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CONSULTING LIMITED

Canterbury City Council
Head of Planning
Military Road
Canterbury
CT1 1YW

Date: 19 February 2021
Your Ref: CA/20/01068 & CA/20/1068/FUL
Our Ref: SAH/2632/10909_Rev3
Email: simon.mb@herringtonconsulting.co.uk

Discharge of Condition 3 for the proposed development at 53 Joy Lane, Whitstable, Kent, CT5 4DB (Unit A)

This letter has been prepared with reference to planning application CA/20/01068 and is aimed at discharging planning condition 5 (herein referred to as Condition 5) for the proposed development at the above address. Condition 5 relates to surface water drainage from the proposed development.

The combined proposal is for the erection of 3 new residential detached dwellings, on previously undeveloped land located on Joy Lane, Whitstable. This specific application is for the construction of Dwelling A.

The full details of the planning condition are quoted below:

Planning Condition 5 (CA/20/02508 | Details submitted pursuant to condition 05 (surface water drainage) of planning permission CA/20/01068/FUL)

*"…"Development shall not begin until a detailed sustainable surface water drainage scheme for the site has been submitted to (and approved in writing by) the local planning authority. The detailed drainage scheme shall demonstrate that due consideration has first been given to the possibility of utilising infiltration techniques and that the surface water generated by this development (for all rainfall durations and intensities up to and including the climate change adjusted critical 100 year storm) can be accommodated and disposed of within the curtilage of the site without increase to flood risk on or off-site. Should the use of infiltration prove to be beyond being reasonably practical then any surface water leaving site shall not exceed a discharge rate of **2l/s for all rainfall events**. The drainage scheme shall also demonstrate that silt and pollutants resulting from the site use and construction can be adequately managed to ensure there is no pollution risk to receiving waters.*

REASON: To ensure adequate drainage provision and to prevent pollution, in accordance with policies CC11, CC12, CC13 and QL12 of the Canterbury District Local Plan 2017 and the National Planning Policy Framework."…"

Herrington Consulting Limited

Canterbury Office
Unit 6 & 7
Barham Business Park
Elham Valley Road
Barham
Canterbury
Kent
CT4 6DQ

Tel 01227 833855

London Office
Unit D
Taper Building
Weston Street
London
SE1 3QB

www.herringtonconsulting.co.uk

Proposed Development

The proposed development is for the construction of 3 residential properties, an access road, and a parking area.

This report includes details of how Property A will be drained, both in isolation and as part of the wider 3 unit scheme. This is to ensure that suitable provisions for surface water management are in place, in the event units B and C are not completed, or are completed at a later date, e.g. due to the phased nature of the development. Separate reports detailing the isolated drainage solution for properties B and C have also been produced and are to be submitted separately. Figure 1 below shows the proposed roof area for Property A.

Figure 1 – Proposed plot A.

National Policy for SuDS

In accordance with the 2019 National Planning Policy Framework (NPPF), Sustainable Drainage Systems (SuDS) should be included within the proposed development scheme where it is practicable to do so. The proposed development must also maintain, or ideally reduce, the rate at which runoff is discharged offsite. This is to ensure that the offsite risk of surface water flooding is not increased by the development.

The proposed development will also need to comply with the Non-statutory Technical Standards for Sustainable Drainage Systems (NTSS) and as such, the NTSS has been referenced when devising the drainage system.

Lead Local Flood Authority (LLFA) Comments

The LLFA provided a response on the 20th January 2021, which recommends that Condition 5 is discharged on the basis of the additional information submitted, which included:

- Construction drawings or a tender document for the proposed drainage system, including details of the storage tank.
- Confirmation of existing capacity within the surface water sewer network for the area.
- Details of the maintenance strategy, including confirmation that the owners of the 3 properties will be tasked with the ongoing maintenance of the SuDS.

Climate Change

The NPPF (2019) and supporting Planning Practice Guidance Suite (2014) state that residential development should be considered for a minimum of 100 years. The Environment Agency (EA) provides guidance regarding the application of the climate change allowances relating to peak rainfall intensity and how they should be applied to the planning process. The recommended allowances for increases in peak rainfall intensity are applicable nationally and have therefore been considered. For this development, an increase of 40% has been applied to the peak rainfall to account for the impacts of climate change over the lifetime of the development.

Drainage Model and Calculations

A hydraulic model has been constructed for the proposed surface water drainage system using Causeway Flow + and hydrological data obtained from the Flood Estimation Handbook (FEH), via the Centre for Ecology and Hydrology online web portal.

The hydraulic model has been used to test the proposed drainage system for a series of rainfall events, with storm durations ranging from 15 minutes to 7 days, and return periods from 1:2 years, up to and including, the design rainfall event 1:100 years. A 40% increase in peak rainfall intensity has also been applied to the rainfall hyetographs to account for climate change.

Existing Drainage

The existing site has no known surface water drains. However, a survey carried out (by others) has confirmed a connection between the site and foul sewer within the adjacent road.

Asset location data has been obtained from the sewerage undertaker Southern Water (SW), which confirms the location of public sewerage infrastructure near to the site. Figure 2 below delineates the network of sewers for the area around Joy Lane.

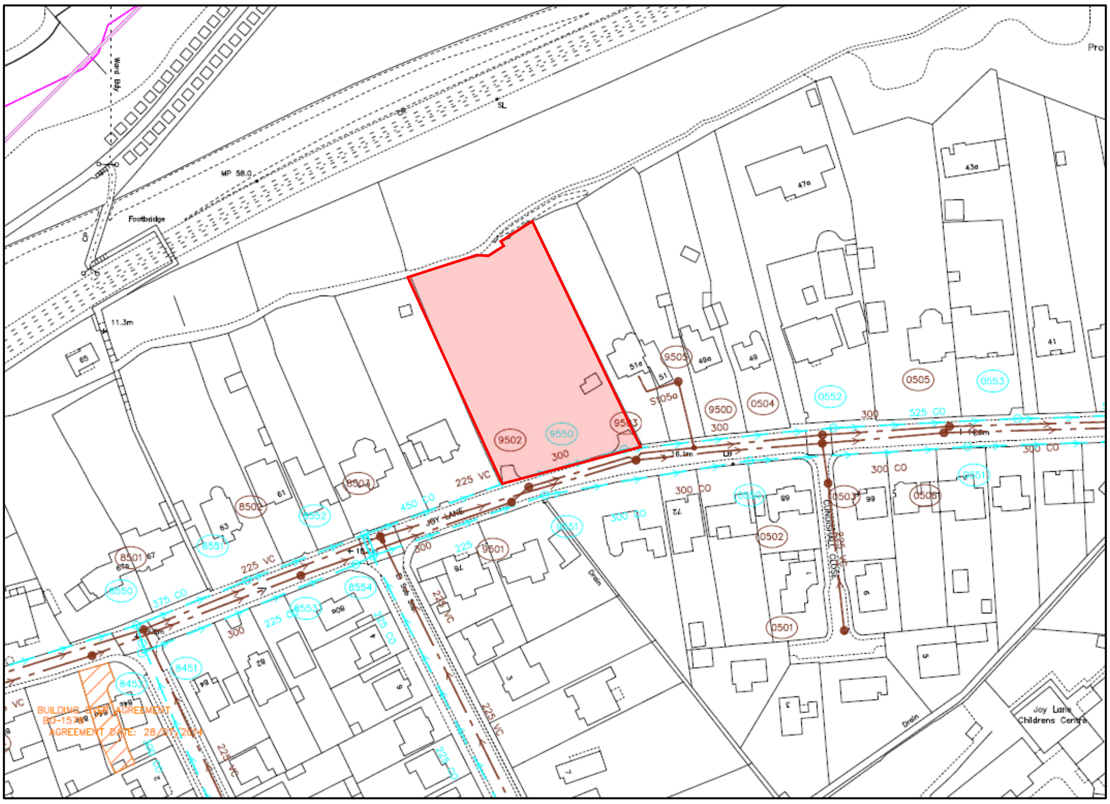


Figure 2 – Sewer mapping for the area around Joy Lane.

Greenfield runoff rates for the site have been calculated using the FEH Statistical Methodology, and are summarised in Table 1 below, along with calculations estimating the pre-development discharge rates based on the total area of existing hardstanding.

Return Period (years)	Greenfield Runoff Rate (l/s/ha)	Pre-development discharge rate based on 380 m^2 of existing hardstanding (l/s)
1:2	2.3	7.2
1:10	4.2	14.1
1:30	6.2	18.7
1:100	8.2	24.0

Table 1 - Summary of greenfield and existing runoff rates for the site.

With the inclusion of additional impermeable areas onto the site, there will be an increase in the rate at which surface water runoff will be discharged from the site (pre-mitigation). In order to reduce this impact, SuDS will need to be incorporated into the development to ensure that the site complies with the NTSS and local planning policy.

Drainage Hierarchy and Opportunities for Managing Surface Water Runoff

The following opportunities for managing the surface water runoff discharged from the development site are listed in order of preference:

Infiltration – Infiltration testing has been undertaken by the applicant and the results confirm that ground conditions at the site are unsuitable for the use of infiltration SuDS. This option for draining the site has therefore been discounted.

Discharge to Watercourses – The nearest mapped watercourse is a small drain located across the public highway to the south of the site. In addition, this drain is located on land outside the applicant's control and does not appear to be connected to the other drainage features in this area (e.g., surface water sewers). As a consequence, draining surface water runoff from the site into this drain is unlikely to be possible and this option for draining the site has therefore been discounted.

Discharge to Public Sewer System – There are several sewers within the road adjacent to the development site, which could facilitate a new surface water drainage connection to drain runoff from the development. On this basis, a connection to the public sewer system is likely to present the most viable solution for draining the development.

Measures to Prevent Discharge to the Highway

To prevent runoff from the site from draining to the highway, threshold drains will be incorporated into the drainage design for the access road into the development. These drainage channels will direct runoff into the SuDS for the site and will ensure that water does not leave the site during storms with return periods less than the design rainfall event. These drainage channels are shown on the detailed drainage drawing below (Figure 3).

Drainage for Property A (In Isolation)

Assuming Property A is constructed in isolation from the 2 remaining units, the drainage system can still be constructed beneath the area that will eventually become the access road and parking for the dwellings. The drainage layout plan below shows how a large geo-cellular storage tank can be incorporated into the proposals to drain Property A and future proof the design for further development at a later date, so that units B and C can be constructed without the need for any upgrades to the capacity of the proposed storage tank.

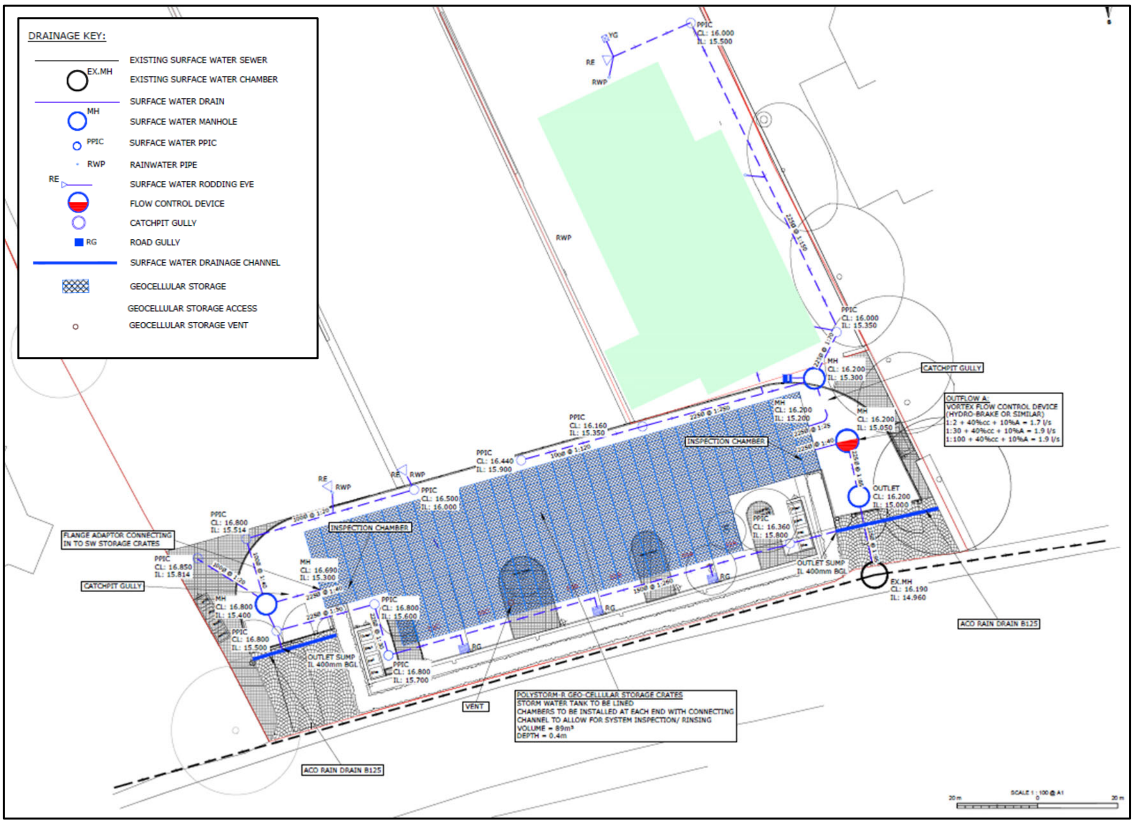


Figure 3 – Surface water drainage layout for Property A, Joy Lane, Whitstable.

Geo-Cellular Storage Tank – Runoff from Property A, the surrounding hardstanding and parking area will be drained to a storage tank located beneath the access drive and parking area. The design parameters for the geo-cellular storage tank are summarised in Table 2 below.

Parameter	**Design (1:100yr+40%cc event)**
Total impermeable area drainage to SuDS	940 m^2
Urban creep allowance	10 %
Infiltration	Not permitted (high ground water and clay soils)
Porosity of storage tank	95 %
Dimensions of storage tank	~223m^2 x 400mm (deep)
Required storage volume	~ 89 m^3
Flow restriction device	Vortex flow control (1.9 l/s)

Table 2 – Proposed drainage storage tank for a design of 1:100+ 40%cc.

Results from Hydraulic Model

The performance of the proposed drainage system has been tested by applying a series of rainfall events with varying return periods to a hydraulic model of the proposed drainage network. These calculations have been undertaken based on the combined 3 unit scheme, to ensure that on completion the storage provided by the site will be sufficient. A range of storm durations have been applied to each of the return period scenarios to determine the peak runoff rates from the proposed development. The proposed drainage system has been modelled in Causeway Flow + V9.0, using the FEH2013 rainfall methodology.

If Property A is constructed prior to properties B and C, the total area draining to the storage system will be less than that used within the drainage model (discussed above). The consequence of this will be that the storage tank will have spare capacity during the design rainfall event and will therefore be less likely to surcharge. The results from this hydraulic model are summarised in Table 3 below.

Element	Surface water runoff calculations for a range of return period events for the pre- and post- developed scenarios		
	1:2yr	1:30yr	1:100yr
Pre-development discharge	7.2 l/s	18.7 l/s	24.0 l/s
Proposed discharge rate from storage tank, including 40% allowance for climate change	1.7 l/s	1.9 l/s	1.9 l/s

Table 3 – Pre- and post- development surface water runoff calculations.

From Table 3 above and the model results appended, it is evident that with the inclusion of the proposed SuDS, there is potential to accommodate all of the surface water runoff from the site, up to and including, the design rainfall event. This provides runoff characteristics which are closer to the greenfield runoff rates for the site and therefore, presents a betterment when compared to the existing situation. Consequently, it is considered that this will be acceptable to the LPA and LLFA.

Combined Site Drainage

A drainage layout plan for the 3 unit scheme has been produced (Figure 4 below), which shows how units B and C can be connected into the drainage network either as a single phase or in isolation.

