

South View Farmhouse, Trowbridge

Drainage Strategy

For: Coulston Estates Ltd

Date: 10/12/2025

File Ref: 19682-TUM-RP-XXX-0001



Document Control

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Client	Coulston Estates Ltd
Project name	South View Farmhouse, Trowbridge
Report title	Drainage Strategy
Reference	19682-TUM-RP-XXX-0001
Issue date	10/12/2025

Revision History

Rev	Date	Details	Author	Checked by
A	10.12.25	First Issue	RP	BF
B	14.01.26	Updated with new plan layout	RP	BF

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Executive Summary

Tumu Consulting Ltd have been appointed by Coulston Estates Ltd to undertake a Drainage Strategy for a proposed development at South View Farmhouse, Trowbridge.

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1 Introduction

Tumu Consulting Ltd have been appointed by Coulston Estates Ltd to undertake a Drainage Strategy for a proposed development South View Farmhouse, Trowbridge. The report will support a planning application, it is proposed to redevelop the existing site with a renovation and extension of the farmhouse into a dwelling (Class C3) and a new nursery (Class E) with supporting infrastructure.

1.1 Site Location

The site has an area of approximately 0.42ha and is located to the southeast of Trowbridge at approximate grid reference 385950, 156800, as shown in Figure 1-1. The site is bounded by the Cardiff-Portsmouth railway line to the east, Drynham Lane to the west, an arable field associated with Southview Farmhouse to the south and existing residential areas to the north and west.

Land to the south of the site has secured planning permission under application reference 19/11459/OUT for the erection of up to 261-dwellings and erection of multi-use community facility.

Access to the site is via Drynham Lane to the north and Bradley Road to the west.

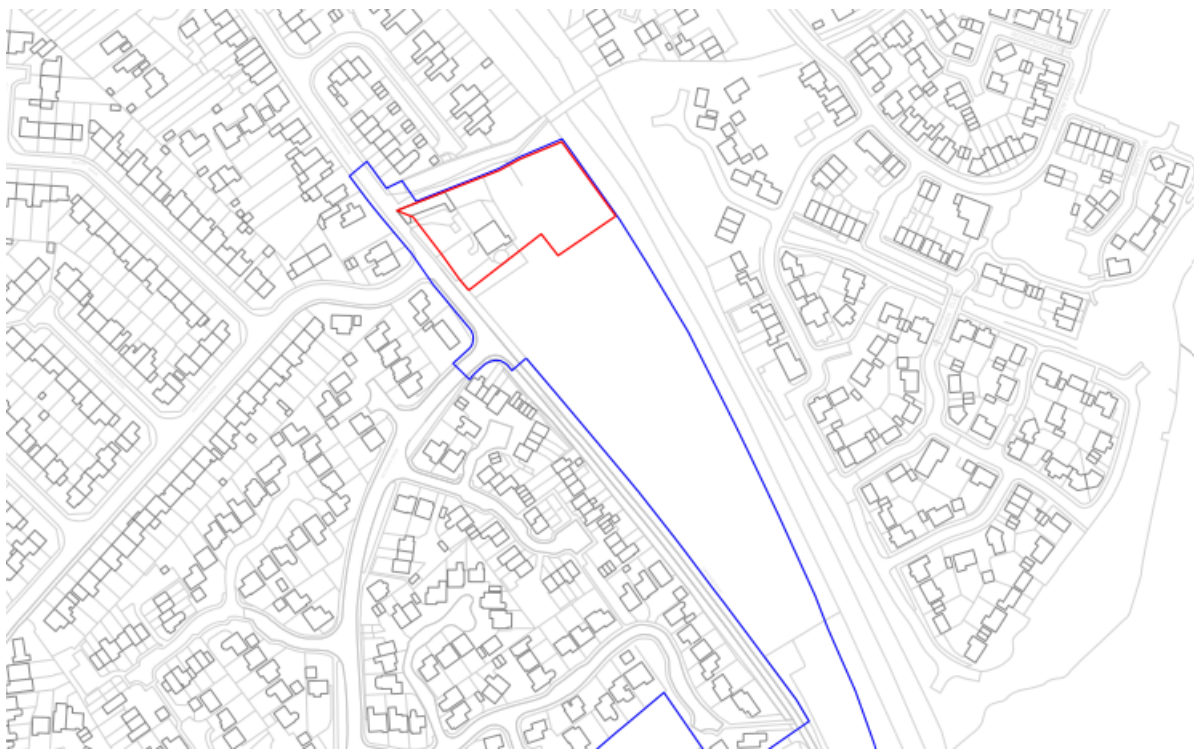


Figure 1-1 **Site Location Plan**

1.2 Existing Site Usage

The site currently comprises South View Farmhouse and associated disused agricultural barns, with a historical agricultural usage.

1.3 Topography

A topographic survey of the site has been undertaken by Anthony Brookes Surveys Ltd in October 2018. There have been no significant changes to levels since this time. The survey was undertaken to Ordnance Survey Benchmark datum and grid.

The site falls from 47.0m AOD in the north to 45m AOD in the south. The topographic survey is provided as Appendix A.

1.4 Geology & Hydrogeology

The British Geological Survey mapping indicates that the site is underlain by bedrock geology of Oxford Clay Formation – mudstone. There are no superficial deposits shown to be present beneath the site.

The site is not shown to be located within a groundwater Source Protection Zone (SPZ).

1.5 Hydrology

There are no watercourses within the site boundary. The closest watercourse, the Drynham Brook, which is a tributary of the River Biss, is located 300m to the south of the site. This is classified as an ordinary watercourse and is therefore the responsibility of the LLFA.

1.6 Existing Drainage

Wessex Water sewer records are provided in the figure below, with these showing that there are existing surface water and foul water public sewers within the vicinity of the site.

The existing farmhouse is fully serviced, and the topographical survey indicates that there is existing foul drainage which runs approximately 300m south of the site across the fields to discharge into the public foul sewer system at MH 1501. The existing foul sewer is 150mm diameter up to the point where it connects to the public sewer system, where it increases to 1050mm diameter. sewer records appear to indicate a connection from the site into MH9803 to the north of the site. Given the age of the existing buildings on site it is likely that there is also some existing surface water discharged connected to this sewer.

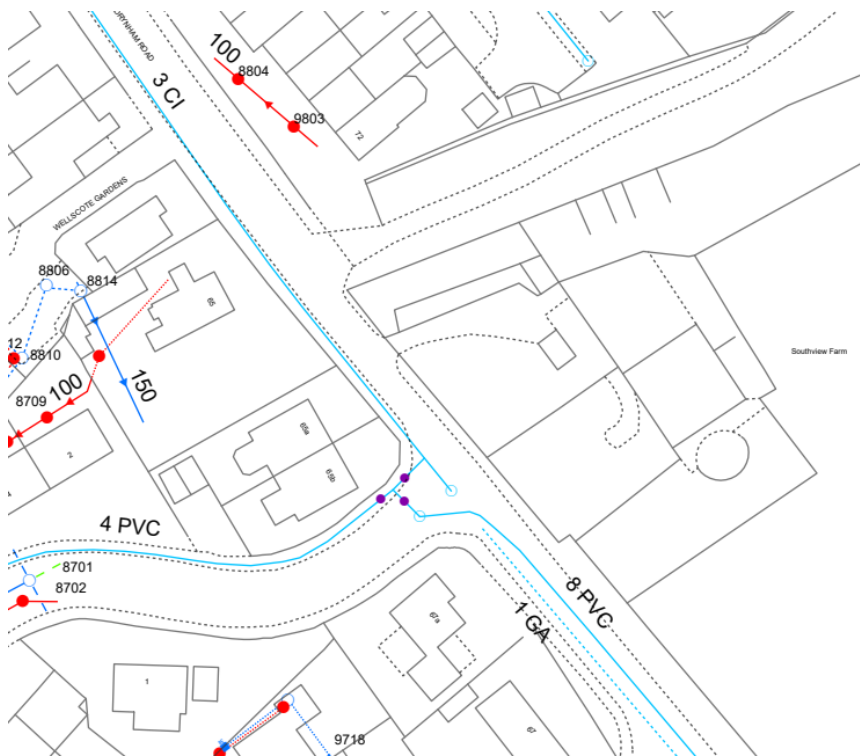


Figure 1-2 Wessex Water Asset Maps

1.7 Existing Discharge Rates

The existing site is primarily brownfield therefore the Modified Rational Method has been used to calculate the pre-development surface water rate. The average rainfall intensity has been derived from a 15-minute storm for each return period, using FEH22 data, which is appropriate given the time of concentration that would be anticipated for the small site area. The parameters used in the calculation and results are summarised in Table 1-1.

Return Period (yr)	Rainfall Intensity, R_i (mm/hr)	Area, A (ha)	Brownfield Discharge Rate (l/s)
Q_2	31.36	0.073	6.36
Q_{30}	76.08	0.073	15.44
Q_{100}	97.04	0.073	16.69

Table 1-1 Existing Brownfield Discharge Rates

1.8 Flood Risk

As the site is under 1.0ha and not within a flood zone, a flood risk assessment is not required for this development. However, the report will briefly describe any flood risk to the property. Environment Agency (EA) desktop sources have been used to assess the risk for the development.



