	43.652	-0.005	0.000	0.04		5.932
1.009	115	30 minute 100 year Winter I+40%	45.817	43.657	0.055	0.000	0.49		6.499
1.010	116	30 minute 100 year Winter I+40%	45.818	43.662	0.111	0.000	0.65		6.208
1.011	Headwall	30 minute 100 year Winter I+40%	44.750	43.666	0.191	0.000	1.14		6.121
4.000	201	15 minute 100 year Winter I+40%	45.355	44.898	0.476	0.000	0.51		0.872
4.001	202	15 minute 100 year Winter I+40%	45.737	44.812	0.671	0.000	0.92		5.945
4.002	203	15 minute 100 year Winter I+40%	46.183	44.735	0.656	0.000	0.86		2.142
4.003	206	15 minute 100 year Winter I+40%	46.091	44.610	0.695	0.000	1.90		2.425
4.004	Tank Inlet	15 minute 100 year Winter I+40%	45.896	44.344	0.499	0.000	3.22		1.183
5.000	Dock 2	15 minute 100 year Winter I+40%	44.585	44.310	0.255	0.000	1.00		0.096
5.001	207	15 minute 100 year Winter I+40%	45.216	44.180	0.030	0.000	0.28		1.404
5.002	208	15 minute 100 year Winter I+40%	45.216	44.164	0.074	0.000	0.99		4.174
5.003	209	15 minute 100 year Winter I+40%	45.216	44.043	0.073	0.000	2.96		2.454
4.005	Tank 2	30 minute 100 year Winter I+40%	45.252	43.822	-0.198	0.000	0.11		224.550
4.006	210	15 minute 100 year Summer I+40%	45.414	43.824	-0.187	0.000	0.24		0.933
4.007	211	15 minute 100 year Summer I+40%	45.860	43.974	0.003	0.000	0.20		4.518
4.008	212	15 minute 100 year Winter I+40%	45.813	43.963	0.047	0.000	0.90		6.401
4.009	213	15 minute 100 year Winter I+40%	45.830	43.915	0.054	0.000	1.88		6.464

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

PN	US/MH Name	Pipe Flow (l/s)	Status
1.000	101	27.2	SURCHARGED
1.001	102	34.9	SURCHARGED
1.002	103	48.6	FLOOD RISK
1.003	104	50.1	FLOOD RISK
1.004	105	62.0	SURCHARGED
2.000	106	46.4	SURCHARGED
1.005	107	106.3	SURCHARGED
1.006	109	186.7	SURCHARGED
3.000	Dock	37.8	SURCHARGED
3.001	111	39.5	SURCHARGED
3.002	112	182.7	SURCHARGED
3.003	113	180.6	SURCHARGED
1.007	Tank	0.0	SURCHARGED
1.008	114	7.5	OK
1.009	115	86.0	SURCHARGED
1.010	116	142.8	SURCHARGED
1.011	Headwall	139.2	SURCHARGED
4.000	201	34.6	SURCHARGED
4.001	202	53.3	SURCHARGED
4.002	203	76.2	SURCHARGED
4.003	206	125.7	SURCHARGED
4.004	Tank Inlet	122.0	SURCHARGED
5.000	Dock 2	38.5	FLOOD RISK
5.001	207	38.5	SURCHARGED
5.002	208	193.2	SURCHARGED
5.003	209	187.9	SURCHARGED
4.005	Tank 2	18.7	OK
4.006	210	36.9	OK
4.007	211	36.5	SURCHARGED
4.008	212	159.8	SURCHARGED
4.009	213	225.6	SURCHARGED

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Maximum Vol (m³)
6.000	Stub	15 minute 100 year Summer I+40%	44.808	43.874	0.339	0.000	0.55		0.548
4.010	214	15 minute 100 year Winter I+40%	44.859	43.862	0.019	0.000	1.01		2.550
4.011	Headwall 2	30 minute 100 year Winter I+40%	44.750	43.680	0.010	0.000	0.68		15.717
1.012	PPS	30 minute 100 year Winter I+40%	44.750	43.670	0.222	0.000	0.06		211.883

PN	US/MH Name	Pipe Flow (l/s)	Status
6.000	Stub	8.3	SURCHARGED
4.010	214	210.7	SURCHARGED
4.011	Headwall 2	161.2	SURCHARGED
1.012	PPS	15.0	SURCHARGED

Summary and Conclusions

Currently the site is a greenfield bounded by the M4, A4 and Hoad Way.

2 commercial units with associated access road, service yard and car parking will be erected on the western portion of the site.

The surface water system is proposed to connect into the Thames Water Surface Water Sewer in Rotherfield Close. Other methods of discharging the surface water have been discounted.

Existing ground water levels have been found to be high and as such drainage features will need to be assessed for buoyancy during design and suitably wrapped in an impermeable geotextile membrane to prevent ground water ingress.

The surface water system is modelled with 35% climate change in the 30 year storms and 40% climate change in the 100 year storms.

As part of the drainage the discharge rate for the whole site has been limited to 15 l/s as per the provisional approval from Thames Water.

Due to the level difference between the site and the existing Thames Water Surface Water sewer the connection is proposed to be provided via a rising main and package pumping station. This pumping station will be fitted with an appropriate alarm system to ensure any blockages do not result in onsite flooding.

The modelled system presented here has been assessed for a suite of storm durations, and presents the results of the critical storm duration for the 100 year plus 40% climate change. The results of these simulations indicates that the designed system minor flooding in the modelled 100 year plus 40% climate change, this water will all be managed on site.

An allowance of 5l/s for the remaining third of the site has been account for in the current modelling to ensure that the installed pump and rising main are suitable sized

Based on the proposed design, and the hydraulic assessment presented herein, the drainage network for the site will be suitable for the proposed development and is envisaged to have no adverse affects on the downstream drainage system or catchment.

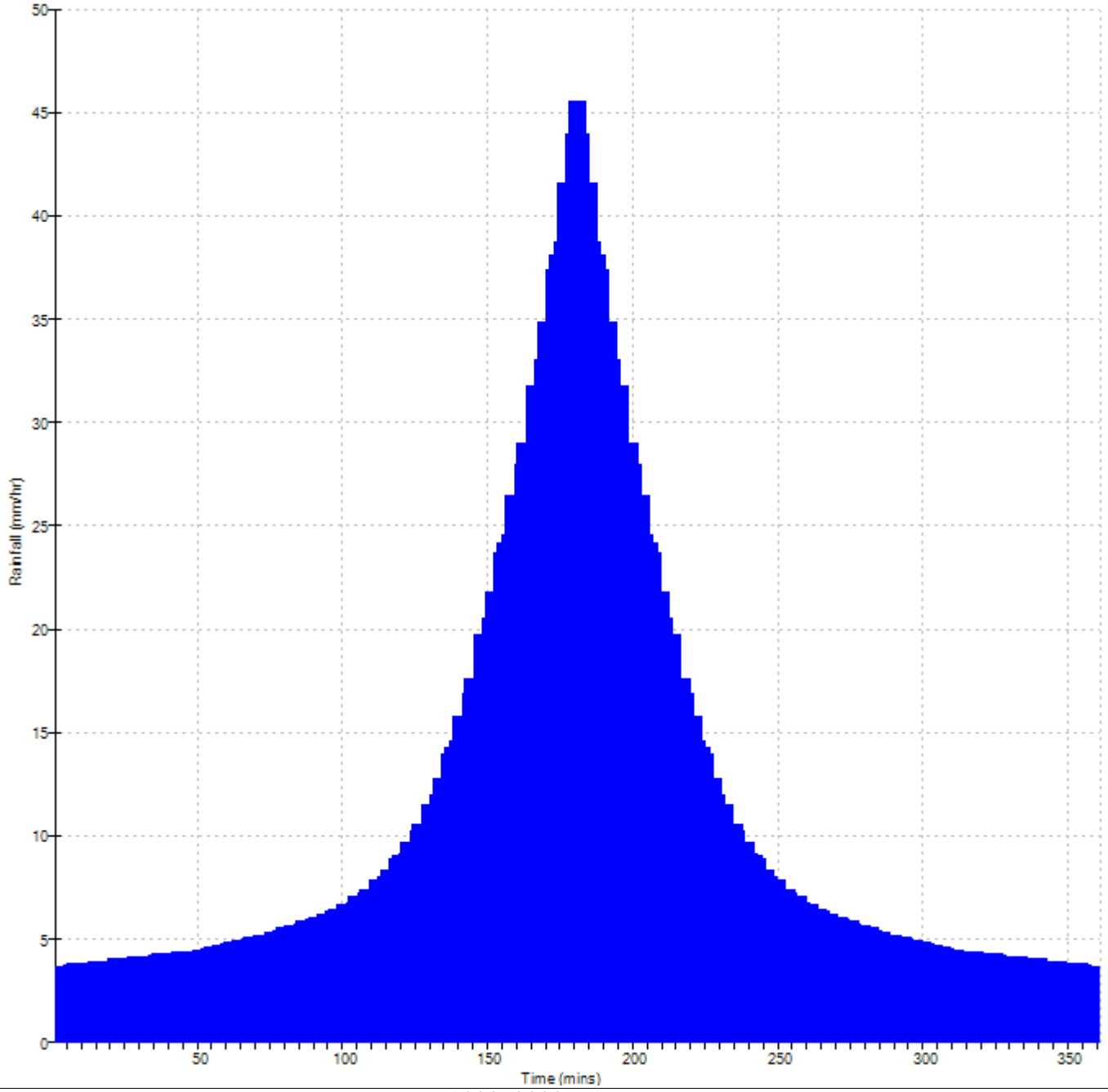
The foul water from the scheme will connect via a package puming station into the existing Thames Water sewer that crosses the site, the discharge rate is to be agreed with Thames Water.