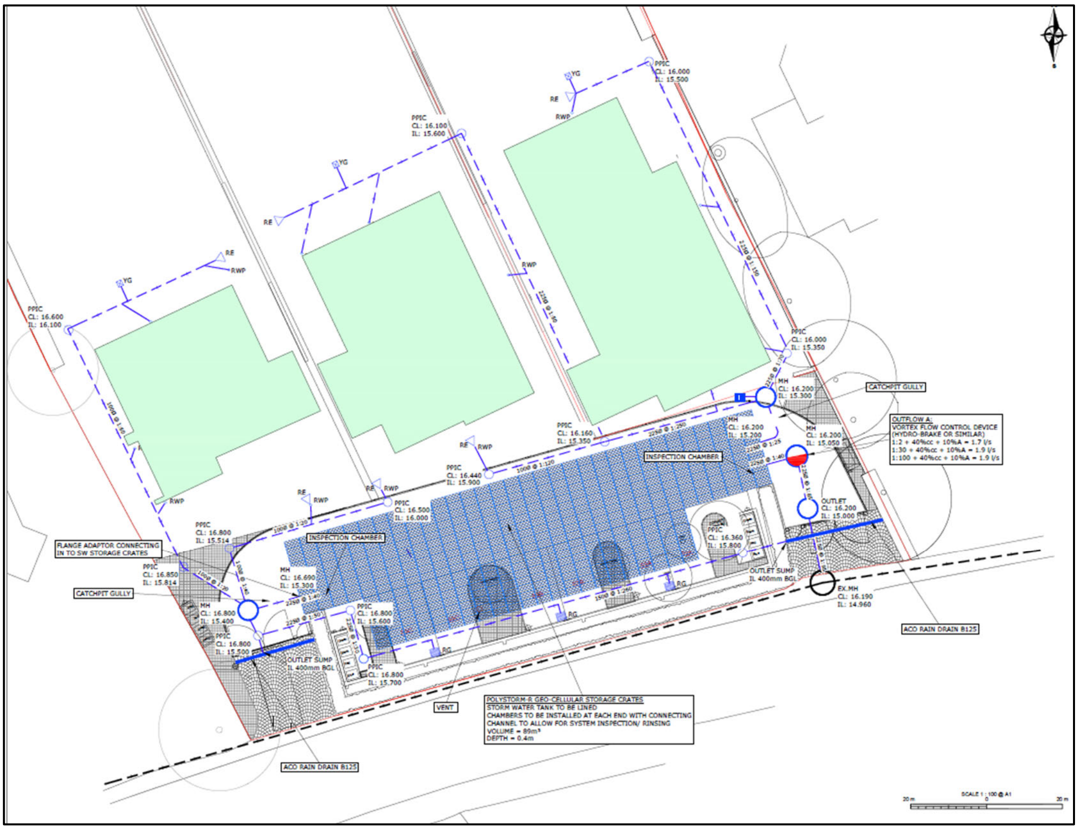


Figure 4 – Combined site drainage for the 3 unit scheme.

Existing Sewer Capacity

The sewerage undertaker has been contacted to determine the capacity of the existing sewerage infrastructure at the site, and to confirm whether the additional runoff from the proposed development can be accommodated within the existing surface water sewer network, without the need to upgrade the sewers in this area. The results of this capacity check have confirmed that there is currently adequate capacity for the proposed 2.1l/s discharge, and a copy has been appended to this letter.

Design Exceedance

The proposed drainage system has been designed to accommodate surface water runoff generated under an extreme rainfall event, with a return period of 1 in 100 years, including a 40% increase in peak rainfall intensity (to account for the impacts of climate change). As such, this additional percentage increase complies with the EA's most contemporary guidance on climate change for the upper allowances.

Nonetheless, in the event of an exceedance scenario (i.e., an event which exceeds the design rainfall event), it is considered likely that water would back up within the drainage system and overflow to the rear of the properties, resulting in localised flooding within the gardens. Figure 5 below shows the proposed drainage system and likely pathways water will take as it flows across the site, in the event that the drainage system fails

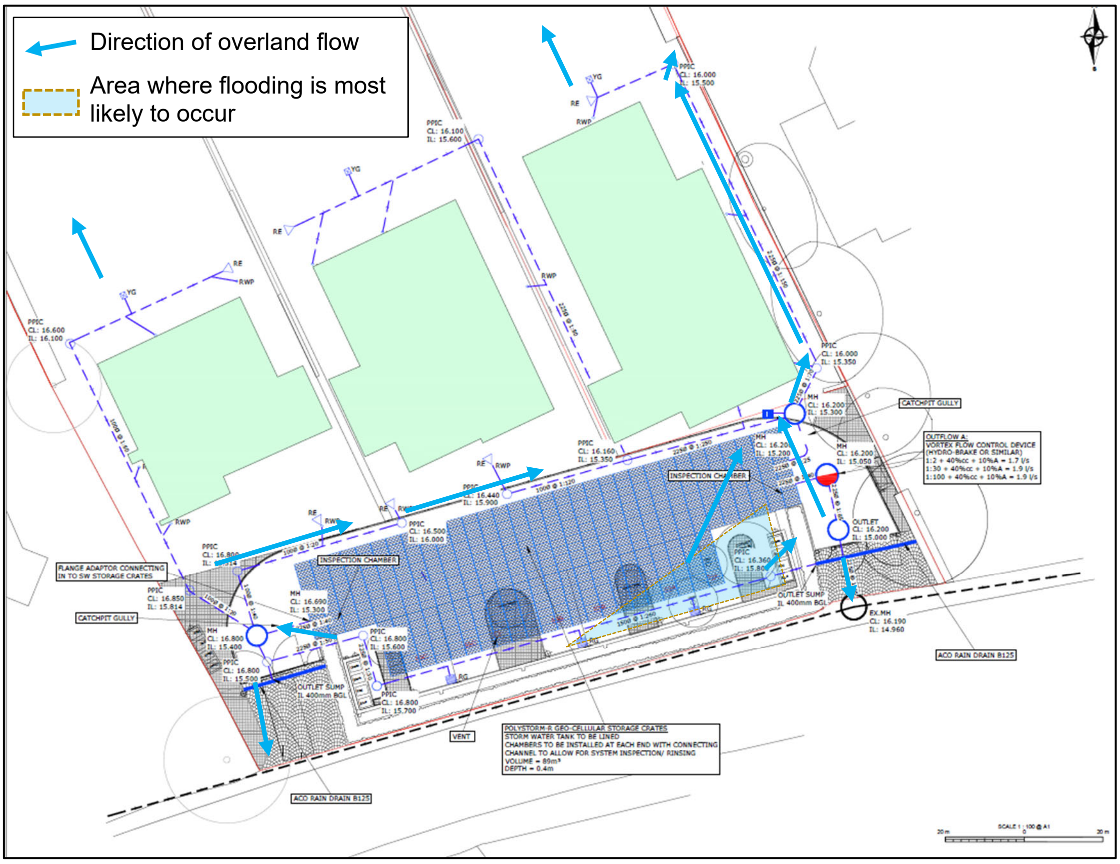


Figure 5 - Anticipated flow routes during an exceedance or blockage event.

In summary, with the inclusion of the SuDS discussed within this strategy, the proposed surface water drainage solution will not increase the risk of flooding at the site or within the surrounding area during an exceedance event and is therefore considered appropriate.

Maintenance and Management

A maintenance and management plan for the drainage system and SuDS has been prepared, and a copy is appended to this document.

It is envisaged that each of the property owners / occupants will be tasked with the ongoing maintenance of the drainage system. As a result, for Property A in isolation, maintenance for the entire drainage system would be tasked to the occupants / property owner. As additional units are constructed, agreements would need to be put in place to ensure responsibility for maintaining the SuDS is spread across all of the land owners / occupiers. As a result, drains lying within private land ownership will remain the responsibility of the individual property owner, with the communal elements of the drainage system being maintained as part of an agreement between all 3 property owners.

Summary

The opportunities for draining surface water runoff from the proposed development of both Plot A and the 3 unit scheme at Joy Lane, Whitstable have been assessed, with the aim of discharging Condition 5.

The analysis has shown that discharging surface water runoff into the existing public sewer system will present the most viable solution for draining the site. A large geo-cellular storage tank has been incorporated into the drainage system for the development, in order to provide storage for stormwater. This tank has been designed to manage runoff from the 3 unit scheme but is still appropriate for use in managing runoff from the single dwelling.

The results of the hydraulic drainage model for the proposed drainage system confirm that the proposed SuDS have sufficient capacity to store runoff from the entire design rainfall event, with a return period of 1:100 years, including a 40% increase in peak rainfall intensity to account for climate change. The peak discharge rate under this scenario is limited to a rate of 1.9l/s. As a consequence, the proposals meet the requirements of both the NTSS and the NPPF.

Construction drawings for the proposed drainage system have been prepared, alongside an indicative drawing showing plot A and the storage tank in isolation. A copy of these drawings is appended to this report.

Maintenance and management schedules for the proposed SuDS are included within a maintenance plan that has been prepared for the development, a copy of which is appended to this document.

Confirmation of the foul and surface water sewer networks capacity has been obtained from the sewerage undertaker and following the discharge of Condition 5, approval for any new sewer connection(s) will need to be obtained from the sewerage undertaker.

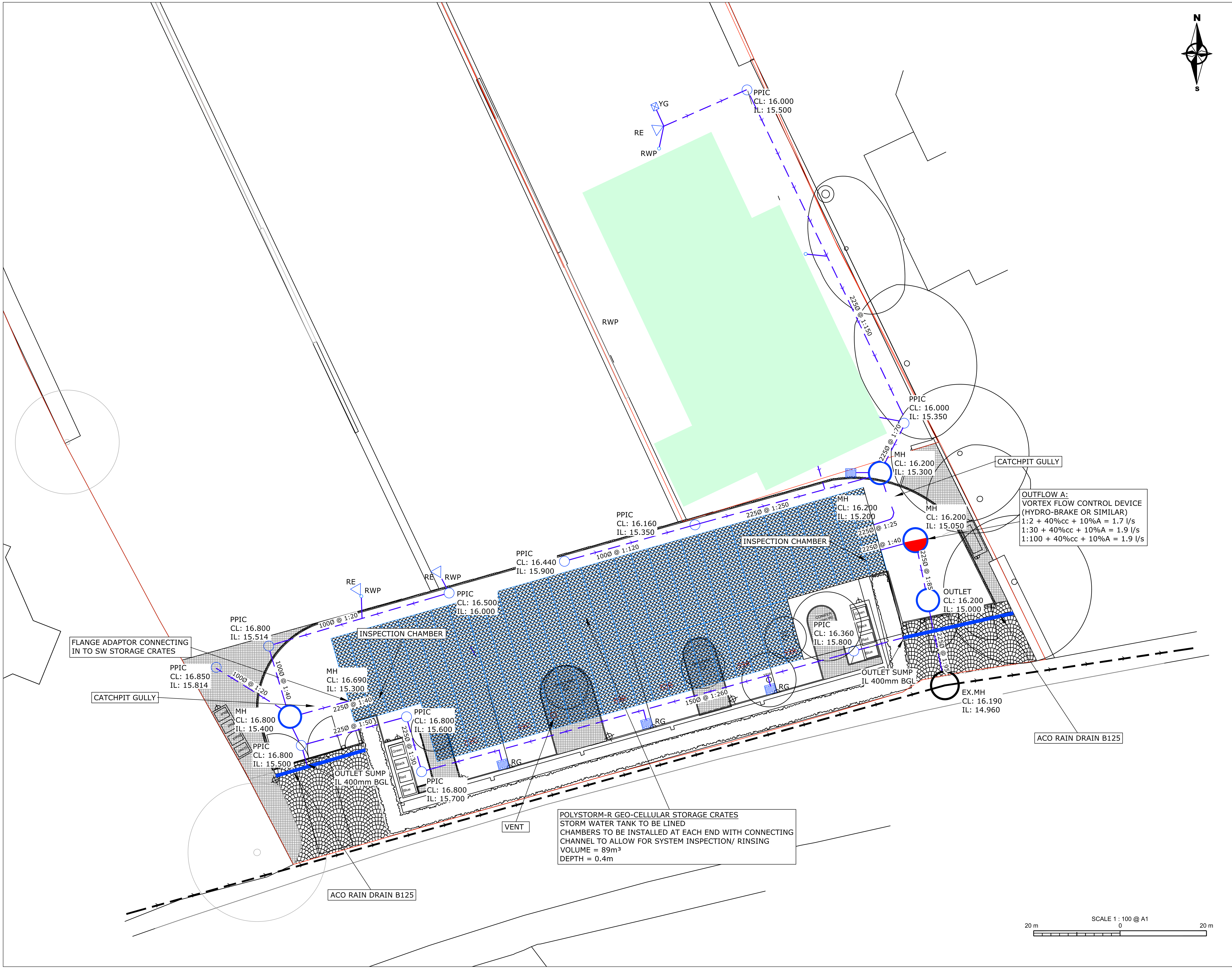
The information contained within this document provides details to demonstrate how surface water runoff and foul effluent will be managed on site, and addresses the comments raised by the LLFA. I trust that this information will be sufficient to enable Condition 5 to be discharged in full.

Yours faithfully,

Simon Maiden-Brooks BSc. (Hons) MSc. C.Eng C.WEM MCIWEM
Technical Director & Partner

Enclosed documents:

- Drainage Details
- Causeway Flow+ Calculations
- SuDS Maintenance Plan
- Southern Water Correspondence



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
2. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, EUROPEAN NORMS, CODES OF PRACTICE AND BUILDING PRACTICE.
3. ALL DIMENSIONS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. INFILTRATION FEATURES WILL BE SUBJECT TO SITE SPECIFIC INFILTRATION TESTING AND TRIAL HOLES.
5. ALL DRAINAGE SYSTEMS WILL NEED TO BE INSTALLED AND DESIGNED FOR SUITABLE LOADING REQUIREMENTS.
6. THE CONTRACTOR SHALL OBTAIN PRIOR APPROVAL AND ALL NECESSARY LICENCES FROM THE THE HIGHWAY AUTHORITY AND/OR SEWERAGE UNDERTAKER BEFORE CARRYING OUT ANY WORKS.