Figure 1-3 EA Flood Map for Planning

Figure 1-3 shows that the site is located within Flood Zone 1, which is the lowest classification of fluvial and tidal flood risk, corresponding to an annual risk of <0.1% AEP.

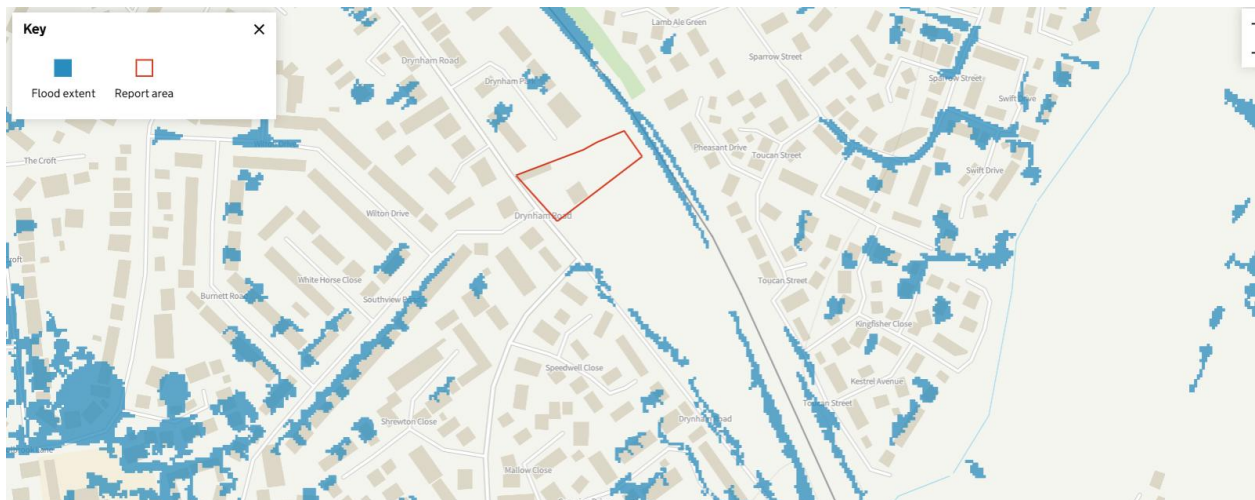


Figure 1-4 EA Surface Water Flood Risk – 0.1% AEP

Figure 1-4 shows that the site is not located within an area at risk of in the 0.1% AEP pluvial event. It is therefore considered that the site is at very low risk of flooding from surface water.

2 Development Proposals

2.1 Description of the Proposed Works

It is proposed to develop the existing brownfield site with the renovation and extension of the existing Farmhouse to the south of the site, as well as provide a new nursery to the north of the site as well as all associated infrastructure and engineering works. Refer to Appendix B for the Landscape Plan by Greenhalgh Landscape Architecture ref. 259_GLA_XX_XX_DR_L_1001_PA.

2.2 Design Life

As the use of the site is mixed, the residential usage has an anticipated design life of 100 years, which has been adopted for the surface water drainage design.

3 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 C for the Proposed Drainage Strategy, and Appendix D for the Standard Drainage Details.

3.1 Surface Water Discharge Hierarchy

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

Water butts are to be provided to both the nursery and the dwelling. However, these will feature a high level overflow into the surface water drainage network. As it can't be guaranteed that the water butts will be empty before every rainfall event.

Infiltration testing was undertaken as part of the Flood Risk Assessment (FRA) for the site to the south of the site (19/11459/OUT). This testing was undertaken to BRE 365 and concluded that infiltration is not a viable means of disposal. Given that BGS data indicates that the geology does not vary between this site and the application to the south, infiltration has been discounted.

The closest watercourse is the Drynham Brook which is over 300m from the site and not within the application boundary. The previously consented application for the site, PL/2023/11008, proposed to discharge into the existing ditch to the south west of the development. However, it is understood, this has now been infilled.

To the immediate south of the site, a Redrow Homes Ltd residential development is proposed. It has been agreed between the client, and Redrow Homes Ltd that a surface water spur is to be provided for the development at a discharge rate of 3.8l/s.

3.2 Surface Water Drainage Arrangement

The development is accessed from Drynham Road to the west of the site. The access roads and car parks of both the farmhouse and the nursery will be permeable surfaced, with a clean stone sub-base suitable for attenuation. Where feasible, rainwater pipes from both roofs will discharge onto the surface, or into the sub base of the system. Flows from each permeable paving will be restricted by a 40mm orifice control chamber, downstream of the permeable paving, to surcharge the sub base in rainfall events, and limit the flow downstream to the wider system.

Sections of the nursery roof which cannot discharge through the permeable paving sub abse will discharge to a hydrobrake chamber to the east of the site. In heavier rainfall events, the system will surcharge into a geocellular attenuation tank. Rates will be limited to 3.8l/s. It is not possible to provide above ground attenuation, as the landscaped area to the east is used as a nursery play space.

A green roof is also proposed to the extension of the farmhouse roof. This will discharge to the private surface water drainage system serving the plot, and allow for interception of the roofs runoff. Refer to Appendix C for the Proposed Drainage Strategy Layout and Appendix D for the Standard Drainage Details.

3.3 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 Upper End 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.

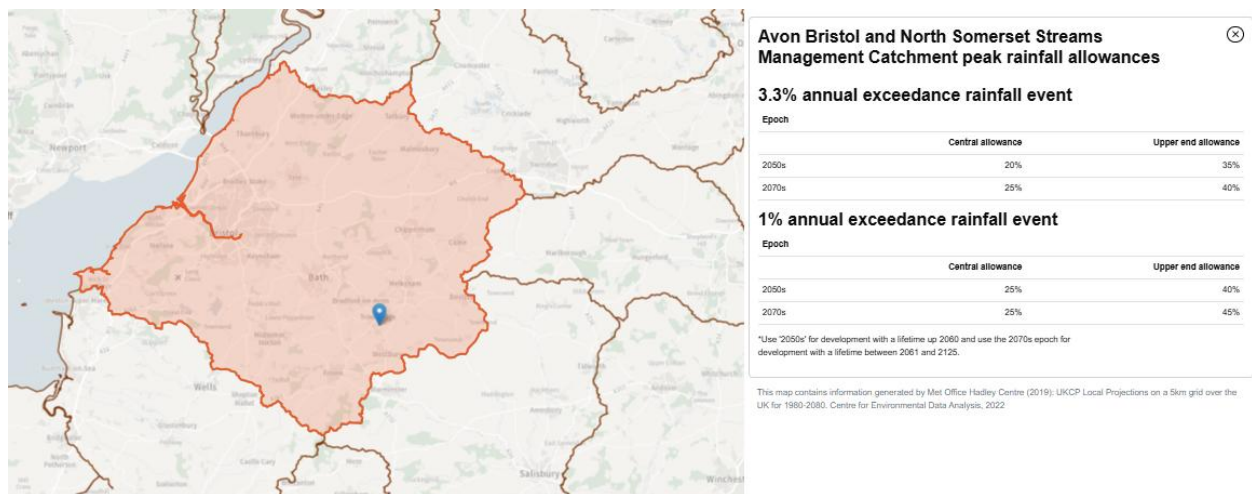


Figure 3-1 Avon Bristol and North Somerset Streams Management Catchment Peak Rainfall Allowances

3.4 Discharge Rates

As part of the previously consented application, PL/2023/11008, a 3.8 l/s discharge rate from the development was deemed acceptable. The latest development continues to propose at this discharge rate.

Rainfall Event	Pre-Development Discharge Rate (l/s)	Post-Development Discharge Rate (l/s)	Betterment (%)
Q ₂	6.36	3.8	40
Q _{30+40%}	15.44	3.8	75
Q _{100+45%}	16.69	3.8	77

Table 3-1 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 40% in the 2 year rainfall event. The betterment increases to 77% in the 100 year rainfall event, additionally considering climate change.

The Redrow Homes Ltd parcel in which the surface water is discharging to is limited to a rate agreed with the LLFA. The additional flow the Southview Farm development will be accommodated within the Redrow Homes Ltd surface water drainage system. The peak flow discharged from the Redrow development will be the limit of discharge for the Redrow development in addition to the 3.8l/s from the Southview Farm.

3.5 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 E, demonstrate that there is no flooding in the system for the 1.0% AEP rainfall event with a 45% allowance for climate change.

3.6 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 3-2 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 surfacing have been outlined below in Table 4-3.

SuDS Component	TSS	Metals	Hydrocarbons
Permeable Surfacing	0.7	0.6	0.7

Table 3-3 CIRIA 753 Table 26.3 Mitigation Indices for a Permeable Surfacing

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

In addition to this, the extended farmhouse roof is proposed as a green roof. This will delay water discharging to the wider surface water network, and promote evapotranspiration, while providing biodiversity and amenity benefits.