APPENDIX 9: Rainfall Profile

Rainfall profile

Storm duration (mins) 360

FEH Data	
FEH Rainfall Version	1999
Site Location	GB 465000 171200 SU 65000 71200
C (1km)	-0.029
D1 (1km)	0.280
D2 (1km)	0.299
D3 (1km)	0.349
E (1km)	0.309
F (1km)	2.560
Peak Intensity (mm/hr)	45.533
Ave. Intensity (mm/hr)	11.616
Return Period (years)	100.0



APPENDIX 10: SuDS Optioneering

BWB
A CAF GROUP COMPANY

TRANSPORT AND INFRASTRUCTURE

CP Logistics UK Reading Propco Limited
Theale
Reading

SuDS Optioneering

www.bwbconsulting.com

Project Number:	NTE2460
Project Name:	Theale, Reading
Client:	CP Logistics UK Reading Propco Limtied
Document Title:	SuDS Optioneering Assessment
Phase / Unit reference	2 Unit Masterplan
Revision:	P01
Stage:	Planning
Prepared by:	Rebekah Duncan
Date:	16/08/2023
Authorised by:	Kristen Jones
Date:	16/08/2023
File Ref:	THR-BWB-GEN-xx-RP-D-0001_SuDS Optioneering

CONTENTS

Project Number:	NTE2460	Page	1
Project Name:	Theale, Reading	Rev.	P01
Plot Reference / Zone:	2 Unit Masterplan	Stage	Planning
Client:	CP Logistics UK Reading Propco Limtied	Date	16/08/2023
File Ref:	THR-BWB-GEN-xx-RP-D-0001_SuDS Optioneering	Prepared by	Rebekah Duncan
Document Title:	SuDS Optioneering Assessment	Authorised by	Kristen Jones

Introduction

Existing Site :

Greenfield development.

It is assumed that current surface water runoff from the site infiltrates into the ground. In the event of exceedance, it is assumed that excess surface water would enter the existing National Highways watercourse within the site boundary

Proposed Development :

Two thirds of the site will be developed and 2 commerical units with associated access road, service yard and car parking will be erected

Design Assumptions :

Discharge location will follow the hierarchy strategy which is briefly:

Step 1: to ground by infiltration. The sub-surface ground conditions and ground water levels have been found to be unfavourable and as such, infiltration SuDS are currently not considered viable as a method of surface water disposal.

Step 2: to an adjacent watercourse. The nearest watercourse to the Site is along the southern boundary but this has been identifeied as a National Highways ditch and they have advised that we cannot connect into it, as such is not not considered viable as a method of surface water disposal. The nearest EA watercourse would require crossing of 3rd party land, we have been advised that the 3rd party has rejected any proposals to cross their land as such is not not considered viable as a method of surface water disposal.

Step 3: to the surface water sewers within / adjacent to the site. The site will discharge to the existing surface water drainage via a rising main into the existing Thames Water Sewer in Rotherfield Close.

Step 4: to the combined sewers within / adjacent to the site. As Step 3 can be achieved, discharge to public combined sewers is not necessary.

The current advice from Thames Water (email 26/02/2020) advises that a discharge rate of 15l/s/ha can be used for the whole site, as only 2/3rd's of the development is proposed to come forward at this time it is proposed that the pump and rising main installed are designed to match this discharge rate (15l/s) to prevent any future requirements to upgrade the rising main beneath the public highway. The third unit will need to be designed to attenuate itself and will be allowed a pass though flow of 5l/s which will be accounted in the microdrainage modelling for the network.

Project Number: NTE2460	Project Name: Theale, Reading		Rev. P01	Page 1
Client: CP Logistics UK Reading Propco Limtied	Plot Reference / Zone: 2 Unit Masterplan		Stage Planning	Prepared by Rebekah Duncan
Document Title: SuDS Optioneering Assessment	File Ref: THR-BWB-GEN-xx-RP-D-0001_SuDS Optioneering		Date 16/08/2023	Authorised by Kristen Jones

SuDS Viability Review

Component Type	Description	Comments	Viable for: Buildings	Externals	Infrastructure	Viable for the site?	For the Site
Rainwater harvesting systems	Can reduce the overall volume of water leaving the site and volume of water supply. Would be suitable for reducing purchased water for domestic (not drinking) operations.	Would not be considered as a part of the attenuation provision as, when full, water from a storm would bypass the harvesting system entirely.	Yes	Possibly	No	Yes	Implementation is a Client requirements, details to be confirmed in detailed design.
Green roofs	Depending on specification these can reduce storm runoff whilst improving winter heat retention and reducing summer solar gain.	Can provide water quality treatment and ecological benefits with some reduction in water volumes leaving the site by plant uptake. Green roofs also help to reduce heating in winter (by providing more insulation) and reduce cooling in the summer (by plant absorption).	Yes	No	No	Possibly	Possible opportunity on viable roofs, bike / bin stores, although not suitable for the main structure due to additional loading, maintenance and subsequent cost.
Infiltration systems	Such as soakaways, filter strips or permeable ponds / detention basins	Not viable within 5m of existing or proposed building or utilities. Not viable in high ground water conditions, contaminated land or flood zones	Yes	Yes	Yes	No	Not viable due to brownfield history of the site and insufficient infiltration potential.
Proprietary treatment systems	Including petrol interceptors, vortex separators etc.	Interceptors will be required for parking and service yards. Additionally fire water retention will be required to protect ground water from pollution.	Yes	Yes	Yes	Yes	Full retention/bypass interceptors are included in the proposed development.
Filter strips	A gravel filled trench which collects, and stores surface water for conveyance to ground or pond.	Both filter drains and strips can be supplemented with swales for additional water collection and can be part of a raingarden / landscaping to discharge to ground.	No	Yes	Yes	Yes	Raingardens to be provide to drian the proposed carpark. Filterstrips to be provided for footpaths around the units and the proposed bund.
Filter drains	A filter strip within a perforated pipe for additional conveyance of water.		Yes	Yes	Yes	Yes	
Swales	Typically a dry ditch for collection and conveyance of surface water.	Swales can be used in lieu of pipes for conveying surface water runoff through a site, reducing hard materials and excavation whilst providing water treatment. They can be used to discharge to ground.	Yes	Yes	Yes	No	Not suitable for the proposed development due to high water table and space constraints
Bioretention systems	Including swales, ponds etc.	Can be used for above ground storage reducing hard materials whilst providing ecological benefits and water quality treatment.	Yes	Yes	Yes	No	Not suitable for the proposed development due to constraints.
Trees		Trees can provide ecological benefits and take up water. However, quantifying this as part of a drainage strategy is not possible.	No	Yes	Yes	Subject to design	Included as part of the landscaping. Can be combined with permeable pavement subbase to reduce water volumes.
Pervious pavements	Pavement surfaces which allow percolation of surface water to below ground storage / conveyance.	Pervious pavements avoid / reduce formal collection (gullies, channels etc) whilst also providing water quality treatment. If combined with a below ground aggregate attenuation, in low risk situations, these can be used in lieu of petrol interceptors.	No	Yes	No	No	Implementation is subject to Client/Tenant requirements.
Attenuation storage tanks	Such as oversized pipes, and below ground storage tanks.	Efficient storage of significant water volumes can be provided while minimising land take by being located beneath hard surfaces.	Yes	Yes	Yes	Yes	Geocellular attenuation is included in the drainage system to accommodate the discharge rate limits.
Detention basins	A dry basin which is allowed to flood during extreme storm events.	As with ponds, dry basins require additional land take in comparison with below ground tanks. However, subject to design such basins can provide public open space during lesser storm events.	Yes	Yes	Yes	Yes	Detention Basin is provided as part of the drainage system to accommodate the discharge rates
Ponds and wetlands	Can provide water quality treatment and ecological benefits. Although this would not provide significant storage this would assist in an overall reduction in water volumes leaving the site by plant uptake. H15:N29	Ponds and wetlands provide ecological benefits to the surrounding area, and can be used for water storage and water quality treatment. They will need to make due allowance for health and safety, and require additional land take in comparison with below ground tanks.	Yes	Yes	Yes	No	Not suitable for the proposed development due to constraints.