DRAINAGE KEY:

EXISTING SURFACE WATER SEWER
EX.MH EXISTING SURFACE WATER CHAMBER
SURFACE WATER DRAIN
MH SURFACE WATER MANHOLE
PPIC SURFACE WATER PPIC
RWP RAINWATER PIPE
RE SURFACE WATER RODDING EYE
FLOW CONTROL DEVICE
CATCHPIT GULLY
RG ROAD GULLY
SURFACE WATER DRAINAGE CHANNEL
GEOCELLULAR STORAGE
GEOCELLULAR STORAGE ACCESS
GEOCELLULAR STORAGE VENT

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Unit 6-7 Barham Business Park
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Kent CT4 6DQ
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London Office
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Rev	Description	Author	Checked	Date
P4	Amendments to Scheme Drawings	SH	SMB	18/02/21
P3	Amendments to Roof Layouts	SH	SB	16/12/20
P3	SW system updated	PW	SH	11/09/20
P2	Site Layout Updated	PW	SH	14/04/20
P1	First issue	PW	SH	25/03/20

CLIENT
LIDDICOAT & GOLDHILL LLP

PROJECT
SWMS - JOY LANE, WHITSTABLE

SCALE	PROJ REF	ORIGINATOR	CHECKED BY
1:100	2632	PW	SH

DWG REF.
DRAINAGE DETAILS: LAYOUT PLAN PROPERTY A SHEET 1 of 3

DWG No.
HC-2632-504

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Unit 6-7 Barham Business Park
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London Office
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CLIENT
LIDDICOAT & GOLDHILL LLP

PROJECT
SWMS - JOY LANE, WHITSTABLE

SCALE	PROJ REF	ORIGINATOR	CHECKED BY
1:100	2632	PW	SH

DWG REF.	DWG No.
DRAINAGE DETAILS: LAYOUT PLAN SHEET 1 of 3	HC-2632-501

Design Settings

Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	200.0	Include Intermediate Ground	✓
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	1.000	Connection Type	Level Soffits		
Time of Entry (mins)	4.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
8	0.004	4.00	16.800	650		1093.000	16.000	1.286
9	0.005	4.00	16.500	650		1103.000	19.000	0.500
10	0.004	4.00	16.850	650		1090.000	16.000	1.036
Storage Tank	0.000	4.00	16.400	1500		1111.182	18.220	1.300
Flow Control Device	0.000	4.00	16.200	1350		1130.000	23.000	1.150
Outlet	0.000	4.00	16.200	1200		1131.000	19.000	1.200
1	0.003	4.00	16.300	650	400	1130.000	17.000	0.450
2			16.360	650		1127.000	16.000	0.560
3	0.033	4.00	16.800	650		1102.000	9.000	1.100
4			16.800	650		1101.000	12.000	1.200
5			16.800	650		1096.000	11.000	1.300
6	0.009	4.00	16.900	200	400	1095.989	9.796	0.500
7			16.800	1200		1095.963	12.252	1.400
11	0.007	4.00	16.100	650		1107.000	41.000	0.500
12	0.000	4.00	16.160	650		1116.000	23.000	0.810
13	0.013	4.00	16.200	1200		1128.103	26.084	0.900
14	0.004	4.00	16.000	650		1130.000	29.000	0.650
15	0.015	4.00	16.000	650		1120.128	49.000	0.500
16			16.690	800		1097.846	12.736	1.390
17			16.160	1200		1128.593	24.782	0.960
18	0.006	4.00	16.600	650		1082.386	31.211	0.500
19	0.004	4.00	16.440	650		1110.000	22.000	0.540
Existing Surface Water Sewer			16.190	1200		1132.214	15.396	1.210

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	3.162	0.060	15.850	15.800	0.050	63.2	150	4.03	165.0
1.001	2	3	25.962	0.060	15.800	15.700	0.100	259.6	150	4.60	165.0
1.002	3	4	3.162	0.060	15.700	15.600	0.100	31.6	225	4.62	165.0
1.007	Storage Tank	Flow Control Device	19.416	0.060	15.100	15.050	0.050	388.3	375	5.14	163.5
1.008	Flow Control Device	Outlet	4.123	0.600	15.050	15.030	0.020	206.2	150	5.24	162.4
1.003	4	5	5.099	0.060	15.600	15.500	0.100	51.0	225	4.66	165.0
2.000	6	5	1.204	0.060	16.400	16.300	0.100	12.0	100	4.01	165.0
1.004	5	7	1.253	0.060	15.500	15.400	0.100	12.5	225	4.66	165.0
4.001	8	7	4.778	0.060	15.514	15.400	0.114	41.9	100	4.13	165.0
1.005	7	16	1.944	0.060	15.400	15.300	0.100	19.4	225	4.67	165.0
1.006	16	Storage Tank	14.420	0.060	15.300	15.200	0.100	144.2	225	4.85	165.0
4.000	9	8	10.440	0.060	16.000	15.514	0.486	21.5	100	4.08	165.0
3.001	10	7	7.043	0.060	15.814	15.450	0.364	19.3	100	4.27	165.0
7.001	14	13	3.479	0.060	15.350	15.300	0.050	69.6	225	4.31	165.0

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	1.609	28.4	2.0	0.300	0.410	0.003	0.0	27	0.933
1.001	0.761	13.5	2.0	0.410	0.950	0.003	0.0	39	0.545
1.002	2.982	118.6	23.6	0.875	0.975	0.036	0.0	67	2.343
1.007	1.111	122.7	69.5	0.925	0.775	0.107	0.0	203	1.145
1.008	0.696	12.3	69.1	1.000	1.020	0.107	0.0	150	0.709
1.003	2.329	92.6	23.6	0.975	1.075	0.036	0.0	77	1.957
2.000	2.945	23.1	5.9	0.400	0.400	0.009	0.0	34	2.464
1.004	4.797	190.8	29.5	1.075	1.175	0.045	0.0	59	3.539
4.001	1.538	12.1	5.9	1.186	1.300	0.009	0.0	50	1.533
1.005	3.830	152.3	42.0	1.175	1.165	0.064	0.0	80	3.298
1.006	1.353	53.8	42.0	1.165	0.975	0.064	0.0	150	1.490
4.000	2.181	17.1	3.3	0.400	1.186	0.005	0.0	29	1.685
3.001	2.303	18.1	6.6	0.936	1.250	0.010	0.0	42	2.130
7.001	1.981	78.8	12.5	0.425	0.675	0.019	0.0	60	1.463

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)
5.001	12	13	12.490	0.060	15.350	15.300	0.050	249.8	225	4.39	165.0
5.002	13	17	1.391	0.060	15.300	15.200	0.100	13.9	225	4.39	165.0
5.003	17	Storage Tank	18.607	0.060	15.200	15.100	0.100	186.1	225	4.66	165.0
5.000	11	12	20.125	0.060	15.600	15.350	0.250	80.5	225	4.18	165.0
7.000	15	14	22.304	0.060	15.500	15.350	0.150	148.7	225	4.28	165.0
3.000	18	10	17.010	0.060	16.100	15.814	0.286	59.5	100	4.22	165.0
6.000	19	12	6.083	0.060	15.900	15.850	0.050	121.7	100	4.12	165.0
1.009	Outlet	Existing Surface Water Sewer	3.803	0.600	15.000	14.980	0.020	190.2	225	5.42	50.0

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)
5.001	1.012	40.2	7.2	0.585	0.675	0.011	0.0	65	0.771
5.002	4.547	180.8	28.2	0.675	0.735	0.043	0.0	59	3.353
5.003	1.183	47.0	28.2	0.735	1.075	0.043	0.0	126	1.236
5.000	1.836	73.0	4.6	0.275	0.585	0.007	0.0	38	1.044
7.000	1.331	52.9	9.8	0.275	0.425	0.015	0.0	65	1.025
3.000	1.279	10.0	3.9	0.400	0.936	0.006	0.0	43	1.201
6.000	0.874	6.9	2.6	0.440	0.210	0.004	0.0	43	0.813
1.009	0.945	37.6	21.3	0.975	0.985	0.107	0.0	122	0.974

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	3.162	63.2	150	Circular	16.300	15.850	0.300	16.360	15.800	0.410
1.001	25.962	259.6	150	Circular	16.360	15.800	0.410	16.800	15.700	0.950
1.002	3.162	31.6	225	Circular	16.800	15.700	0.875	16.800	15.600	0.975
1.007	19.416	388.3	375	Circular	16.400	15.100	0.925	16.200	15.050	0.775
1.008	4.123	206.2	150	Circular	16.200	15.050	1.000	16.200	15.030	1.020
1.003	5.099	51.0	225	Circular	16.800	15.600	0.975	16.800	15.500	1.075
2.000	1.204	12.0	100	Circular	16.900	16.400	0.400	16.800	16.300	0.400
1.004	1.253	12.5	225	Circular	16.800	15.500	1.075	16.800	15.400	1.175
4.001	4.778	41.9	100	Circular	16.800	15.514	1.186	16.800	15.400	1.300
1.005	1.944	19.4	225	Circular	16.800	15.400	1.175	16.690	15.300	1.165
1.006	14.420	144.2	225	Circular	16.690	15.300	1.165	16.400	15.200	0.975
4.000	10.440	21.5	100	Circular	16.500	16.000	0.400	16.800	15.514	1.186
3.001	7.043	19.3	100	Circular	16.850	15.814	0.936	16.800	15.450	1.250
7.001	3.479	69.6	225	Circular	16.000	15.350	0.425	16.200	15.300	0.675
5.001	12.490	249.8	225	Circular	16.160	15.350	0.585	16.200	15.300	0.675

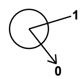
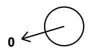
Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	650	400	Manhole	Adoptable	2	650	Manhole	Adoptable
1.001	2	650		Manhole	Adoptable	3	650	Manhole	Adoptable
1.002	3	650		Manhole	Adoptable	4	650	Manhole	Adoptable
1.007	Storage Tank	1500		Manhole	Adoptable	Flow Control Device	1350	Manhole	Adoptable
1.008	Flow Control Device	1350		Manhole	Adoptable	Outlet	1200	Manhole	Adoptable
1.003	4	650		Manhole	Adoptable	5	650	Manhole	Adoptable
2.000	6	200	400	Manhole	Adoptable	5	650	Manhole	Adoptable
1.004	5	650		Manhole	Adoptable	7	1200	Manhole	Adoptable
4.001	8	650		Manhole	Adoptable	7	1200	Manhole	Adoptable
1.005	7	1200		Manhole	Adoptable	16	800	Manhole	Adoptable
1.006	16	800		Manhole	Adoptable	Storage Tank	1500	Manhole	Adoptable
4.000	9	650		Manhole	Adoptable	8	650	Manhole	Adoptable
3.001	10	650		Manhole	Adoptable	7	1200	Manhole	Adoptable
7.001	14	650		Manhole	Adoptable	13	1200	Manhole	Adoptable
5.001	12	650		Manhole	Adoptable	13	1200	Manhole	Adoptable

Pipeline Schedule

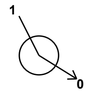
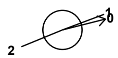
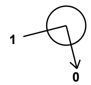
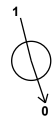
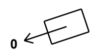
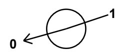
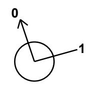
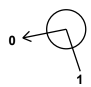
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.002	1.391	13.9	225	Circular	16.200	15.300	0.675	16.160	15.200	0.735
5.003	18.607	186.1	225	Circular	16.160	15.200	0.735	16.400	15.100	1.075
5.000	20.125	80.5	225	Circular	16.100	15.600	0.275	16.160	15.350	0.585
7.000	22.304	148.7	225	Circular	16.000	15.500	0.275	16.000	15.350	0.425
3.000	17.010	59.5	100	Circular	16.600	16.100	0.400	16.850	15.814	0.936
6.000	6.083	121.7	100	Circular	16.440	15.900	0.440	16.160	15.850	0.210
1.009	3.803	190.2	225	Circular	16.200	15.000	0.975	16.190	14.980	0.985

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.002	13	1200		Manhole	Adoptable	17	1200	Manhole	Adoptable
5.003	17	1200		Manhole	Adoptable	Storage Tank	1500	Manhole	Adoptable
5.000	11	650		Manhole	Adoptable	12	650	Manhole	Adoptable
7.000	15	650		Manhole	Adoptable	14	650	Manhole	Adoptable
3.000	18	650		Manhole	Adoptable	10	650	Manhole	Adoptable
6.000	19	650		Manhole	Adoptable	12	650	Manhole	Adoptable
1.009	Outlet	1200		Manhole	Adoptable	Existing Surface Water Sewer	1200	Manhole	Adoptable

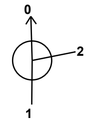
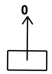
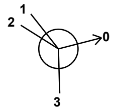
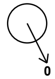
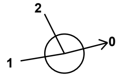
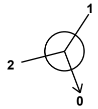
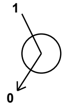
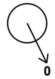
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
8	1093.000	16.000	16.800	1.286	650			1	4.000	15.514	100
								0	4.001	15.514	100
9	1103.000	19.000	16.500	0.500	650			0	4.000	16.000	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
10	1090.000	16.000	16.850	1.036	650			1	3.000	15.814	100
								0	3.001	15.814	100
Storage Tank	1111.182	18.220	16.400	1.300	1500			1	5.003	15.100	225
								2	1.006	15.200	225
								0	1.007	15.100	375
Flow Control Device	1130.000	23.000	16.200	1.150	1350			1	1.007	15.050	375
								0	1.008	15.050	150
Outlet	1131.000	19.000	16.200	1.200	1200			1	1.008	15.030	150
								0	1.009	15.000	225
1	1130.000	17.000	16.300	0.450	650	400					
								0	1.000	15.850	150
2	1127.000	16.000	16.360	0.560	650			1	1.000	15.800	150
								0	1.001	15.800	150
3	1102.000	9.000	16.800	1.100	650			1	1.001	15.700	150
								0	1.002	15.700	225
4	1101.000	12.000	16.800	1.200	650			1	1.002	15.600	225
								0	1.003	15.600	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections		Link	IL (m)	Dia (mm)
5	1096.000	11.000	16.800	1.300	650			1	2.000	16.300	100
								2	1.003	15.500	225
								0	1.004	15.500	225
6	1095.989	9.796	16.900	0.500	200	400		0	2.000	16.400	100
7	1095.963	12.252	16.800	1.400	1200			1	4.001	15.400	100
								2	3.001	15.450	100
								3	1.004	15.400	225
								0	1.005	15.400	225
11	1107.000	41.000	16.100	0.500	650			0	5.000	15.600	225
12	1116.000	23.000	16.160	0.810	650			1	6.000	15.850	100
								2	5.000	15.350	225
								0	5.001	15.350	225
13	1128.103	26.084	16.200	0.900	1200			1	7.001	15.300	225
								2	5.001	15.300	225
								0	5.002	15.300	225
14	1130.000	29.000	16.000	0.650	650			1	7.000	15.350	225
								0	7.001	15.350	225
15	1120.128	49.000	16.000	0.500	650			0	7.000	15.500	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
16	1097.846	12.736	16.690	1.390	800		1	1.005	15.300	225
							0	1.006	15.300	225
17	1128.593	24.782	16.160	0.960	1200		1	5.002	15.200	225
							0	5.003	15.200	225
18	1082.386	31.211	16.600	0.500	650		0	3.000	16.100	100
19	1110.000	22.000	16.440	0.540	650		0	6.000	15.900	100
Existing Surface Water Sewer	1132.214	15.396	16.190	1.210	1200		1	1.009	14.980	225

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Additional Storage (m^3/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

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

Node Flow Control Device Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	x
Invert Level (m)	15.050	Product Number	CTL-CHE-0067-2000-0850-2000
Design Depth (m)	0.850	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node Storage Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	15.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	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	238.0	0.0	0.400	238.0	0.0	0.401	0.0	0.0

Results for 2 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	8	10	15.544	0.030	2.4	0.0117	0.0000	OK
15 minute summer	9	10	16.018	0.018	1.3	0.0094	0.0000	OK
15 minute summer	10	10	15.840	0.026	2.7	0.0108	0.0000	OK
240 minute summer	Storage Tank	168	15.184	0.084	8.5	19.3876	0.0000	OK
240 minute summer	Flow Control Device	176	15.187	0.137	2.6	0.1956	0.0000	OK
360 minute summer	Outlet	248	15.035	0.035	1.8	0.0393	0.0000	OK
15 minute summer	1	10	15.867	0.017	0.8	0.0067	0.0000	OK
15 minute summer	2	10	15.822	0.022	0.8	0.0074	0.0000	OK
15 minute summer	3	10	15.749	0.049	9.6	0.0458	0.0000	OK
15 minute summer	4	10	15.653	0.053	9.6	0.0176	0.0000	OK
15 minute summer	5	10	15.552	0.052	12.0	0.0171	0.0000	OK
15 minute summer	6	10	16.427	0.027	2.4	0.0118	0.0000	OK
15 minute summer	7	10	15.468	0.068	17.0	0.0774	0.0000	OK
15 minute summer	11	10	15.623	0.023	1.9	0.0142	0.0000	OK
15 minute summer	12	10	15.389	0.039	3.0	0.0130	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	8	4.001	7	2.4	0.633	0.199	0.0183	
15 minute summer	9	4.000	8	1.3	0.930	0.076	0.0149	
15 minute summer	10	3.001	7	2.7	1.714	0.149	0.0111	
240 minute summer	Storage Tank	1.007	Flow Control Device	2.6	0.188	0.021	0.5306	
240 minute summer	Flow Control Device	Hydro-Brake®	Outlet	1.8				
360 minute summer	Outlet	1.009	Existing Surface Water Sewer	1.7	0.468	0.046	0.0142	33.2
15 minute summer	1	1.000	2	0.8	0.632	0.028	0.0043	
15 minute summer	2	1.001	3	0.8	0.279	0.057	0.0862	
15 minute summer	3	1.002	4	9.6	1.418	0.081	0.0213	
15 minute summer	4	1.003	5	9.6	1.371	0.103	0.0355	
15 minute summer	5	1.004	7	11.9	1.412	0.063	0.0107	
15 minute summer	6	2.000	5	2.4	1.693	0.104	0.0017	
15 minute summer	7	1.005	16	17.0	1.385	0.112	0.0240	
15 minute summer	11	5.000	12	1.9	0.593	0.026	0.0680	
15 minute summer	12	5.001	13	2.9	0.526	0.073	0.0729	