3.7 Flood Exceedance

The calculations provided show no flooding in the 1% AEP event with a 45% allowance for climate change. However, in the rare event this is exceeded or the drainage system becomes blocked and cannot function, water is to be directed to the eastern boundary away from the nursery and farmhouse, as well as the Redrow Homes Ltd plots to the southern boundary. The nursery and farmhouse will be raised a minimum of 150mm from external levels, therefore no structure or utility will be affected by an exceedance event.

3.8 Maintenance Arrangements

Drainage elements which serve the farmhouse only, the maintenance responsibility lies with the plot owner. Shared drainage features and serving the nursery will remain private and a maintenance company will be appointed by the client to undertake drainage maintenance.

Operation and maintenance will be undertaken in accordance with the recommendations outlined in the SuDS Manual (CIRIA C753), provided in Tables 4-4, 4-5, 4-6 and 4-7.

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 3-4 **Operation and Maintenance Requirements for Inlets, Outlets, Controls, and Inspection Chambers.**

Maintenance schedule	Required action	Typical frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary	Annually
Remedial Actions	Remove sediment from pre-treatment structures and/ or internal forebays	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

Table 3-5 **Operation and Maintenance Requirements for Geocellular Attenuation Tanks**

Maintenance schedule	Required action	Typical frequency
Regular inspections	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional Maintenance	Removal of weeds	As required – once per year on less frequently used pavements.
Remedial action	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 3-6 **Operation and Maintenance Requirements for Permeable Surfacing**

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structures	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular Maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e year one), replace dead plants as required	Monthly (but usually responsibility of the manufacturer)
	Post establishment, replace dead plants	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial maintenance	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Table 3-7 **Operation and Maintenance Requirements for Green Roofs**

4 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 Design and Construction Guidance (DCG) for foul and surface water sewers offered for adoption . It is proposed to drain foul water from the nursery and dwelling into a shared system, which ultimately discharges to the east of the development. Redrow Homes Ltd will be providing a foul spur to accommodate the flows from the development.

5 Conclusion

- The site is at a low risk of all types of flooding.
- The access roads and car park will be permeable surfaced with a clean stone sub base, which will attenuate surface water runoff. Flow will be locally limited by an orifice control chamber before discharging to the wider system. Surface water ultimately discharges east and is finally limited by a flow control device. Geocellular storage has also been provided for surcharging flows from the hydrobrake. Redrow Homes Ltd will provide a surface water spurs for the development to discharge at 3.8l/s.
- The permeable paving proposed, has higher SuDS mitigation indices than the pollution hazard indices anticipated from the proposed land use type. The farmhouse extension will also feature a green roof.
- The site will not flood in the 1% AEP event with a 45% allowance for climate change.
- Flood exceedance flows will discharge east, and not affect and structure or utility.
- Foul sewerage will discharge east to a spur provided by Redrow Homes Ltd.
- Plot drainage for the farmhouse will remain private and the responsibility of the owner of the plot. Drainage serving the nursery and farmhouse will remain private and will be the responsibility of a management company as selected by the client.

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

156900.00 N

156800.00 N

385900.00 E

386000.00 E



ABBREVIATIONS

bb	belisha beacon	ko	kerb outlet
bl	bollard	lp	lamp post
brw	brick ret. wall	mh	manhole
bs	bus stop	mk	marker post
bt	telecoms cover	np	nameplate (road)
bw	brick wall	obf	open boarded fence
catv	cable TV cover	p	post
cbf	closeboarded fence	pb	post box
cbrw	conc block ret. wall	ret.	retaining wall
cbw	conc block wall	re	rodding eye
cl	cover level	rg	road gully
clf	chainlink fence	rs	road sign
conc	concrete	rwp	rainwater pipe
cp	concrete post	sp	signpost
cws	combined sewer	srw	stone ret. wall
dk	drop kerb	sv	stop valve
ep	electricity pole	svp	soil vent pipe
ESS	Elec. Sub-Station	tcb	telephone callbox
fb	flower bed	tl	traffic light
fh	fire hydrant	tp	telegraph pole
fl	floor level	utr	unable to raise
fws	foul water sewer	vp	vent pipe
g	gully	wlap	woodlap fence
gsv	gas valve	wm	water meter
ic	inspection cover	wp	wood post
il	invert level		
irf	iron railing fence		
jb	junction box		

Notes

1. This survey has been computed and drawn about the Ordnance Survey National Grid.
2. All levels are in metres and relate to the mean of the nearest five Ordnance Survey active GPS stations.
3. This survey was measured for a scale of 1:500, any subsequent enlargements should be verified on site.

Revisions

8. Public cyclepath added October 2018.



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Surveyed	R McArdell	Date	Oct 2018
Drawn	R McArdell	Checked	Oct 2018

Drawing Title	Topographical Survey Southview Farmhouse Elm Grove, Drynham Lane Trowbridge
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Client	Coulston Estates Ltd Titsey Estate Office Pilgrims Lane Oxsted, Surrey
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Drawing No.	Rev	Scale	A2 @
A768/8434/8		1:500	

Appendix B – Landscape Plan



KEY:

SOFT LANDSCAPE
Refer to Planting Plan and Plant Schedule for more information (ref: 259_GLA_XX_XX_DR_L_200 and 259_GLA_XX_XX_DR_L_201)

- Proposed infrastructure trees
- Proposed orchard trees
- Proposed multi-stem trees
- Ornamental planting mix A - To Farm House setting
- Ornamental planting mix B - To outdoor nursery area and infrastructure
- Ornamental planting mix C - To nursery car park
- Infrastructure planting mix - To dark zone and habitat area
- Amenity Lawn
- Species rich meadow grass edge
- Mixed native hedgerow

HARD LANDSCAPING

- SF1 - Tarmac to footpath
- SF2 - Resin bound gravel, colour: buff - to nursery main access
- SF3 - High quality permeable pre-cast concrete block paving, colour: mix of dark and mid grey - to parking spaces
- SF4 - Forest of Dean Pennant natural stone paving, colour: mixed - to Farm House garden
- SF5 - Self-binding gravel, colour: buff - to residential front garden path
- SF6 - Self-binding gravel, colour: buff - to residential front garden path
- SF7 - Play safety surfacing, colour: multi-colour - to nursery recreation area
- SF8 - Astro turf

BOUNDARIES & FURNITURE

- B1A - Proposed stone wall, using stone from existing wall, 1.2m high
- B1A - Proposed stone wall, material to match existing walls, 1.2m high
- B2 - Proposed stone wall, using stone from existing wall, 1.2m high. With 0.6m high close board fence above
- B3 - Timber palisade fence, 1.1m high, with matching gates
- B4 - Close board fence, 1.8m high, with matching gates
- B5 - Wavy edge timber fence, 2.1m high, with matching gates, to dark zone and habitat area
- Open space contours
Existing in black, proposed in grey
- Timber planters
- Trim trail

0m 5m 10m 20m		
Rev	Note	Date
P1	For Planning	09.01.2026
PA	For Comment	28.11.2025

GREENHALGH

Landscape Architecture

Project
Southview Farm,
Trowbridge

Drawing Name Landscape Plan		
Drawn By BS	Checked By IG	Scale 1:200 @A1
Job No. 259	Status S3	
Drawing No. 259_GLA_XX_XX_DR_L_1001	Rev P1	

Appendix C – Proposed Drainage Strategy



KEY

PROPOSED PRIVATE SURFACE WATER DRAINAGE

PROPOSED PRIVATE FOUL WATER DRAINAGE

PROPOSED PRIVATE PPIC

PROPOSED PRIVATE RODDING EYE

PROPOSED TANKED PERMEABLE SURFACING
(SURFACING AS PER LANDSCAPE ARCHITECT'S PROPOSALS)

PROPOSED GREEN ROOF

PROPOSED GECELLULAR ATTENUATION TANK

PROPOSED HYDROBRAKE

FLOOD EXCEEDANCE ROUTE

INDICATIVE LEVEL

INVERT OF PERMEABLE PAVING SUB BASE

3m SEWER EASEMENT

NOTES

ALL LEVELS, SVPS AND RWP'S INDICATIVE AND SUBJECT TO DETAILED DESIGN AND SETTING OUT POST-PLANNING.

