

49, 51 & 53 Rowden Hill, Chippenham

Drainage Strategy and Flood Risk Assessment

For: Rowden Hill Holdings Ltd

Date: 03/10/2025

File Ref: 19979-TUM-RP-XXX-0001



Document Control

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Executive Summary

Tumu Consulting Ltd have been appointed by Rowden Hill Holdings Ltd to undertake a Drainage Strategy and Flood Risk Assessment for a proposed renovation of 3 buildings, and development of self-build residential dwellings (Class C3), with associated landscaping and infrastructure, at 49, 51 & 53 Rowden Hill, Chippenham.

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1 Introduction

Tumu Consulting Ltd have been appointed by Rowden Hill Holdings Ltd to undertake a Drainage Strategy and Flood Risk Assessment for a proposed development to provide a number of Residential Dwellings (Class C3), with associated landscaping and parking at 49, 51 & 53 Rowden Hill, Chippenham. The report will support a hybrid planning application, where a number of self-build plots are proposed to the south of the site, which will be considered for outline planning. The renovation and development of the supporting infrastructure, including the access road and basin, will form part of the full planning application.

1.1 Site Location

The site is located at The Land West of Chippenham, Community Hospital, Rowden Hill, Chippenham, SN15 2AJ. The Easting Northing coordinates for the site are 391174, 172632 and the OS reference is ST911726. The total area of the site is 1.06ha.



Figure 1-1 Site Location Plan

1.2 Existing Site Usage

The existing site consists of a number of Grade II listed buildings, which used to form part of the wider Chippenham Hospital site, these buildings are currently unoccupied. To the west of the buildings, and forming the majority of the site, is a parcel of greenfield land.

1.3 Topography

A topographic survey was conducted in December 2022 by Brunel Surveys ref:25004-200-01 , Refer to Appendix A.

It was found that the site falls east-west with the highest point on site being 66.08mAOD in the north-eastern corner and the lowest point on site being 56.87mAOD in the south-western corner. Levels across site generally fall

at a gradient of 1 in 40 at the shallowest, and 1 in 3 at the steepest, with multiple areas of banking across the site. The total site captures an area of approximately 1.3ha.

1.4 Geology & Hydrogeology

The site is predominantly underlain by a bedrock geology of the Kellaways Formation, a grey mudstone.

The site is located within Source Protection Zone 2, the Outer Protection Zone.

BRE365 compliant infiltration testing has been undertaken by Firm Foundations Bristol Ltd. Test pits were filled with water and did not drain away in time for a rate to be calculated from the first tests in each pit. Therefore, it is considered that soakaways are not a viable discharge receptor for drainage from the development. A groundwater test pit was also dug, which found no ingress of groundwater during the testing. Refer to Appendix B for the BRE365 infiltration testing results.

1.5 Hydrology

The nearest watercourse to the site is Ladyfield Brook, flowing north-to-south approximately 140m east of the site boundary.

The nearest main river to the site is the River Avon, flowing north-to-south 700m to the west.

1.6 Existing Drainage

Wessex Water Network Maps and a Drainage and Water search produced on 21/12/2025 and conducted by CON29DW shows there are no recorded public sewers passing through the site. The nearest public foul sewer flows east-to-west beneath the A4 immediately north of the site. The nearest surface water sewer flows north-to-south beneath the A4 to the west of the site.

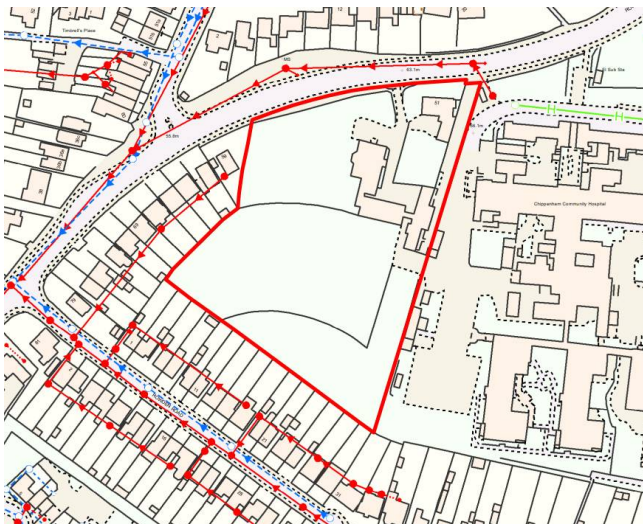


Figure 1-2 Wessex Water Asset Maps

A CCTV drainage survey has been undertaken by Point Surveys Ltd ref: 2260 which found private foul, surface and combined networks serving the development. Large parts of the drainage systems were heavily silted, with buried covers prominent. Outfalls to chambers within Rowden Hill were located, however surveying within Rowden Hill wasn't possible due to no Traffic Management. It is anticipated that the site discharges to the Wessex Water Foul Sewer. The Wessex Water Sewers were also surveyed where, to confirm chamber locations and associated depths. The surface water sewer was found to be heavily silted. Refer to Appendix C for CCTV Survey Plan.

1.7 Existing Discharge Rates

As shown by the CCTV survey, the existing listed buildings and associated hardstanding discharge into the Wessex Water sewerage network. FEH22 rainfall intensity data, has been utilised in the Modified Rationale Method, to calculate the existing discharge rate of the development. The rainfall intensity for the 15-minute storm has been considered, which is appropriate considering the size of the existing development.

Return Period (yr)	Rainfall Intensity, R_i (mm/hr)	Area, A (ha)	Brownfield Discharge Rate (l/s)
Q_2	27.32	0.148	11.2
Q_{30}	70.64	0.148	29.1
Q_{100}	90.56	0.148	37.3

Table 1-1 Existing Brownfield Discharge Rates

2 Development Proposals

2.1 Description of the Proposed Works

It is proposed that the Grade 2 listed buildings be updated for residential use, the later accretions be removed, and new residential units are proposed across the site. This will be accompanied by the landscaping and associated infrastructure across the site. The highway serving the site is to be offered for adoption.

2.2 Flood Risk Vulnerability Classification

In accordance with Table D2 of the NPPF, residential usage as dwellings is classified as 'more vulnerable'.

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Figure 2-1 Annex 3 of the NPPF Flood Risk Vulnerability Classification

2.3 Design Life

As the use of the site is residential, it is anticipated that the design life of the site will be 100 years.

3 Flood Risk Assessment

As the suite boundary encompasses a total site area greater than 1.0ha, a Flood Risk Assessment has been undertaken in order to identify any flood risk that the site may experience. Readily available desktop sources such as the Flood Map for Planning, as well as the Long Term Flood Risk Maps, have been consulted for the assessment. The Wiltshire Council Level 1 Strategic Flood Risk Assessment has been consulted for specific flood risk to Wiltshire.

3.1 Flood Map for Planning

The EA's Flood Map for Planning shows the site to be situated in Flood Zone 1 as shown in Figure 3-1. Flood Zone 1 signifies that the annual probability of fluvial and tidal flooding is less than 0.1%. Therefore, there is a low risk of fluvial flooding onsite. The nearest point of fluvial and tidal flood risk is approximately 225m to the south west, where its extents are amplified when considering climate change; Pudding Brook is the source of the flood risk, however is at a much lower elevation to the proposed site.



Figure 3-1 Flood Map for Planning

3.2 Surface Water Flood Risk

According to the EA's Long Term Flood Risk Data, the annual risk of surface water flooding for the 2040-2060 epoch is shown to be very low across the vast majority of the site with a small area on the south-western border classified as having a high risk. This area of high risk is a natural low point in the surrounding topography. With the introduction of a surface water drainage system, the flows contributing to this surface water flood risk, as overland flows, will be reduced.



Surface water map

Yearly chance of flooding

○ Flood area (extent)

Yearly chance of flooding between 2040 and 2060

● Flood area (extent)

■ High chance

■ Medium chance

■ Low chance

Figure 3-2 Surface Water Flood Risk Map (2040-2060 epoch)

Therefore, it is considered that there is predominantly a low risk of surface water flooding on site, and this will continue into the 2040-2060 time period barring a small area on the south-west border.

3.3 Sewers: Combined, Foul, or Surface Water Flood Risk

According to the commercial drainage and water search, the site is not recorded as being at risk of flooding due to overloaded public sewers. If any sewer within Rowden Hill were to flood, the flows would flow west down the road, following the road topography, and bypass the site.

3.4 Groundwater Flood Risk

According to Gov.UK Long Term Flood Risk Data, flooding from groundwater has been determined unlikely.

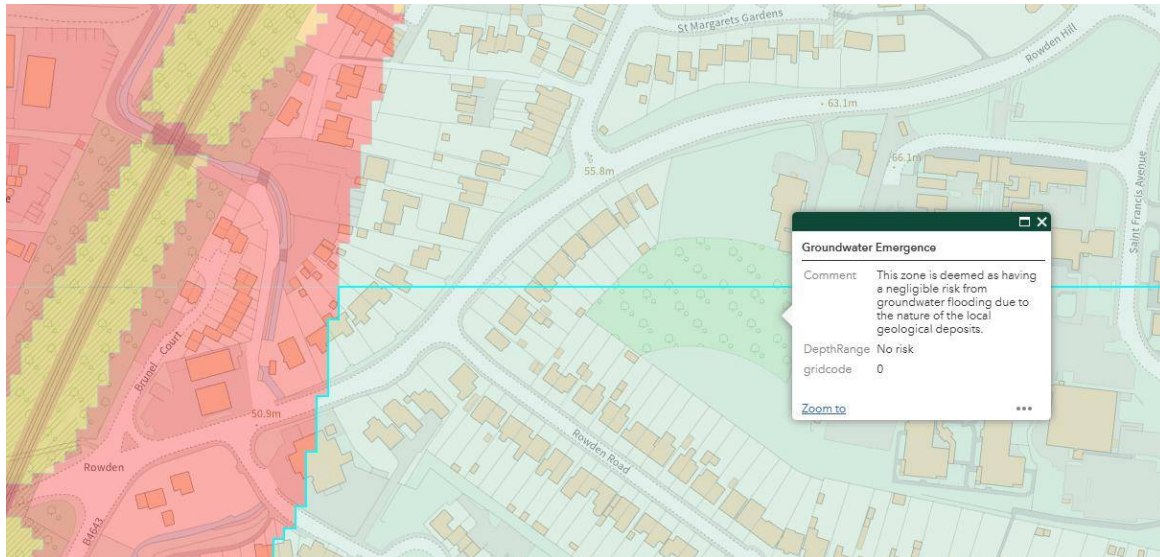


Figure 3-3 Wiltshire Council Level 1 SFRA – Groundwater Emergence

The Wiltshire Council Level 1 SFRA in the figure above describes the site as at 'no risk' of groundwater emergence.

3.5 Reservoirs, Canals, & Other Artificial Sources

According to Gov.UK Long Term Flood Risk Data, there is no risk of reservoir flooding as shown in Figure 3-4.