Results for 2 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute summer	13	10	15.353	0.053	11.5	0.0749	0.0000	OK
15 minute summer	14	10	15.393	0.043	5.1	0.0197	0.0000	OK
15 minute summer	15	10	15.539	0.039	4.0	0.0366	0.0000	OK
15 minute summer	16	10	15.388	0.088	17.0	0.0445	0.0000	OK
15 minute summer	17	9	15.288	0.088	11.5	0.0997	0.0000	OK
15 minute summer	18	10	16.126	0.026	1.6	0.0147	0.0000	OK
15 minute summer	19	10	15.927	0.027	1.1	0.0128	0.0000	OK
360 minute summer	Existing Surface Water Sewer	248	15.013	0.033	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute summer	13	5.002	17	11.5	1.147	0.064	0.0148	
15 minute summer	14	7.001	13	5.1	0.831	0.065	0.0216	
15 minute summer	15	7.000	14	4.0	0.806	0.076	0.1110	
15 minute summer	16	1.006	Storage Tank	17.1	1.269	0.317	0.1939	
15 minute summer	17	5.003	Storage Tank	11.8	1.634	0.251	0.1481	
15 minute summer	18	3.000	10	1.6	0.989	0.159	0.0275	
15 minute summer	19	6.000	12	1.1	0.687	0.160	0.0097	

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	8	10	15.556	0.042	4.7	0.0166	0.0000	OK
15 minute summer	9	10	16.025	0.025	2.6	0.0132	0.0000	OK
15 minute summer	10	10	15.849	0.035	5.2	0.0142	0.0000	OK
240 minute summer	Storage Tank	240	15.270	0.170	14.4	39.2230	0.0000	OK
240 minute winter	Flow Control Device	192	15.287	0.237	11.1	0.3396	0.0000	SURCHARGED
720 minute summer	Outlet	390	15.036	0.036	1.9	0.0407	0.0000	OK
15 minute summer	1	10	15.875	0.025	1.6	0.0098	0.0000	OK
15 minute summer	2	10	15.832	0.032	1.6	0.0105	0.0000	OK
15 minute summer	3	10	15.775	0.075	18.8	0.0699	0.0000	OK
15 minute summer	4	10	15.680	0.080	18.8	0.0264	0.0000	OK
15 minute summer	5	10	15.585	0.085	23.4	0.0283	0.0000	OK
15 minute summer	6	10	16.441	0.041	4.7	0.0182	0.0000	OK
15 minute summer	7	10	15.512	0.112	33.3	0.1268	0.0000	OK
15 minute summer	11	10	15.631	0.031	3.6	0.0192	0.0000	OK
15 minute summer	12	10	15.405	0.055	5.7	0.0183	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	8	4.001	7	4.7	0.734	0.388	0.0262	
15 minute summer	9	4.000	8	2.6	1.131	0.152	0.0243	
15 minute summer	10	3.001	7	5.2	1.697	0.287	0.0264	
240 minute summer	Storage Tank	1.007	Flow Control Device	11.2	0.238	0.091	1.1713	
240 minute winter	Flow Control Device	Hydro-Brake®	Outlet	1.9				
720 minute summer	Outlet	1.009	Existing Surface Water Sewer	1.9	0.478	0.050	0.0149	66.1
15 minute summer	1	1.000	2	1.6	0.722	0.056	0.0073	
15 minute summer	2	1.001	3	1.6	0.309	0.117	0.1492	
15 minute summer	3	1.002	4	18.8	1.556	0.158	0.0381	
15 minute summer	4	1.003	5	18.7	1.427	0.202	0.0670	
15 minute summer	5	1.004	7	23.4	1.430	0.123	0.0210	
15 minute summer	6	2.000	5	4.7	1.916	0.203	0.0030	
15 minute summer	7	1.005	16	33.3	1.504	0.219	0.0431	
15 minute summer	11	5.000	12	3.6	0.697	0.049	0.1097	
15 minute summer	12	5.001	13	5.6	0.559	0.140	0.1319	

Results for 10 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	15.384	0.084	22.4	0.1197	0.0000	OK
15 minute summer	14	10	15.418	0.068	9.9	0.0310	0.0000	OK
15 minute summer	15	10	15.555	0.055	7.8	0.0513	0.0000	OK
15 minute summer	16	10	15.434	0.134	33.3	0.0672	0.0000	OK
15 minute summer	17	9	15.317	0.117	22.4	0.1319	0.0000	OK
15 minute summer	18	10	16.137	0.037	3.1	0.0212	0.0000	OK
15 minute summer	19	10	15.938	0.038	2.1	0.0184	0.0000	OK
960 minute summer	Existing Surface Water Sewer	525	15.014	0.034	1.9	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)
15 minute summer	13	5.002	17	22.4	1.340	0.124	0.0239	
15 minute summer	14	7.001	13	9.9	0.853	0.126	0.0412	
15 minute summer	15	7.000	14	7.8	0.893	0.147	0.1965	
15 minute summer	16	1.006	Storage Tank	33.3	1.485	0.620	0.3237	
15 minute summer	17	5.003	Storage Tank	22.7	1.835	0.483	0.2391	
15 minute summer	18	3.000	10	3.1	1.229	0.309	0.0429	
15 minute summer	19	6.000	12	2.1	0.812	0.306	0.0157	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	8	10	15.581	0.067	6.3	0.0263	0.0000	OK
15 minute summer	9	10	16.029	0.029	3.5	0.0154	0.0000	OK
15 minute summer	10	10	15.854	0.040	6.9	0.0165	0.0000	OK
480 minute winter	Storage Tank	448	15.348	0.248	11.1	57.1860	0.0000	OK
360 minute summer	Flow Control Device	344	15.349	0.299	3.0	0.4285	0.0000	SURCHARGED
240 minute summer	Outlet	120	15.036	0.036	1.9	0.0407	0.0000	OK
15 minute summer	1	10	15.879	0.029	2.1	0.0114	0.0000	OK
15 minute summer	2	10	15.836	0.036	2.1	0.0120	0.0000	OK
15 minute summer	3	10	15.791	0.091	24.9	0.0846	0.0000	OK
15 minute summer	4	10	15.697	0.097	24.9	0.0321	0.0000	OK
15 minute summer	5	10	15.608	0.108	31.0	0.0359	0.0000	OK
15 minute summer	6	10	16.450	0.050	6.2	0.0220	0.0000	OK
15 minute summer	7	10	15.541	0.141	44.2	0.1595	0.0000	OK
15 minute summer	11	10	15.636	0.036	4.8	0.0221	0.0000	OK
15 minute summer	12	10	15.417	0.067	7.6	0.0222	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	8	4.001	7	6.3	0.854	0.518	0.0320	
15 minute summer	9	4.000	8	3.5	1.129	0.204	0.0388	
15 minute summer	10	3.001	7	6.9	1.745	0.381	0.0367	
480 minute winter	Storage Tank	1.007	Flow Control Device	9.2	0.177	0.075	1.6677	
360 minute summer	Flow Control Device	Hydro-Brake®	Outlet	1.9				
240 minute summer	Outlet	1.009	Existing Surface Water Sewer	1.9	0.478	0.050	0.0149	30.6
15 minute summer	1	1.000	2	2.1	0.767	0.074	0.0089	
15 minute summer	2	1.001	3	2.1	0.316	0.154	0.1870	
15 minute summer	3	1.002	4	24.9	1.591	0.210	0.0494	
15 minute summer	4	1.003	5	24.8	1.424	0.268	0.0896	
15 minute summer	5	1.004	7	31.0	1.431	0.163	0.0282	
15 minute summer	6	2.000	5	6.2	2.006	0.268	0.0037	
15 minute summer	7	1.005	16	44.2	1.550	0.290	0.0553	
15 minute summer	11	5.000	12	4.8	0.742	0.066	0.1407	
15 minute summer	12	5.001	13	7.5	0.576	0.187	0.1738	

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	15.404	0.104	29.7	0.1479	0.0000	OK
15 minute summer	14	10	15.435	0.085	13.2	0.0386	0.0000	OK
15 minute summer	15	10	15.564	0.064	10.4	0.0600	0.0000	OK
15 minute summer	16	10	15.463	0.163	44.2	0.0818	0.0000	OK
480 minute winter	17	448	15.356	0.156	7.5	0.1770	0.0000	OK
15 minute summer	18	10	16.144	0.044	4.1	0.0249	0.0000	OK
15 minute summer	19	10	15.945	0.045	2.8	0.0217	0.0000	OK
240 minute summer	Existing Surface Water Sewer	120	15.014	0.034	1.9	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)
15 minute summer	13	5.002	17	29.8	1.416	0.165	0.0297	
15 minute summer	14	7.001	13	13.2	0.859	0.168	0.0550	
15 minute summer	15	7.000	14	10.4	0.915	0.196	0.2566	
15 minute summer	16	1.006	Storage Tank	44.1	1.574	0.820	0.4033	
480 minute winter	17	5.003	Storage Tank	3.4	0.667	0.072	0.6442	
15 minute summer	18	3.000	10	4.1	1.319	0.408	0.0529	
15 minute summer	19	6.000	12	2.8	0.871	0.408	0.0196	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	8	10	15.641	0.127	7.9	0.0499	0.0000	SURCHARGED
15 minute summer	9	10	16.033	0.033	4.4	0.0173	0.0000	OK
15 minute summer	10	10	15.862	0.048	8.8	0.0196	0.0000	OK
720 minute winter	Storage Tank	675	15.487	0.387	12.9	89.1227	0.0000	SURCHARGED
720 minute winter	Flow Control Device	675	15.487	0.437	5.9	0.6255	0.0000	SURCHARGED
240 minute winter	Outlet	108	15.036	0.036	1.9	0.0407	0.0000	OK
15 minute summer	1	10	15.884	0.034	2.7	0.0132	0.0000	OK
15 minute summer	2	10	15.841	0.041	2.7	0.0137	0.0000	OK
15 minute summer	3	10	15.809	0.109	31.9	0.1014	0.0000	OK
15 minute summer	4	10	15.718	0.118	31.8	0.0391	0.0000	OK
15 minute summer	5	10	15.638	0.138	39.8	0.0457	0.0000	OK
15 minute summer	6	10	16.460	0.060	8.0	0.0264	0.0000	OK
15 minute summer	7	10	15.577	0.177	56.2	0.2004	0.0000	OK
15 minute summer	11	10	15.641	0.041	6.2	0.0251	0.0000	OK
720 minute winter	12	675	15.487	0.137	0.8	0.0455	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	8	4.001	7	7.6	0.978	0.633	0.0374	
15 minute summer	9	4.000	8	4.4	1.123	0.257	0.0524	
15 minute summer	10	3.001	7	8.8	1.671	0.486	0.0406	
720 minute winter	Storage Tank	1.007	Flow Control Device	5.9	0.152	0.048	2.1415	
720 minute winter	Flow Control Device	Hydro-Brake®	Outlet	1.8				
240 minute winter	Outlet	1.009	Existing Surface Water Sewer	1.9	0.478	0.050	0.0149	34.5
15 minute summer	1	1.000	2	2.7	0.809	0.095	0.0109	
15 minute summer	2	1.001	3	2.7	0.329	0.199	0.2284	
15 minute summer	3	1.002	4	31.8	1.603	0.269	0.0633	
15 minute summer	4	1.003	5	31.8	1.426	0.344	0.1185	
15 minute summer	5	1.004	7	39.7	1.426	0.208	0.0370	
15 minute summer	6	2.000	5	8.0	2.088	0.346	0.0046	
15 minute summer	7	1.005	16	56.1	1.583	0.368	0.0687	
15 minute summer	11	5.000	12	6.2	0.780	0.085	0.1819	
720 minute winter	12	5.001	13	1.4	0.454	0.034	0.3789	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	13	675	15.487	0.187	4.2	0.2660	0.0000	OK
720 minute summer	14	615	15.487	0.137	3.1	0.0625	0.0000	OK
15 minute summer	15	10	15.574	0.074	13.3	0.0693	0.0000	OK
15 minute summer	16	10	15.499	0.199	56.1	0.1001	0.0000	OK
720 minute winter	17	675	15.487	0.287	13.2	0.3250	0.0000	SURCHARGED
15 minute summer	18	10	16.151	0.051	5.3	0.0289	0.0000	OK
15 minute summer	19	10	15.952	0.052	3.5	0.0249	0.0000	OK
240 minute winter	Existing Surface Water Sewer	108	15.014	0.034	1.9	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)
720 minute winter	13	5.002	17	13.2	1.031	0.073	0.0522	
720 minute summer	14	7.001	13	2.3	0.907	0.029	0.1054	
15 minute summer	15	7.000	14	13.3	0.940	0.251	0.3174	
15 minute summer	16	1.006	Storage Tank	55.8	1.643	1.037	0.4878	
720 minute winter	17	5.003	Storage Tank	4.8	0.656	0.103	0.7400	
15 minute summer	18	3.000	10	5.3	1.388	0.528	0.0652	
15 minute summer	19	6.000	12	3.5	0.918	0.510	0.0232	

The drainage system at Joy Lane consists of a piped drainage network, geocellular storage tank, flow control device, sediment traps, gullies, and linear drainage channels. Each of these elements of the drainage system will require different maintenance.

Maintenance Responsibilities

For any private drainage within the curtilage of each property the responsibility for the continued maintenance will belong solely to the owner of the property.

For the communal elements of the drainage system, including any lateral drains, the responsibility for maintenance will be tasked to all three property owners. This includes the inspection and maintenance of the geo-cellular storage tank. An agreement will need to be drawn up between the property owners to ensure continued maintenance is carried out. The final copy of this maintenance plan should be provided to each of the owners / occupants of the properties to ensure they are aware of their responsibilities with regard to the maintenance of any SuDS.

Maintenance and Management Requirements

Regular maintenance for the drainage system must be carried out to ensure continued performance of the drainage system: Maintenance schedules for the SuDS and drainage components are appended to this document. These schedules include typical inspection frequencies which should be adjusted after the first few years following installation, to account for more or less frequent maintenance and inspection depending on how the drainage system performs after this bedding in period.

List of maintenance schedules included:

- Geo-Cellular Storage
- Flow Control Device
- Pipework
- Sediment Traps / Catchpits
- Road Gullies
- Linear Drainage Channels
- Manholes
- PPIC's

Following construction, manufacturer-specific maintenance requirements must also be appended to this document.

Contact Details

Contact details for all manufactures should be included within the final maintenance and management plan for the site, which will need to be provided to the site occupants. At present, the following contact information is known:

Designers: Herrington Consulting Limited

- *Email: enquiries@herringtonconsulting.co.uk*
- *Telephone: 01227 833855*
- *Website: www.herringtonconsulting.co.uk*

Lead Local Flood Authority: Kent County Council

- *Email: SuDS@kent.gov.uk*

To be contacted if changes to the drainage system are proposed following construction.

Sewerage undertaker: Southern Water

Website Advice: www.southernwater.co.uk/help-advice/what-to-do-in-an-emergency

To be contacted if flooding from the sewer network offsite occurs, or if changes to the drainage system are to be made.

Flow Control Device: Manufacturer TBC

Geo-Cellular Storage Crates: Manufacturer TBC

Emergency Action

Spillages: The outfall from the drainage system discharges into a Southern Water public sewer. Any accidental spillage of pollutants, such as; oils, spirits, etc. could result in contamination reaching the sewer network. If a spillage or accident occurs it is recommended that the outlets from the site are closed as soon as possible to reduce the potential for contamination to be discharged offsite. The Environment Agency should be informed of the spillage as soon as possible via their incident reporting service and should be contacted during the clean-up and remediation operations. Further advice can be obtained from https://www.gov.uk/report-an-environmental-incident

Flooding: If residents or maintenance personnel notice evidence of the drainage system failing e.g. from visible flooding or deformation of the land surface around pipes, manholes, or geo-cellular storage crates, the contractor responsible for installing the drainage system should be contacted as soon as possible to provide advice. It may also be necessary to contact the manufacturer of the geo-cellular storage tank and flow control device, and the designers of the drainage system. Inspections should also be carried out to determine the source of the failure.