B	UPDATED IN LINE WITH LANDSCAPING PLAN	14.01.26	RJP	BS
A	FIRST ISSUE	10.12.25	RJP	BF

REV.	DESCRIPTION	Date	BY	CHK
------	-------------	------	----	-----

DESIGN BY:

CLIENT:

COULSTON ESTATES LTD

DRAWING STATUS:

PLANNING APPLICATION

SCALE @ A1:

0 1:200 10 metres

PROJECT:

SOUTH VIEW FARMHOUSE, TROWBRIDGE

TITLE:

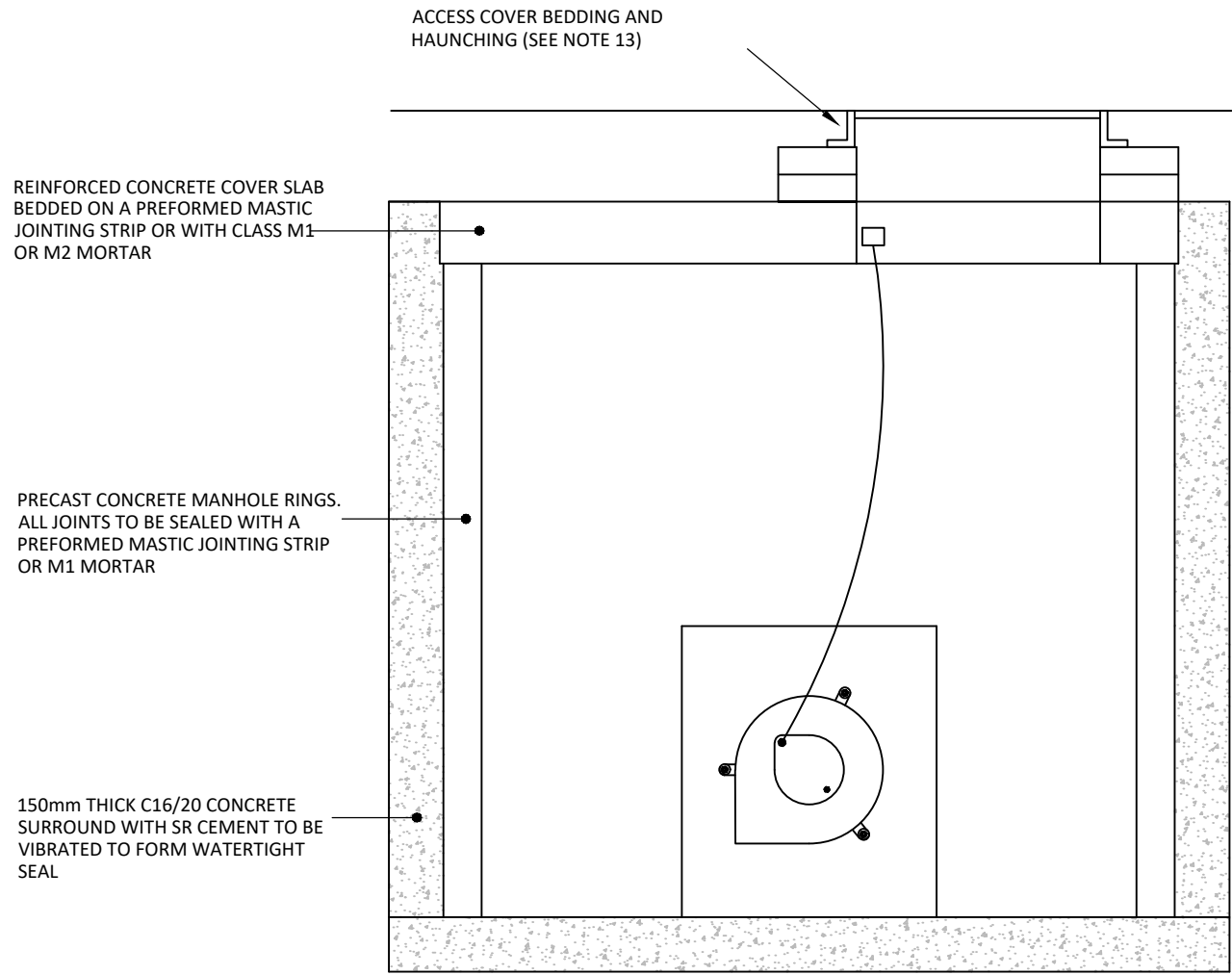
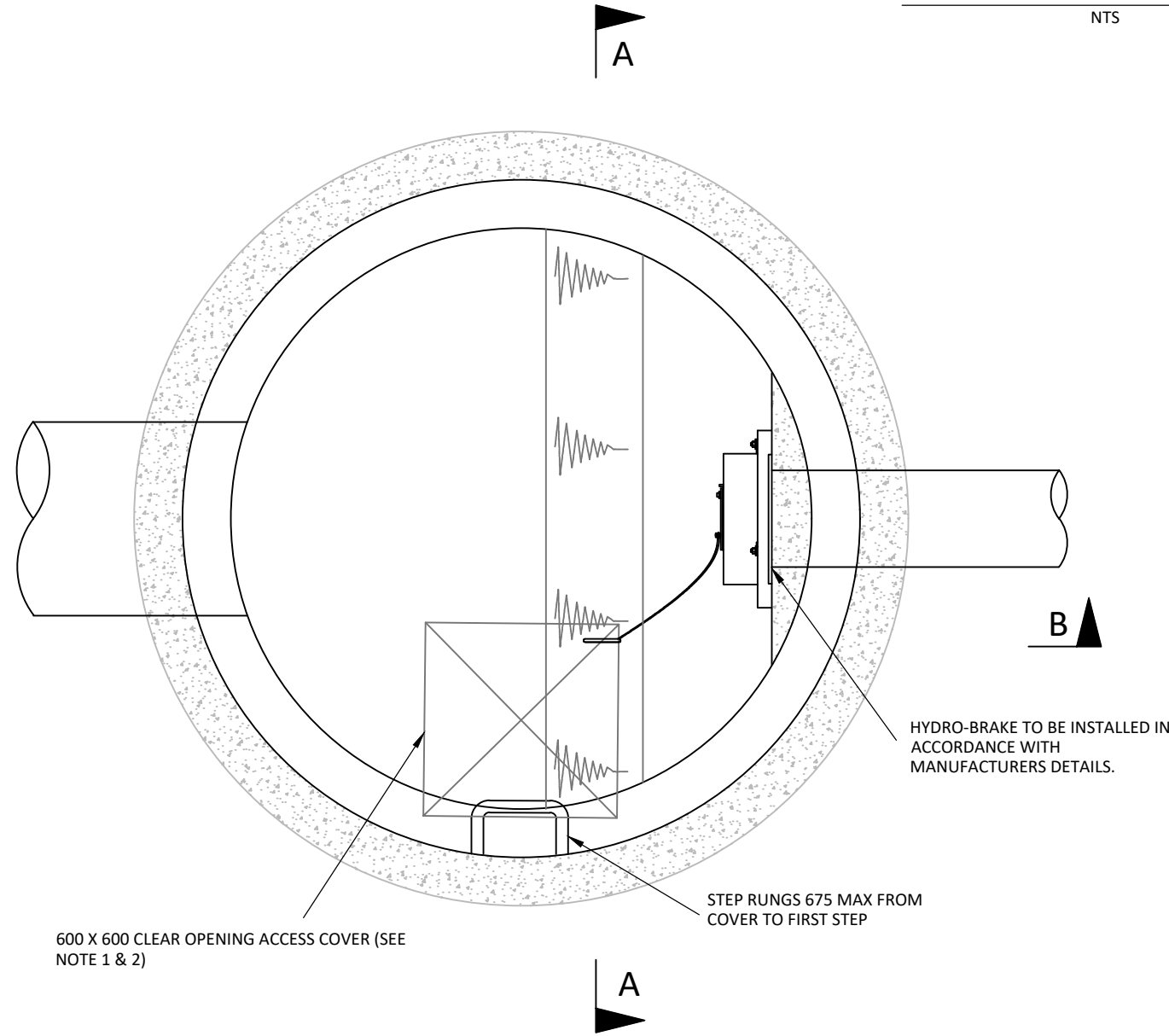
DRAINAGE STRATEGY