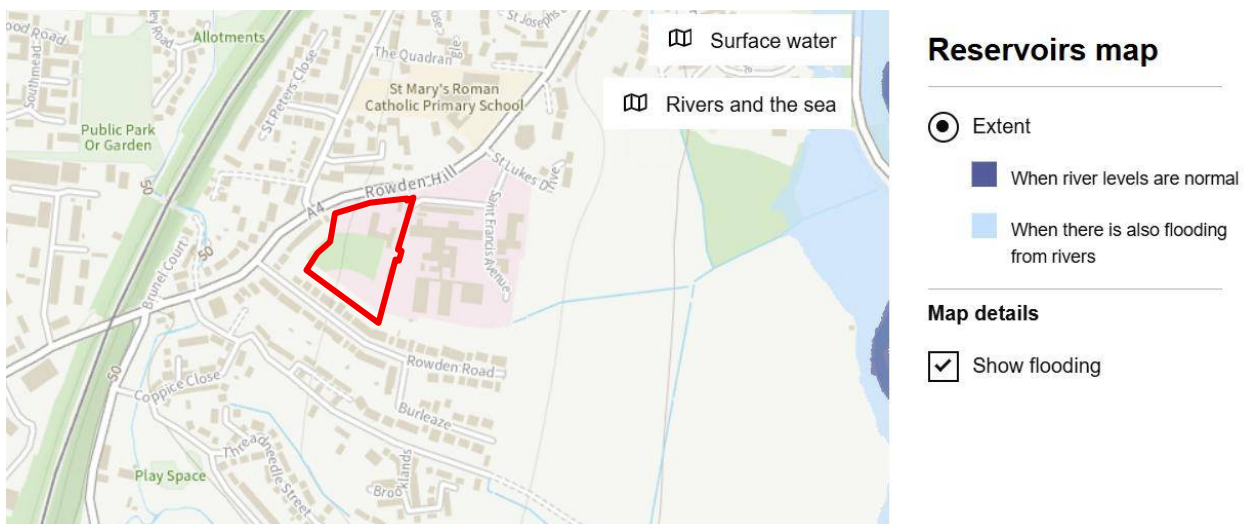


Figure 3-4 Reservoir Flood Risk Map

3.6 Flood Zone Compatibility of Development

As the development is located within Flood Zone 1, an sequential and exception test are not required.

4 Surface Water Drainage Strategy

The surface water drainage strategy has been developed in accordance with the relevant design standard and guidance, including but not limited to; CIRIA C753 The SuDS Manual, The Approved Documents: Building Regulations 2010 Part H: Drainage and Waste Disposal, and the Non-Statutory Technical Standards for SuDS (NTSS).

The NTSS states that for a previously developed site, the rate of discharge should never exceed the rate pre redevelopment. The NTSS also states that flooding should not occur to any part of the site in the 1 in 30 year event, and no flooding to buildings or utility plant should occur in the 1 in 100 year event.

Refer to Appendix D for the Proposed Drainage Strategy, and Appendix F for the Standard Drainage Details.

4.1 Surface Water Drainage Arrangement

In line with the surface water drainage discharge hierarchy, consideration should be given to discharge in order of priority to: Soakaways/Infiltrating Drainage system, Watercourse, Public Surface Water Sewer then finally, Public Combined Sewer.

Infiltration has been ruled out as a discharge receptor of surface water due to the poor soakage rates as described in section 1.4.

Watercourses have been ruled out as a discharge receptor as there are no watercourse within a reasonable proximity to the site.

A 300mm Wessex Water surface water sewer is located in the verge, at the junction between Rowden Hill and Lowden, which has been selected as the discharge receptor for the surface water flow. A S104 agreement will be required with Wessex Water for the adoption of surface water sewers within the adopted highway on site, as well as for the laying of surface water sewers within Rowden Hill.

Private surface water plot drainage will discharge into the surface water sewer, before being conveyed to a shared basin. A hydrobrake will restrict the flow rate, before discharging down Rowden Hill and into the existing Wessex Water surface water sewer.

4.2 Climate Change

As a lifespan of 100 years is being considered, the end of life can be estimated as 2125. According to government guidance, a development with a lifespan after 2100 should use the Central Allowance for a 2070's epoch when considering peak rainfall climate change allowances. For the Avon Bristol and North Somerset Streams Management Catchment, the climate change allowance to consider should be 40% for the 3.3%, and 45% for the 1% AEP events as shown in Figure 4-1 below. As well as the climate change allowance, an additional 10% allowance for urban creep has been considered.

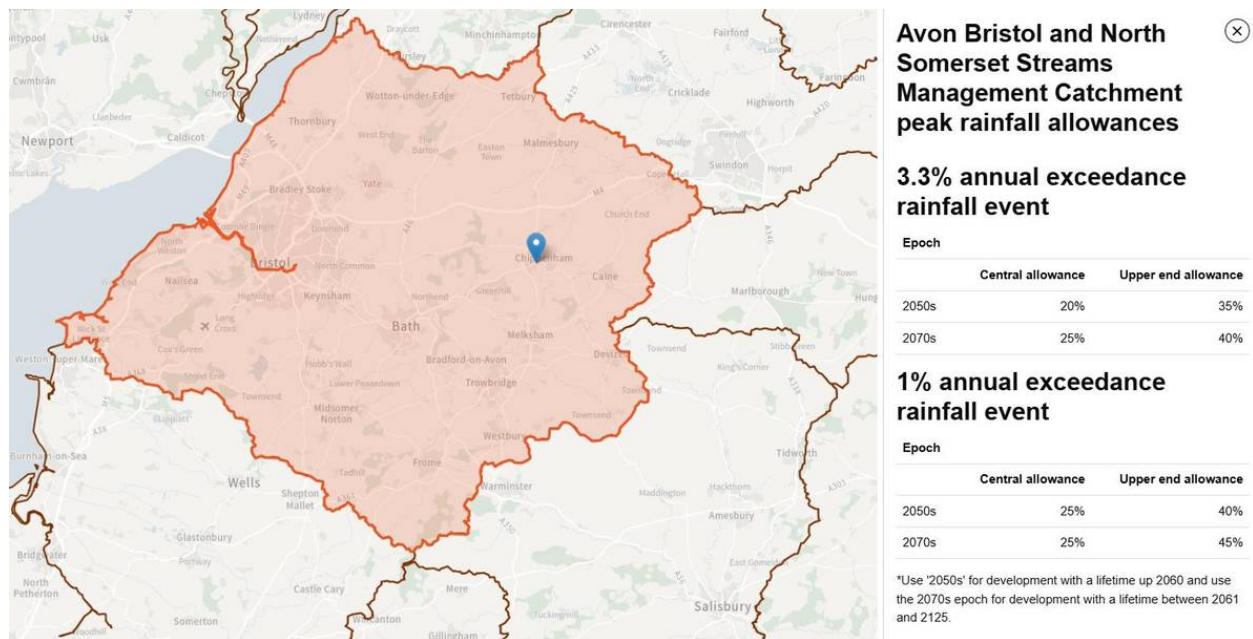


Figure 4-1 Avon Bristol and North Somerset Streams Management Catchment Peak Rainfall Allowances

4.3 Discharge Rates

A pre-development enquiry was undertaken to Wessex Water was undertaken to ensure capacity within their sewer for the proposed surface water discharge. It was agreed a discharge rate of 5.0l/s could be accommodated within their network, for a previously developed brownfield site. Refer to Appendix F for the correspondence with Wessex Water. Flows which were previously entering sewer designated as foul, will be directed to the surface water sewer, west of the site. This will provide greater capacity within the existing Wessex Water foul sewer.

Rainfall Event	Pre-Development Discharge Rate (l/s)	Post-Development Discharge Rate (l/s)	Betterment (%)
Q ₂	11.2	5.0	55
Q _{30+40%}	29.1	5.0	82
Q _{100+45%}	37.3	5.0	85

Table 4-1 Pre and Post Development Discharge Rates from the Development

Table 4-1 above shows a reduction in discharge rate as a result of the development, in the order of a minimum of 55% in the 2 year rainfall event. The betterment increases to 85% in the 100 year rainfall event, additionally considering climate change and urban creep.

4.4 Calculations

A network model of the proposed surface water drainage system was developed using Causeway FLOW software. The Cv value has been set to 1.0 for the analysis. The calculations, which can be found in Appendix G, demonstrate that there is no flooding in the system for the 3.3% AEP rainfall event with a 40% allowance for climate change, and an additional 10% allowance for urban creep.

Minor flooding has been experienced at node SW.07 in the 1% AEP rainfall event with a 45% climate change allowance, and 10% allowance for urban creep. However this will be contained on site.

4.5 Water Quality

The CIRIA 753 SuDS Manual has been consulted to ensure that the SuDS provided successfully mitigate the anticipated pollutants, which may arise from the proposed land use. Table 26.2 of CIRIA 753 outlines the pollution hazard indices for the anticipated land use type. These are outlined below in Table 4-2.

Land Use	Pollution Hazard Level	TSS	Metals	Hydrocarbons
Low Traffic Road	Low	0.5	0.4	0.4

Table 4-2 CIRIA 753 Table 26.2 Pollution Hazard Indices for a Low Traffic Road

Table 26.3 of CIRIA 753 outlines the mitigation indices for SuDS which can mitigate the pollution indices above. The mitigation indices for permeable paving have been outlined below in Table 4-3.

SuDS Component	TSS	Metals	Hydrocarbons
Detention Basin	0.5	0.5	0.6

Table 4-3 CIRIA 753 Table 26.3 Mitigation Indices for a Detention Basin.

As the mitigation indices are equal or greater than the pollution hazard indices, the detention basin will successfully mitigate against the expected pollutants.

4.6 Flood Exceedance

As discussed in section 4.4, approximately 4.75m³ of surface water flooding was experienced in node SW.07 in the 1% AEP event with a 45% allowance for climate change and 10% allowance for urban creep. The exceedance flows will be routed to the gullies which serve the proposed road, where flows will be intercepted. In the event that gullies can not intercept the exceedance routes, a dropped kerb will be located adjacent to the basin, at the low point of the road, which will allow exceedance flows to discharge directly into the basin. No utility or structure will be affected by the minor surface water flooding, and will be retained on site.

4.7 Maintenance Arrangements

Drainage elements serving the access road will adopted by the relevant undertaker, being either Wiltshire Highways or Wessex Water, depending at what point plot drainage discharges into the system. Private shared drainage features, such as the basin will be maintained under a management company selected by the client.

Operation and maintenance will be undertaken in accordance with the recommendations outlined in the SuDS Manual (CIRIA C753), provided in Tables 4-4 and 4-5.

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Inspect surface structures, removing obstructions and silt as necessary. Check there is no physical damage.	Monthly
	Remove cover and inspect, ensuring water is flowing freely and that the exit route for water is unobstructed. Remove any debris and silt	Annually
	Undertake inspection after leaf fall in autumn.	
	Jet the pipes leading from overflow structures and check water is going through the overflow	Annually
Remedial Actions	Repair physical damage	As required

Table 4-4 Operation and Maintenance Requirements for Inlets, Outlets, Controls, and Inspection Chambers.

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Monthly at start, then as required
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies, undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices eg penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from waters edge to a minimum of 1m above water level	Annually
Occasional maintenance	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of the ponds without sediment forebays	Every 5 years, or as required
	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets, outlets and overflows	As required

Table 4-5 Operation and Maintenance Requirements for Detention Basins

5 Foul Water Drainage Strategy

The foul water drainage strategy has been designed in accordance with The Approved Documents: Building Regulations 2010 Part H: Drainage and Waste Disposal, and the Appendix C of the Dersing and Construction Guidance (DCG) for foul and surface water sewers offered for adoption . The majority of the development will discharge foul flows into a new proposed foul water sewer which is located on the main access road, which will be offered for adoption as part of a S104 agreement. Foul plot drainage will remain private and discharge into the sewer. Where feasible, existing foul drainage will be utilised.

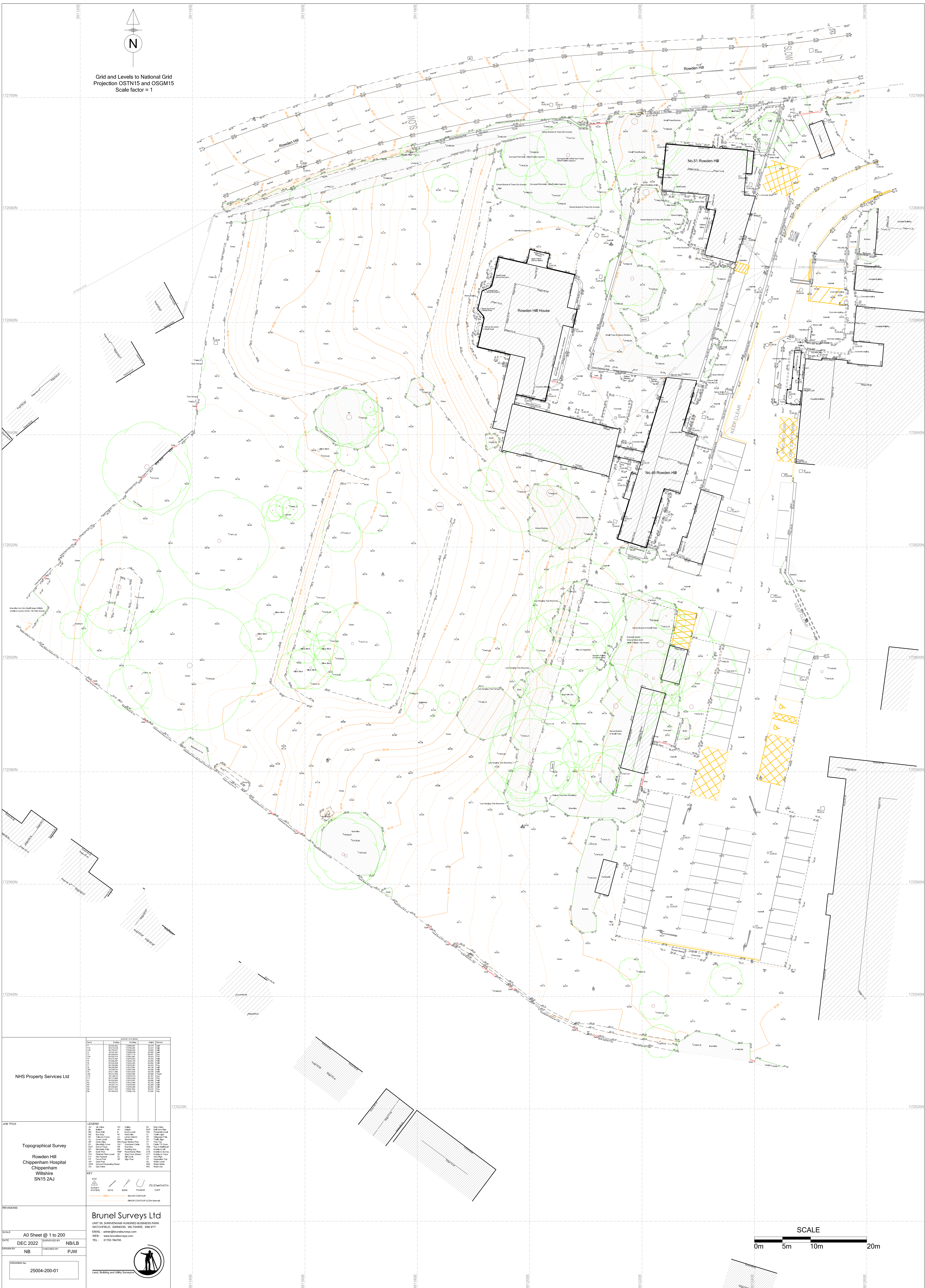
Wessex Water were consulted as part of a pre-development enquiry. It was confirmed that there was capacity within their 225mm foul sewer for the proposed development. Refer to Appendix F for the Wessex Water correspondence.

6 Conclusion

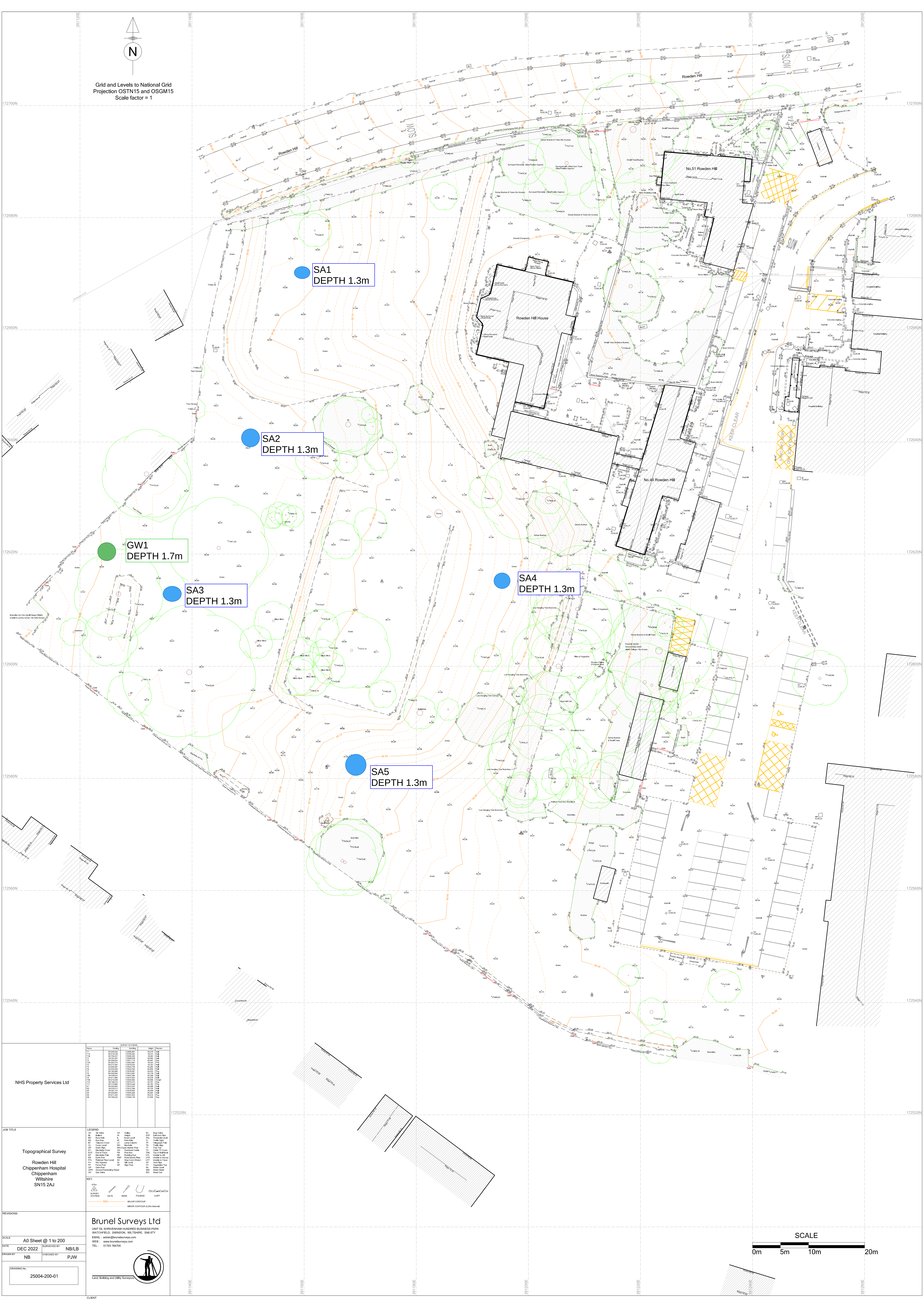
- The site is at a low risk of all types of flooding.
- Private plot drainage will re-route existing surface water connections, as well as provide new drainage for the self builds plot, to a proposed surface water sewer within the adopted road. This will then discharge to a detention basin which has been sized to discharge at 5.0l/s for the 1% AEP rainfall event with a 45% allowance for climate change and 10% allowance for urban creep. The site ultimately discharges at the controlled rate to the Wessex Water Surface Sewer within Rowden Hill.
- The detention basin proposed, has higher SuDS mitigation indices than the pollution hazard indices anticipated from the proposed land use type.
- Flood exceedance flows will be intercepted by gullies within the adopted road serving the site. A dropped kerb will provide a flow route into the basin, if the gullies do not intercept the flow.
- A foul sewer is proposed within the adoptable access road, which will convey private plot drainage to the Wessex Water Foul Sewer within Rowden Hill.
- It is proposed to offer maintenance responsibilities for adoption under a S104 agreement for the proposed sewers within the adopted road. Shared drainage features such as the basin will be maintained by a management company, selected by the developer. Plot drainage serving individual properties will be maintained by the property owner.

It is concluded that the development can be undertaken in a sustainable manner without increasing the flood risk to the proposed development or to existing properties/systems.

Appendix A – Topographic Survey



Appendix B – BRE365 Infiltration Testing Results



NHS Property Services Ltd

Topographical Survey

Rowden Hill
Chippenham Hospital
Chippenham
Wiltshire
SN15 2AJ

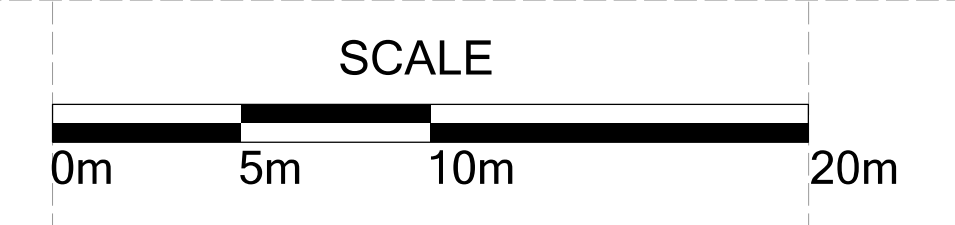
LEGEND

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365

Client	Rowden Hill Holdings Ltd
Site	49, 51 & 53 Rowden Hill, Chippenham
Project No.	19979
Test date	01-Sep-25
Test supervised by	Andrew Mounterj

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (mm)
0	975
112	615
171	565
1215	430
1328	425

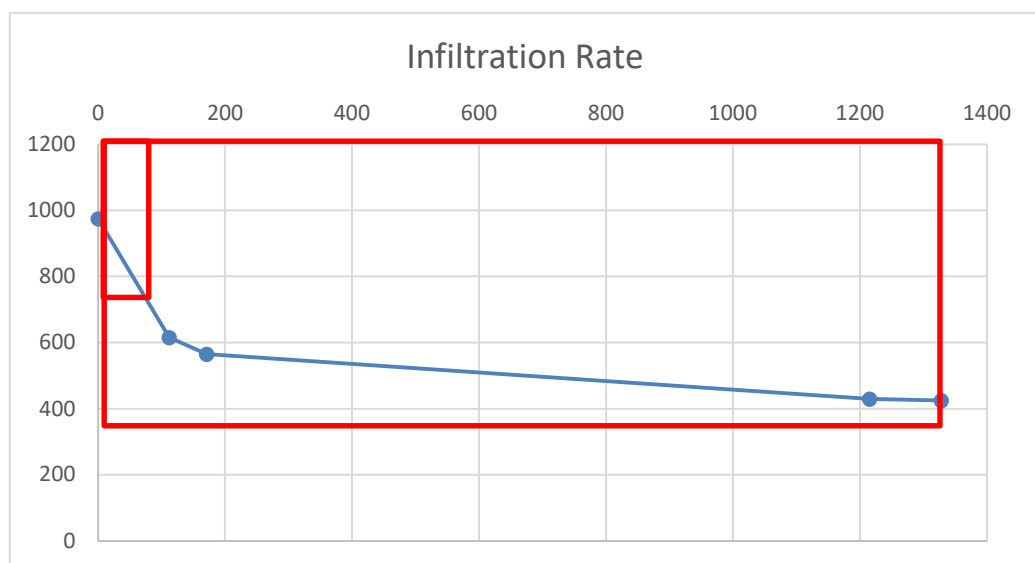
Trial pit/Test No.	SA1/1
Length (m)	1.400
Width (m)	0.300
Depth (m)	1.300

Depth to water at start of test (m)	0.975
Depth to water at end of test (m)	0.000
Depth to water at 75% level (m)	0.731
Depth to water 50% level (m)	0.488
Depth to water at 25% level (m)	0.244

Base area of trial pit	0.42
a_{P50}	3.1825
V_{P75-25}	-0.20475

from the graph (below)	
t_{P75}	75
t_{P25}	-

Soil infiltration rate, f	=	-	m/s
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SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365

Client	Rowden Hill Holdings Ltd
Site	49, 51 & 53 Rowden Hill, Chippenham
Project No.	19979
Test date	01-Sep-25
Test supervised by	Andrew Mounterj

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (mm)
0	975
154	385
205	380
1257	340
1369	335

Trial pit/Test No.	SA1/1
Length (m)	1.400
Width (m)	0.300
Depth (m)	1.300

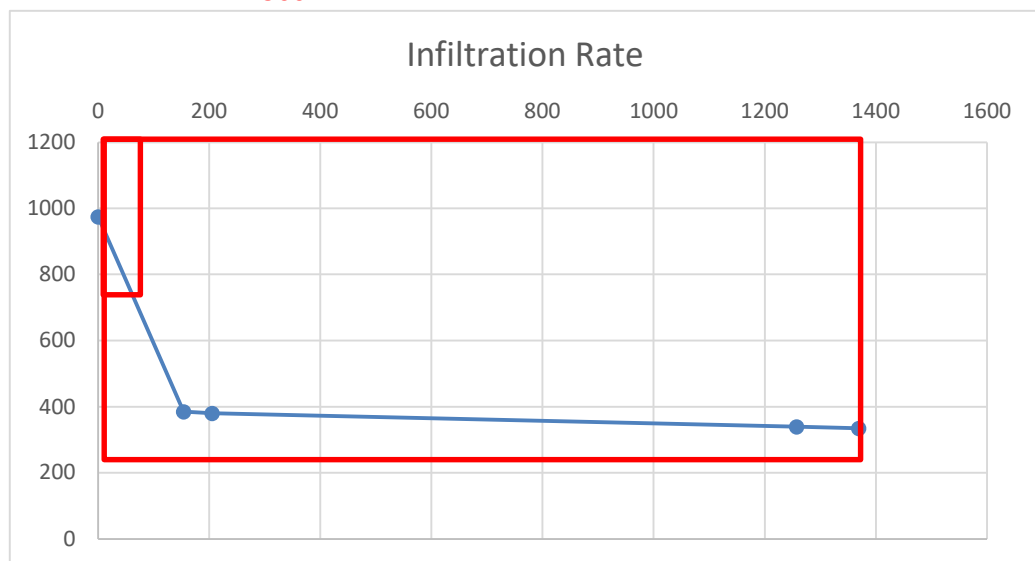
Depth to water at start of test (m)	0.975
Depth to water at end of test (m)	0.000
Depth to water at 75% level (m)	0.731
Depth to water 50% level (m)	0.488
Depth to water at 25% level (m)	0.244

Base area of trial pit	0.42
a_{P50}	3.1825
V_{P75-25}	-0.20475

from the graph (below)	
t_{P75}	60
t_{P25}	-

Soil infiltration rate, f	=	-	m/s
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* INVALID TEST. LAND DRAIN HIT AT 500mm.



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365

Client	Rowden Hill Holdings Ltd
Site	49, 51 & 53 Rowden Hill, Chippenham
Project No.	19979
Test date	01-Sep-25
Test supervised by	Andrew Mounterj

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (mm)
0	975
163	775
1198	615
1310	615

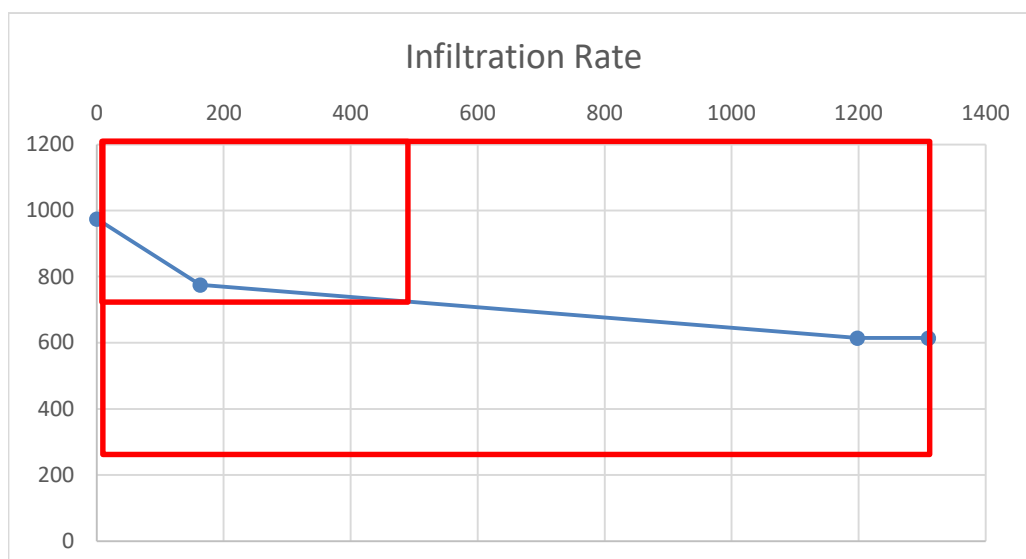
Trial pit/Test No.	SA1/1
Length (m)	1.400
Width (m)	0.300
Depth (m)	1.300

Depth to water at start of test (m)	0.975
Depth to water at end of test (m)	0.000
Depth to water at 75% level (m)	0.731
Depth to water 50% level (m)	0.488
Depth to water at 25% level (m)	0.244

Base area of trial pit	0.42
a_{P50}	3.1825
V_{P75-25}	-0.20475

from the graph (below)	
t_{p75}	475
t_{p25}	-

Soil infiltration rate, f	=	-	m/s
---------------------------	---	---	-----



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365

Client	Rowden Hill Holdings Ltd
Site	49, 51 & 53 Rowden Hill, Chippenham
Project No.	19979
Test date	01-Sep-25
Test supervised by	Andrew Mounterj

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (mm)
0	975
1	765
136	575
189	575
1244	535
1355	535

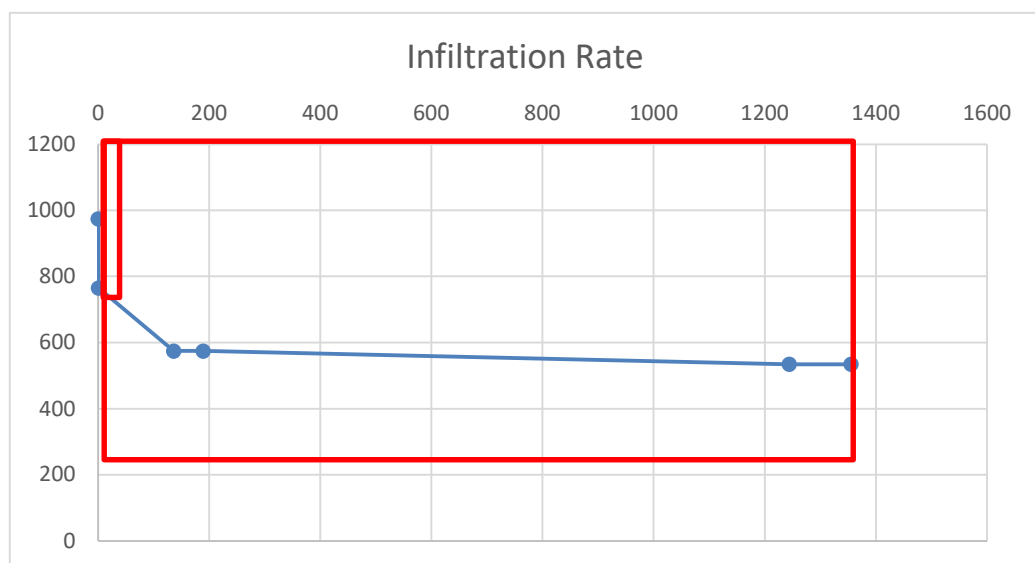
Trial pit/Test No.	SA1/1
Length (m)	1.600
Width (m)	0.440
Depth (m)	1.300

Depth to water at start of test (m)	0.975
Depth to water at end of test (m)	0.000
Depth to water at 75% level (m)	0.731
Depth to water 50% level (m)	0.488
Depth to water at 25% level (m)	0.244

Base area of trial pit	0.704
a_{P50}	4.019
V_{P75-25}	-0.3432

from the graph (below)	
t_{P75}	25
t_{P25}	-

Soil infiltration rate, f	=	-	m/s
----------------------------------	---	---	------------



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365

Client	Rowden Hill Holdings Ltd
Site	49, 51 & 53 Rowden Hill, Chippenham
Project No.	19979
Test date	01-Sep-25
Test supervised by	Andrew Mounterj

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (mm)
0	975
7	705
80	685
1107	600
1216	590

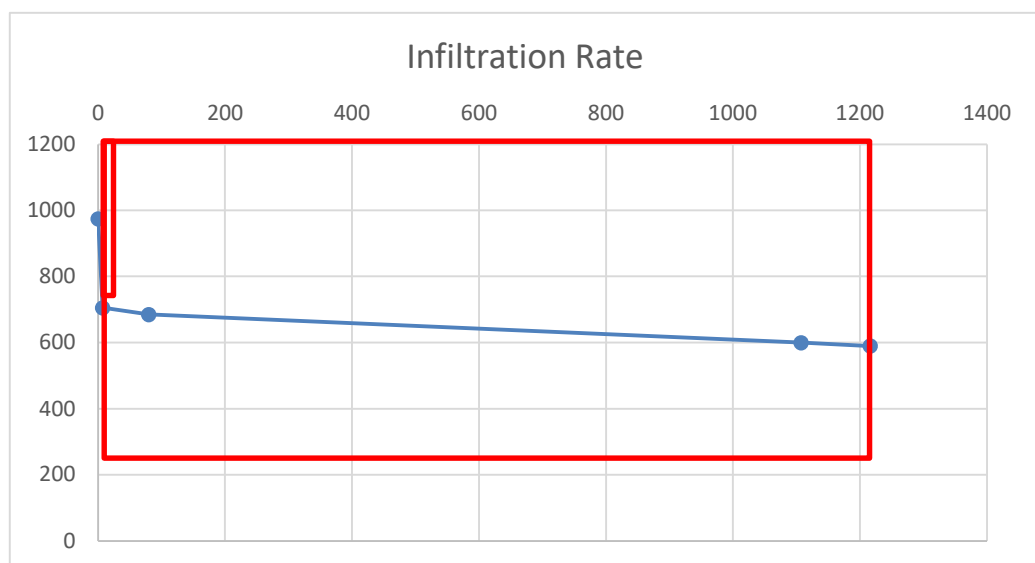
Trial pit/Test No.	SA1/1
Length (m)	1.400
Width (m)	0.300
Depth (m)	1.300

Depth to water at start of test (m)	0.975
Depth to water at end of test (m)	0.000
Depth to water at 75% level (m)	0.731
Depth to water 50% level (m)	0.488
Depth to water at 25% level (m)	0.244

Base area of trial pit	0.42
a_{P50}	3.1825
V_{P75-25}	-0.20475

from the graph (below)	
t_{P75}	6
t_{P25}	-

Soil infiltration rate, f	=	#VALUE!	m/s
----------------------------------	---	----------------	------------



Appendix C – CCTV Survey Plan





POINT SURVEYS LTD
TOPOGRAPHICAL SURVEYS, PAS128 UTILITY
SURVEYS, CCTV DRAINAGE SURVEYS,
AS-BUILT SURVEYS, 3D LASER SCANNING,
SETTING OUT.
0 Holly Close
Steepleton
B55 7XP
0117 4527477
07553 345000
sales@psurveys.co.uk

- Drainage Notes:**
- Grid and elevation measurements are based on the OSGB36 National Datum, sourced from the National GPS network.
 - We work to a standard specification as recommended by the Royal Institute of Chartered Surveyors (RICS) for measured surveys of Land, Buildings and Utilities.
 - Drainage details have been ascertained without direct access to chambers. While diligent efforts have been made for accuracy, it's advisable to independently verify critical information for future planning.
 - Unless verified by tracing techniques, all sewer segments are assumed to be linear between chambers.
 - The OS site & Topo data provided is sourced from a third party and has not been confirmed through field verification.

CCTV & DRAINAGE

- Survey to be read in conjunction with the CCTV Report.
- Attempts were made to carry out CCTV Surveys of all assets across the site. Surveys may have been abandoned due to structural defects or a build up of debris. Furthermore some sewers may have not been surveyed due to access to the pipe inside the manhole being impeded, too deep or blocked.
- All findings from the CCTV Survey have been added to the drawing. Positioning of pipes is indicative using CCTV Chirange unless these have been proved using underground positioning techniques.

KEY

- FOUL WATER
- STORM WATER
- COMBINED WATER
- SURVEY ABANDONED
- SEWER CAPPED
- BACKSTOP
- P-TRAP
- MANHOLE CHAMBER
- (x) Indicates Downstream Pipe

ABBREVIATIONS

AC Acoustic Connection	IL Invert Level	SOF Soft Level
AR Assumed Route	IC Inspection Cover	SOF'd Soft'd Depth
BO Backdrop	KO Kerb Outlet	SP Soil Pipe
BD Base Depth	LP Lamp Post	SS Soil Stack
BL Base Level	MH Manhole	SV Stop Valve
CL Cover Level	NFI No Further Information	SVP Soil Vent Pipe
CP Culvert	OSA Out of Survey Area	TFR Taken From Records
DCH Drainage Channel	PTG Pipe to Ground	TL Traffic Light
DP Down Pipe	PTS Pipe to Surface	TP Telegraph Pole
EOT End Of Trace	RE Rooting Eye	UTF Unable to Trace Further
EP Electric Pole	RS Rod Stop	UTL Unable to Locate
ER Earth Rod	RWP Rain Water Pipe	UTR Unable to Raise
FI Fire Hydrant	SA Survey Abandoned	UTS Unable to Survey
GV Gas Valve	Sd Silt Depth	Ud Unable to Trace
GY Gully	SL Silt Level	WD Water Depth
Id Invert Depth	SP Soil Pipe	WL Water Level

PAS128:2022 UTILITY CLASSIFICATION		
Survey Type	Quality Level	Description
D - Desktop (W99 Records Search)	QL-D	Provisional location has been provided by a utility record search only. This is the lowest quality level a survey can provide.
	QL-C	Provisional location has been confirmed by visual inspection and reference to street furniture, topographical features or evidence of previous street works, such as a manhole cover.
	QL-B4	Provisional location has been confirmed. The utility, or segment of utility, is expected to exist but was not detected by the geographical information used.
	QL-B3	Provisional location has been detected by one of the geographical techniques but with no confidence in depth.
B - Detection	QL-B2	Provisional location and depth of the utility has been determined by one of the geographical techniques and the accuracy has a reasonable confidence in the survey accuracy or quality level.
	QL-B1	Provisional location and depth of the utility has been determined by one of the geographical techniques and the accuracy has a high degree of confidence in the survey accuracy or quality level.
A - Verification	QL-A	Provisional location and depth of the utility has been determined by one of the geographical techniques and the accuracy has a high degree of confidence in the survey accuracy or quality level. The location and depth of the utility has been confirmed by a separate method, such as a manhole cover, or by a separate method, such as a manhole cover, or by a separate method, such as a manhole cover.

SHEET LAYOUT



(NOT TO SCALE)

Project:

Rowden Chippenham

Client:

itumu

Title:

CCTV Drainage Survey

RS		
R4		
R3		
R2		
R1		
R0	13/08/25	CCTV Drainage Survey
No.	Date	Drawing Revisions
Job No.:	2260	Sheet No.: 1
Scale:	1:250	Date: 13/08/25
Surveyor:	LF	Revision: R0
Status:	Complete	Approved: LF

Appendix D – Proposed Drainage Strategy



INSET

INSET

KEY

EXISTING

- WESSEX WATER SURFACE WATER SEWER
- PRIVATE SURFACE WATER DRAIN
- WESSEX WATER FOUL WATER SEWER
- PRIVATE FOUL WATER DRAIN
- CHAMBER COVER

PROPOSED

- S104 SURFACE WATER SEWER
- PRIVATE SURFACE WATER DRAIN
- S104 FOUL WATER SEWER
- PRIVATE FOUL WATER DRAIN
- HIGHWAYS DRAIN
- PCC CHAMBER
- POLYPROPYLENE INSPECTION CHAMBER
- MINI-ACCESS CHAMBER
- RWP, GULLY, RODDING EYE
- SOIL VENT PIPE
- FLOOD EXCEEDANCE ROUTING
- PERMEABLE CAR PARK SELF-DRAINING SURFACING (GRASSCRETE OR SIMILAR)

NOTES

DRAINAGE NOTES - PRIVATE DRAINAGE

- ALL PRIVATE DRAINAGE WORKS TO BE CARRIED OUT IN ACCORDANCE WITH BUILDING REGULATIONS PART H.
- ALL FOUL WATER PRIVATE PIPES TO BE 100MM DIAMETER UNLESS OTHERWISE STATED. MIN GRADIENT 1:80 WHERE CONNECTED TO A MINIMUM OF 1WC, OTHERWISE MIN 1:40. ALL SURFACE PRIVATE DRAINAGE PIPES TO BE 100MM DIAMETER UNLESS OTHERWISE STATED WITH A MIN GRADIENT OF 1:100 UNLESS OTHERWISE STATED.
- ALL SURFACE WATER PIPES 600MM+ OR LESS TO BE POLYPIPE RIDGDRAIN OR SIMILAR APPROVED. SURFACE WATER PIPES GREATER THAN 600MM+ TO BE POLYPIPE RIDGDRAIN XL OR SIMILAR APPROVED. ALL 100MM DIAMETER FOUL WATER DRAINS TO BE PVCU. ALL 150MM DIAMETER FOUL DRAINS TO BE POLYPIPE POLYSEWER OR SIMILAR APPROVED.
- ALL DRAINAGE ARRANGEMENTS ARE TO BE CARRIED OUT TO THE SATISFACTION OF THE LOCAL AUTHORITY BUILDING INSPECTOR ONSITE.
- PRIVATE FOUL WATER ROUTE UNDER SLAB IS INDICATIVE ONLY; BEDDING, PIPE MATERIAL AND PENETRATION OF PROPERTY WALL DETAILS BY OTHERS.
- CONTRACTOR TO REVIEW ALL BELOW SLAB PRIVATE DRAINAGE AND ENSURE, WHERE REQUIRED, FOUNDATION PENETRATIONS/PLINTHS ARE PROVIDED IN ACCORDANCE WITH STRUCTURAL ENGINEER REQUIREMENTS.
- IMPORTANT NOTE** * WHERE RETAINING WALLS AND PLOT/GARAGE FOUNDATIONS ARE IN THE CLOSE VICINITY OF PRIVATE (AND ADOPTABLE) DRAINAGE, ALL FOUNDATIONS ARE TO BE BELOW INVERT LEVELS OF PIPES / TANKS AS NOT TO CAUSE LOADING ONTO DRAINAGE.

DRAINAGE NOTES - ADOPTABLE DRAINAGE

- ALL SURFACE WATER SEWERS UP TO 600MM DIAMETER TO BE POLYPIPE'S RIDGDRAIN OR SIMILAR APPROVED. SEWERS GREATER THAN 600MM TO BE POLYPIPES RIDGDRAIN XL OR SIMILAR APPROVED.
- ALL 100MM DIAMETER FOUL SEWERS TO BE UPVC. SEWERS GREATER THAN 100MM DIAMETER TO BE POLYPIPES POLYSEWER OR SIMILAR APPROVED.
- WHERE DEPTH TO SOFIT OF PROPOSED PIPES IS LESS THAN 1.2M TYPE Z PIPE BEDDING IS TO BE CONSTRUCTED, DEPTHS 1.2M OR GREATER TO BE TYPE S PIPE BEDDING.
- THE POSITION OF THE MANHOLES FROM THE CO-ORDINATES GIVEN IN THE MANHOLE SCHEDULES SHOULD BE CHECKED AGAINST THE MANHOLE POSITIONS SHOWN ON THE DRAINAGE LAYOUT PLAN. ANY DISCREPANCIES SHOULD BE REPORTED BACK TO THE ENGINEER PRIOR TO CONSTRUCTION.
- S104 DRAINAGE TO BE CARRIED OUT TO THE SATISFACTION OF THE WATER AUTHORITY INSPECTOR AND COMPLY TO WESSEX WATER DESIGN SPECIFICATION.
- IF THE CONTRACTOR DEVIATES FROM THE APPROVED DESIGN DRAWINGS, ANY CHANGES SHOULD BE AGREED WITH THE INSPECTING ENGINEER AND CLIENT PRIOR TO CONSTRUCTION.
- ALL DRAINAGE WORKS TO COMMENCE AT OUTFALL.
- LOCATION AND LEVEL OF EXISTING MANHOLES AND OUTFALLS TO BE VERIFIED ONSITE PRIOR TO CONSTRUCTION; VARIATIONS TO BE REPORTED PRIOR TO ANY CONSTRUCTION TO ALLOW FOR DESIGN AMENDMENTS IF REQUIRED.
- ANY SEWERS OR DRAIN WHICH ARE TO BE ABANDONED ARE TO BE CHECKED FOR ANY LIVE CONNECTIONS.
- THE PLANNING, DESIGN AND CONSTRUCTION OF SEWERS SHALL BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, A DESIGN AND CONSTRUCTION GUIDE FOR DEVELOPERS, THE CIVIL ENGINEERING SPECIFICATION FOR THE WATER INDUSTRY 7TH EDITION AND SOUTH WEST WATER AMENDMENTS TO CESWI DATED MAY 2011.
- THE MINIMUM SIZE OF SEWER WHERE GUIDE BARS, SAFETY CHAINS, OR OTHER SAFETY DEVICES ARE REQUIRED IN MANHOLES SHALL BE 375MM DIAMETER.
- ALL MANHOLES / INSPECTION CHAMBERS SHOULD HAVE A CONCRETE SURROUND. CONCRETE RINGS SHALL BE SEALED USING "TOKSTRIP" AND LIFTING EYES POINTED WITH RESIN MODIFIED MORTAR.
- COMPLIANCE WITH HEALTH & SAFETY MATTERS ON ANY TRENCH/MANHOLE IS OBLIGATORY AND A PERMIT TO ENTER A CONFINED

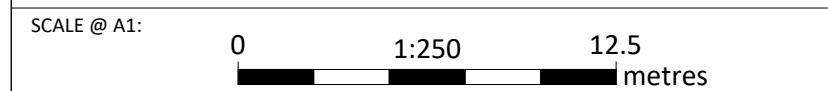
A	FIRST ISSUE	07.10.25	RP	BF
REV.	DESCRIPTION	Date	BY	CHK

DESIGN BY:



CLIENT:
ROWDEN HILL HOLDINGS LTD

DRAWING STATUS:
PLANNING APPLICATION

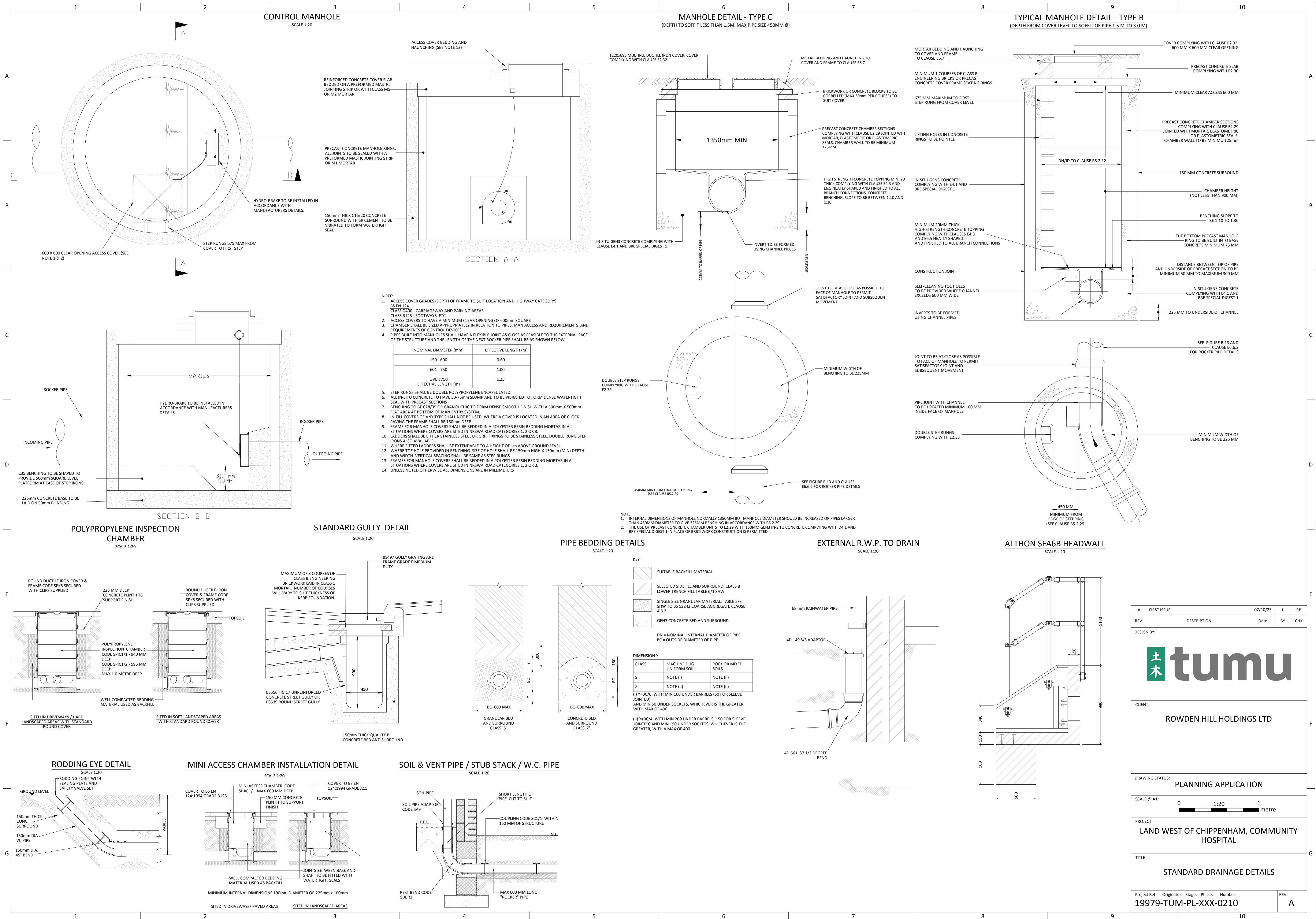


PROJECT:
49, 51 & 53 ROWDEN HILL, CHIPPENHAM

TITLE:
PROPOSED DRAINAGE STRATEGY

Project Ref: 19979-TUM-PL-XXX-0200
Originator: Stage: Phase: Number: 19979-TUM-PL-XXX-0200
REV: **A**

Appendix E – Standard Drainage Details



Appendix F – Wessex Water Pre-Development Enquiry

From: Stella Davies <Stella.Davies@wessexwater.co.uk>
Sent: 08 July 2025 15:51
To: robbie.parnham@tumuconsulting.com
Cc: ben.stoodley@tumuconsulting.com
Subject: WW Dev Resp ST97SW/ 421 - 19979 Pre-Development Enquiry - Land to the West of Chippenham Community Hospital 12 dwellings [Filed 22 Jul 2025 08:44]
Attachments: WW Dev Map ST97SW_421 Land to the West of Chippenham Community Hospital.pdf
Categories: Filed by Mail Manager

Thank you for your below enquiry. We have the following comments to make and copy of our map is attached. More maps can be obtained here: <https://developerservices.wessexwater.co.uk/network-maps>

Surface Water Disposal:

Surface water must be disposed of via the SuDS Hierarchy which is subject to Building Regulations and NPPF.

No surface water runoff, land drainage or ground water will be accepted into a public sewer that carries sewerage, either directly or indirectly.

The National Planning Policy Framework (NPPF) mandates that Sustainable Drainage Systems (SuDS) must be incorporated into new developments to manage surface water runoff, mitigate flood risks, and provide additional benefits, including enhanced water quality and green spaces.

In line with the drainage hierarchy outlined in Approved Document H of the Building Regulations, Planning Practice Guidance, and the necessity to address water scarcity, all surface water runoff should aim to be discharged as high up the surface water discharge hierarchy as feasible.

Defra announced new national standards for SuDS. The national surface water hierarchy has been updated and runoff from the development shall be discharged to the following final destinations, to the maximum extent practicable, in accordance with the below hierarchy:

- collected for non-potable use (water re-use)
- infiltrated to ground
- discharged to an above ground surface water body
- discharged to a surface water sewer, or another piped surface water drainage system

Note: To utilise a lesser priority final destination, appropriate evidence shall be provided that demonstrates all higher priority final destinations have been utilised to the maximum extent practicable. Higher cost alone shall not be a reason to utilise lower priority final destinations.

Wessex Water statement on surface water discharge can be accessed via the following link: <https://developerservices.wessexwater.co.uk/media/m4rjrfmg/wwds-dev063p-rainwater-drainage-policy.pdf>

Review of the site mapping indicates that majority of the site is made of greenfield area. No re-use is proposed as part of the drainage strategy. No CCTV has been submitted to support that all of the hardstanding is connected to Wessex Water sewers. Please note that any historic cross connections must be disconnected and re-directed to separate systems. If utilising higher tiers of discharge hierarchy will prove unfeasible, Wessex Water could consider 5 l/s with evidence that they are using full suite of SUDS to deal with rainfall runoff as close as possible to where it falls.

Foul Drainage

Wessex Water will accommodate domestic type foul flows in the public foul sewer with connections made on a size for size basis, Developers fund the cost of connecting to the nearest 'size for size' sewer and Wessex Water will manage the sewer network to accommodate foul flows from granted development. We fund this through our infrastructure charging arrangements.

The most appropriate point for connection from the site would be 225mm diameter public foul sewer in Rowden Hill.

The point of connection to the public network is by application and agreement with Wessex Water and subject to satisfactory engineering proposals constructed to current adoptable standards. The developer should contact the local development team development.north@wessexwater.co.uk to agree proposals for the Section 104 adoption or Section 106 connection and submit details for technical review prior to construction. We will not accept foul connections from below ground level, foul flows from below ground level must be pumped to ground level prior to connection to the public foul sewer.

Please Note: No surface water runoff or land drainage will be accepted into the foul sewer either directly or indirectly.

Water Supply – Point of Connection

A development of this scale requires a water main connection with a minimum diameter of 90 mm.

The nearest suitable point of connection for the proposal is the 6" dia Water Main in Rowden Hill. The connection to 3" dia Water Distribution Main is too small to provide size for size connection. There is also 15" Distribution Trunk Main – no connections allowed.

Please note that the cost of any new connection or the upsizing of the existing main must be borne by the developer.

Wessex Water can provide a point of connection for new water mains to be laid into the development site, either through a Section 41 agreement or a self-lay arrangement.

Developers may connect to our water network on a 'size for size' basis at their cost and Wessex Water will undertake any network reinforcement that may be required to accommodate granted development, this is funded through our infrastructure charging arrangements.

For more details and guidance for applying to connect to our networks please see our website:

<https://www.wessexwater.co.uk/services/building-and-developing/building-multiple-properties-or-large-developments>

Note: These comments are based upon known circumstances prevailing at the time of writing. A review of the contents of this email is required where 18 months or more have elapsed since issue or in the light of significant changes likely to impact upon the response (e.g. changes in development numbers or phasing). Please email review requests to planning.liaison@wessexwater.co.uk

Best Regards,

Stella Davies

Senior Planning Liaison Engineer



Wessex Water
YTL GROUP

Wessex Water

Operations Centre, Claverton Down, Bath BA2 7WW

Web ytl.com | wessexwater.co.uk



Wessex Water
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This email is being sent to you on behalf of Wessex Water Limited, a company registered in England and Wales with number 02366633. Its registered office is Wessex Water Operations Centre, Claverton Down Road, Claverton Down, Bath, BA2 7WW.

From: robbie.parnham@tumuconsulting.com <robbie.parnham@tumuconsulting.com>

Sent: 08 July 2025 09:33

To: Planning Liaison <planning.liaison@wessexwater.co.uk>

Cc: ben.stoodley@tumuconsulting.com

Subject: WW ST97SW/ 421 - 19979 Pre-Development Enquiry - Land to the West of Chippenham Community Hospital

Good Morning,

Please can I submit a pre-development enquiry for a project to the West of Chippenham Community Hospital for the discharge of surface and foul water.

The development will consist of the redevelopment of the existing buildings to the east of the site, into apartments and houses. Specified below:

- No.49 Rowden Hill – 4 x Townhouses (2no. 2 bed & 2no. 3 bed)
- No.51 Rowden Hill – 1 no. 5 bed house
- No.53 Rowden Hill House – 5no. 2 bed flats

Also, 7no. self-build dwellings are proposed on the existing greenfield area of site.

Surface Water

- Existing community hospital hardstanding area of 0.148ha calculated using the modified rationale method and FEH22 rainfall data, at brownfield rate of 12.9l/s in 2-year event.
- It is proposed to limit all flows from proposed hardstanding (0.429ha) to 9l/s for all storms up to and including the 1% AEP event, with a 45% allowance for climate change. This provides a 30% betterment on pre-development flows in accordance with the Wiltshire Council Drainage and Betterment Strategy (June 2024) for the associated storm. It also provides a much greater betterment on storms above the 2 year.
- The attached PDF shows the proposed discharge point for surface water flows. Please can we confirm there is adequate capacity for the proposed surface water drainage rates.

Foul Water

- Proposed to discharge 12no. houses and 5no. flats into the existing surface water sewer marked up above.

If you need any more information, please let me know.

Kind Regards,

Robbie Parnham

Senior Infrastructure Engineer

tel: 07508 945099

email: robbie.parnham@tumuconsulting.com

web: www.tumuconsulting.com



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This email is being sent to you on behalf of Wessex Water Services Limited, a company registered in England and Wales with number 02366648. The registered office is Wessex Water Operations Centre, Claverton Down Road, Claverton Down, Bath, BA2 7WW.

Appendix G – Causeway FLOW Network Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
HW1	0.011	5.00	63.310	1350	391212.307	172693.056	1.360
SW2	0.068	5.00	64.000	1200	391214.461	172679.607	2.220
SW3	0.044	5.00	64.370	1200	391207.144	172643.635	2.760
SW4	0.033	5.00	62.990	1350	391203.785	172621.370	1.480
SW5	0.018	5.00	61.570	1350	391195.209	172609.198	1.350
SW6	0.013	5.00	60.870	1350	391187.887	172606.548	1.220
SW7	0.028	5.00	60.050	1200	391177.617	172607.255	2.000
SW8	0.015	5.00	59.520	1200	391166.860	172611.712	2.150
SW9	0.026	5.00	59.370	1200	391158.718	172619.750	2.210
SW10			59.250	1200	391155.976	172628.987	2.140
SW11	0.020	5.00	59.130	1200	391156.251	172638.987	2.070
HW12	0.003	5.00	58.600	1350	391163.783	172684.361	1.270
HW13	0.014	5.00	58.720	1350	391168.074	172667.219	1.500
HW14	0.012	5.00	58.850	1200	391166.466	172657.069	1.700
SW15	0.012	5.00	59.000	1200	391160.385	172647.811	2.000
SW16			58.500	1350	391150.132	172677.765	1.650
SW17			57.710	1350	391145.219	172688.536	1.350
SW18			54.850	1350	391097.847	172665.025	1.350
SW4A			62.170	1350	391200.201	172613.797	1.420

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	13.620	80.0	225	Circular	63.310	61.950	1.135	64.000	61.780	1.995
1.001	36.709	215.9	225	Circular	64.000	61.780	1.995	64.370	61.610	2.535
1.002	22.517	225.0	225	Circular	64.370	61.610	2.535	62.990	61.510	1.255
1.003	8.378	11.0	225	Circular	62.990	61.510	1.255	62.170	60.750	1.195
1.004	6.788	12.8	225	Circular	62.170	60.750	1.195	61.570	60.220	1.125
1.005	7.787	13.7	225	Circular	61.570	60.220	1.125	60.870	59.650	0.995
1.006	10.294	6.4	225	Circular	60.870	59.650	0.995	60.050	58.050	1.775

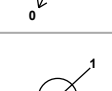
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	HW1	1350	Manhole	Adoptable	SW2	1200	Manhole	Adoptable
1.001	SW2	1200	Manhole	Adoptable	SW3	1200	Manhole	Adoptable
1.002	SW3	1200	Manhole	Adoptable	SW4	1350	Manhole	Adoptable
1.003	SW4	1350	Manhole	Adoptable	SW4A	1350	Manhole	Adoptable
1.004	SW4A	1350	Manhole	Adoptable	SW5	1350	Manhole	Adoptable
1.005	SW5	1350	Manhole	Adoptable	SW6	1350	Manhole	Adoptable
1.006	SW6	1350	Manhole	Adoptable	SW7	1200	Manhole	Adoptable

Pipeline Schedule

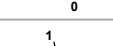
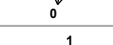
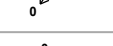
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	11.644	17.1	225	Circular	60.050	58.050	1.775	59.520	57.370	1.925
1.008	11.441	54.5	225	Circular	59.520	57.370	1.925	59.370	57.160	1.985
1.009	9.635	192.7	300	Circular	59.370	57.160	1.910	59.250	57.110	1.840
1.010	10.004	200.1	300	Circular	59.250	57.110	1.840	59.130	57.060	1.770
1.011	9.744	162.4	300	Circular	59.130	57.060	1.770	59.000	57.000	1.700
2.000	17.671	160.6	225	Circular	58.600	57.330	1.045	58.720	57.220	1.275
2.001	10.277	146.8	225	Circular	58.720	57.220	1.275	58.850	57.150	1.475
2.002	11.077	158.2	225	Circular	58.850	57.150	1.475	59.000	57.080	1.695
1.012	31.660	211.1	300	Circular	59.000	57.000	1.700	58.500	56.850	1.350
1.013	11.839	24.2	300	Circular	58.500	56.850	1.350	57.710	56.360	1.050
1.014	52.885	18.5	300	Circular	57.710	56.360	1.050	54.850	53.500	1.050

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	SW7	1200	Manhole	Adoptable	SW8	1200	Manhole	Adoptable
1.008	SW8	1200	Manhole	Adoptable	SW9	1200	Manhole	Adoptable
1.009	SW9	1200	Manhole	Adoptable	SW10	1200	Manhole	Adoptable
1.010	SW10	1200	Manhole	Adoptable	SW11	1200	Manhole	Adoptable
1.011	SW11	1200	Manhole	Adoptable	SW15	1200	Manhole	Adoptable
2.000	HW12	1350	Manhole	Adoptable	HW13	1350	Manhole	Adoptable
2.001	HW13	1350	Manhole	Adoptable	HW14	1200	Manhole	Adoptable
2.002	HW14	1200	Manhole	Adoptable	SW15	1200	Manhole	Adoptable
1.012	SW15	1200	Manhole	Adoptable	SW16	1350	Manhole	Adoptable
1.013	SW16	1350	Manhole	Adoptable	SW17	1350	Manhole	Adoptable
1.014	SW17	1350	Manhole	Adoptable	SW18	1350	Manhole	Adoptable

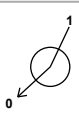
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
HW1	391212.307	172693.056	63.310	1.360	1350				
						0	1.000	61.950	225
SW2	391214.461	172679.607	64.000	2.220	1200		1	1.000	61.780
						0	1.001	61.780	225
SW3	391207.144	172643.635	64.370	2.760	1200		1	1.001	61.610
						0	1.002	61.610	225
SW4	391203.785	172621.370	62.990	1.480	1350		1	1.002	61.510
						0	1.003	61.510	225
SW5	391195.209	172609.198	61.570	1.350	1350		1	1.004	60.220
						0	1.005	60.220	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SW6	391187.887	172606.548	60.870	1.220	1350		1	1.005	59.650	225
							0	1.006	59.650	225
SW7	391177.617	172607.255	60.050	2.000	1200		1	1.006	58.050	225
							0	1.007	58.050	225
SW8	391166.860	172611.712	59.520	2.150	1200		1	1.007	57.370	225
							0	1.008	57.370	225
SW9	391158.718	172619.750	59.370	2.210	1200		1	1.008	57.160	225
							0	1.009	57.160	300
SW10	391155.976	172628.987	59.250	2.140	1200		1	1.009	57.110	300
							0	1.010	57.110	300
SW11	391156.251	172638.987	59.130	2.070	1200		1	1.010	57.060	300
							0	1.011	57.060	300
HW12	391163.783	172684.361	58.600	1.270	1350		0	2.000	57.330	225
HW13	391168.074	172667.219	58.720	1.500	1350		1	2.000	57.220	225
							0	2.001	57.220	225
HW14	391166.466	172657.069	58.850	1.700	1200		1	2.001	57.150	225
							0	2.002	57.150	225
SW15	391160.385	172647.811	59.000	2.000	1200		1	2.002	57.080	225
							2	1.011	57.000	300
							0	1.012	57.000	300
SW16	391150.132	172677.765	58.500	1.650	1350		1	1.012	56.850	300
							0	1.013	56.850	300
SW17	391145.219	172688.536	57.710	1.350	1350		1	1.013	56.360	300
							0	1.014	56.360	300
SW18	391097.847	172665.025	54.850	1.350	1350		1	1.014	53.500	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
SW4A	391200.201	172613.797	62.170	1.420	1350		1	1.003	60.750	225
							0	1.004	60.750	225

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	40	10	0
100	45	10	0

Node SW16 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	56.850	Product Number	CTL-SHE-0103-5000-1200-5000
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node SW16 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	56.950
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	102.0	0.0	1.250	293.0	0.0	1.251	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	96.480	27.301
2 year 15 minute winter	67.705	27.301
2 year 30 minute summer	61.474	17.395
2 year 30 minute winter	43.140	17.395
2 year 60 minute summer	40.797	10.782
2 year 60 minute winter	27.105	10.782
2 year 120 minute summer	28.836	7.621
2 year 120 minute winter	19.158	7.621
2 year 180 minute summer	23.721	6.104
2 year 180 minute winter	15.419	6.104
2 year 240 minute summer	19.550	5.166

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 240 minute winter	12.988	5.166
2 year 360 minute summer	15.619	4.019
2 year 360 minute winter	10.153	4.019
2 year 480 minute summer	12.597	3.329
2 year 480 minute winter	8.369	3.329
2 year 600 minute summer	10.458	2.861
2 year 600 minute winter	7.146	2.861
2 year 720 minute summer	9.398	2.519
2 year 720 minute winter	6.316	2.519
2 year 960 minute summer	7.775	2.047
2 year 960 minute winter	5.150	2.047
2 year 1440 minute summer	5.667	1.519
2 year 1440 minute winter	3.808	1.519
30 year +40% CC +10% A 15 minute summer	349.527	98.904
30 year +40% CC +10% A 15 minute winter	245.282	98.904
30 year +40% CC +10% A 30 minute summer	226.733	64.158
30 year +40% CC +10% A 30 minute winter	159.111	64.158
30 year +40% CC +10% A 60 minute summer	150.199	39.693
30 year +40% CC +10% A 60 minute winter	99.789	39.693
30 year +40% CC +10% A 120 minute summer	93.038	24.587
30 year +40% CC +10% A 120 minute winter	61.812	24.587
30 year +40% CC +10% A 180 minute summer	72.422	18.637
30 year +40% CC +10% A 180 minute winter	47.076	18.637
30 year +40% CC +10% A 240 minute summer	57.956	15.316
30 year +40% CC +10% A 240 minute winter	38.505	15.316
30 year +40% CC +10% A 360 minute summer	45.067	11.597
30 year +40% CC +10% A 360 minute winter	29.294	11.597
30 year +40% CC +10% A 480 minute summer	36.008	9.516
30 year +40% CC +10% A 480 minute winter	23.923	9.516
30 year +40% CC +10% A 600 minute summer	29.789	8.148
30 year +40% CC +10% A 600 minute winter	20.353	8.148
30 year +40% CC +10% A 720 minute summer	26.742	7.167
30 year +40% CC +10% A 720 minute winter	17.972	7.167
30 year +40% CC +10% A 960 minute summer	22.142	5.830
30 year +40% CC +10% A 960 minute winter	14.667	5.830
30 year +40% CC +10% A 1440 minute summer	16.076	4.309
30 year +40% CC +10% A 1440 minute winter	10.804	4.309
100 year +45% CC +10% A 15 minute summer	463.992	131.294
100 year +45% CC +10% A 15 minute winter	325.608	131.294
100 year +45% CC +10% A 30 minute summer	303.133	85.776
100 year +45% CC +10% A 30 minute winter	212.725	85.776
100 year +45% CC +10% A 60 minute summer	201.776	53.323
100 year +45% CC +10% A 60 minute winter	134.055	53.323
100 year +45% CC +10% A 120 minute summer	123.428	32.618
100 year +45% CC +10% A 120 minute winter	82.002	32.618
100 year +45% CC +10% A 180 minute summer	95.998	24.704
100 year +45% CC +10% A 180 minute winter	62.401	24.704
100 year +45% CC +10% A 240 minute summer	77.064	20.366
100 year +45% CC +10% A 240 minute winter	51.199	20.366
100 year +45% CC +10% A 360 minute summer	60.570	15.587
100 year +45% CC +10% A 360 minute winter	39.372	15.587
100 year +45% CC +10% A 480 minute summer	48.811	12.899

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC +10% A 480 minute winter	32.429	12.899
100 year +45% CC +10% A 600 minute summer	40.614	11.109
100 year +45% CC +10% A 600 minute winter	27.750	11.109
100 year +45% CC +10% A 720 minute summer	36.599	9.809
100 year +45% CC +10% A 720 minute winter	24.597	9.809
100 year +45% CC +10% A 960 minute summer	30.403	8.006
100 year +45% CC +10% A 960 minute winter	20.140	8.006
100 year +45% CC +10% A 1440 minute summer	22.022	5.902
100 year +45% CC +10% A 1440 minute winter	14.800	5.902

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	HW1	11	61.976	0.026	1.7	0.0420	0.0000	OK
15 minute summer	SW2	11	61.870	0.090	12.4	0.1568	0.0000	OK
15 minute summer	SW3	11	61.731	0.121	18.9	0.1762	0.0000	OK
15 minute summer	SW4	11	61.573	0.063	23.8	0.1175	0.0000	OK
15 minute summer	SW5	11	60.295	0.075	26.5	0.1269	0.0000	OK
15 minute summer	SW6	11	59.706	0.056	28.6	0.0925	0.0000	OK
15 minute summer	SW7	11	58.128	0.078	32.8	0.1098	0.0000	OK
15 minute summer	SW8	11	57.496	0.126	35.1	0.1606	0.0000	OK
15 minute summer	SW9	11	57.333	0.173	38.9	0.2364	0.0000	OK
15 minute summer	SW10	11	57.283	0.173	38.8	0.1958	0.0000	OK
15 minute summer	SW11	11	57.232	0.172	41.5	0.2276	0.0000	OK
15 minute summer	HW12	11	57.347	0.017	0.5	0.0257	0.0000	OK
15 minute summer	HW13	11	57.258	0.038	2.7	0.0607	0.0000	OK
15 minute summer	HW14	11	57.200	0.050	4.5	0.0630	0.0000	OK
15 minute summer	SW15	12	57.178	0.178	47.4	0.2229	0.0000	OK
240 minute summer	SW16	160	57.150	0.300	16.8	23.9173	0.0000	OK
240 minute summer	SW17	160	56.389	0.029	4.9	0.0412	0.0000	OK
240 minute summer	SW18	160	53.529	0.029	4.9	0.0000	0.0000	OK
15 minute summer	SW4A	11	60.815	0.065	23.8	0.0934	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	HW1	1.000	SW2	1.7	0.214	0.029	0.1184	
15 minute summer	SW2	1.001	SW3	12.1	0.664	0.343	0.6726	
15 minute summer	SW3	1.002	SW4	18.8	1.232	0.545	0.3474	
15 minute summer	SW4	1.003	SW4A	23.8	2.572	0.151	0.0777	
15 minute summer	SW5	1.005	SW6	26.6	2.771	0.188	0.0749	
15 minute summer	SW6	1.006	SW7	28.6	2.884	0.138	0.1025	
15 minute summer	SW7	1.007	SW8	32.8	1.872	0.259	0.2044	
15 minute summer	SW8	1.008	SW9	35.0	1.249	0.496	0.3187	
15 minute summer	SW9	1.009	SW10	38.8	0.921	0.486	0.4056	
15 minute summer	SW10	1.010	SW11	38.5	0.919	0.492	0.4194	
15 minute summer	SW11	1.011	SW15	41.1	0.971	0.473	0.4141	
15 minute summer	HW12	2.000	HW13	0.5	0.179	0.012	0.0506	
15 minute summer	HW13	2.001	HW14	2.6	0.487	0.061	0.0555	
15 minute summer	HW14	2.002	SW15	4.4	0.550	0.108	0.1255	
15 minute summer	SW15	1.012	SW16	46.9	1.167	0.615	1.3978	
240 minute summer	SW16	1.013	SW17	4.9	1.338	0.022	0.0436	
240 minute summer	SW17	1.014	SW18	4.9	1.444	0.019	0.1807	66.1
15 minute summer	SW4A	1.004	SW5	23.8	2.268	0.163	0.0715	

Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	HW1	11	62.470	0.520	10.3	0.8374	0.0000	SURCHARGED
15 minute summer	SW2	11	62.477	0.697	44.4	1.2579	0.0000	SURCHARGED
15 minute summer	SW3	11	62.178	0.568	69.4	0.8418	0.0000	SURCHARGED
15 minute summer	SW4	11	61.647	0.137	87.0	0.2626	0.0000	OK
15 minute summer	SW5	12	60.572	0.352	97.5	0.6072	0.0000	SURCHARGED
15 minute summer	SW6	13	60.227	0.577	101.2	0.9618	0.0000	SURCHARGED
15 minute summer	SW7	13	59.760	1.710	112.6	2.4604	0.0000	FLOOD RISK
15 minute summer	SW8	13	59.124	1.754	110.3	2.2525	0.0000	SURCHARGED
15 minute summer	SW9	13	58.423	1.263	120.5	1.7561	0.0000	SURCHARGED
15 minute summer	SW10	13	58.244	1.134	118.2	1.2829	0.0000	SURCHARGED
30 minute summer	SW11	21	58.074	1.014	120.1	1.3634	0.0000	SURCHARGED
30 minute summer	HW12	21	57.899	0.569	7.6	0.8436	0.0000	SURCHARGED
30 minute summer	HW13	21	57.898	0.678	15.0	1.1103	0.0000	SURCHARGED
30 minute summer	HW14	21	57.897	0.747	13.2	0.9602	0.0000	SURCHARGED
30 minute summer	SW15	21	57.892	0.892	132.8	1.1269	0.0000	SURCHARGED
360 minute winter	SW16	344	57.794	0.944	26.3	141.8960	0.0000	SURCHARGED
30 minute winter	SW17	259	56.389	0.029	5.0	0.0415	0.0000	OK
15 minute summer	SW18	164	53.529	0.029	5.0	0.0000	0.0000	OK
15 minute summer	SW4A	12	60.913	0.163	86.7	0.2337	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	HW1	1.000	SW2	11.8	0.351	0.203	0.5417	
15 minute summer	SW2	1.001	SW3	43.3	1.089	1.230	1.4600	
15 minute summer	SW3	1.002	SW4	67.2	1.878	1.949	0.7317	
15 minute summer	SW4	1.003	SW4A	86.7	3.270	0.550	0.2296	
15 minute summer	SW5	1.005	SW6	93.5	3.414	0.660	0.3097	
15 minute summer	SW6	1.006	SW7	95.0	3.094	0.460	0.4094	
15 minute summer	SW7	1.007	SW8	102.4	2.575	0.811	0.4631	
15 minute summer	SW8	1.008	SW9	107.7	2.708	1.526	0.4550	
15 minute summer	SW9	1.009	SW10	118.2	1.678	1.481	0.6785	
15 minute summer	SW10	1.010	SW11	116.8	1.659	1.492	0.7045	
30 minute summer	SW11	1.011	SW15	119.1	1.692	1.370	0.6862	
30 minute summer	HW12	2.000	HW13	-5.9	0.210	-0.145	0.7028	
30 minute summer	HW13	2.001	HW14	-6.9	0.550	-0.161	0.4087	
30 minute summer	HW14	2.002	SW15	10.2	0.543	0.248	0.4405	
30 minute summer	SW15	1.012	SW16	131.9	1.873	1.731	2.2295	
360 minute winter	SW16	1.013	SW17	5.0	1.343	0.022	0.0440	
30 minute winter	SW17	1.014	SW18	5.0	1.450	0.019	0.1823	75.4
15 minute summer	SW4A	1.004	SW5	86.7	2.854	0.593	0.2398	

Results for 100 year +45% CC +10% A Critical Storm Duration. Lowest mass balance: 99.53%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	HW1	12	63.099	1.149	15.6	1.8482	0.0000	FLOOD RISK
15 minute summer	SW2	12	63.097	1.317	57.4	2.3777	0.0000	SURCHARGED
15 minute summer	SW3	12	62.698	1.088	87.7	1.6127	0.0000	SURCHARGED
15 minute summer	SW4	12	62.074	0.564	107.3	1.0838	0.0000	SURCHARGED
15 minute summer	SW5	12	61.241	1.021	106.1	1.7616	0.0000	SURCHARGED
15 minute summer	SW6	12	60.741	1.091	112.3	1.8180	0.0000	FLOOD RISK
15 minute summer	SW7	11	60.050	2.000	129.2	2.8780	4.7466	FLOOD
30 minute summer	SW8	20	59.458	2.088	115.2	2.6813	0.0000	FLOOD RISK
30 minute summer	SW9	20	58.769	1.609	128.4	2.2370	0.0000	SURCHARGED
30 minute summer	SW10	20	58.575	1.465	124.3	1.6568	0.0000	SURCHARGED
30 minute summer	SW11	20	58.375	1.315	136.3	1.7678	0.0000	SURCHARGED
30 minute summer	HW12	20	58.161	0.831	7.6	1.2325	0.0000	SURCHARGED
30 minute summer	HW13	20	58.160	0.940	16.6	1.5390	0.0000	SURCHARGED
30 minute summer	HW14	20	58.156	1.006	15.1	1.2933	0.0000	SURCHARGED
30 minute summer	SW15	20	58.142	1.142	155.2	1.4430	0.0000	SURCHARGED
480 minute winter	SW16	448	58.093	1.243	30.2	218.3375	0.0000	SURCHARGED
480 minute winter	SW17	448	56.389	0.029	5.0	0.0416	0.0000	OK
480 minute winter	SW18	448	53.529	0.029	5.0	0.0000	0.0000	OK
15 minute summer	SW4A	12	61.620	0.870	104.0	1.2445	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	HW1	1.000	SW2	15.0	0.376	0.257	0.5417	
15 minute summer	SW2	1.001	SW3	52.8	1.327	1.498	1.4600	
15 minute summer	SW3	1.002	SW4	81.1	2.104	2.351	0.8955	
15 minute summer	SW4	1.003	SW4A	104.0	3.269	0.660	0.3332	
15 minute summer	SW5	1.005	SW6	104.2	3.434	0.737	0.3097	
15 minute summer	SW6	1.006	SW7	110.9	3.250	0.537	0.4094	
15 minute summer	SW7	1.007	SW8	106.7	2.682	0.844	0.4631	
30 minute summer	SW8	1.008	SW9	109.0	2.741	1.544	0.4550	
30 minute summer	SW9	1.009	SW10	124.3	1.765	1.557	0.6785	
30 minute summer	SW10	1.010	SW11	122.7	1.743	1.568	0.7045	
30 minute summer	SW11	1.011	SW15	134.4	1.909	1.545	0.6862	
30 minute summer	HW12	2.000	HW13	-5.6	0.212	-0.137	0.7028	
30 minute summer	HW13	2.001	HW14	8.9	0.533	0.208	0.4087	
30 minute summer	HW14	2.002	SW15	14.9	0.550	0.362	0.4405	
30 minute summer	SW15	1.012	SW16	153.4	2.179	2.013	2.2295	
480 minute winter	SW16	1.013	SW17	5.0	1.345	0.022	0.0442	
480 minute winter	SW17	1.014	SW18	5.0	1.452	0.019	0.1829	194.8
15 minute summer	SW4A	1.004	SW5	94.6	2.859	0.647	0.2700	