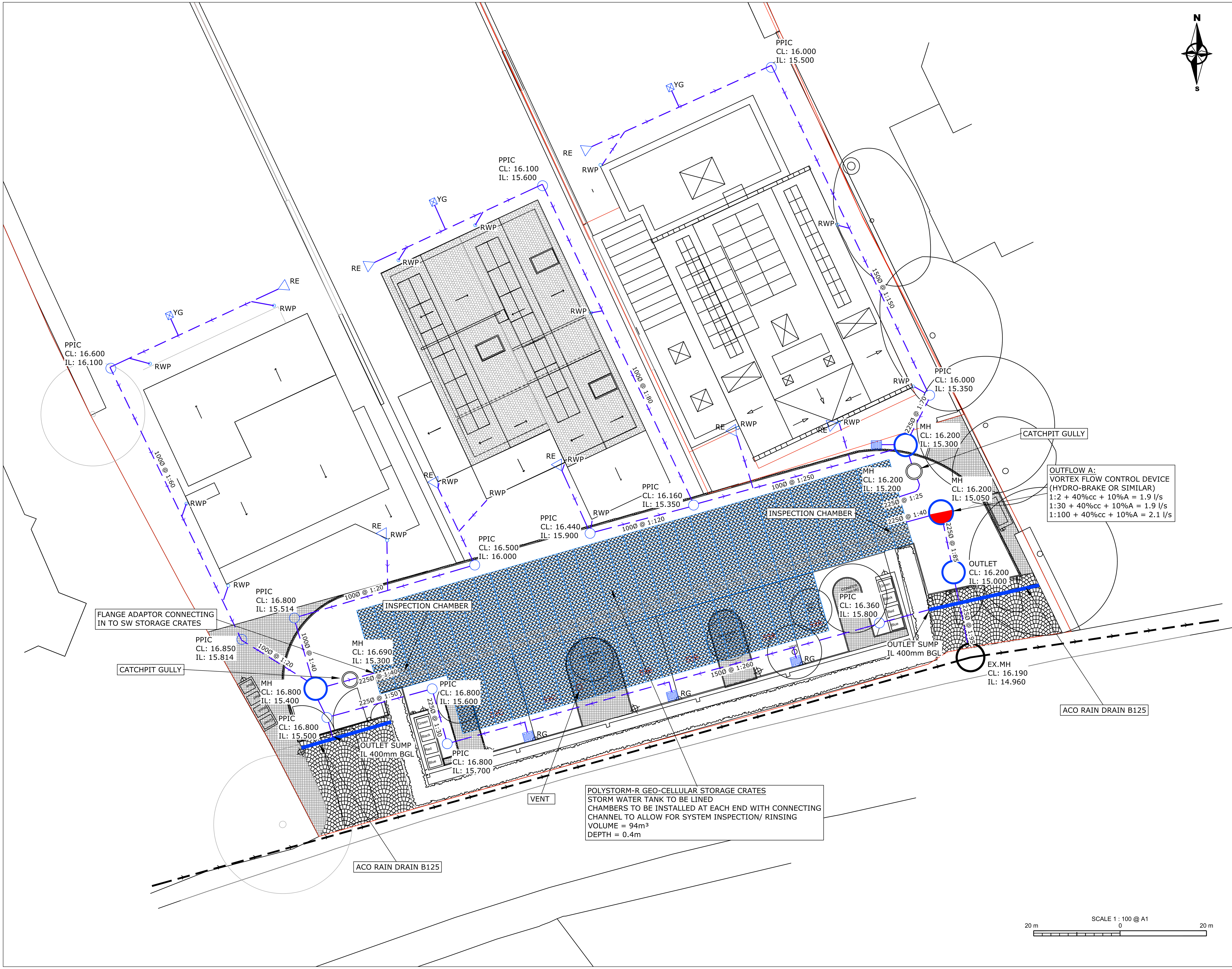
Summary

The traditional elements of the drainage system, as well as the SuDS will require maintenance. The owners of the properties will be tasked with the maintenance of the proposed drainage system and SuDS.

This maintenance agreement should include a detailed maintenance and management plan which expands on the above maintenance strategy, which should include all of the manufacturer specific maintenance requirements.

Attached

- Detailed Drainage Layout Plan
- Maintenance Schedules
- Detailed Drainage Drawings



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
2. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT BRITISH STANDARDS, EUROPEAN NORMS, CODES OF PRACTICE AND BUILDING PRACTICE.
3. ALL DIMENSIONS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING THE WORKS ON SITE. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. INFILTRATION FEATURES WILL BE SUBJECT TO SITE SPECIFIC INFILTRATION TESTING AND TRIAL HOLES.
5. ALL DRAINAGE SYSTEMS WILL NEED TO BE INSTALLED AND DESIGNED FOR SUITABLE LOADING REQUIREMENTS.
6. THE CONTRACTOR SHALL OBTAIN PRIOR APPROVAL AND ALL NECESSARY LICENCES FROM THE THE HIGHWAY AUTHORITY AND/OR SEWERAGE UNDERTAKER BEFORE CARRYING OUT ANY WORKS.

DRAINAGE KEY:

	EXISTING SURFACE WATER SEWER
EX.MH	EXISTING SURFACE WATER CHAMBER
	SURFACE WATER DRAIN
MH	SURFACE WATER MANHOLE
PPIC	SURFACE WATER PPIC
RWP	RAINWATER PIPE
RE	SURFACE WATER RODDING EYE
	FLOW CONTROL DEVICE
	CATCHPIT GULLY
RG	ROAD GULLY
	SURFACE WATER DRAINAGE CHANNEL
	GEOCELLULAR STORAGE
	GEOCELLULAR STORAGE ACCESS
	GEOCELLULAR STORAGE VENT

herrington
CONSULTING LIMITED

Unit 6-7 Barham Business Park
Elham Valley Road
Canterbury
Kent CT4 6DQ

London Office
Unit D
Taper Building
London
SE1 3QB

Tel : 01227 833855
enquiries@herringtonconsulting.co.uk
www.herringtonconsulting.co.uk

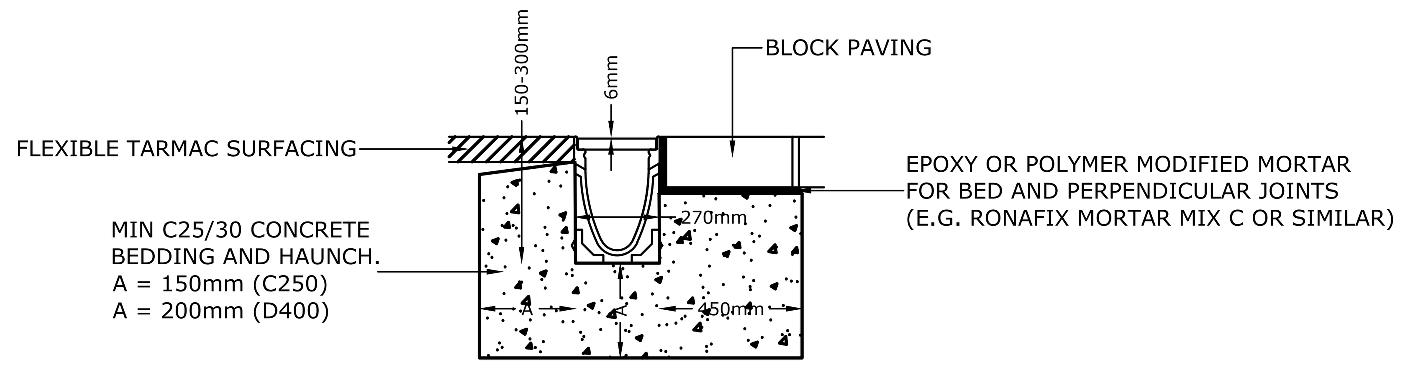
Rev	Description	Author	Checked	Date
P3	SW system updated	PW	SH	11/09/20
P2	Site Layout Updated	PW	SH	14/04/20
P1	First issue	PW	SH	25/03/20

CLIENT
LIDDICOAT & GOLDHILL LLP

PROJECT
SWMS - JOY LANE, WHITSTABLE

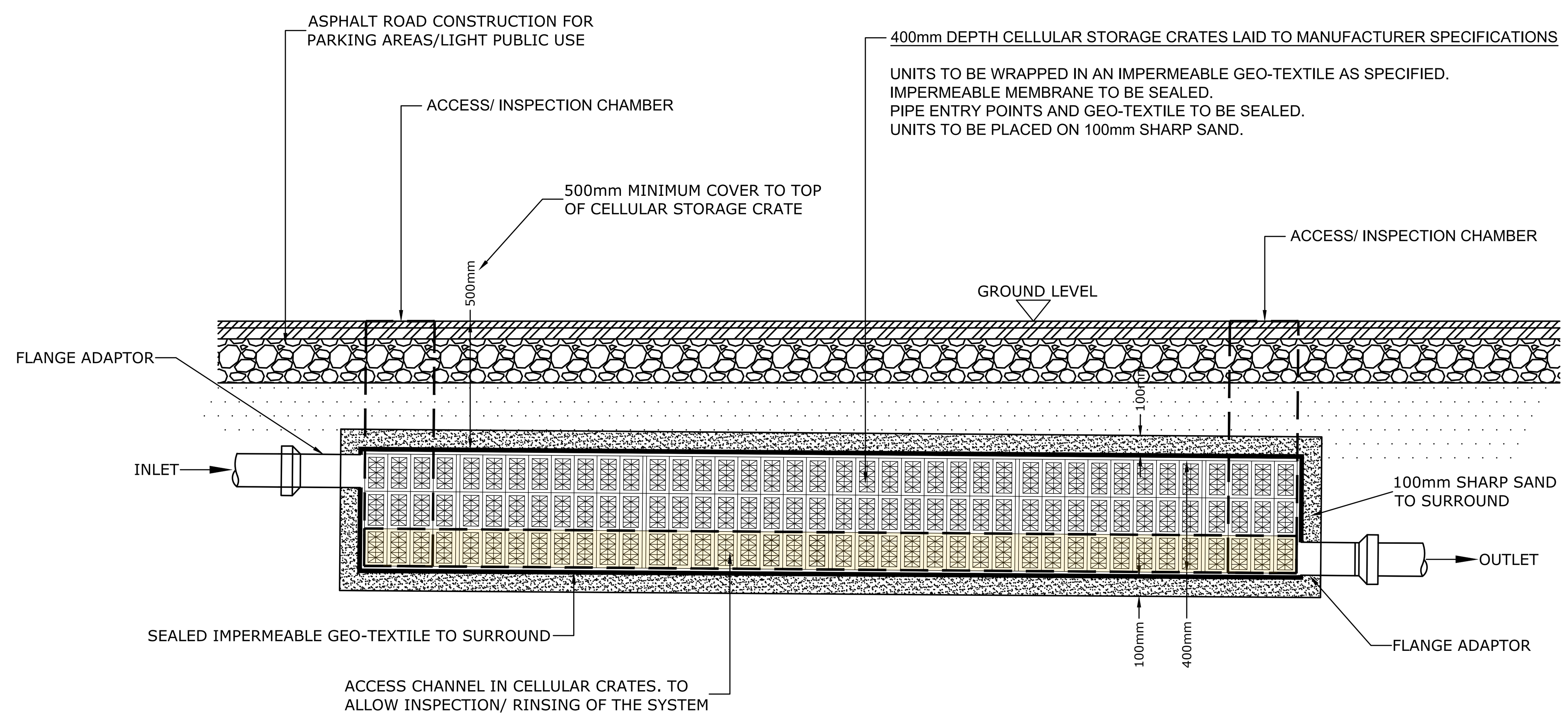
SCALE	PROJ REF	ORIGINATOR	CHECKED BY
1:100	2632	PW	SH

DWG REF.	DWG No.
DRAINAGE DETAILS: LAYOUT PLAN SHEET 1 of 3	HC-2632-501



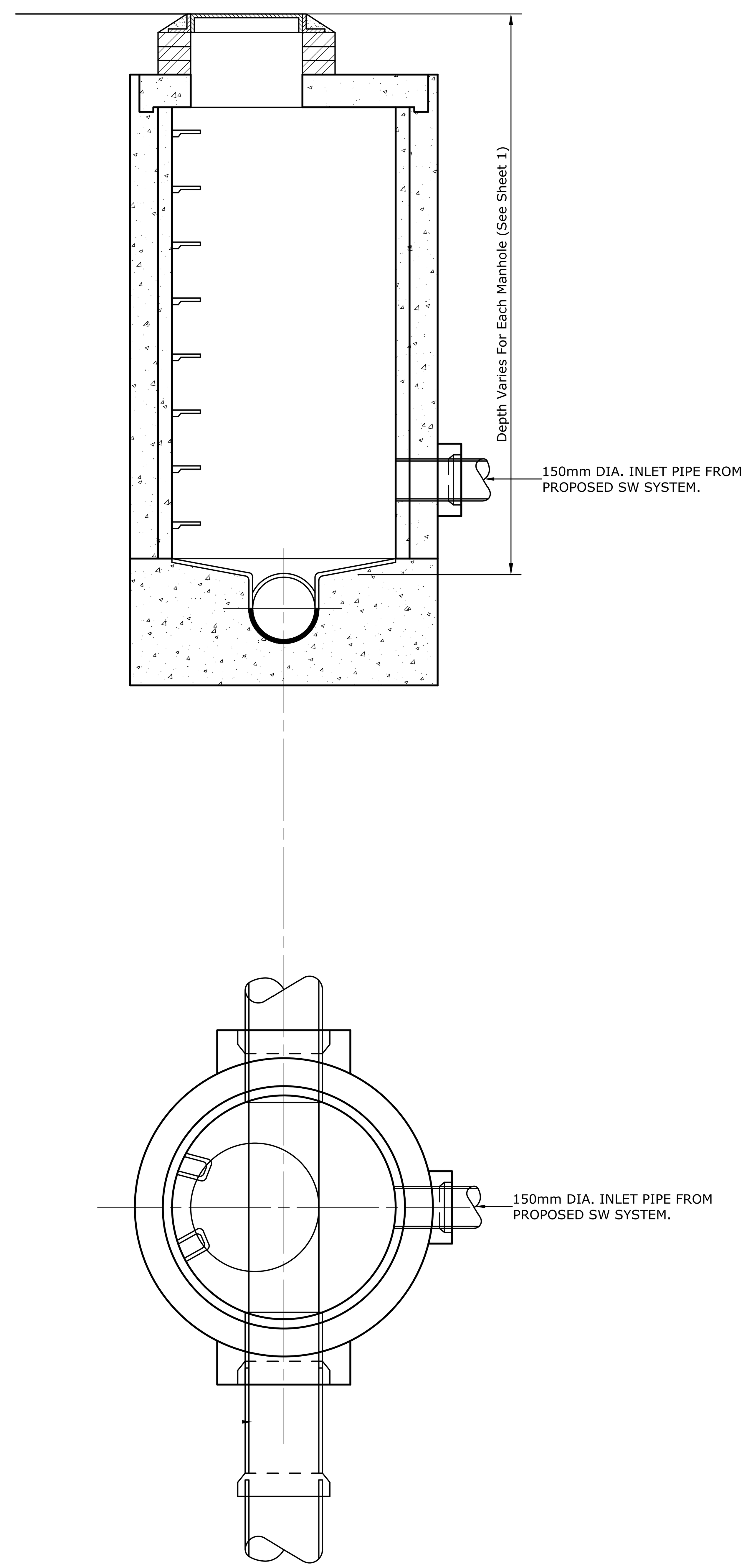
ACO M100D DRAINAGE CHANNEL

SCALE 1:10



SW CELLULAR STORAGE CRATES DETAILS

SCALE 1:20



CONNECTION IN TO EXISTING SOUTHERN WATER MANHOLE

SCALE 1:20

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herrington
CONSULTING LIMITED