Number	NTE2460	Calc No./Sketch No.	-	Rev.	P01	Page	???
Project	Theale, Reading			Date	16/08/2023	Prepared by	Rebekah Duncan
Title	SuDS Optioneering Assessment 2 Unit Masterplan					Authorised by	Kristen Jones

Summary and Conclusions

Currently the site is a greenfield bounded by the M4, A4 and Hoad Way.

2 commercial units with associated access road, service yard and car parking will be erected on the western portion of the site.

It is proposed that the following SuDS treatments will be implemented into the propsoed scheme based on the site contraints & client requirementes:

- Rainwater harvesting systems
- Proprietary treatment systems
- Filter strips
- Raingardens (Filter drains beneath a swale)
- Attenuation storage tanks
- Detention basins

The potential to add any further SuDS such as green roofs will be reviewed at detailed design.

APPENDIX 11: Proposed Drainage Layout & Exceedance Drawing

SEE INSET 1

INSET 1

TW Ref: 5551
CL: 45.35
IL: 44.21 225Ø
IL: 44.06 375Ø

S302
PCC 1200Ø
CL: 45.40 TBC
IL: 44.270

TW Ref: 5402
CL: 46.360
IL: 44.070

<<< Rising Main Size TBC
Length = 92.8m

<<< 300Ø

TW Ref: 6401
CL: 45.610
IL: 44.260

TW Ref: 7502
CL: 45.880
IL: 44.430

TW Ref: 7501
CL: 46.110
IL: 44.540
IL: 44.690 (150Ø)

S301
Package Pump Station
CL: 46.277
Incoming IL: 42.923
Pump Rate 15.0 l/s

Proposed Attenuation Pond
Max. Attenuation volume: 694m³
Top of Pond: 44.750
IL: 42.950 (1 in 500 fall to outfall)
Freeboard: 300mm (min)

IL: 43.145

<<< 525Ø @ 1 in 460

FWMH12
CL: 46.173
IL: 44.753

Levels to be locally raised to suit required cover level)

<<< Rising Main Size TBC
Length = 26.1m

F10
Package Pump Station
Pump Rate TBC
CL: 45.024
Incoming IL: 44.917

S214
CL: 44.859
IL: 43.318

IL: 43.385

F5
Package Pump Station
Pump Rate TBC
CL: 45.799
IL: 43.458

525Ø @ 1 in 495 >>>

IL: 43.212

IL: 43.212

1500Ø @ 1 in 80 >>>

Rising Main, Size TBC, Length = 179.4m >>>

Valve Chamber

S213
CL: 45.830
IL: 43.336

S116
CL: 45.818
IL:43.026

All internal pop up/Siphonic RWP's shown are indicative. Locations to be confirmed by Architect/M&E Engineer/Specialist.

Primary and Secondary siphonics are assumed to fall to the same end of building

Location of rainwater harvesting for each unit to be confirmed at detailed design

FFL 45.910m

Proposed junction drainage to be reviewed as part of junction works

S101
CL: 45.994
IL: 44.869

225Ø @ 1 in 73 >>>

Catchpit
CL: 46.005
IL: 45.255 (150Ø)

F4a
CL: 45.799
IL: 43.728

S115
CL: 45.817
IL: 43.077

F4
CL: 45.799
IL: 43.997

F3
CL: 45.799
IL: 44.108

S114
CL: 45.817
IL: 43.132

F2
CL: 45.784
IL: 44.190

<<< 150Ø @ 1 in 80

F1
CL: 45.849
IL: 44.482

F8
CL: 45.845
IL: 44.795

150Ø @ 1 in 80 >>>

F10a
CL: 45.031
IL: 44.074

S212
CL: 45.813
IL: 43.391

F10
CL: 45.032
IL: 44.374

S211
CL: 45.660
IL: 43.446

F9
CL: 44.973
IL: 44.516

S102
CL: 45.721
IL: 44.596

225Ø @ 1 in 87 >>>

Catchpit
CL: 45.533
IL: 44.708 (225Ø)

Cellular Attenuation Tank
25m x 25m x 1m
Voids Ratio: 95%
Storage Volume: 601m³
IL: 43.143

Area Served = 676m²

Area Served = 666m²

Cellular Attenuation Tank
50.5m x 14m x 1m
Voids Ratio: 95%
Storage Volume: 343m³

IL: 43.760

225Ø @ 1 in 160 >>>

IL: 43.630

225Ø @ 1 in 160 >>>

S210
CL: 45.414
IL: 43.486

S103
CL: 45.373
IL: 44.248

225Ø @ 1 in 89 >>>

Area Served = 2497m²

Area Served =2599?m²

S209
CL: 45.216
IL: 43.520
Non-return valve to be installed in incoming pipe

IL: 43.465 (525Ø)

IL: 43.465 (Tank)

IL: 43.505 (450Ø)

IL: 43.505 (Tank)

S113
CL: 45.215
IL: 43.161

Full Retention Seperator for 3173m³

S112
CL: 45.215
IL: 43.498 (225Ø)
IL: 43.273 (450Ø)

<<< 225Ø @ 1 in 160

S111
CL: 45.216
IL: 43.640

S207
CL: 45.216
IL: 43.700

450Ø @ 1 in 385 >>>

S208
CL: 45.216
IL: 43.640

Full Retention Seperator for 3265m³

1500Ø @ 1 in 100 >>>

S104
CL: 45.156
IL: 44.031

100Ø @ 1 in 100 >>>

Catchpit
CL: 45.395
IL: 44.645 (150Ø)
IL: 44.123 (225Ø)

Bypass Seperator for 4130m³

S109
CL: 45.263
IL: 43.490 (225Ø)
IL: 43.265 (450Ø)

Catchpit
CL: 45.423
IL: 44.106 (225Ø)

Catchpit
CL: 46.145
IL: 44.575

IL: 43.545 (450Ø)
IL: 43.545 (Tank)

225Ø @ 1 in 83 >>>

S105
CL: 45.203
IL: 43.859 (225Ø)

225Ø @ 1 in 95 >>>

S107
CL: 45.225
IL: 43.558

<<< 225Ø @ 1 in 160

Area Served = 914m²

S106
CL: 45.108
IL: 43.683

Bypass Seperator for 2718m³

<<< 225Ø @ 1 in 15

Catchpit
CL: 46.000
IL: 44.186

S203
CL: 46.183
IL: 43.854 (225Ø)
IL: 43.779 (300Ø)

300Ø @ 1 in 120 >>>

S206
CL: 46.091
IL:43.690 (225Ø)
IL: 43.615 (300Ø)
IL:43.615 (450Ø)

S201
CL: 45.355
IL: 44.122

300Ø @ 1 in 240 >>>

S202
CL: 45.737
IL: 43.841

300Ø @ 1 in 240 >>>

Important CDM / H&S Note

The Designers would draw the readers attention to the key residual health and safety risks that have not been eliminated from the designs shown on this drawing through the design process. These key residual risks are identified below:

- Existing drainage and service infrastructure not to be compromised. Refer to utilities records and surveys for additional details
- Care to be taken around deep excavations and high embankments, plant to be kept at a safe distance.
- Moving plant, care to be taken adjacent to existing highway.
- Care to be taken adjacent to overhead pylons.

Any construction personnel including operatives intending to construct the designs shown on this drawing should ensure that they are regularly and thoroughly briefed by the principal Contractor on all health and safety matters and have had sight of:

1 - The full Designers and Contractors risk assessments and risk registers.
2 - The developed construction health and safety plan.
3 - The Contractors construction method statements.

Hazards that are obvious to a competent Contractor are not shown, as are considered as 'every day' and low risk hazards.

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

Key Plan

Legend

- Proposed Surface Water Drainage
- Rain Garden with Filter Drain Beneath
- Slot Drain - Channel Drain
- Slot Drain - QMax
- Filter Drain
- Surface Water Rising Main
- Gully
- Siphonic Rain Water Pipe
- Channel Drain Sump
- Surface Water Stub Connection
- Surface Water Vented Access Chamber
- Surface Water Rodding Eye
- Surface Water Catchpit
- Headwall
- Surface Water Pumping Station
- Full Retention Interceptor
- Bypass Interceptor
- Petrol Interceptor Vent Pipe
- Cellular Attenuation Tank
- Proposed Foul Sewer Drainage
- Foul Sewer Rising Main
- Foul Pumping Station
- Foul Water Channel Drain
- Channel Drain Sump
- Existing Surface Water Drainage
- Existing Foul Sewer Drainage
- Proposed Bund

NOTE HIGH GROUND WATER LEVELS WILL REQUIRE REVIEW OF FLOTATION CALCULATIONS DURING DETAILED DESIGN AND INCLUSION IN ANY TEMPORARY WORKS DESIGNS

DISCHARGE RATES SUBJECT TO THAMES WATER APPROVAL

DRAINAGE DESIGN PROPOSALS ARE SUBJECT TO APPROVAL OF THE WATER AUTHORITY, BUILDING CONTROL AND THE ENVIRONMENT AGENCY

PROPOSALS PRESENTED IN THIS PACKAGE ARE SUBJECT TO CHANGE DURING DETAILED DESIGN AND PROJECT TEAM REVIEW

P02	08.09.23	Updated to suit design team comments	RAD	RAD
P01	18.08.23	Planning Issue	IB	RAD
P01	01.08.23	Draft Issue	RAD	PJL
Rev	Date	Details of issue / revision	Drw	Rev

Issues & Revisions

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Leeds | 0113 233 8000
London | 020 7407 3879
Manchester | 0161 233 4260
Nottingham | 0115 924 1100
www.bwbconsulting.com

Client
CP Logistics UK Reading Propco Limited

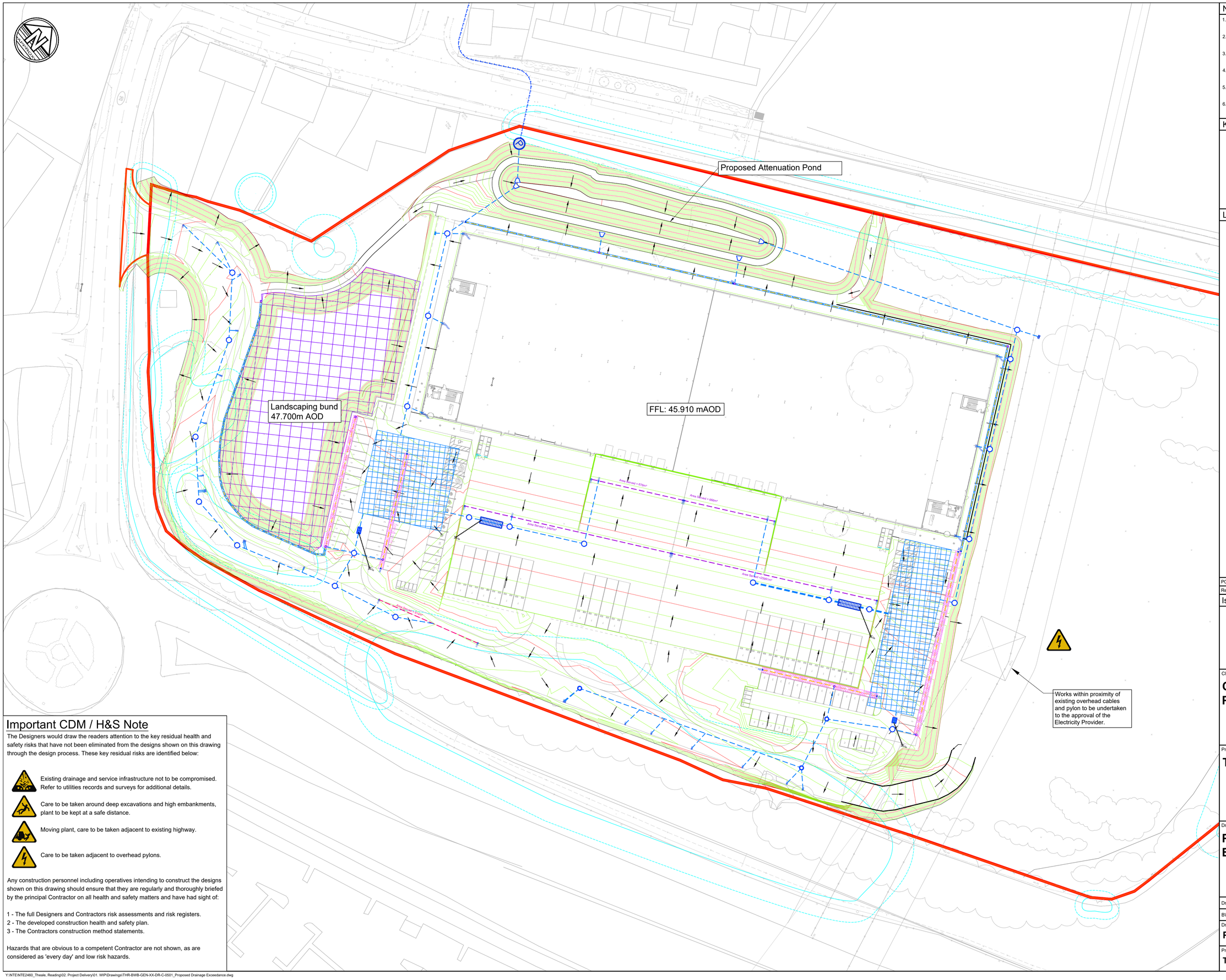
Project Title
Theale, Reading

Drawing Title
Proposed Drainage Layout

Drawn:	R. Duncan		Reviewed:	P. Laidler	
BWB Ref.	NTE 2460	Date:	Aug '23	Scale@A0:	1:250

Drawing Status
Planning

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
THR-BWB-GEN-XX-DR-D-500	S8	P02



Important CDM / H&S Note

The Designers would draw the readers attention to the key residual health and safety risks that have not been eliminated from the designs shown on this drawing through the design process. These key residual risks are identified below:

Existing drainage and service infrastructure not to be compromised. Refer to utilities records and surveys for additional details.

Care to be taken around deep excavations and high embankments, plant to be kept at a safe distance.

Moving plant, care to be taken adjacent to existing highway.

Care to be taken adjacent to overhead pylons.

Any construction personnel including operatives intending to construct the designs shown on this drawing should ensure that they are regularly and thoroughly briefed by the principal Contractor on all health and safety matters and have had sight of:

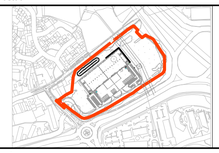
1 - The full Designers and Contractors risk assessments and risk registers.
2 - The developed construction health and safety plan.
3 - The Contractors construction method statements.

Hazards that are obvious to a competent Contractor are not shown, as are considered as 'every day' and low risk hazards.

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. FFL is based on the Flood Risk Assessment, exact levels are subject to detailed design.
6. To be read in in conjunction with BWB drawings: THR-BWB-GEN-XX-DR-D-0500

Key Plan



Legend

- Major Contour (2.5m Intervals)
- Minor Contour (0.5m Intervals)
- Retaining Structure
- Drainage Route
- Site Boundary
- Proposed Topsoil Bund
- Existing Tree & Root Protection Area

PROPOSALS PRESENTED IN THIS PACKAGE ARE SUBJECT TO CHANGE DURING DETAILED DESIGN AND PROJECT TEAM REVIEW.

Rev	Date	Details of issue / revision	Drw	Rev
P01	08.09.23	Planning Issue	RAD	RAD

Issues & Revisions

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■ Leeds | 0113 233 8000
☐ London | 020 7407 3879
☐ Manchester | 0161 233 4260
☐ Nottingham | 0115 924 1100
www.bwbconsulting.com

Client

CP Logistics UK Reading Propco Limited

Project Title

Theale, Reading

Drawing Title

Proposed Drainage Exceedance

Drawn:	A. Biag	Reviewed:	R. Duncan		
BWB Ref:	NTE 2460	Date:	Sep '23	Scale@A1:	1:500

Drawing Status

Planning

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
THR-BWB-GEN-XX-DR-D-0501	**S8**	**P01**

APPENDIX 12: Thames Water Records

Asset location search

Thames Water Property Searches

BWB Consulting Limited
35Livery Street
COLMORE BUSINESS DISTRICT
BIRMINGHAM
B3 2PB

Search address supplied

65
High Street
Theale
Reading
RG7 5AG

Your reference NTE2460 - Theale Reading

Our reference ALS/ALS Standard/2019_3971335

Search date 19 March 2019

Keeping you up-to-date

Notification of Price Changes

From 1 September 2018 Thames Water Property Searches will be increasing the price of its Asset Location Search in line with RPI at 3.23%.

For further details on the price increase please visit our website: www.thameswater-propertysearches.co.uk
Please note that any orders received with a higher payment prior to the 1 September 2018 will be non-refundable.

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

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

0845 070 9148

searchcode

Asset location search

Property Searches

Search address supplied: 65, High Street, Theale, Reading, RG7 5AG

Dear Sir / Madam

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

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

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

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

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

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

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

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

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

Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

SU6471NE
SU6471SE

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

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

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

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

For your guidance:

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

Clean Water Services

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

The following quartiles have been printed as they fall within Thames' water area:

SU6471NE
SU6471SE

Enclosed is a map showing the approximate positions of our water mains and

associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

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

For your guidance:

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

Payment for this Search

A charge will be added to your suppliers account.

Further contacts:

Waste Water queries

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

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

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

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

Clean Water queries

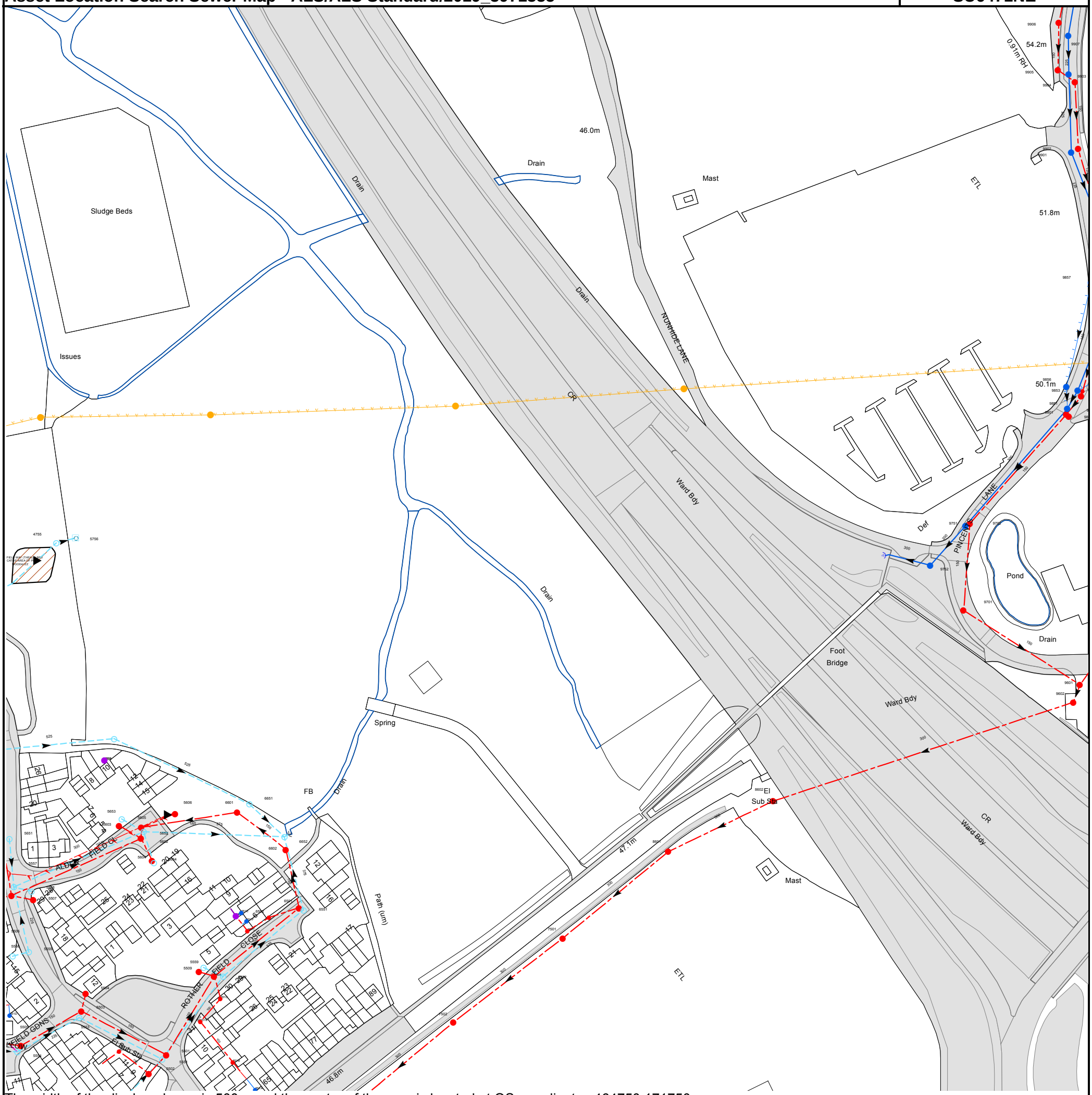
Should you require any advice concerning clean water operational issues or clean water connections, please contact:

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

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

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3971335

SU6471NE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 464750,171750

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9857	51.51	50
9901	52.57	51.04
9902	52.59	51.04
9904	53.83	52.3
9903	54.06	51.54
9905	54.25	52.75
9907	54.92	53.49
9906	55.42	54.04
9602	47.67	45.04
9601	49.03	45.37
9701	48.4	45.92
9751	48.36	46.8
9702	48.3	46.24
9852	50.01	48.78
9801	49.94	46.69
9851	49.98	47.08
9802	50.14	46.73
9853	50.17	47.11
9856	50.23	48.44
5655	44.87	43.76
5603	45.08	43.1
5653	45.06	44.01
5602	44.98	42.69
5605	45.18	41.25
5652	44.95	43.79
5604	45.33	43.14
5654	45.34	44.02
5606	45.08	41.22
5509	45.58	43
551B	n/a	n/a
5559	45.61	44.15
5508	45.47	42.79
551C	n/a	n/a
6552	45.5	43.88
6601	44.89	41.45
6651	44.88	43.68
6502	45.3	43.36
6652	45.29	43.64
6602	44.91	41.89
6501	45.21	42.26
6551	45.23	43.74
7502	45.88	44.43
7501	46.11	44.54
8601	46.33	44.63
8602	46.76	44.78
9752	48.63	46.68
5651	45.26	44.4
551D	n/a	n/a
5506	45.42	43.68
5556	45.6	44.45
5557	45.4	44.06
5555	45.55	44.32
5558	45.58	44.34
5507	45.57	44
4755	n/a	n/a
5756	n/a	n/a
5553	45.76	44.51
5503	45.78	43.87
5504	45.87	44.17
561A	n/a	n/a
5554	45.54	44.6
5505	45.52	44.36
551A	n/a	n/a
5502	45.47	43.51
5551	45.35	44.06
5501	45.36	43.26
651B	n/a	n/a
651A	n/a	n/a

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

Asset Location Search Sewer Map - ALS/ALS Standard/2019_3971335

SU6471SE

The width of the displayed area is 500m and the centre of the map is located at OS coordinates 464750,171250

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

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

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5450	45.36	44.59
541A	n/a	n/a
5401	46.09	43.91
531A	n/a	n/a
5552	45.37	44.37
5402	46.36	44.07
6401	45.61	44.26
801A	n/a	n/a

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

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

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

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

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

- Trunk Surface Water
- Trunk Foul
- Storm Relief
- Trunk Combined
- Vent Pipe
- Bio-solids (Sludge)
- Proposed Thames Surface Water Sewer
- Proposed Thames Water Foul Sewer
- Gallery
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Sludge Rising Main
- Proposed Thames Water Rising Main
- Vacuum

Sewer Fittings

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

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

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

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

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

- Outfall
- Undefined End
- Inlet

Other Symbols

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

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

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

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

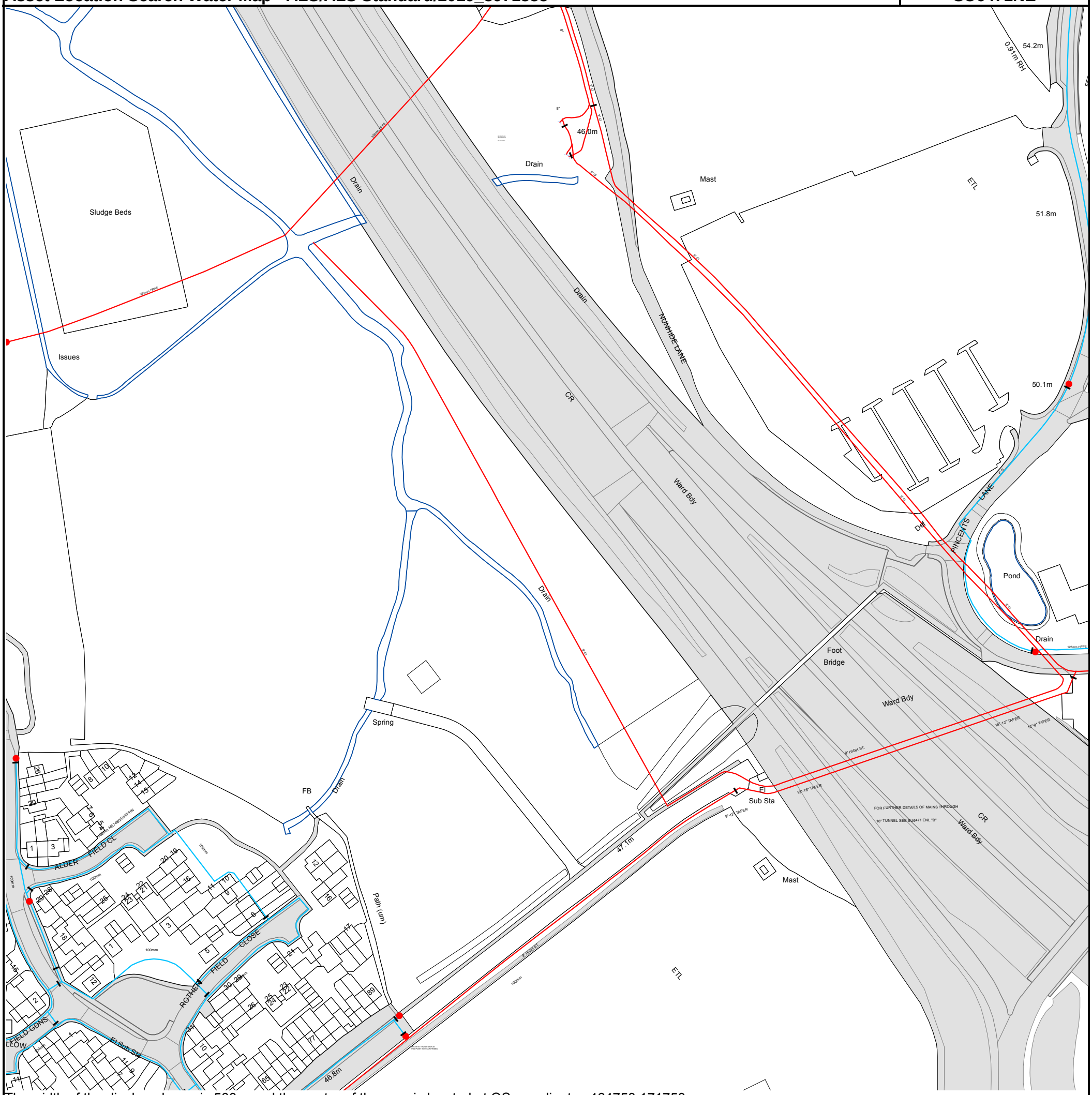
- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed
- Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2019_3971335

SU6471NE

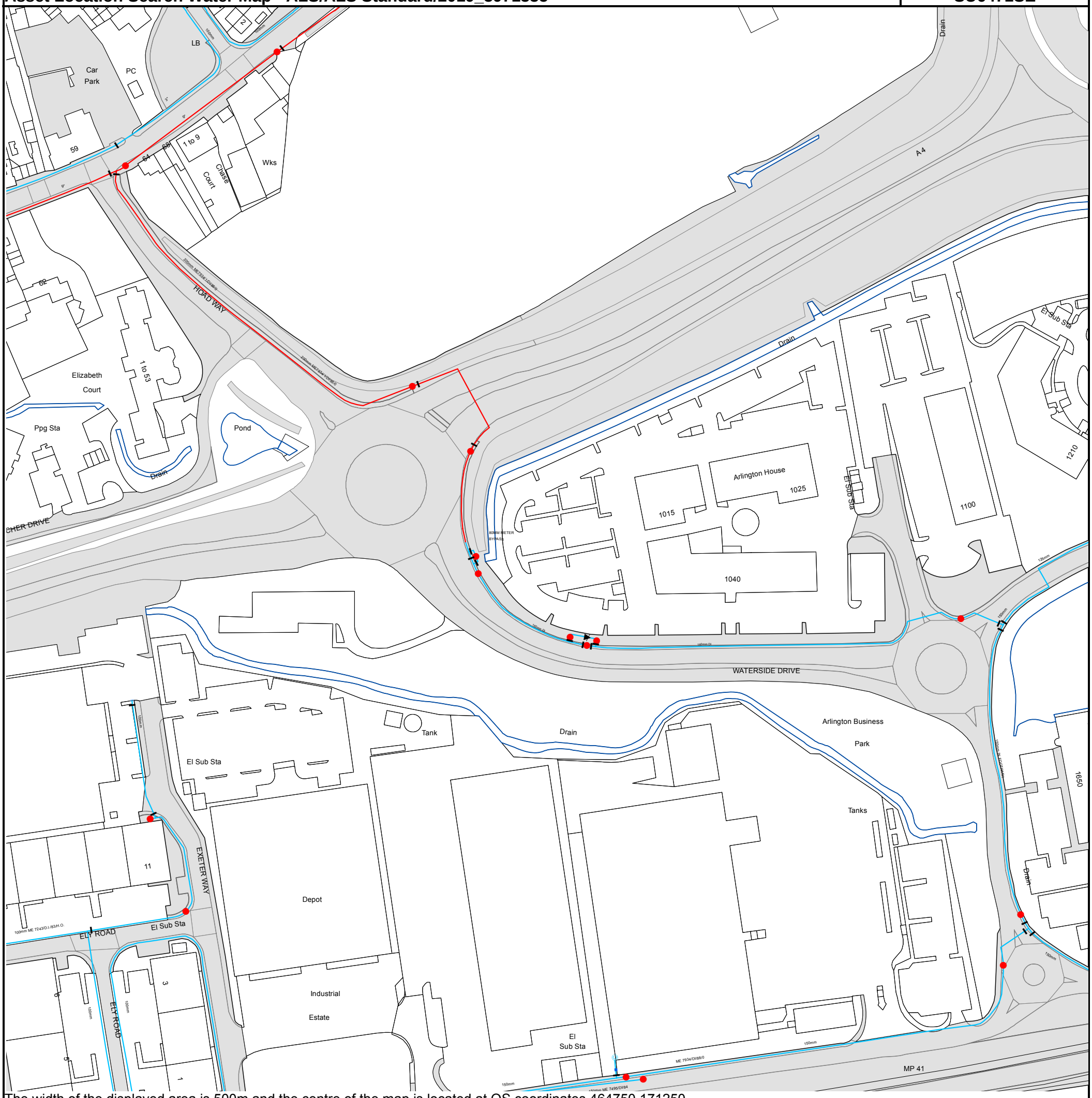


The width of the displayed area is 500m and the centre of the map is located at OS coordinates 464750,171750

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

Asset Location Search Water Map - ALS/ALS Standard/2019_3971335

SU6471SE



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 464750,171250

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

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

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

16"

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

3" SUPPLY

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

3" FIRE

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

3" METERED

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

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

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

Valves

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

Hydrants

- Single Hydrant

Meters

- Meter

End Items

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

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

Operational Sites

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

Other Symbols

- Data Logger

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

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

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

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

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Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

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This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

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Firms which subscribe to the Search Code will:

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- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if the Ombudsman finds that you have suffered actual loss and/or aggravation, distress or inconvenience as a result of your search provider failing to keep to the code.

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TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Web site: www.tpos.co.uk
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

APPENDIX 13: SuDS O&M Document

BWB
A CAF GROUP COMPANY

TRANSPORT & INFRASTRUCTURE

CP Logistics UK Reading Propco Limited
Land to the North of the A4
Theale

SuDS Operation and Maintenance Plan

www.bwbconsulting.com

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Land to the North of the A4

Theale

SuDS Operation and Maintenance Plan

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September 2023

DOCUMENT ISSUE RECORD

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			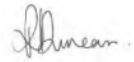		

Notice

CONTENTS

APPENDICES

1. INTRODUCTION

Summary Information

This SDS has been produced by BWB Consulting on behalf of CP Logistics UK Reading Propco Limited in respect of a site located to the north of the A4 in Theale, Reading, approximate grid reference SU647714. The proposed development is anticipated to comprise the construction of a new student accommodation complex.

This report sets out the principles for the maintenance and management of the Sustainable Drainage Systems (SuDS) proposed for the site. Regular inspections and maintenance are crucial for the effective operation of green infrastructure.

This MP should be read in conjunction with the BWB Flood Risk Assessment (FRA) ref: THR-BWB-ZZ-XX-RP-YE-0001_FRA and Sustainable Drainage Statement (SDS) ref: THR-BWB-ZZ-XX-RP-CD-0001_SDS produced as part of the planning application.

Limitations

This report has been prepared for the sole use of the Client. No other third parties may rely upon or reproduce the contents of this report without the written permission of BWB. If any unauthorised third party comes into possession of this report, they rely on it at their own risk and the authors do not owe them any Duty of Care or Skill.

This document is for information only and is based on the general maintenance expectations for the Project specified and the SuDS features proposed. The details contained herein are based on the general requirements for operation and maintenance based on the CIRIA C753 'The SuDS Manual' dated 2015. The specific requirements of each feature will need to be considered and reviewed by the Adopting Local Highway Authority based on their requirements.

Inspection and maintenance aspects noted in this document will need to be reviewed and revised as necessary depending on the in-use performance and the information presented should be considered as a guide only.

.

2. THE SITE

Site Location

The site is located at Theale, in Reading located at national grid reference SU. 647 714 The location of the site is shown in Figure 2.1.

Figure 2.1: Site Location Plan

Site Description

The site forms an irregular shaped plot of land covering approximately 0.9 hectares. The topography varies across the site decreasing in elevation from northwest to southeast.

The ground cover is generally open grassland with overgrown vegetation and several trees in the east and south.

The site is currently agricultural and appears to be entirely permeable based on available aerial imagery. An unnamed ordinary watercourse cuts through the site, from the culvert underneath the M4 to the culvert underneath the A4. The route of the watercourse is illustrated in **Figure 2.1.**

Table 2.1: Site Details

Site Name	Land to the North of the A4
Location	Theale
NGR (approx.)	SU647714
Application Site Area (ha)	5.43
Development Type	3.89
Lead Local Flood Authority	Commercial
Local Planning Authority	West Berkshire Council
Sewerage Undertaker	West Berkshire Council
	Thames Water

Proposed Development

The development proposals are for two warehouse units with first floor office space. Each warehouse is accompanied by a service yard area, car parking spaces and associated landscaping.

Proposed Surface Water Drainage Design

The proposed surface water drainage strategy incorporates SuDS which aim to reduce the impact of the development by replicating the natural runoff regime in a sustainable, cost-effective manner, whilst protecting water quality and reducing pollution.

The proposed drainage design has been developed using 15.0 l/s discharge as a maximum discharge rate for all storm events up to and including the 1 in 100 year plus 40% climate change event with attenuation storage being included to facilitate this.

The primary storage features proposed on site are a detention basin and below ground geo-cellular storage. The proposed detention basin will be generally dry and vegetated to treat runoff as it is conveyed and filtered across the base of the basin.

Although not strictly a requirement, a minimum of a 1m maintenance strip has been provided around each basin. The constraints of the site are such that a maintenance strip greater than this is difficult to achieve.

Below ground storage has been proposed in areas where there is all round easy access, to allow for maintenance and inspections.

Basins may be fenced off for safety purposes. This fencing should be designed so as to not impede access for maintenance requirements.

3. SuDS Management and Maintenance

During the development period and thereafter a maintenance and management regime will be adopted. The establishment and future success of the site is largely dependent on the standard and frequency of the subsequent maintenance and management it receives.

Maintenance responsibility should always be placed with an appropriate, long-term, accountable organisation. This often takes the form of a local or county council, sewerage undertaker or Management Companies. In this case, it is assumed a Management Company will be adopted.

The sustainable drainage measures proposed for the scheme include:

- Soft landscaping
- Rainwater Harvesting
- Proprietary treatment systems
- Filter strips
- Filter drains
- Swales
- Trees
- Attenuation storage tanks
- Detention basins

The above SuDS features are supported by trapped gullies and nominal kerb drainage.

A specification for inspection and maintenance actions, including frequency of maintenance tasks required for each proposed SuDS, setting out a minimum standard to which the SuDS system must be maintained. This will include information relating to:

- Schedule of cleaning
- Inspection
- General repair and maintenance
- Replacement details and lifespan

For guidance relating to the maintenance of SuDS refer to the CIRIA C753 SuDS Manual[1], Part D and Part E Chapter 36. Also refer to CIRIA C753 SuDS Manual, Appendix B, Section B.8 for an indicative Maintenance Plan and Checklist.

Generally, maintenance will be in accordance with the specific requirements of each feature which are summarised, in high level terms in **Appendix 1**.

[1] The SuDS Manual C753" by CIRIA, 2015

Maintenance may require the input of specialists including proprietary suppliers and Landscape Architects / Installers / specialist consultants.

4. CONCLUSION AND RECOMMENDATIONS

BWB Consulting (BWB) was instructed by CP Logistics UK Reading Propco Limited (the Client) to carry out a Sustainable Drainage Strategy (SDS).

This document illustrates how a sustainable drainage strategy can be achieved for the site wide development, with the aim of achieving a viable, manageable, phased development to suit the development programme and the sustainable aspirations of the Client.

This document and supporting appendices demonstrate that the preliminary drainage proposed will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

In order to comply with the premise of the SDS, discharge rates from the entire site will be limited to the rate agreed with Thames Water of 15.0l/s.

To facilitate the restricted discharge rate attenuation will be provided below ground within the existing water features on the site, and supplemented where / if necessary, on plot.

Foul flows will be conveyed to the existing sewers within the vicinity of the site using new connections. Additional investigation will be required to confirm the exact location, level and available capacity of the existing connections into the Site and the wider public infrastructure network.

Finished levels have been engineered to ensure falls are away from buildings and building access points where possible and to provide positive drainage to prevent ponding. The risk of accumulation of standing water against the buildings would therefore be minimised.

The preliminary flood exceedance routing indicates that flood volumes for the current design proposal can be managed through detailed design to direct flows via infrastructure and public open space to the water features and ultimate to the Manchester Ship Canal without causing flooding to the proposed buildings or to 3rd party land.

It is envisaged that the final drainage strategy will be determined during the detailed design stage, as the development layout is finalised.

APPENDICES

APPENDIX 1: General SuDS Operation and Maintenance Requirements

General Soft Landscaping

In the first 12 months from the date of practical completion, all planted areas should be carefully maintained, including: watering, cutting, pruning, firming, adjusting stakes/ties, applying only approved chemicals and clearing weeds and litter. The frequency of this maintenance will be determined based on the previous conditions reported on site. This approach will ensure that the new vegetation around the watercourse establishes as quickly as possible, to aid slope stability and limit soil erosion.

Ongoing Maintenance

Management thereafter should follow the below guidance recorded in **Table A**. This guidance has been informed by The SuDS Manual2 and while extensive, it is not exhaustive. Reasonable judgement of the landscape operative and/or civil engineer should be used, and anything thought to be of note on the site should be recorded and actioned as required.

[2] The SuDS Manual (CIRIA, 2015)

Table A: Maintenance of Soft Landscaping

Maintenance Schedule	Required Action	By Whom?	Typical Frequency
Regular Inspection	Remove litter and debris	Landscape Operative	Monthly, or as required
	Cut grass (where required) *	Landscape Operative	Monthly (during growing season), or as required
	Manage vegetation: fertilising, watering, remove nuisance plants, prune and trim trees etc (subject to nesting bird season)	Landscape Operative	Monthly (during initial phase of growth), then as required
	Inspect warning signs/lifebelts (where necessary)	Landscape Operative	Bi-monthly
	Inspect banks checking for signs of settlement, seepage, wet patches, and erosion and inside and outside faces, damage by animals or vegetation. Monitor or take appropriate remedial action if required	Civil Engineer	Monthly, or after a large storm
Occasional Maintenance	Re-seed areas of poor vegetation growth	Landscape Operative	As required
	Check for signs of siltation, and erosion of detention basin banks. Monitor or take appropriate remedial action if required	Civil Engineer	Every 6 months for first two years after construction, then as required
	Removal of accumulated inorganic and organic silt using suitable tracked machinery	Suitably Trained Staff	Every 3 years, or as required
Remedial Actions	Re-level uneven surfaces and reinstate design levels	Civil Engineer	As required

*It is recommended that where possible grass is cut to a length of 75-150mm to assist in filtering out pollutants and sediments from the water.

Rainwater Harvesting

Operation and maintenance shall be in accordance with the tank manufacturers guidance and warranty requirements and will be product specific. Generally:

Table B: Maintenance of Proprietary Below Ground Tank

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspection of the tank for debris and sediment build up including inlets, outlets, pumps, filters etc.	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris.	Annually (and following poor performance)
Occasional maintenance	Cleaning and / or replacement of filters	Three monthly or as required
Remedial Actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs / replacement	As required

Proprietary Treatment Systems

Various types of proprietary treatment systems are available, although the most common are:

- Bioretention in concrete (or other material) structures – filtration using soil or other materials to support plants a
- Treatment channels designed to collect and treat water rather than convey.
- Hydrodynamic or vortex separators using gravity and centrifugal force to separate and collect sediments and litter.
- Proprietary filtration systems to filter water though filter media.
- Oil separators designed to separate large volumes of oils, silt and suspended solids from water.
- Multi process systems which use multiple treatment processes in series.

Table C: Maintenance of Filter Strips

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris and inspect for sediment oil and grease.	Six monthly
	Change the filter media	As recommended by the manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spills
Occasional Maintenance	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first six months of operation then every six months

Filter strips

Operation and maintenance in accordance with local authority requirements where Adopted. Generally:

Table D: Maintenance of Filter Strips

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly or as required
	Grass cutting – to retain grass height within specified design range	Monthly during growing season or as required.
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (e.g., oils)	Monthly at start then half yearly
	Check flow spreader and filter strip surface for even gradients	Monthly at start then half yearly
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly at start then half yearly
	Inspect sill accumulation rates and establish appropriate removal frequencies.	Monthly at start then 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% of filter strip area.
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required

	Re-level uneven surfaces and reinstate designed levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction 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 petrol residues using safe standard practices	As required

Filter Drains

Operation and maintenance in accordance with local authority and/or water authority requirements where Adopted or in accordance with the Landscape Architects' specification and / or Clients' maintenance team requirements where to remain private (not adopted). Generally:

Table E: Maintenance of Filter Drains

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly or as required
	Inspect filter drain surface, inlet / outlet pipework and control systems for blockage, clogging, standing water and structural damage.	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies.	Half yearly
	Remove sediment from pre-treatment devices.	Half yearly or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain using recommended methods (e.g., NJUG, 2007 or BS 3998:2110)	As required
	At locations with high pollution loads remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly or as required
	Clear perforated pipework of blockages	As required

Swales

Operation and maintenance in accordance with local authority and/or water authority requirements where Adopted or in accordance with the Landscape Architects' specification and / or Clients' maintenance team requirements where to remain private (not adopted).

Table F: Maintenance of Swales

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly or as required
	Grass cutting – to retain grass height within specified design range	Monthly during growing season or as required.
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	Inspect inlets, outlets and overflows for blockages and clear if required.	Monthly
	Inspection infiltration surface for ponding, compaction, silt accumulation, and record areas where water is ponding for >48 hours	Monthly or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish 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% of filter strip area.
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required

	Re-level uneven surfaces and reinstate designed levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction 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 petrol residues using safe standard practices	As required

Trees

Maintenance requirements of trees will be dependent on species, location, growth rate and age. Specific maintenance of all soft landscaping including trees and hedge species will be confirmed in the landscape maintenance plan.

Maintenance will typically be greatest during the first few years after planting when the vegetation is becoming established. Specific maintenance needs of tree pits and planters should be monitored closely, and maintenance schedules should be reviewed regularly to ensure planting remains productive.

Table G: Maintenance of Trees

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start and then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional Maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually or as required
	Water	As required (during periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Proprietary below ground Tank (including geocellular storage)

Operation and maintenance shall be in accordance with the tank manufacturers guidance and warranty requirements and will be product specific. Generally:

Table H: Maintenance of Proprietary Below Ground 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 three months then annually
	Remove debris from the catchment surface.	Monthly
	For systems where infiltration enters into the tank from the above, check surface of filter material for blockage by sediment, algae or other material; remove and replace surface infiltration material as required.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually or as required.
Remedial Actions	Repair / rehabilitate inlets, outlets, overflows and vents	Annually or 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

Detention Basins

Operation and maintenance in accordance with local authority and/or water authority requirements where Adopted or in accordance with the Landscape Architects' specification and / or Clients' maintenance team requirements where to remain private (not adopted).

Table I: Maintenance of Detention Basins

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly
	Grass cutting – for spillways and access routes	Monthly during growing season or as required.
	Grass cutting – meadow grass in and around basin	Half yearly (spring before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	Inspect inlets, outlets and overflows for blockages and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for any evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly for first year then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually or as required

	Manage wetland plants in outlet pool – where provided.	Annually
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years or as required (likely to be minimal requirements where effective upstream source control is provided.
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair / rehabilitation of inlets, outlets and overflows	As required
	Re-level uneven surfaces and reinstate design levels	As required

Operation and Maintenance Requirements of the General Drainage Features

For the proposed drainage systems to perform effectively, it is essential that all inlet, outlets, flow control devices, gullies, pipes and manhole structures are monitored to ensure they remain operational. Any specific manufacturer recommendations should be adhered to in the first instance.

Following CIRIA guidance[3], during operational monitoring, the structures should be assessed against a range of criteria: condition, structural performance, hydraulic performance, environmental performance and health and safety.

Initial Inspections

In the months following construction, silt runoff and erosion will need to be managed rigorously until the disturbed soils have stabilised (through vegetation or other methods) to ensure structures do not become blocked. The frequency of inspections during this period should be determined based on the previous conditions reported on site and silt removal should be undertaken as required.

Ongoing Maintenance

The maintenance guidance for the drainage features on site is recorded in **Table J**. In line with CIRIA definitions, inspections are separated into two categories, General and Principle, which are defined as follows:

- A general inspection is the examination of all parts of a structure that can be inspected without specialist equipment.
- A principal inspection is defined as a close examination of all accessible parts, including adjacent earthworks, with man-entry or CCTV inspection taking place. (Pressure jetting may be required prior to CCTV inspection).

Table J: Maintenance of Drainage System

Maintenance Schedule	Required Action	By Whom?	Typical Frequency
Regular Inspection	Remove litter and debris	Landscape Operative	Monthly, or as required
	General inspection of vortex flow control devices	Landscape Operative	Every 6 months, or after a large storm
	General inspection of inlet/outlet structures	Landscape Operative	Every 6 months, or after a large storm
Occasional Maintenance	Principle inspection (CCTV or Man-Entry)	Suitably Trained Staff	Every 5 years, or as required

[3] Culvert, screen and outfall manual (CIRIA, 2019)

Remedial Actions	Blockage clearances	Civil Engineer	As required

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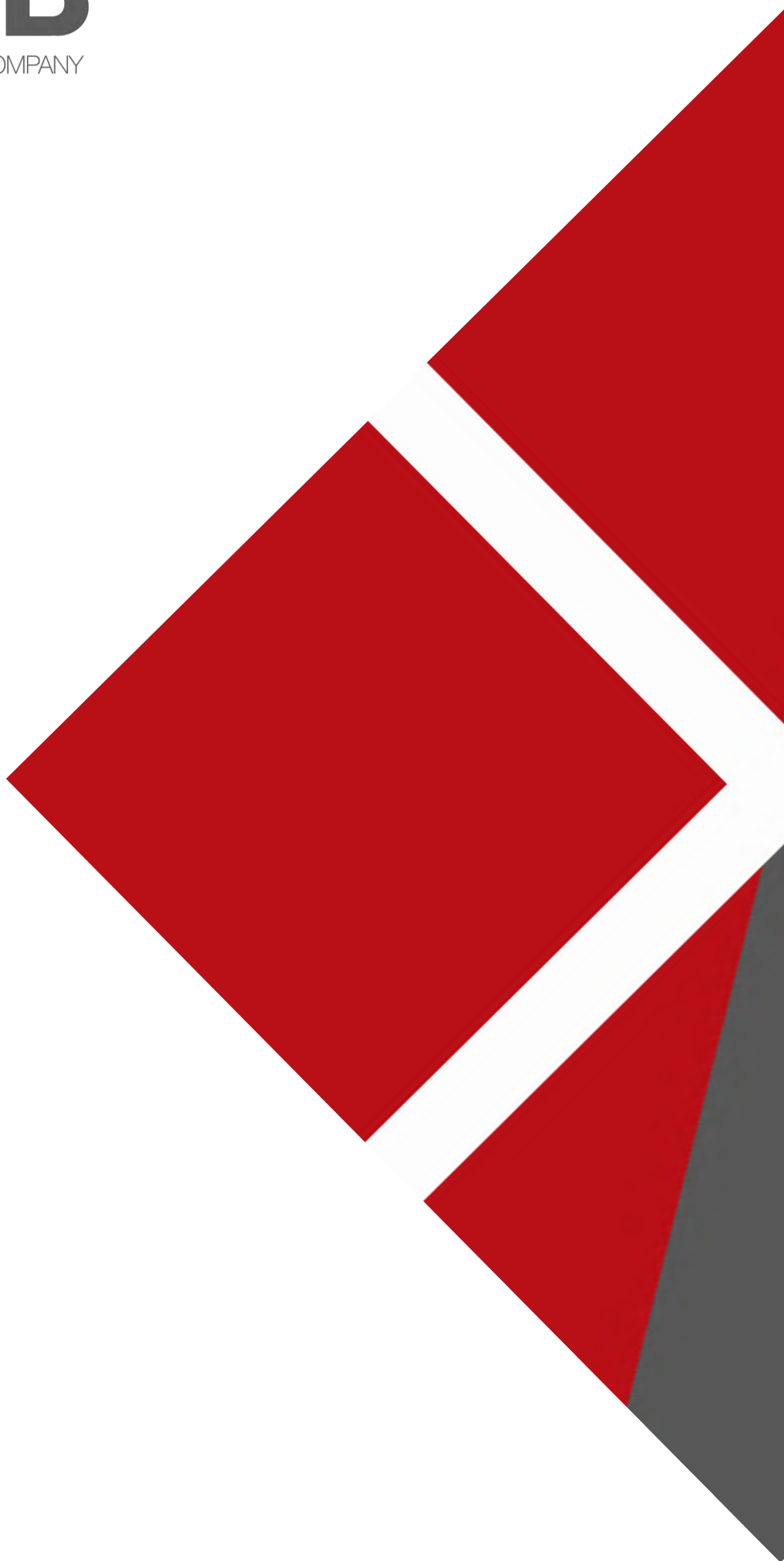

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