Project Ref:	Originator:	Stage:	Phase:	Number:	REV:
19862-TUM-DD-XXX-0200					B

Appendix D – Standard Drainage Details

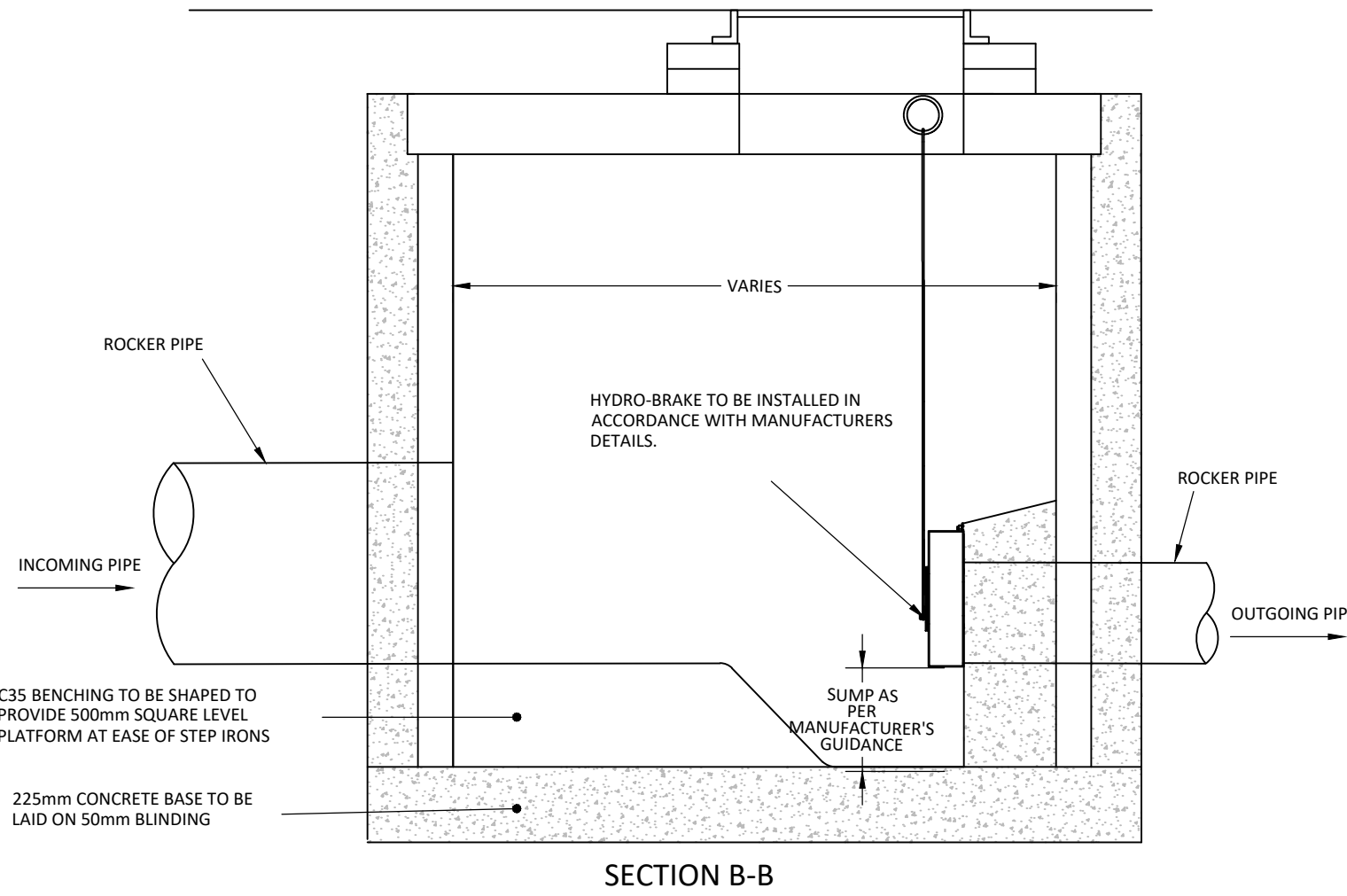
FLOW CONTROL MANHOLE

NTS



SECTION A-A

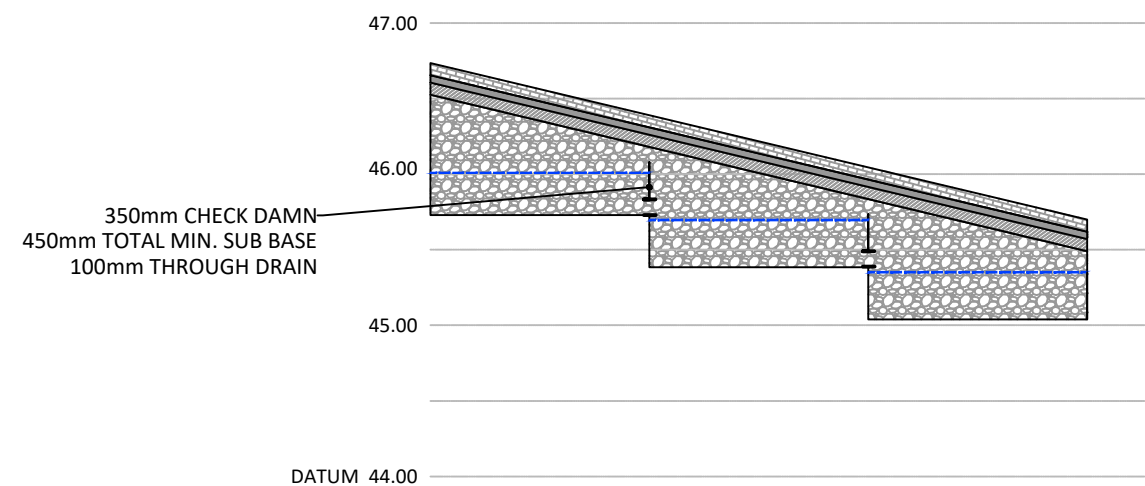
- NOTE:
- ACCESS COVER GRADES (DEPTH OF FRAME TO SUIT LOCATION AND HIGHWAY CATEGORY)
BS EN 124
CLASS D400 - CARRIAGEWAY AND PARKING AREAS
CLASS B125 - FOOTWAYS, ETC
 - ACCESS COVERS TO HAVE A MINIMUM CLEAR OPENING OF 600mm SQUARE
CHAMBER SHALL BE SIZED APPROPRIATELY IN RELATION TO PIPES, MAN ACCESS AND REQUIREMENTS AND REQUIREMENTS OF CONTROL DEVICES
 - PIPES BUILT INTO MANHOLES SHALL HAVE A FLEXIBLE JOINT AS CLOSE AS FEASIBLE TO THE EXTERNAL FACE OF THE STRUCTURE AND THE LENGTH OF THE NEXT ROCKER PIPE SHALL BE AS SHOWN BELOW
- | NOMINAL DIAMETER (mm) | EFFECTIVE LENGTH (m) |
|-----------------------|----------------------|
| 150 - 600 | 0.60 |
| 601 - 750 | 1.00 |
| OVER 750 | 1.25 |
- EFFECTIVE LENGTH (m)
- STEP RUNGS SHALL BE DOUBLE POLYPROPYLENE ENCAPSULATED
 - ALL IN-SITU CONCRETE TO HAVE 50-75mm SLUMP AND TO BE VIBRATED TO FORM DENSE WATERTIGHT SEAL WITH PRECAST SECTIONS
 - BENCHING TO BE C28/35 OR GRANULITHIC TO FORM DENSE SMOOTH FINISH WITH A 500mm X 500mm FLAT AREA AT BOTTOM OF MAN ENTRY SYSTEM
 - IN-FILL COVERS OF ANY TYPE SHALL NOT BE USED, WHERE A COVER IS LOCATED IN AN AREA OF CLOCK PAVING THE FRAME SHALL BE 150mm DEEP
 - FRAME FOR MANHOLE COVERS SHALL BE BEDDED IN A POLYESTER RESIN BEDDING MORTAR IN ALL SITUATIONS WHERE COVERS ARE SITED IN NSW ROAD CATEGORIES 1, 2 OR 3
 - LADDERS SHALL BE EITHER STAINLESS STEEL OR GRP, FIXINGS TO BE STAINLESS STEEL. DOUBLE RUNG STEP IRONS ALSO AVAILABLE
 - WHERE FITTED LADDERS SHALL BE EXTENDABLE TO A HEIGHT OF 1m ABOVE GROUND LEVEL
 - WHERE TOP HOLE PROVIDED IN BENCHING, SIZE OF HOLE SHALL BE 150mm HIGH X 150mm (MIN) DEPTH AND WIDTH. VERTICAL SPACING SHALL BE SAME AS STEP RUNGS
 - FRAMES FOR MANHOLE COVERS SHALL BE BEDDED IN A POLYESTER RESIN BEDDING MORTAR IN ALL SITUATIONS WHERE COVERS ARE SITED IN NSW ROAD CATEGORIES 1, 2 OR 3
 - UNLESS NOTED OTHERWISE ALL DIMENSIONS ARE IN MILLIMETERS



SECTION B-B

SECTION A-A PERMEABLE PAVING SECTION

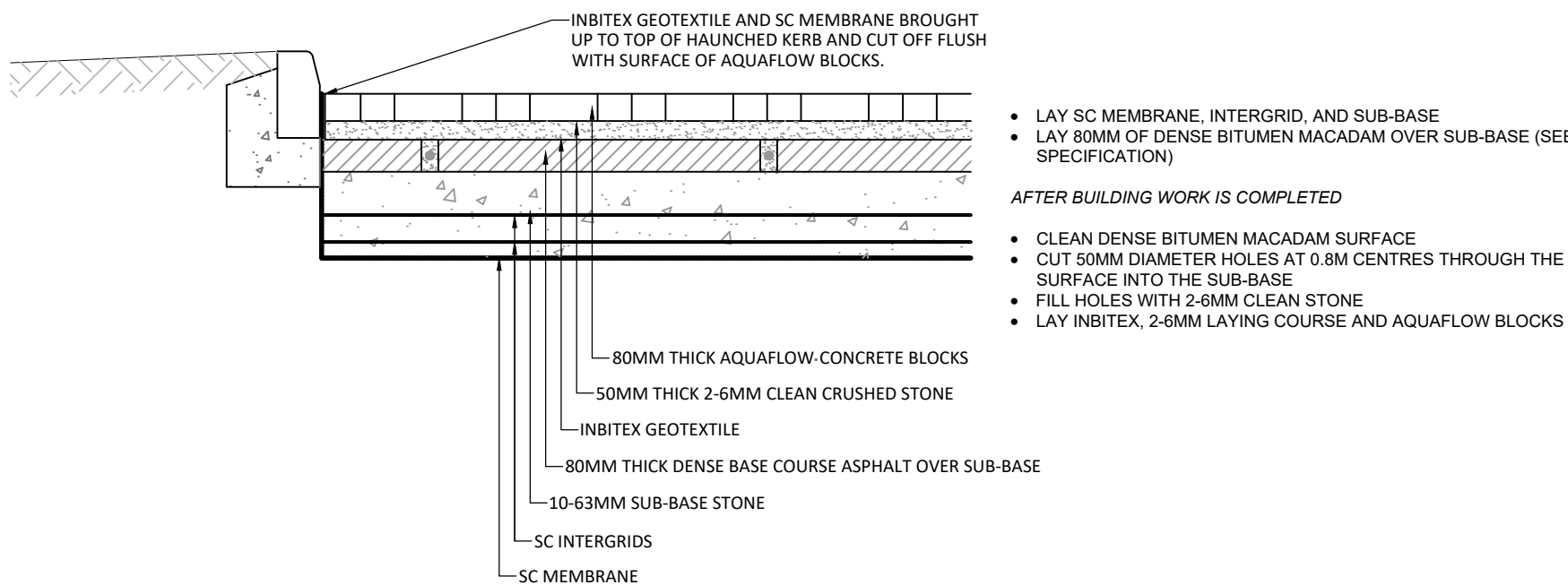
NTS



CHAINAGE	0.00	7.24	14.48	21.72
EXISTING GROUND LEVEL	46.58			46.30
PROPOSED ROAD LEVEL	46.70	46.36	46.03	45.70
ROAD LONGITUDINAL GRADIENT	1:21	1:21	1:21	
INVERT LEVEL	45.70	45.36	45.04	45.04
WATER LEVEL (1%AE+CC)	46.02	45.52	45.52	45.52

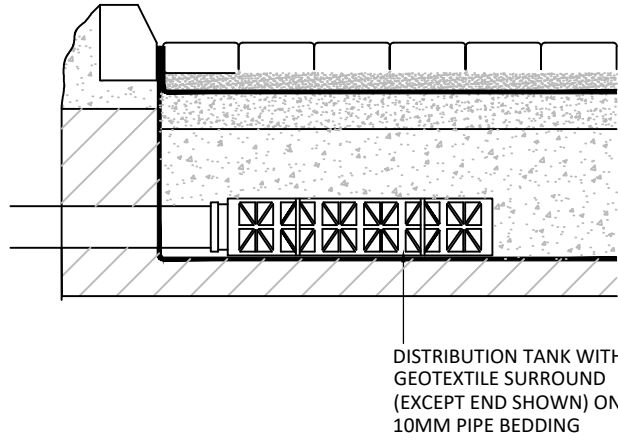
TYPICAL SECTION THROUGH FORMPAVE AQUAFLOW ATTENUATION SYSTEM

(HEAVY DUTY CONSTRUCTION) NTS



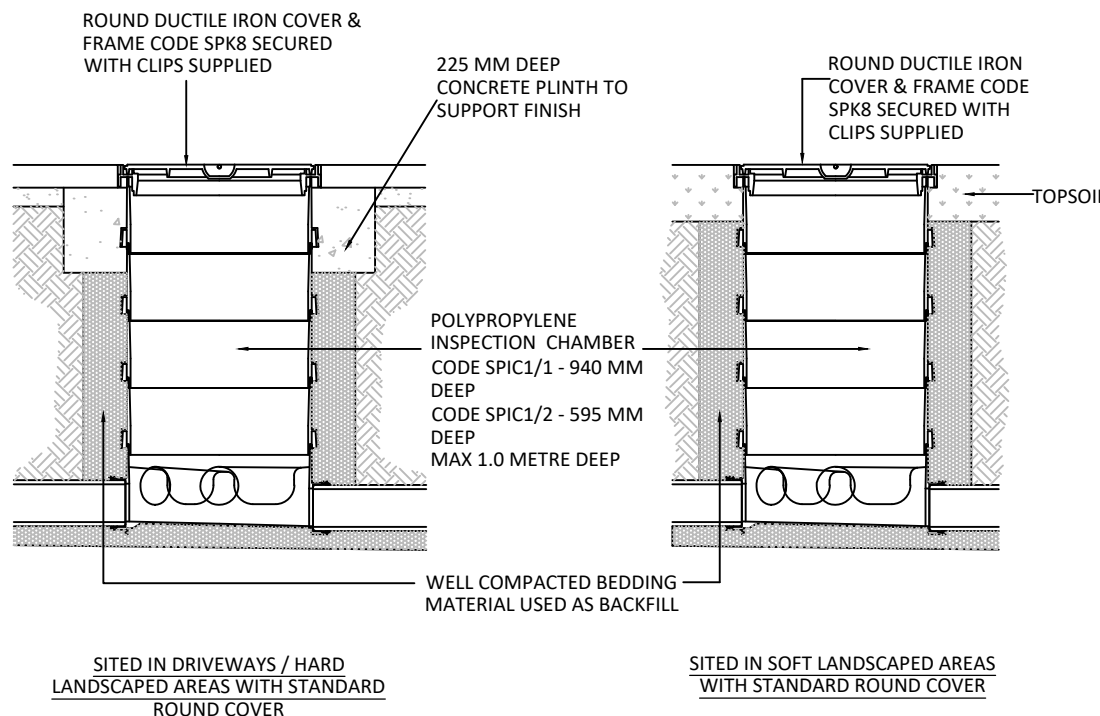
TYPICAL MODULAR BLOCK PAVING DISTRIBUTION BOX INLET DETAIL

NTS



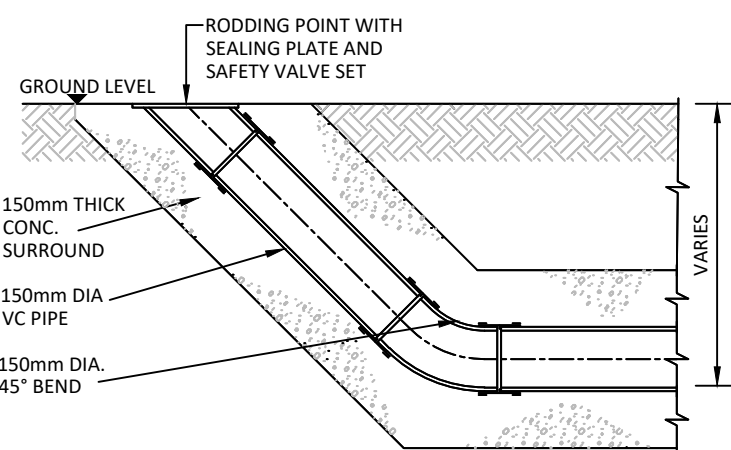
POLYPROPYLENE INSPECTION CHAMBER

SCALE 1:20



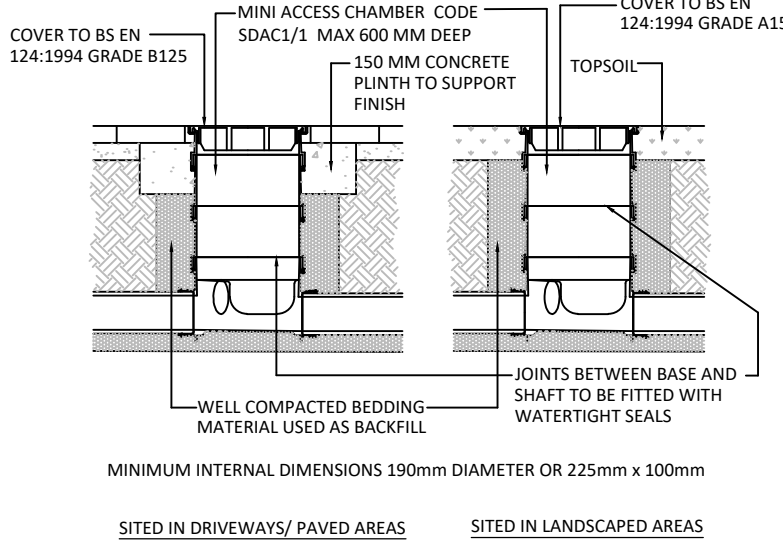
RODDING EYE DETAIL

SCALE 1:20



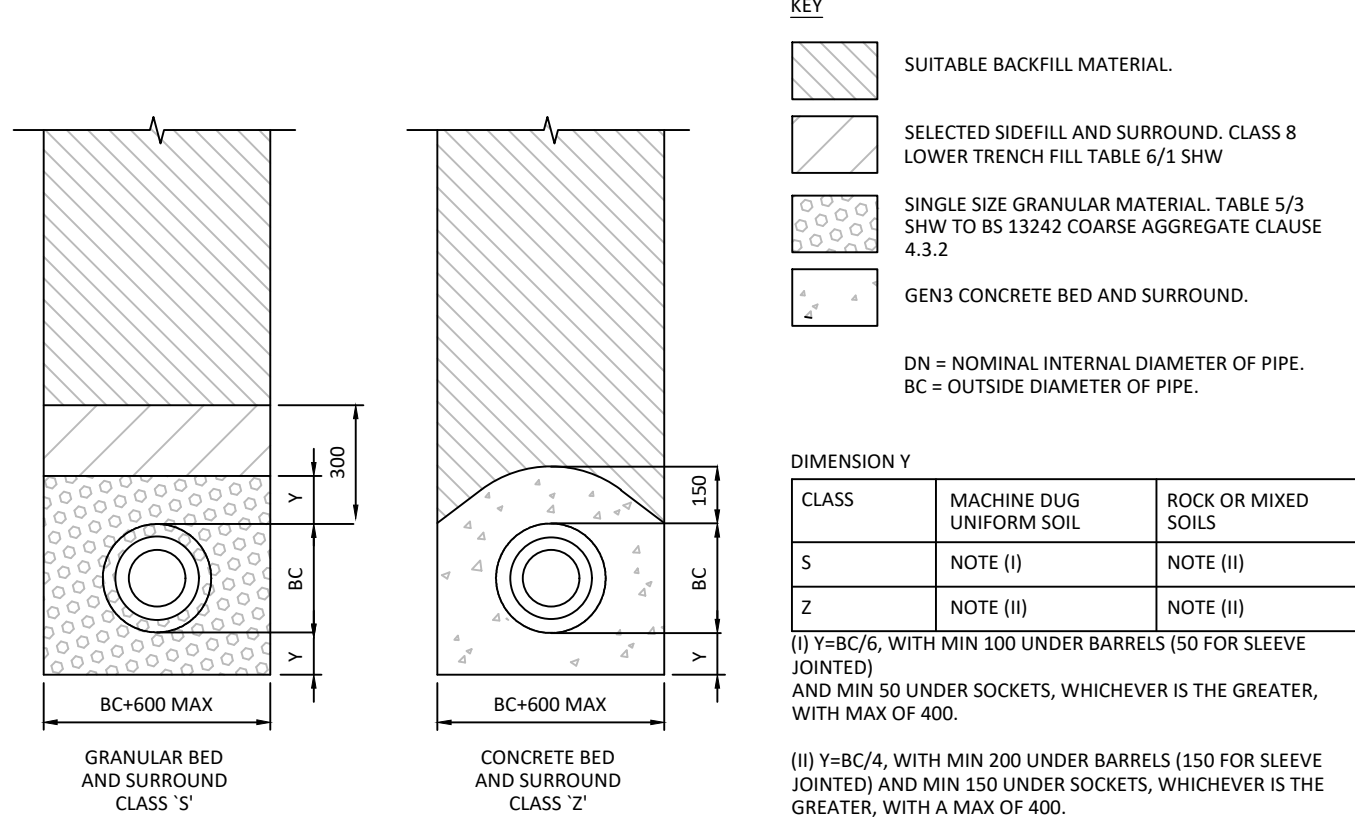
MINI ACCESS CHAMBER DETAIL

SCALE 1:20



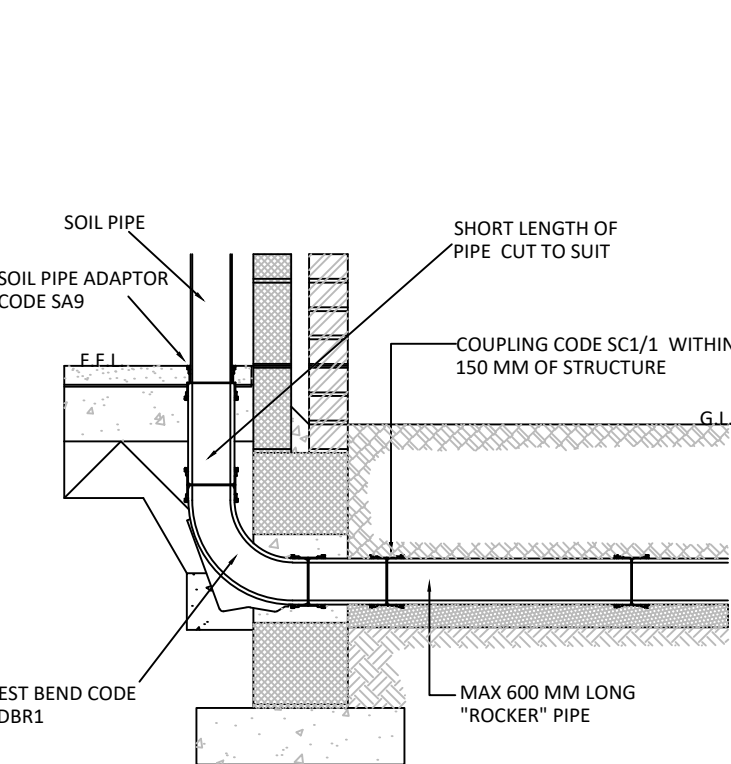
PIPE BEDDING DETAILS

SCALE 1:20



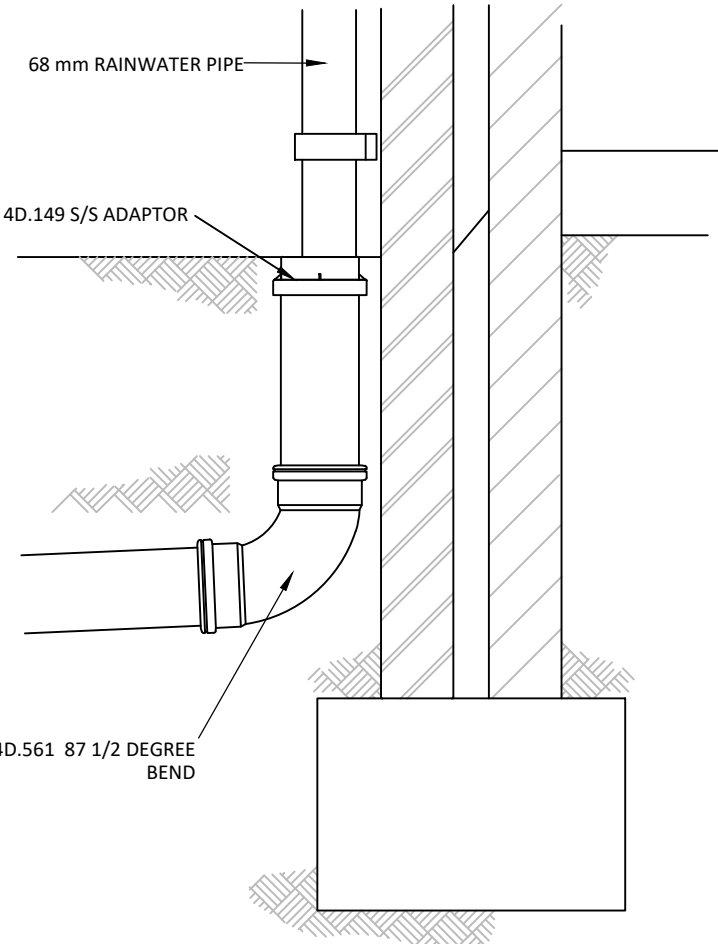
SOIL & VENT PIPE / STUB STACK / W.C. PIPE

SCALE 1:20



EXTERNAL R.W.P. TO DRAIN

SCALE 1:20



DESIGN BY:				CLIENT:		PROJECT:	
				COULSTON ESTATES LTD		SOUTH VIEW FARM HOUSE	
ARCHITECT:				TITLE:		STANDARD DRAINAGE DETAILS	
DRAWING STATUS:				SCALE @ A1:		PROJECT No:	DRAWING No:
PLANNING APPLICATION				AS SHOWN		19682	TUM-PL-XXX-0220
REV.				REVISION		REV:	
B UPDATED WITH NEW SITE PLAN				14/01/26		RP	
A FIRST ISSUE				10/12/25		NKS	
REV.				Date		BY	
DESCRIPTION				Date		CHK	

Appendix E – Causeway FLOW Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	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	✓
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)
1	0.023	5.00	45.850	450	385967.722	156788.502	0.850
2	0.006	5.00	45.850	450	385974.284	156793.250	0.950
3	0.010	5.00	45.850	450	385963.524	156809.058	1.080
4	0.087	5.00	45.650	450	385963.880	156811.240	0.700
5	0.003	5.00	45.650	450	385965.046	156811.675	0.900
6			45.400	450	385983.770	156817.485	1.470
7	0.031	5.00	45.750	450	385987.641	156842.317	1.300
8			45.100	1200	385996.482	156822.193	1.240
9			44.600	450	386009.206	156820.480	0.868

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	8.100	0.600	45.000	44.900	0.100	81.0	150	5.12	46.7
1.001	2	3	19.123	0.600	44.900	44.770	0.130	147.1	150	5.51	45.4
1.002	3	5	3.027	0.600	44.770	44.750	0.020	150.0	150	5.57	45.2
2.000	4	5	1.245	0.600	44.950	44.750	0.200	6.2	150	5.01	47.1
1.003	5	6	19.605	0.600	44.750	44.005	0.745	26.3	150	5.73	44.0
1.004	6	8	13.556	0.600	43.930	43.860	0.070	193.7	225	5.98	43.8
3.000	7	8	21.980	0.600	44.450	43.935	0.515	42.7	150	5.24	46.3
1.005	8	9	12.839	0.600	43.860	43.732	0.128	100.0	225	6.14	43.3

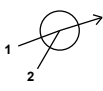
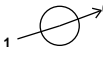
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.118	19.8	3.9	0.700	0.800	0.023	0.0	45	0.868
1.001	0.826	14.6	4.8	0.800	0.930	0.029	0.0	59	0.739
1.002	0.818	14.5	6.4	0.930	0.750	0.039	0.0	69	0.791
2.000	4.066	71.8	14.8	0.550	0.750	0.087	0.0	46	3.210
1.003	1.970	34.8	20.5	0.750	1.245	0.129	0.0	83	2.050
1.004	0.936	37.2	20.4	1.245	1.015	0.129	0.0	119	0.957
3.000	1.544	27.3	5.2	1.150	1.015	0.031	0.0	44	1.192
1.005	1.307	52.0	25.0	1.015	0.643	0.160	0.0	110	1.297

Pipeline Schedule

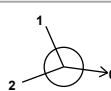
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	8.100	81.0	150	Circular	45.850	45.000	0.700	45.850	44.900	0.800
1.001	19.123	147.1	150	Circular	45.850	44.900	0.800	45.850	44.770	0.930
1.002	3.027	150.0	150	Circular	45.850	44.770	0.930	45.650	44.750	0.750
2.000	1.245	6.2	150	Circular	45.650	44.950	0.550	45.650	44.750	0.750
1.003	19.605	26.3	150	Circular	45.650	44.750	0.750	45.400	44.005	1.245
1.004	13.556	193.7	225	Circular	45.400	43.930	1.245	45.100	43.860	1.015
3.000	21.980	42.7	150	Circular	45.750	44.450	1.150	45.100	43.935	1.015
1.005	12.839	100.0	225	Circular	45.100	43.860	1.015	44.600	43.732	0.643

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	450	Manhole	Adoptable	2	450	Manhole	Adoptable
1.001	2	450	Manhole	Adoptable	3	450	Manhole	Adoptable
1.002	3	450	Manhole	Adoptable	5	450	Manhole	Adoptable
2.000	4	450	Manhole	Adoptable	5	450	Manhole	Adoptable
1.003	5	450	Manhole	Adoptable	6	450	Manhole	Adoptable
1.004	6	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
3.000	7	450	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.005	8	1200	Manhole	Adoptable	9	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	385967.722	156788.502	45.850	0.850	450		0	1.000	45.000	150
2	385974.284	156793.250	45.850	0.950	450		1	1.000	44.900	150
3	385963.524	156809.058	45.850	1.080	450		1	1.001	44.770	150
4	385963.880	156811.240	45.650	0.700	450		0	1.002	44.770	150
5	385965.046	156811.675	45.650	0.900	450		1	2.000	44.750	150
6	385983.770	156817.485	45.400	1.470	450		2	1.002	44.750	150
7	385987.641	156842.317	45.750	1.300	450		0	1.003	44.750	150
							1	1.003	44.005	150
							0	1.004	43.930	225
							0	3.000	44.450	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
8	385996.482	156822.193	45.100	1.240	1200		1	3.000	43.935	150
							2	1.004	43.860	225
							0	1.005	43.860	225
9	386009.206	156820.480	44.600	0.868	450		1	1.005	43.732	225

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	✓
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
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	40	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Node 3 Online Orifice Control

Flap Valve	x	Invert Level (m)	44.770	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.040		

Node 4 Online Orifice Control

Flap Valve	x	Invert Level (m)	44.950	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.040		

Node 8 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	43.860	Product Number	CTL-SHE-0090-3800-1200-3800
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	3.8	Min Node Diameter (mm)	1200

Node 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	45.140	Slope (1:X)	999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	43	Depth (m)	0.350
Safety Factor	2.0	Width (m)	6.000	Inf Depth (m)	
Porosity	0.30	Length (m)	26.000		

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	45.040	Slope (1:X)	9999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.350
Safety Factor	2.0	Width (m)	23.000	Inf Depth (m)	
Porosity	0.30	Length (m)	25.200		

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	43.860
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	288

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	44.0	0.0	0.750	44.0	0.0	0.751	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.28%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	22	45.156	0.156	3.1	0.2529	0.0000	SURCHARGED
30 minute summer	2	22	45.156	0.256	3.9	0.0407	0.0000	SURCHARGED
30 minute summer	3	22	45.155	0.385	3.3	0.0612	0.0000	SURCHARGED
240 minute summer	4	164	45.087	0.137	4.9	7.9364	0.0000	OK
15 minute summer	5	12	44.782	0.032	3.4	0.0051	0.0000	OK
180 minute summer	6	120	43.997	0.067	3.1	0.0106	0.0000	OK
15 minute summer	7	10	44.493	0.043	4.8	0.0069	0.0000	OK
180 minute summer	8	120	43.996	0.136	4.9	5.8537	0.0000	OK
15 minute summer	9	1	43.732	0.000	2.3	0.0000	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)
30 minute summer	1	1.000	2	3.1	0.617	0.155	0.1426	
30 minute summer	2	1.001	3	2.2	0.277	0.148	0.3367	
30 minute summer	3	Orifice	5	2.0				
240 minute summer	4	Orifice	5	1.1				
15 minute summer	5	1.003	6	3.4	1.243	0.098	0.0538	
180 minute summer	6	1.004	8	3.0	0.616	0.080	0.2375	
15 minute summer	7	3.000	8	4.7	1.147	0.173	0.0908	
180 minute summer	8	Hydro-Brake®	9	3.3				29.8

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.28%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	1	48	45.339	0.339	13.2	8.7716	0.0000	SURCHARGED
60 minute summer	2	47	45.339	0.439	4.0	0.0697	0.0000	SURCHARGED
60 minute summer	3	47	45.336	0.566	4.1	0.0901	0.0000	SURCHARGED
180 minute winter	4	172	45.264	0.314	12.3	38.7140	0.0000	SURCHARGED
15 minute summer	5	11	44.791	0.041	5.4	0.0065	0.0000	OK
240 minute summer	6	248	44.400	0.470	4.4	0.0748	0.0000	SURCHARGED
15 minute summer	7	10	44.547	0.097	19.1	0.0154	0.0000	OK
240 minute summer	8	248	44.400	0.540	9.1	23.1635	0.0000	SURCHARGED
15 minute summer	9	1	43.732	0.000	3.6	0.0000	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)
60 minute summer	1	1.000	2	-3.8	0.517	-0.190	0.1426	
60 minute summer	2	1.001	3	2.4	0.326	0.162	0.3367	
60 minute summer	3	Orifice	5	2.5				
180 minute winter	4	Orifice	5	1.8				
15 minute summer	5	1.003	6	5.4	1.411	0.154	0.1092	
240 minute summer	6	1.004	8	4.3	0.688	0.115	0.5391	
15 minute summer	7	3.000	8	18.9	1.621	0.692	0.2560	
240 minute summer	8	Hydro-Brake®	9	3.8				88.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.28%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	57	45.444	0.444	12.8	13.6646	0.0000	SURCHARGED
60 minute winter	2	57	45.443	0.543	3.7	0.0863	0.0000	SURCHARGED
60 minute winter	3	57	45.440	0.670	4.0	0.1065	0.0000	SURCHARGED
240 minute winter	4	228	45.352	0.402	13.2	53.9739	0.0000	FLOOD RISK
360 minute winter	5	336	45.056	0.306	4.6	0.0486	0.0000	SURCHARGED
360 minute winter	6	336	45.048	1.118	4.6	0.1778	0.0000	SURCHARGED
360 minute winter	7	336	45.048	0.598	3.5	0.0950	0.0000	SURCHARGED
360 minute winter	8	336	45.047	1.187	7.6	32.7137	0.0000	FLOOD RISK
15 minute summer	9	1	43.732	0.000	3.8	0.0000	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)
60 minute winter	1	1.000	2	-3.5	0.557	-0.176	0.1426	
60 minute winter	2	1.001	3	2.6	0.323	0.178	0.3367	
60 minute winter	3	Orifice	5	2.7				
240 minute winter	4	Orifice	5	2.1				
360 minute winter	5	1.003	6	4.6	1.252	0.133	0.3451	
360 minute winter	6	1.004	8	4.5	0.693	0.122	0.5391	
360 minute winter	7	3.000	8	3.5	0.708	0.128	0.3870	
360 minute winter	8	Hydro-Brake®	9	3.8				114.3