Unit 6-7 Barham Business Park
Elham Valley Road
Canterbury
Kent CT4 6DQ

London Office
Unit D
Taper Building
London
SE1 3QB

Tel : 01227 833855
enquiries@herringtonconsulting.co.uk
www.herringtonconsulting.co.uk

Rev	Description	Author	Checked	Date
P1	First issue	PW	SH	09/09/20

CLIENT: LIDDICOAT & GOLDHILL LLP

PROJECT: SWMS - JOY LANE, WHITSTABLE

SCALE	PROJ REF	ORIGINATOR	CHECKED BY
AS SHOWN	2632	PW	SH

DWG REF.	DWG No.
DRAINAGE DETAILS SHEET 2 OF 3	HC-2632-502

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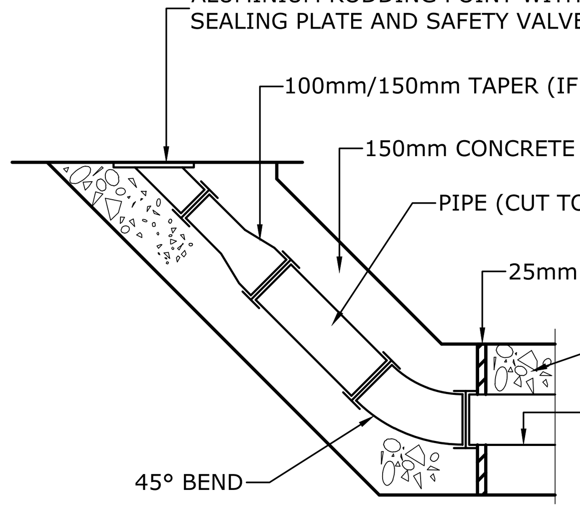
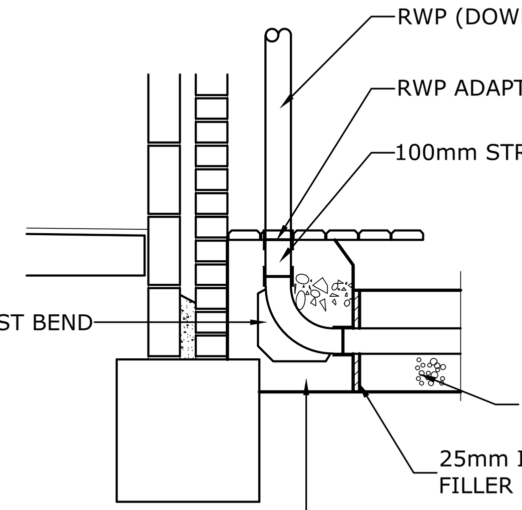


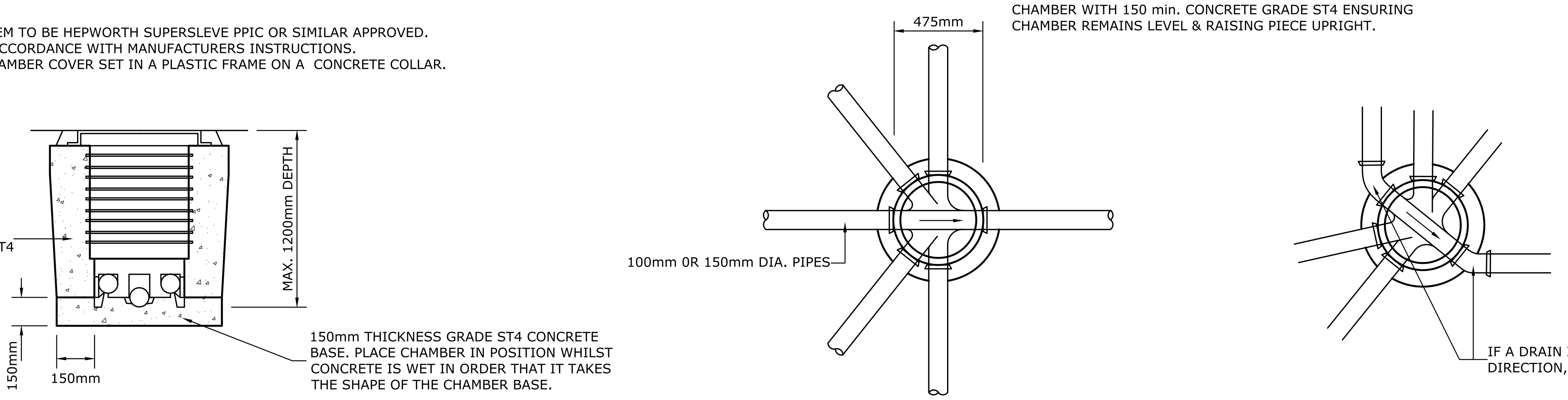
LIGHT DUTY RODDING EYE DETAIL (RE)
(ON NON TRAFFICKED AREA)
SCALE 1:20



RWP OUTLET
SCALE 1:20

MANHOLE SYSTEM TO BE HEPWORTH SUPERSLEVE PPIC OR SIMILAR APPROVED.
INSTALLED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
INSPECTION CHAMBER COVER SET IN A PLASTIC FRAME ON A CONCRETE COLLAR.

PREFORMED POLYPROPYLENE INSPECTION CHAMBER WITH FACILITY FOR UP TO FIVE INLET CONNECTIONS. SURROUND CHAMBER WITH 150 min. CONCRETE GRADE ST4 ENSURING CHAMBER REMAINS LEVEL & RAISING PIECE UPRIGHT.



PROPRIETARY POLYPROPYLENE INSPECTION CHAMBER (PPIC)
FOR USE IN FOOTPATHS OR GRASSED AREAS. MAX. DEPTH COVER TO INVERT 1.2m
SCALE 1:20

herrington
CONSULTING LIMITED

Unit 6-7 Barham Business Park
Elham Valley Road
Canterbury
Kent CT4 6DQ

London Office
Unit D
Taper Building
London
SE1 3QB

Tel : 01227 833855
enquiries@herringtonconsulting.co.uk
www.herringtonconsulting.co.uk

Rev	Description	Author	Checked	Date
P1	First issue	PW	SH	09/09/20

CLIENT
LIDDICOAT & GOLDHILL LLP

PROJECT
SWMS - JOY LANE, WHITSTABLE

SCALE	PROJ REF	ORIGINATOR	CHECKED BY
AS SHOWN	2632	PW	SH

DWG REF.	DWG No.
DRAINAGE DETAILS SHEET 3 OF 3	HC-2632-503

Operation and Maintenance Schedule – Geo-Cellular Storage System		
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 and sediment from the catchment surface, wherever is presents a risk to the performance of the drainage system,	Monthly, or as required based on inspection frequencies.
	Remove sediment from pre-treatment structurers (e.g. sediment traps) and from internal forebays	Annually or as required based on inspection frequencies
Remedial Actions	Repair; inlets, outlets, overflow pipes, and vent mechanisms	As required, based on inspections
	Replace tank or geotextile if significant damage is observed or geotextile is torn.	As required
Monitoring	Inspect and check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed.	Following installation, and annually hereafter
	Survey inside of tank, and at any sediment trap mechanisms, for sediment build-up and remove sediment if necessary. Use inspections to develop a regular maintenance and inspection procedure for sediment removal.	Every 5 years, or as required if inspections show high siltation rates.

General Operation and Maintenance Table for Geo-Cellular Storage Systems

ACO Water Management:
Building + Landscape

Uniclass L7315	EPIC J3413
CI/SfB (52.5)	

ACO RainDrain® B 125

- ✔ Ideal for driveways and light duty applications
- ✔ Easy and quick to install
- ✔ Clip locking grating for secure installation
- ✔ Full range of accessories for professional installation
- ✔ CE marked and fully certified to Load Class B 125 BS EN 1433:2002

ACO RainDrain® B 125

The ideal drainage channel for light duty applications

Manufactured from Vienite®, ACO's high strength recycled polymer concrete material, ACO RainDrain® B 125 is suitable for vehicle traffic up to Load Class B 125.

The high quality ACO RainDrain® B 125 channels interlock, allowing for quick and easy installation.

The channel comes complete with a cast iron Heelguard™ ATec grating making it ideal for driveway applications.

A full range of accessories are available, designed to aid simple and fast installation.

Applications

- Driveways
- Small private car parks
- Garage thresholds

VIENITE® THE SUSTAINABLE CHOICE

ACO

ACO RainDrain® B 125

System Overview

Driveways and small private car parks

Features

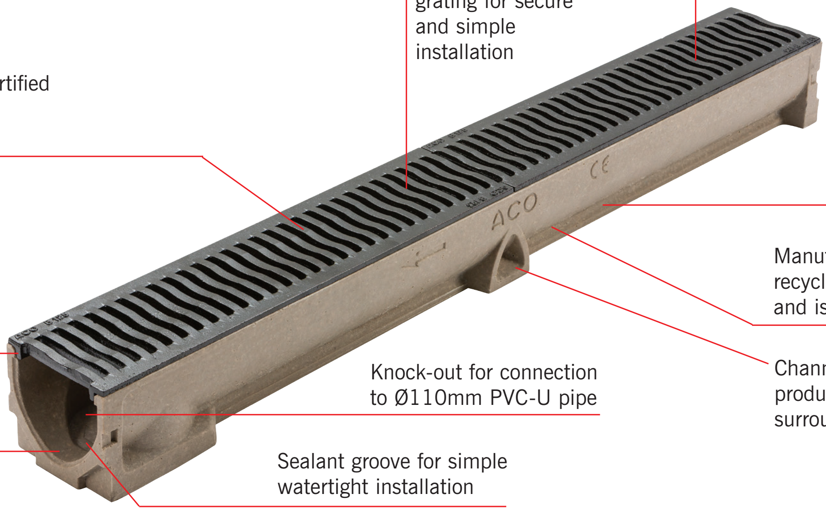
CE marked and fully certified to Load Class B 125 BS EN 1433:2002.

Channels interlock for quick and simple on-site fabrication

Profile improves speed of water and promotes self cleansing

Clip-locking grating for secure and simple installation

Cast iron Heelguard™ ATec grating for Load class B 125



Lightweight design for easy handling and installation

Manufactured from recycled materials and is recyclable

Knock-out for connection to Ø110mm PVC-U pipe

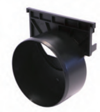
Channel shape anchors product into concrete surround

Sealant groove for simple watertight installation

ACO RAINDRAIN® B 125 ACCESSORIES

Sump unit with silt bucket

Closing end cap



Ø110mm outlet end cap

Ø110mm horizontal foul air-trap

Ø110mm drain union

ACO RainDrain® B 125 channel assembly

Product code	Description	Length (mm)	Width (mm)	Depth (mm)	Invert (mm)	Weight (kg)
47001	Channel with cast iron Heelguard™ ATec grating 1m	1000	118	97	87	10.97

ACO RainDrain® B 125 accessories

Product code	Description	Length (mm)	Width (mm)	Depth (mm)	Invert (mm)	Weight (kg)
20400	Cast iron Heelguard™ ATec grating 500mm B 125 *	500	118	15	-	2.45
47006	Sump with cast iron Heelguard™ ATec grating c/w slit bucket	500	118	303	275	13.60
319288	Closing end cap Ø110mm	6	129	97	-	0.03
319289	Outlet end cap	-	129	135	-	0.07
01684	Horizontal foul air trap	100	Ø110	-	-	0.20
0056	820 Drain union PVC-U Ø110mm	100	Ø110	-	-	0.10
1367	Lifting tools 5mm slots	-	-	-	-	0.20
2618	Socket plug UVPC Ø110mm	110	110	42	-	0.12

ACO RAINDRAIN® B 125 INSTALLATION

Dig trench 318mm wide (218mm wide if against a structure) by 200mm deep for channel (400mm deep for sump). Mark finishing height with fixed line 3mm below final surface. Lay 100mm (min.) bed of concrete.

Knock out pre-formed outlet from the inside (marked with hammer symbol) or fit sump or outlet endcap. Position sump or outlet channel on concrete bed, fit PVC-U union/trap to drainage pipework.

Lay channels starting from outlet/sump, ensuring joints connect by lowering units horizontally. Fit endcap to end channel. For fully watertight joints, use a suitable sealant (contact ACO for further advice).

With gratings fitted, haunch around channels/sumps with concrete (suitable fill material). Final surface to be 3mm above grating. Bricks/paviours should be laid in mortar for lateral stability.

ACO Technologies plc
ACO Business Park, Hitchin Road, Shefford, Bedfordshire SG17 5TE
Tel: 01462 816666 Fax: 01462 815895
e-mail: technologies@aco.co.uk website: www.aco.co.uk

ACO-1897-0819

Polystorm Access

Polystorm Access provides a 1m x 0.5m shaft within a Polystorm geocellular structure to enable surface access for remote camera inspection and maintenance activities, such as flushing and rodding.

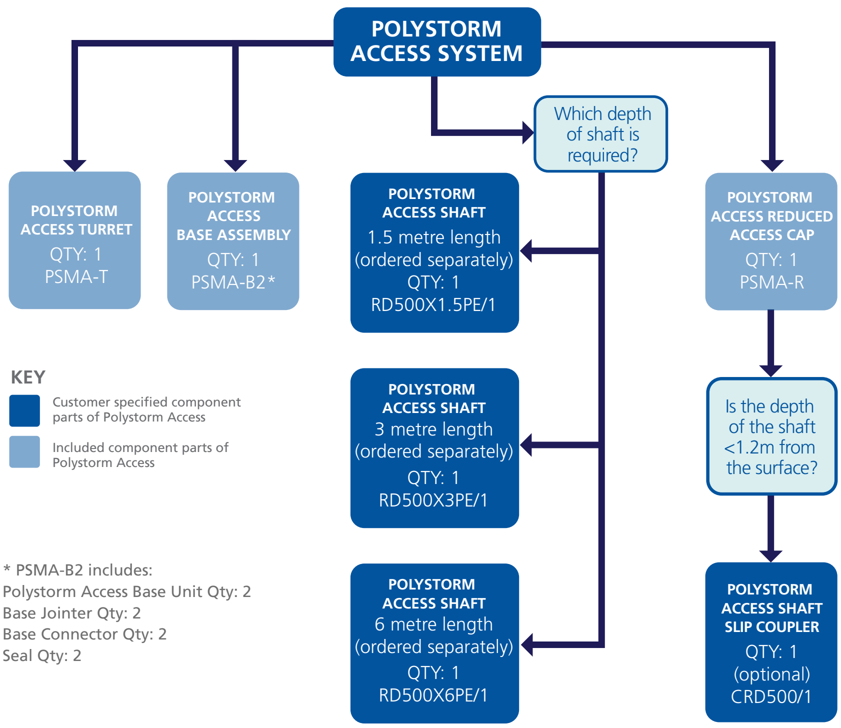
The system consists of a 500mm diameter shaft which extends from surface level to the top of a Polystorm structure, at which point a turret provides an interface between the shaft and the inspection chamber within the Polystorm structure. At the bottom of the chamber, a base unit interlocks with the surrounding layer of Polystorm cells whilst supporting the geomembrane. A 350mm reduced access shaft cap is provided to comply with inspection chamber regulations.

Polystorm Access is suitable for use with Polystorm, Polystorm-R, Polystorm Lite and Polystorm Xtra and may be combined with Polystorm Inspect for full length remote inspection and maintenance.

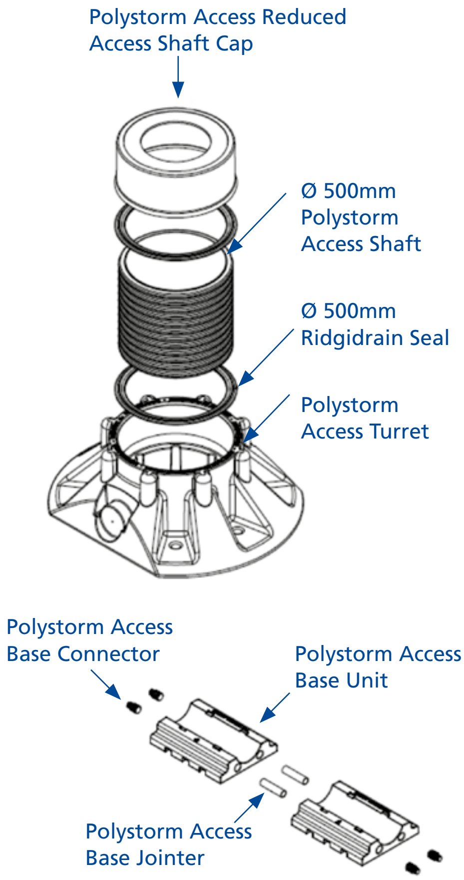
Please note: The Polystorm Access turret and base assembly are black. They are shown blue for illustration purposes.

Key Benefits

- Meets minimum 450mm width requirement for inspection chamber access, with 350mm reduced access where regulations dictate
- Integrated solution; can be used with Polystorm Inspect to monitor internal volume of geocellular structure
- Base unit provides smooth transition between Polystorm Inspect units
- Multiple inspection configurations can be achieved when used in conjunction with Polystorm Inspect
- Manufactured from polyethylene for light weight, ease of handling and high strength
- Sustainability: All components 100% recyclable after use

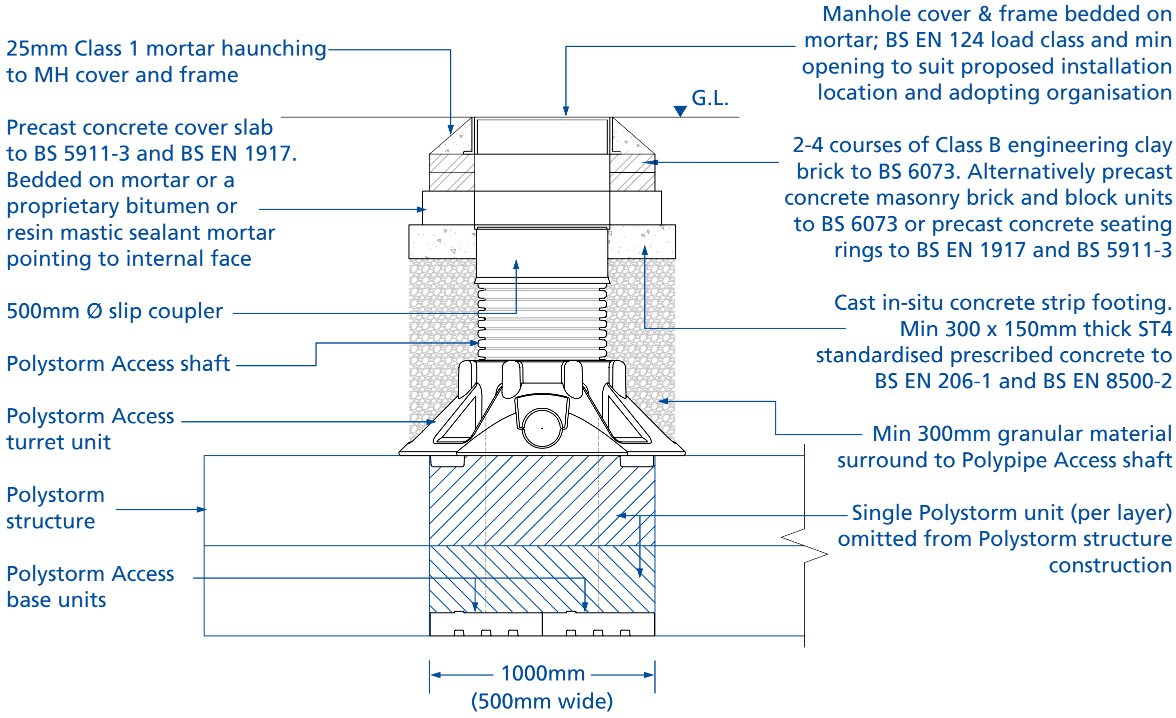


* PSMA-B2 includes:
Polystorm Access Base Unit Qty: 2
Base Jointer Qty: 2
Base Connector Qty: 2
Seal Qty: 2



Polypipe Civils,
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/civils

Typical Elevation



Please note: Above is a typical installation detail for a Polystorm tank with groundwater below the base of the unit. For installation with groundwater above the structure invert please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

Polypipe Plastics Expertise

Polystorm Access is manufactured from sustainable polyethylene using the proven rotational moulding technique.

Reliability and Performance

All components in the Polystorm Access system have a design life of up to 50 years where ground conditions allow.

Easy Handling and Installation

Components are light and easy to handle, reducing health and safety risks and speeding up installation. The Polystorm Access shaft can be quickly and accurately cut to the right depth from 500mm Ridgidrain pipe, adding to the ease and flexibility on-site.

Nominal Weights

PSMA-B2 = 8kg PSMA-T = 19kg PSMA-R = 4kg

Flexible Positioning

The Polystorm Access turret can be positioned anywhere on a Polystorm structure, providing there are two or more Polystorm cells between the access turret and the structure edge.

The Polystorm Access shaft is variable in length depending on the depth you require.

Features

- 1m x 0.5m inspection chamber within Polystorm structure
- 500mm riser shaft from surface to top of Polystorm structure
- Riser shaft may be extended as required using 500mm Ridgidrain pipe and seals
- It is recommended that the 500mm Ridgidrain pipe access shaft is within the limits of 250-1050mm for a standard installation
- Reduced Access shaft cap (350mm) available where required by regulations
- Utilises existing Polystorm Clips and Shear Connections
- Base unit manufactured from recyclable polyethylene
- Choice of standard shaft lengths

Technical Support

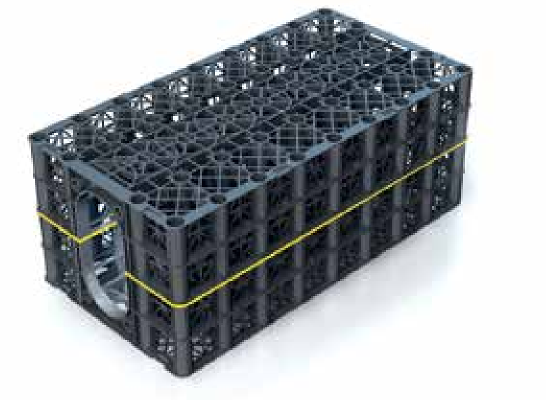
Detailed guidance and assistance is available.
For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

Polypipe Civils,
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/civils

Polystorm Inspect

Product code: PSM4

The Polystorm Inspect cell is complementary to the Polystorm range of modular cell solutions. Its primary purpose is to provide a tunnel along the length of a fully installed Polystorm structure to enable access for inspection and maintenance. Polystorm Inspect is a high strength thermoplastic cell which evenly distributes its load through the Polystorm structure.
The tunnel end is left open by default but the unit can be closed off if required by clipping into place the moulded end plate. For purposes of identification the cell features a yellow centre section and end plate.



Key Benefits

- Creates a horizontal tunnel running through the middle of the tank to provide access for inspection and maintenance, i.e. jetting and rodding
- Can be used with Polystorm Lite, Polystorm-R and Polystorm (cannot be used in the same layer as Polystorm Xtra as the Polystorm Inspect cell is deeper)
- Tunnel can be used as a flow inlet track achieving greater stormwater flow distribution within the unit
- Large access tunnel (height 320mm and width 172mm nominal) – allows maximum field of vision while maintaining the system's structural performance
- High strength to weight ratio
- Light weight cell allows easier handling and reduced Health and Safety risk
- Utilises the same Shear Connectors and Clips as the Polystorm range
- The tunnel restricts the dissipation of silt in to the overall structure making inspection and maintenance easier
- Polystorm Inspect cells with 225mm (PSM4CRD225) or 300mm (PSM4CRD300) inlets are available

Applications

Polystorm Inspect is designed to work with the rest of the Polystorm range within a layered hybrid system enabling an intelligently engineered attenuation or infiltration structure to be created. It is intended to be used from the inlet point of the Polystorm structure. If used other than along an inlet tract, the Polystorm Inspect end plate should be used to cap off the tunnel entrance. The most cost effective way to create a tank is to use a combination of Polystorm Inspect cells and other Polystorm modular cells.

UNIT TYPE	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m³
Unit weight	11.6kg*
Cube storage volume	0.188m³ (188 litres)
Volumetric void ratio	94%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	Minimum 440kN/m²
Lateral	Minimum 63kN/m²
SHORT TERM DEFLECTION	
Short-term vertical deflection	Minimum 70.1kN/m²
LONG TERM DEFLECTION	
Estimated long term vertical deflection (creep)	0.6113Ln (design life in hrs)

Note: The table above is applicable to PSM4 without the end plate.
*Approximate weight
End plates to be purchased separately as required.

Please note: The use of Polystorm Inspect does not negate the requirement for a Silt Trap to be installed prior to the Polystorm structure. The use of a Silt Trap or other silt prevention device would always be recommended.

Technical Support

Detailed guidance and assistance is available.
For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

RECOMMENDED MAXIMUM DEPTH OF INSTALLATION (to cell invert) [m]

TYPICAL SOIL TYPE	TYPICAL ANGLE OF SHEAR RESISTANCE	WITHOUT GROUNDWATER (below base of cells) NORMAL CASE		WITH GROUNDWATER AT 1M BELOW GROUND LEVEL AND UNITS WRAPPED IN GEOMEMBRANE	
		Pedestrian	Trafficked (cars)	Pedestrian	Trafficked (cars)
Stiff over consolidated clay e.g. London clay	24°	2.3	2.0	1.8	1.7
Normally consolidated silty sandy clay e.g. alluvium, made ground	26°	2.4	2.2	1.9	1.7
Loose sand and gravel	30°	2.8	2.6	2.0	1.8
Medium dense sand and gravel	33°	3.2	2.9	2.1	1.9
Dense sand and gravel	38°	3.9	3.6	2.2	2.1

Note:
1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assuming a soil density = 19 kN/m³ water density = 9.81 kN/m³
3) Assumed ultimate limit state (ULS) partial factor of safety applied to: Material = 2.75 Live load = 1.5 Dead load = 1.35

Notes:

1. Unless stated, all values are nominal and may vary within normal production tolerances.
2. Polypipe reserve the right to change product specifications without prior notice.
3. This document is uncontrolled and updates will not be issued automatically.

RECOMMENDED MINIMUM COVER LEVELS [m]

LIVE LOAD CONDITIONS	PEDESTRIAN	LIGHT TRAFFICKED
		Car park with vehicle mass <6000kg
Minimum cover depth required (m)	0.50	0.60

Note:
1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assumed serviceability limit state (SLS) partial factor of safety applied to: Material = 1.5 Live load = 1.0 Dead load = 1.0
3) Shallower minimum burial depths may be applicable subject to specific site conditions.

Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/wms

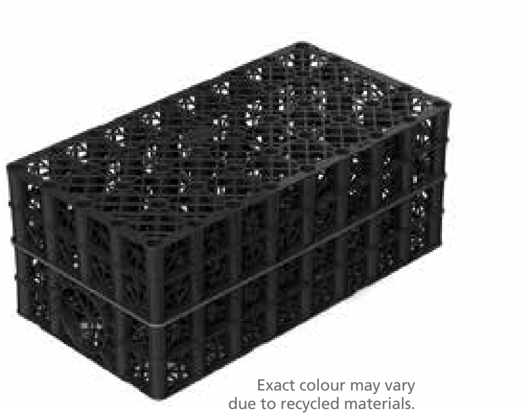
Polypipe

Polystorm-R Modular Cell

Product code: PSM1A

The Polystorm-R modular cell is ideally suited for loaded applications at greater depths, such as housing, commercial and infrastructure projects and has a compressive strength of up to 61 tonnes/m². It offers all the proven performance of the Polystorm cell, with the added benefits of being manufactured from over 90% recycled material content.

Wherever performance criteria and standards allow, we will always maximise the sustainability of our products by using post consumer plastics in their manufacture. By sourcing and carefully controlling the quality of the recycled material we use our precision injection moulding. Therefore we are able to guarantee consistent quality in our recycled plastic, giving you the confidence and the performance levels you expect from the market leader.



Exact colour may vary due to recycled materials.

Key Benefits

- Made from specially selected and controlled recycled materials
- Environmentally friendly, sustainable solution
- Has undergone stringent testing to ensure product performance
- Compressive strength of 61 tonnes/m²
- Ideal for retention, attenuation and infiltration applications with a suitable geomembrane or geotextile
- BBA approved
- Allow flexibility of shape - ideal for shallow excavation systems, narrow strips or use in restricted areas
- Can be used as part of a value engineered hybrid system with Polystorm, Polystorm Lite and Polystorm Xtra
- Integrated inlet and outlet
- 3D flow throughout the structure
- 95% void ratio
- Light weight yet robust - excellent Health and Safety and installation benefits
- 60 years creep limited life expectancy

Technical Support

Detailed guidance and assistance is available.
For further information, please contact our Technical Team on **+44 (0) 1509 615100** or email **civils@polypipe.com**

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 06/4297

ELEMENT	VALUE
PHYSICAL PROPERTIES	
Length	1m
Width	0.5m
Depth	0.4m
Total volume	0.2m³
Unit weight	9kg (approx)
Unit storage volume	0.19m³ (190 litres)
Void ratio	95%
SHORT TERM COMPRESSIVE STRENGTH	
Vertical	610 kN/m² **
Lateral	63 kN/m² **
SHORT TERM DEFLECTION	
Short-term vertical deflection	60 kN/m² per mm
LONG TERM DEFLECTION	
Estimated long term vertical deflection (creep)	0.2798 Ln (design life in hrs) +0.485 [Based on an applied test load = 162 kN/m²] Creep data limit 60 years
Estimated long term lateral deflection (creep)	1.0192 Ln (design life in hrs) -3.864 [Based on an applied test load = 30.8 kN/m²] Creep data limit 60 years

Note: Polystorm-R is ideal for use in trafficked and pedestrian applications subject to a structural design check and suitable installation conditions

* Each unit includes 4 Clips and 2 Shear Connectors.

** Compressive strength at yield, maximum recommended value for design purposes.

Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/wms

Polypipe

Polystorm-R Modular Cell

RECOMMENDED MAXIMUM DEPTH OF INSTALLATION (to cell invert) [m]

TYPICAL SOIL TYPE	TYPICAL ANGLE OF SHEAR RESISTANCE	SOIL WEIGHT kN/m³	WITHOUT GROUNDWATER (below base of cells) NORMAL CASE		WITH GROUNDWATER AT 1M BELOW GROUND LEVEL AND UNITS WRAPPED IN GEOMEMBRANE	
			Pedestrian	Trafficked (cars) <3000kg GVW	Pedestrian	Trafficked (cars) <3000kg GVW
Stiff over consolidated clay e.g. London clay	24	20.0	2.2	1.9	1.8	1.6
Normally consolidated silty sandy clay e.g. alluvium, made ground	26	19.0	2.4	2.2	1.9	1.7
Loose sand and gravel	30	18.0	3.0	2.7	2.0	1.9
Medium dense sand and gravel	33	19.0	3.2	2.9	2.0	1.9
Dense sand and gravel	38	20.0	3.7	3.5	2.1	2.0

Note:
1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assuming water density = 10.0kN/m³
3) Assumed ultimate limit state (ULS) partial factor of safety applied to: Material = 2.75 Lateral pressure = 1.35

Durability

The polymer material used in the manufacture of the Polystorm-R unit has an adequate resistance to attack from the type and quantities of chemicals that may be expected to naturally occur in uncontaminated soils and rainwater runoff. When installed in accordance with our recommendations, it is expected that the Polystorm-R unit will have a design life in excess of 60 years*. The installer of a proposed geocellular structure should ensure that an appropriate design check has been undertaken, in accordance with the recommended methodology and factors of safety given in CIRIA C680 (2008), Structural Design of Modular Geocellular Drainage Tanks, prior to the commencement of construction activities.

* Derived from long term extrapolated creep testing

Notes

1. Unless stated, all values are nominal and may vary within normal production tolerances.
2. The characteristic unit parameters stated have been based on Polypipe BBA certificate N° 06/4297, sheet 3.
3. Polypipe reserve the right to change product specifications without prior notice.
4. This document is uncontrolled and updates will not be issued automatically.

RECOMMENDED MINIMUM COVER LEVELS [m]

LIVE LOAD CONDITIONS	PEDESTRIAN	LIGHT TRAFFICKED	
		Car park with vehicle mass <GVW	
Minimum cover depth required (m)	0.50	<3000kg 0.50	<9000kg 0.65

Note
1) Stated depths based on the calculation methodology detailed within CIRIA C680 (2008)
2) Assumed serviceability limit state (SLS) partial factor of safety applied to: Material = 1.5 Live load = 1.0 Dead load = 1.0
3) Shallower minimum burial depths may be applicable subject to an assessment of the specific site conditions. For further details please consult our Technical Team on 01509 615100.

Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0) 1509 615100 Fax: +44 (0) 1509 610215 Email: civils@polypipe.com
www.polypipe.com/wms

RIDGISTORMSeparate Catchpits

Data Sheet

RIDGISTORMSeparate Catchpits are designed to separate silt and other particles from stormwater, helping to protect the downstream drainage system and local environment. They can be integrated into our range of pipe systems, such as Ridgidrain and Ridgistorm-XL to offer a fully integrated drainage system.

Applications

RIDGISTORMSeparate Catchpits are pre-fabricated for use in a range of stormwater systems requiring silt and debris seperation and retention.

Key Features and Benefits

- Provides easy access for silt collection
- Network Rail Parts and Drawing System (PADs) approved for use in CESS Areas
- Separates silt and debris from the downstream drainage system
- Eliminates wastage associated with in-situ construction
- Multiple inlet and outlet options, supplied with integral sockets as standard allowing quick and seamless connection to pipeline
- Depths can be tailored to suit project requirements
- Optional step rungs to BS EN 13101 and ladders to BS EN 14396
- Integral lifting points available on request to improve Health and Safety of handling and installation
- Stub connections and rocker pipes are available

Other fabrications in our RIDGISTORMSeparate range:

- Silt Traps
- Filter Chambers

Performance

RIDGISTORMSeparate Catchpits are fabricated from Ridgistorm-XL pipework, which is manufactured to meet the material requirements of BS EN 13476:2007 (Part 1-3).

RIDGISTORMSEPARATE CATCHPITS	
PHYSICAL PROPERTIES	
Diameter	450-3000mm
Depth	To suit requirements
Sump depth	To suit (min. 50mm)
Material	HDPE
Colour	Black with blue Interior
Chemical resistance	HDPE is naturally resistant to most chemicals associated with stormwater drainage systems
Inlets/outlets	100-3000mm

Our Ridgistorm-XL Fabrications range

All of our Ridgistorm-XL fabrications are tailor-made, fully-welded, watertight structured wall chambers to suit project-specific requirements. Health and Safety benefits become apparent during handling and installation, due to our fabrications' strong but light in weight nature. In addition, off-site construction ensures uncompromised, high quality products being delivered to site ready-to-install, reducing installation time and costs.

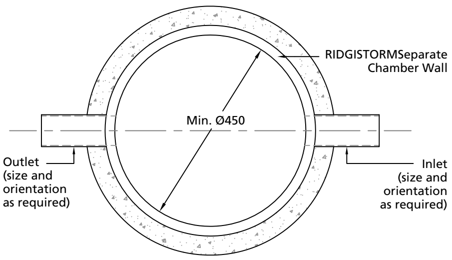
Network Rail

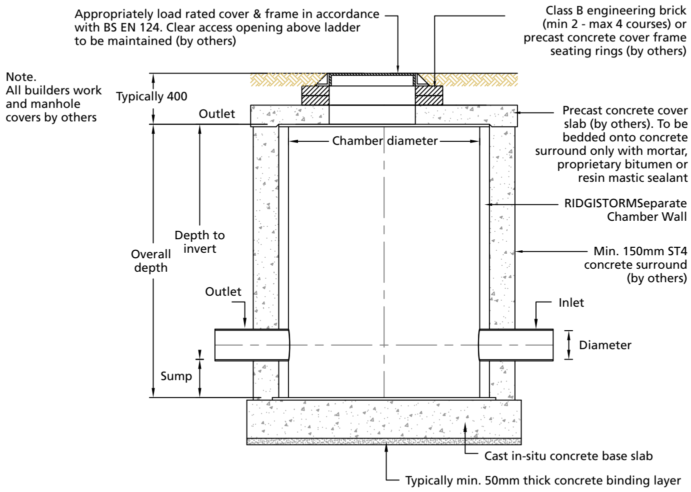
wrc approved PT/348/0614

Polypipe Civils
Charnwood Business Park, Loughborough, Leicestershire LE11 1LE
Tel: +44 (0)1509 615100 Fax: +44 (0)1509 610215 Email: civils@polypipe.com
www.polypipe.com/civils

Polypipe

RIDGISTORMSeparate Catchpit





For further information please contact our Technical Team on +44 (0) 1509 615100 or download our CAD Standard Details from our website www.polypipe.com/toolbox

Polypipe Civils

Charnwood Business Park, Loughborough, Leicestershire LE11 1LE

Tel: +44 (0)1509 615100 Fax: +44 (0)1509 610215 Email: civils@polypipe.com

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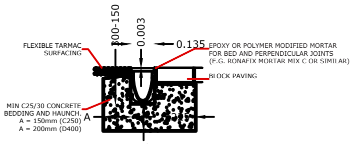
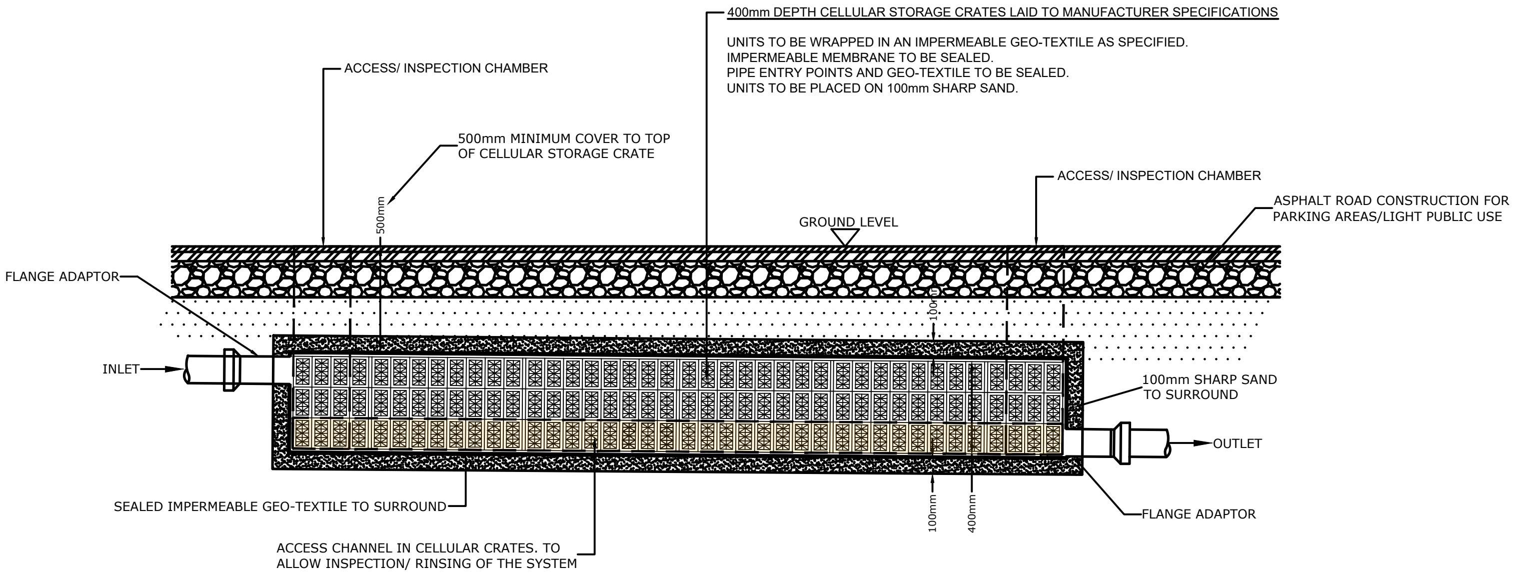


ACO M100D DRAINAGE CHANNEL

SCALE 1:10



SW CELLULAR STORAGE CRATES DETAILS

SCALE 1:20

from Southern Water

Herrington Consulting Ltd
Units 6 & 7
Barham Business Park
Elham Valley Road
Canterbury
Kent
CT4 6DQ

Your ref

Our ref
DS_CC_PDE-119744

Date
07 October 2020

Contact
Tel 0330 303 0119

Dear Sir/Madam,

Level 1 Capacity Check Enquiry: 53 Joy Lane, Whitstable, Kent, CT5 4DB.

We have completed the capacity check for the above development site and the results are as follows:

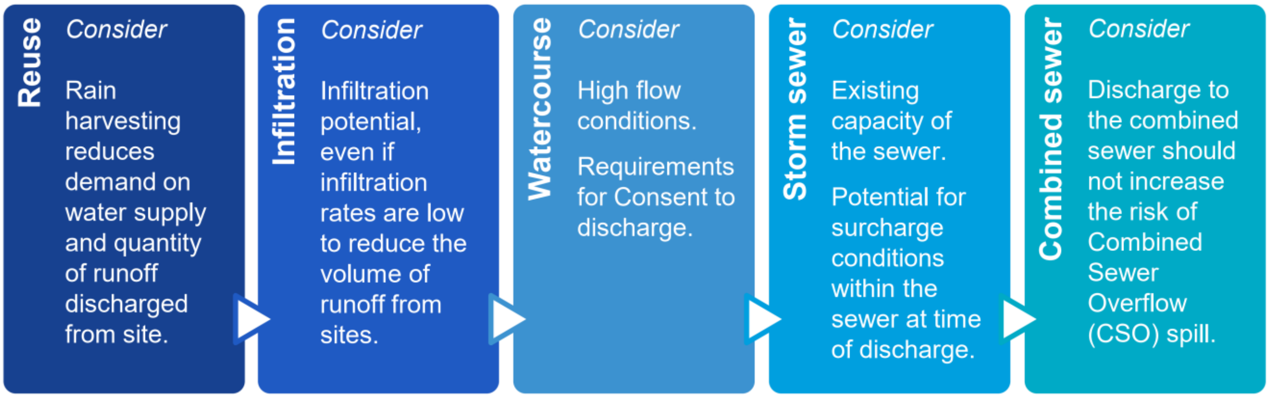
Foul Water

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of **0.03 l/s** for the above development at manhole reference TR0965**9502**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Surface Water

There is currently adequate capacity in the local surface water network to accommodate a surface water flow of **2.1 l/s** for the above development at manhole reference TR0965**9550**.

Although capacity in the surface water network has been identified, in all situations where surface water is being considered for discharge to our network, we require the below hierarchy for surface water to be followed which is reflected in part H3 of the Building Regulations. Whilst reuse does not strictly form part of this hierarchy, Southern Water would encourage the consideration of reuse for new developments.



Guidance on Building Regulations is here: gov.uk/government/publications/drainage-and-waste-disposal-approved-document-h

We would welcome the opportunity to engage with you on the design for disposal of surface water, with a particular focus on the potential for incorporating Sustainable Drainage Systems (SuDS), for this development at the earliest opportunity and we recommend that civil engineers and landscape architects work together and with Southern Water.

Where a surface water connection to the foul or combined sewer is being considered, this should be agreed by the Lead Local Flood Authority, in consultation with Southern Water.

It should be noted that although the above assessment indicates that there is capacity available for your proposed surface water flows the LLFA (Local Lead Flood Authority) may impose/request that a lower flow is discharged to the public surface water sewer.

If the excess surface water flows are to be attenuated on site, it could have a significant effect on any proposed Sewer Adoption (S104) Agreements. Any attenuation proposals should be agreed before any works are implemented on site. Where capacity is limited/restricted, agreement should be sought if you are to include any highway drainage within your proposals as Southern Water is not obligated to accept highway flows.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk/

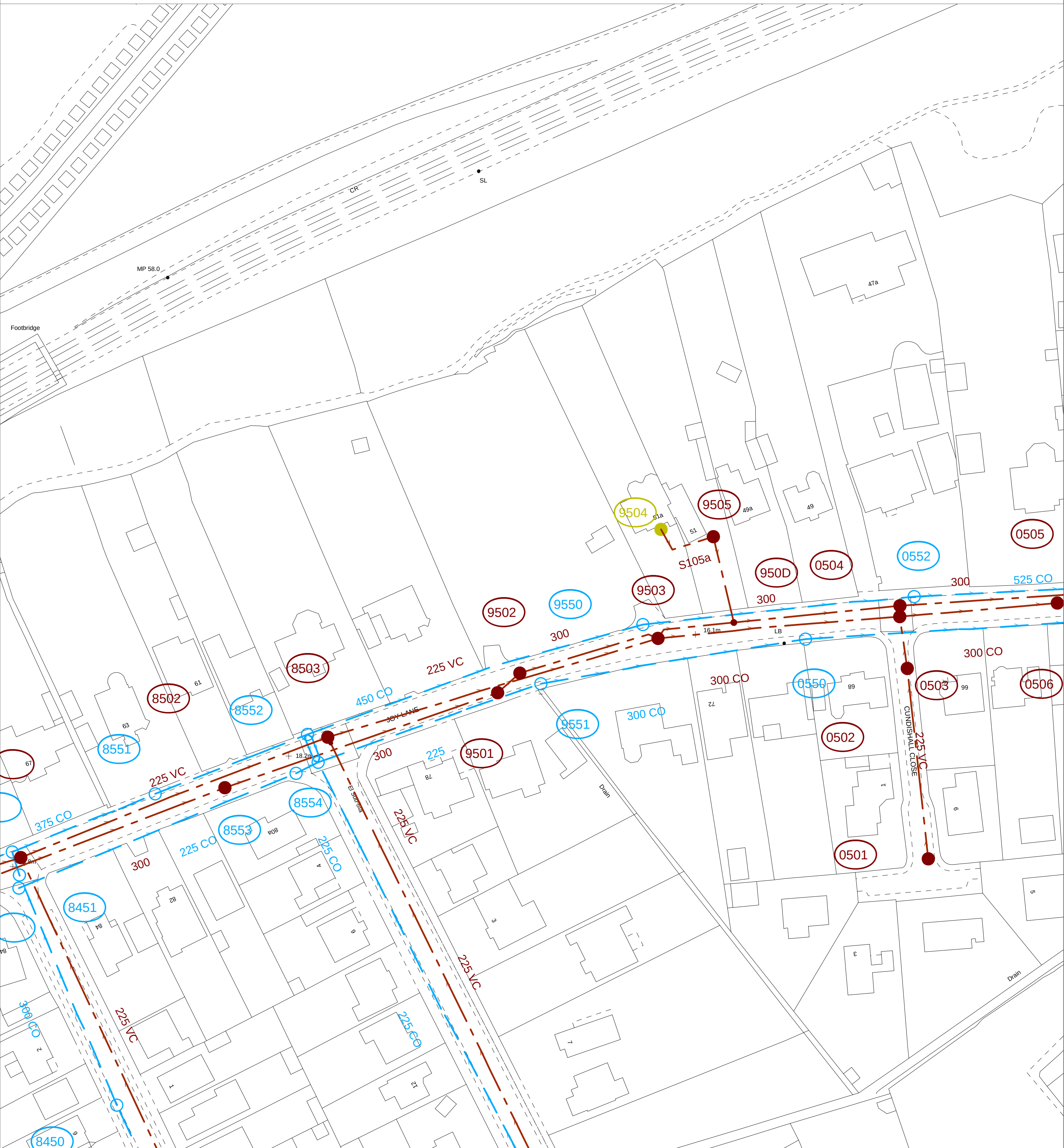
Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

Should it be necessary to contact us please quote our above reference number relating to this application by email at southernwaterplanning@southernwater.co.uk

Yours sincerely,

Joff Edevane
Growth Planning Lead
Business Channels

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

O.S. REF: TR0965NE | Scale: 1:1250

Printed By: Mercy | Date: 10-9-2020

Sewer Plot

Site Plan

Requested By:

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement