

MERIDIAN

CIVIL ENGINEERING CONSULTANCY

IMPERIAL WHARF,
GRAVESEND,
DA11 0DY

SURFACE WATER DRAINAGE DISCHARGE OF CONDITIONS

MAY 2024

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Client : PDE Consulting

Rev	Date	Prepared by	Checked by	Approved by
-	20/05/2024	CL	MN	MN
P1	29/07/2024	CL	MN	MN
P2	13/09/2024	MN		

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LLFA Comment	MCEC Response
"The drainage strategy proposes to discharge Catchments 2 and 3 to existing road drainage outside of the red line boundary and in the case of Catchment 3, to land outside of that controlled by the applicant. It is noted that a CCTV survey has been undertaken for some of the network, however the ownership, condition and eventual connectivity of the network is not clear. At detailed design stage we would like to see information confirming the condition and ownership of the network, and in the case that it is maintained by a third party, that consultation has been undertaken to determine that the principle of discharge is acceptable. This will ensure there is a feasible point of discharge for the site before construction commences."	See attached ownership plans in Appendix V. Both discharge points are shown to be within the clients ownership. As to the condition and eventual connectivity, a further CCTV survey will be conducted prior to construction.
"For Catchment 1, the strategy involves discharge to the River Thames via a new outfall through the Flood Defence. We would also like to see evidence that consultation has been undertaken with the Environment Agency and that they are in agreement with this in principle."	Conway have confirmed an existing outfall through the river wall. We understand that the client, Conway, is in contact with the Environment Agency to obtain permitting for the re-use of the outfall into the River Thames.
"As advised in our original consultation response, as of the 10th of May 2022, the Environment Agency's climate change allowances have been updated. As part of this update, revisions have been made to the 'Peak Rainfall Intensity Allowances' that are used in applying climate change percentages to new drainage schemes. The LLFA would now seek the 'upper end' allowance is designed for both the 30 (3.3%) and 100 (1%) year storm scenarios. This analysis must determine if the impacts of the greater allowance are significant and exacerbate any flood risk. The design may need to be minimally modified but may also need additional mitigation allowances, for example attenuation features or provision of exceedance routes. This will tie into existing designing for exceedance principles."	P2 REVISION The 45% climate change is included on all network calculations.
"Whilst we appreciate that pumping may be ultimately necessary, we would request that pumps are considered only as a last-resort option, and only where infiltration or discharge via gravity can be demonstrated to be unviable. Any pumped system can be prone to failure within the associated development's lifetime, and cannot be considered to be fully sustainable owing to the carbon-cost of the pump's operation. If a pumped system is required, we would like to see details of the pumping system proposed to convey flows at times when the primary outfall is tide locked. We would also like	Catchment 1 (main yard area) is proposed to drain via gravity for most events. Only in combined tidal plus surface water events, where the tidal level is higher than the outfall, will the pump need to be used to drain water offsite. For most rainfall events the drainage will be able to drain via gravity into the tidal section of the River Thames. The pump will be provided with a battery backup to ensure there is power to it at all times. The pump allows the proposal to drain via gravity into the River Thames as without it, draining into the river would not be feasible.

to see the calculations that support the quoted required pumping capacity of 200l/s."	Page 6 of catchment 1 calcs(Appendix II) at node 26 shows a peak flow of 244.2l/s in the network for the critical storm event for the 1in100yr+CC rainfall event. The pump has been updated to match this flow rate. Should the critical storm event occur at a time of tide lock this flow rate will need to be achieved to prevent flooding on site. Use of the pump and draining to the existing outfall will reduce the current reliance of the existing offsite storm drainage in the road and would reduce flows to this network improving flood risk to others as a result.
"We would also like to see details of the non-return valve proposed to be installed in the outlet manhole in Catchment 1."	A drawing has been added to the construction details sheet CIV02 included in Appendix I.

1.0 INTRODUCTION

- 1.1 Meridian Civil Engineering Consultancy LTD (MCEC) has been instructed by PDE Consulting to prepare a surface water design for the site at Imperial Wharf. This design follows the drainage hierarchy and the principles of the previously approved Ambiantal drainage strategy.
- 1.2 The proposals are for the construction of a hardstanding carpark, 2 bitumen tanks with a 4.5m high bund wall, a HGV parking area with a truck loading system and emulsion tanks and plant.
- 1.3 The drainage for the proposals has been split into three catchments, Catchment 1, 2 and 3.
- 1.4 Catchment 1 conveys storm water and discharges into the River Thames to the north of the site. As the River is tidal at this point no flow rate reduction is deemed necessary. An unrestricted gravity outfall is proposed with a supplemental pumped outfall for when tide levels are such that the gravity connection is no longer able to deal with flows from site. An existing outfall to the Thames is proposed to be re-used.
- 1.5 Catchment 2 is an existing hard surfaced area that drains to the road drainage network. It is therefore proposed to have an attenuation tank and hydrobrake to limit runoff from the area in line with current best practice and local guidance. The attenuation tank will have a storage volume of 38.0m³. Runoff rate will be limited to 1.0l/s for all events up to and including the 1 in 100 year+45%CC event. Runoff is proposed to be discharged into nearby storm drainage network. The reduction in runoff is a betterment over the existing situation which drains at an unrestricted rate. Catchment 2 includes a 4.5m high bund surrounding the proposed bitumen tanks. Water falling within the bund is proposed to be drained via the 'Bundguard' system (used for dewatering bunds) and would be pumped from at a rate of 0.7l/s.
- 1.6 Catchment 3 is currently a general storage area. Proposals for this area are for replacement car parking to compensate for the loss of the existing car park when the bitumen tanks are constructed. It is proposed to lay an impermeable asphalt surface on the car park area with permeable paving subbase with a French drain to provide attenuation. A hydrobrake will limit runoff from the subbase to a max rate of 1.0l/s for all events up to and including the 1 in 100 year+45%CC event.
- 1.7 MCEC have created a network model to assess the required storage capacities for the proposed development. The rainfall model used for detailed storage calculations is the FEH22 rainfall model. Storms have been modelled up to, and including, the 1in100yr rainfall event with 45% climate change allowance in accordance with the EA climate change allowed for the Medway Catchment for the 2070 epoch.
- 1.8 This discharge of condition report follows the principles of the Ambiantal Environmental Assessment Surface Water Drainage Strategy (SWDS) report submitted and approved at planning stage.

2.0 SURFACE WATER DRAINAGE STRATEGY

- 2.1 This detailed drainage submission has been produced in line with the CIRIA SuDS manual and follows the drainage hierarchy and the principles of the previously approved Ambient drainage strategy. The drainage for the proposals has been split into three catchments, Catchment 1, 2 and 3.
- 2.2 Catchment 1 is proposed to drain via a network of ACO QMAX 900 drains into the River Thames adjacent to the site. As the Thames is tidal at this point of the river, the runoff rate will be unrestricted. An oil interceptor is proposed prior to discharge to provide treatment for the surface water runoff. The discharge point into the river will have 2 components, a gravity discharge with a non-return valve for when tidal levels are low and a pumped discharge for when tidal levels are above the gravity connection.
- 2.3 The Catchment 2 strategy is based around attenuation and controlled discharge to nearby drainage. A geocellular crate system will provide attenuation storage. The crate will be 100m² in area and 0.4m in depth, giving a total storage volume of 38m³ with a half drain time of 915 minutes. A hydrobrake will limit discharge from the catchment to a maximum rate of 1.0l/s for all events up to and including the 1 in 100 year+45%CC event.
- 2.4 Catchment 2 also includes a 4.5m high bund surrounding 2 bitumen tanks. A Bundguard pump is proposed to provide treatment and pump from inside the bund to the rest of the catchment. The pumping will occur at a rate of 0.7l/s for the head of 4.5m. At this pumping rate the bund will not flood for all events up to and including the 1 in 100 year +45%CC event.
- 2.5 The Catchment 3 strategy is also based on attenuation and controlled discharge. The proposed development for Catchment 3 is for a carpark. Proposals are to formalise this parking and, as such, it is proposed to lay an impermeable asphalt surface on the car park area with permeable paving subbase. A French drain is shown proposed to run around the edge of the carpark which will drain into the permeable paving subbase.
- 2.6 The permeable pavement subbase will be approximately 900m² in area with a storage depth of 0.4m giving a storage volume of 108m³. The French drain running around the edge of the pavement will be approximately 112.5m² in area with an approximate storage volume of 15.2m³. A hydrobrake will control runoff from the subbase to a maximum rate of 1l/s for all events up to and including the 1 in 100 year+45% CC event. Surface water will be discharged to nearby drainage shown in the CCTV survey(Appendix IV).
- 2.7 The proposed drainage strategy is capable of coping with all events up to and including the 1 in 100 year+45%CC event. The critical storm duration varies for each catchment.
- 2.8 Connectivity for the outfalls of catchment 2 and 3 are within clients ownership. Title plans for the clients ownership are shown in Appendix V.
- 2.9 The proposed drainage layout plan drawing is included in Appendix I and associated network calculations in appendix II.

3.0 MANAGEMENT AND MAINTENANCE

- 3.1 All onsite SuDS and drainage systems will be privately maintained by FM Conway.
- 3.2 In addition to a long term maintenance regime it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post construction and monthly for the first quarter following construction

PROPOSED SCHEDULE OF MAINTENANCE FOR BELOW GROUND DRAINAGE				
Item	Visual Inspection	Cleanse / De-sludge	CCTV Survey	Comments
Surface Water Drainage System (pipework, chambers etc.)	5 years	10 years	10 years	Cleansing to be carried as necessary
Gullies/Channels	1 year	1 year	N/A	Cleansing to be carried as necessary
Storm water catchpits	1 year		N/A	Cleansing to be carried as necessary
Pumps	1 year			Maintain as manufacturers guidance
Oil interceptors	1 year	As necessary		Maintain as manufacturers guidance
Geocellular Attenuation	0.5 year	1 year	-	See manufacturers guidelines

4.0 CONCLUSION

- 4.1 Meridian Civil Engineering Consultancy LTD (MCEC) has been instructed by PDE Consulting to prepare a surface water design for the site at Imperial Wharf. This design follows the drainage hierarchy and the principles of the previously approved Ambiental drainage strategy.
- 4.2 The proposals are for the construction of a hardstanding carpark, 2 bitumen tanks with a 4.5m high bund wall, a HGV parking area with a truck loading system and emulsion tanks and plant.
- 4.3 The drainage for the proposals has been split into three catchments, Catchment 1, 2 and 3.
- 4.4 Catchment 1 conveys storm water and discharges into the River Thames to the north of the site. As the River is tidal at this point no flow rate reduction is deemed necessary. An unrestricted gravity outfall is proposed with a supplemental pumped outfall for when tide levels are such that the gravity connection is no longer able to deal with flows from site. An existing outfall to the thames is proposed to be re-used.
- 4.5 Catchment 2 is an existing hard surfaced area that drains to the road drainage network. It is therefore proposed to have an attenuation tank and hydrobrake to limit runoff from the area in line with current best practice and local guidance. The attenuation tank will have a storage volume of 38.0m³. Runoff rate will be limited to 1.0l/s for all events up to and including the 1 in 100 year+45%CC event. Runoff is proposed to be discharged into nearby storm drainage network. The reduction in runoff is a betterment over the existing situation which drains at an unrestricted rate. Catchment 2 includes a 4.5m high bund surrounding the proposed bitumen tanks. Water falling within the bund is proposed to be drained via the 'Bundguard' system (used for dewatering bunds) and would be pumped from at a rate of 0.7l/s.
- 4.6 Catchment 3 is currently a general storage area. Proposals for this area are for replacement car parking to compensate for the loss of the existing car park when the bitumen tanks are constructed. It is proposed to lay an impermeable asphalt surface on the car park area with permeable paving subbase with a French drain to provide attenuation. A hydrobrake will limit runoff from the subbase to a max rate of 1.0l/s for all events up to and including the 1 in 100 year+45%CC event.
- 4.7 MCEC have created a network model to assess the required storage capacities for the proposed development. The rainfall model used for detailed storage calculations is the FEH22 rainfall model. Storms have been modelled up to, and including, the 1in100yr rainfall event with 45% climate change allowance in accordance with the EA climate change allowed for the Medway Catchment for the 2070 epoch.
- 4.8 This discharge of condition report follows the principles of the Ambiental Environmental Assessment Surface Water Drainage Strategy (SWDS) report submitted and approved at planning stage.

APPENDIX I Drainage Design Drawings

River Thames

DRAWING TO BE READ IN
CONJUNCTION WITH CCTV
SURVEY BY CONWAY

River Thames



North Water

CATCHMENT 1
THIS CATCHMENT IS PROPOSED TO DISCHARGE DIRECTLY TO THE THAMES.
AS THE THAMES IS TIDAL, ATTENUATION IS NOT REQUIRED FOR THE SITE.
AS THE LEVELS IN THE THAMES CAN RISE DUE TO HIGH TIDE, A PUMP IS
REQUIRED TO PUMP WATER OUT OF THE SITE WHEN THE TIDE IS HIGH.

ACO QMAX 900 DRAIN PROPOSED TO
DRAIN CATCHMENT 1 HARDSTANDING.
MODELLED AS A 600mm DIAMETER PIPE

ROOF RUNOFF TO DRAIN TO
CHANNEL DRAINS. CONNECTION
AT ACO GULLY LOCATIONS

FULL RETENTION OIL INTERCEPTOR

AREA ASSUMED TO DRAIN AS EXISTING YET HAS STILL
BEEN INCLUDED IN CALCULATIONS TO BE CONSERVATIVE

150mm ACO ROAD DRAIN OR SIMILAR
HIGH LOAD CHANNEL DRAIN

CATCHPIT WITH SMARTSPONGE
PASSIVE SKIMMERS TO OFFER
TREATMENT TO HARD SURFACE
RUNOFF

SURFACE WATER RUNOFF FROM CATCHMENT 2 TO BE
DISCHARGED INTO EXISTING DRAINAGE ON SITE
UPSTREAM MANHOLE IL: 3.52
DOWNSTREAM MANHOLE IL: 3.61
CONNECTION IL: 3.61

HYDROBRAKE AT 1.0 l/s DISCHARGING
TO THE PUBLIC SURFACE WATER
SEWER IN CLIFTON MARINE PARADE
RUNOFF RATE BASED ON MINIMUM
APERTURE OPENING OF 50mm.
DESIGN HEAD: 1.2m
DESIGN FLOW: 1.3 l/s

HYDROBRAKE AT 1.0 l/s DISCHARGING
TO THE PUBLIC SURFACE WATER
SEWER IN CLIFTON MARINE PARADE
RUNOFF RATE BASED ON MINIMUM
APERTURE OPENING OF 50mm.
DESIGN HEAD: 0.5m
DESIGN FLOW: 1.0 l/s

CONNECT TO MANHOLE SHOWN
INSIDE OF SITE BOUNDARY FOR CAR
PARK AS SHOWN ON CCTV SURVEY
PARKING GOES ALL THE WAY TO SITE
BOUNDARY ON SITE

EXISTING mh DEPTH 1.2m
CL: 5.69
IL: 4.49
RECONSTRUCT AS HYDROBRAKE MANHOLE

150mm SLOTTED DRAIN IN
FILTER TRENCH AROUND CAR
PARK TO CAPTURE AND
DISPERSE RUNOFF FROM
CAR PARK SURFACE TO
PERMEABLE SUB-BASE AND
OUTFALL TO HYDROBRAKE

150mm SLOTTED DRAIN IN
SUB-BASE TO DISPERSE
RUNOFF FROM CAR PARK
SURFACE TO PERMEABLE
SUB-BASE AND OUTFALL TO
HYDROBRAKE

IMPERMEABLE ASPHALT SURFACED CAR PARKING. TO
HAVE A PERMEABLE PAVING SUBBASE TO PROVIDE
ATTENUATION
(IMPERMEABLE LINED TO PREVENT INFILTRATION)
PROPOSED TO HAVE FLAT SUB-BASE AT INVERT=5.45.
MIN SUB-BASE DEPTH=300mm

CAPPING LAYER TO BE CONFIRMED FOLLOWING
RECEIPT OF CBR VALUES OF FORMATION ALLOWING
STRUCTURAL DESIGN OF PERMEABLE PAVEMENT

DUMMY PIPE RUN TO ALLOW MODelling QUALITY.

CATCHMENT 2

BUNDGUARD PUMP TO PROVIDE TREATMENT AND
PUMP FROM INSIDE BUND TO SURFACE WATER
DRAINAGE. TO BE DESIGNED BY SPECIALIST.
PUMPING WILL OCCUR AT A RATE OF 0.7 l/s AT THE
HEAD OF 4.5m
AT THIS PUMPING RATE THE BUND WILL NOT
FLOOD FOR ALL EVENTS UP TO AND INCLUDING
THE 1 IN 100 YEAR + 45%CC EVENT

4.5m HIGH BUND WALLS FOR THE CONTAINMENT OF ANY BITUMEN
SPILLS

THE AREA CONFINED BY THE BUNDS IS APPROXIMATELY 900m²
AND EXCLUDING THE BITUMEN TANKS AREA: 450m²

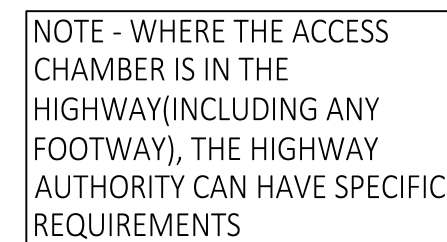
THE VOLUME CONFINED BY THE BUNDS (2000m³) IS LARGER THAN
THE 6 HOUR 100-YEAR +40%CC RAINFALL EVENT VOLUME (85m³)

RUNOFF CONTAINED WITHIN THE BUND AREA WOULD BE PUMPED
VIA A BUNDGUARD INTO SURFACE WATER DRAINAGE

- GENERAL
a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.
b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
e. CDM REGULATIONS 2015. ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.
f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.
- CONSTRUCTION NOTE
a. THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.
b. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.
c. ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT AUTHORITY, HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION WHILST UNDERTAKING THE WORKS.
d. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.
e. ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS. IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE DETAILS ON ANY MERIDIAN DRAWINGS, THE MANUFACTURER'S INSTRUCTIONS MUST BE USED.
- BELOW GROUND DRAINAGE
a. UPVC-U PIPES TO BS 4660: 2000 AND PLASTIC INSPECTION CHAMBERS AND FITTINGS TO BS EN 13598-1:2020. CLAY PIPES TO BS EN 295-1:2013. CONCRETE MANHOLE AND INSPECTION CHAMBERS TO BS EN 1917:2002.
b. ALL ADAPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH SEWERAGE SECTOR GUIDANCE App C - DESIGN AND CONSTRUCTION GUIDANCE AND THE RELEVANT COUNCIL DESIGN GUIDE.
c. ALL PRIVATE FOUL WATER SEWERS TO BE LAID AT 1 IN 40 AT THE HEAD OF PIPE RUNS AND 1 IN 80 ELSEWHERE UNLESS OTHERWISE STATED.
d. ALL PRIVATE FOUL SEWER PIPES TO BE 100mm DIAMETER FROM SOIL STACKS UNLESS OTHERWISE STATED ON THE DRAWING AND 150mm WHERE SERVING MORE THAN 9 PROPERTIES.
e. ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS OTHERWISE STATED ON THE DRAWING.
f. ALL PRIVATE SURFACE WATER SEWER PIPES TO BE 100mm DIAMETER FROM DOWNPIPES AND 150mm DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.
g. ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER DOWNPIPES OR SOIL STACKS DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION CHAMBER.
h. EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND LEVELED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND REBURIED IF NECESSARY.
i. CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.
j. ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.
- MANHOLE COVERS AND FRAMES
a. MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
b. MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.

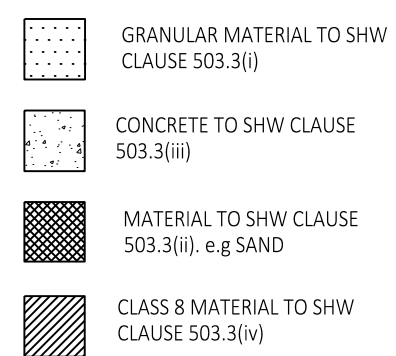
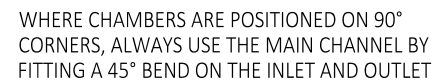
LEGEND	
	PROPOSED SW PIPE RUN
	PROPOSED PERFORATED SW DRAIN
	PROPOSED TYPE 2 SW MANHOLE
	PROPOSED SW PUMP
	PROPOSED HYDROBRAKE MANHOLE
	SLOT/CHANNEL DRAIN
	PERMEABLE PAVING (ASSUMED TANKED) - SUB-BASE LAID FLAT WITH MINIMUM DEPTH REQUIRED FOR STORAGE
	RAINWATER PIPE
	EXISTING PRIVATE SW RUN - RETAINED
	PETROL INTERCEPTOR
	CATCHPIT CHAMBER/MANHOLE

REV	DESCRIPTION	BY	DATE
1	PRELIMINARY		
MERIDIAN CIVIL ENGINEERING CONSULTANCY			
CLIENT: PDE CONSULTING			
SITE: IMPERIAL WHARF DA11 0DY			
TITLE: SURFACE WATER DRAINAGE OVERALL LAYOUT			
SCALE AT A1: 1:250	DATE: 31/07/2024	DRAWN: CL / BB	CHECKED: MN
PROJECT NO: MC0367	DRAWING NO: CIV-01	REVISION: P4	



(FOR USE IN AREAS SUBJECT TO VEHICLE LOADING,
DEPTH FROM COVER LEVEL TO SOFFIT OF PIPE UP TO 3M)

ALTERNATIVE BASE INVERT LAYOUTS
ALL CONNECTIONS TO BE MIN. SOFFIT TO SOFFIT



400mm COVER

50mm VENT PIPE

GROUND LEVEL

COMPACTED AS-DUG BACKFILL

100

400

PERMAVOID HIGH LOAD STORMWATER MANAGEMENT SYSTEM

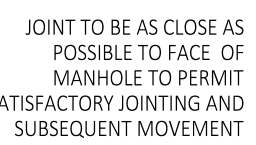
1mm THK IMPERMEABLE MEMBRANE WITH WELDED JOINTS

100mm COMPACTED COARSE SAND

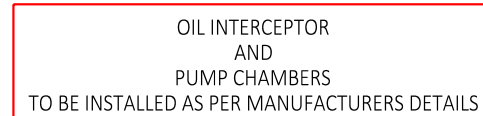
(nts)



(nts)



(DEPTH FROM COVER LEVEL TO
SOFFIT OF PIPE LESS 1.5m TO 3m
ALTERNATE RIGID MATERIAL
CONSTRUCTION WITH CONCRETE
SURROUND)

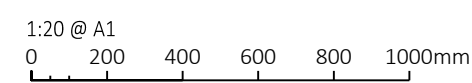


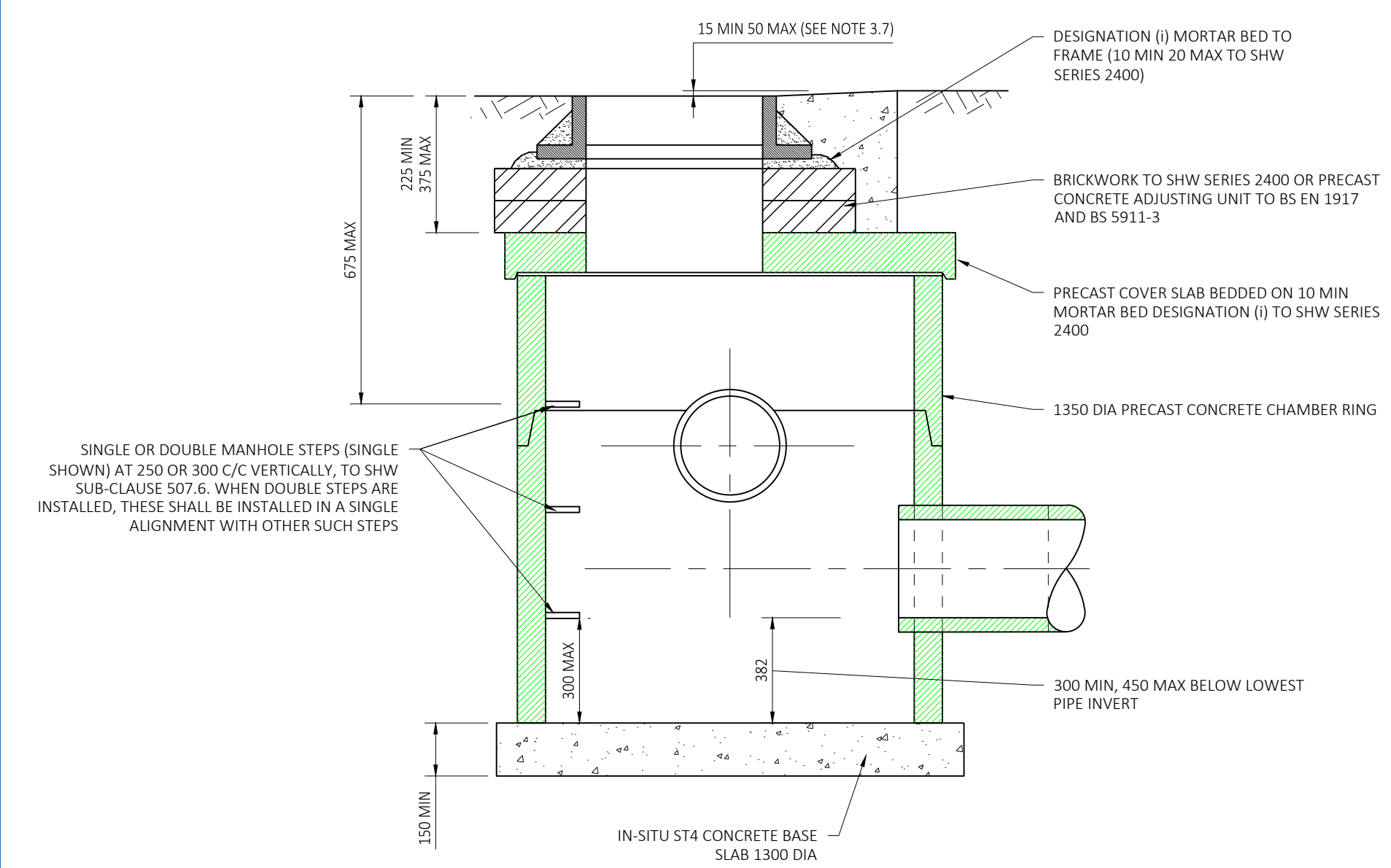
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CLIENT: PDE CONSULTING

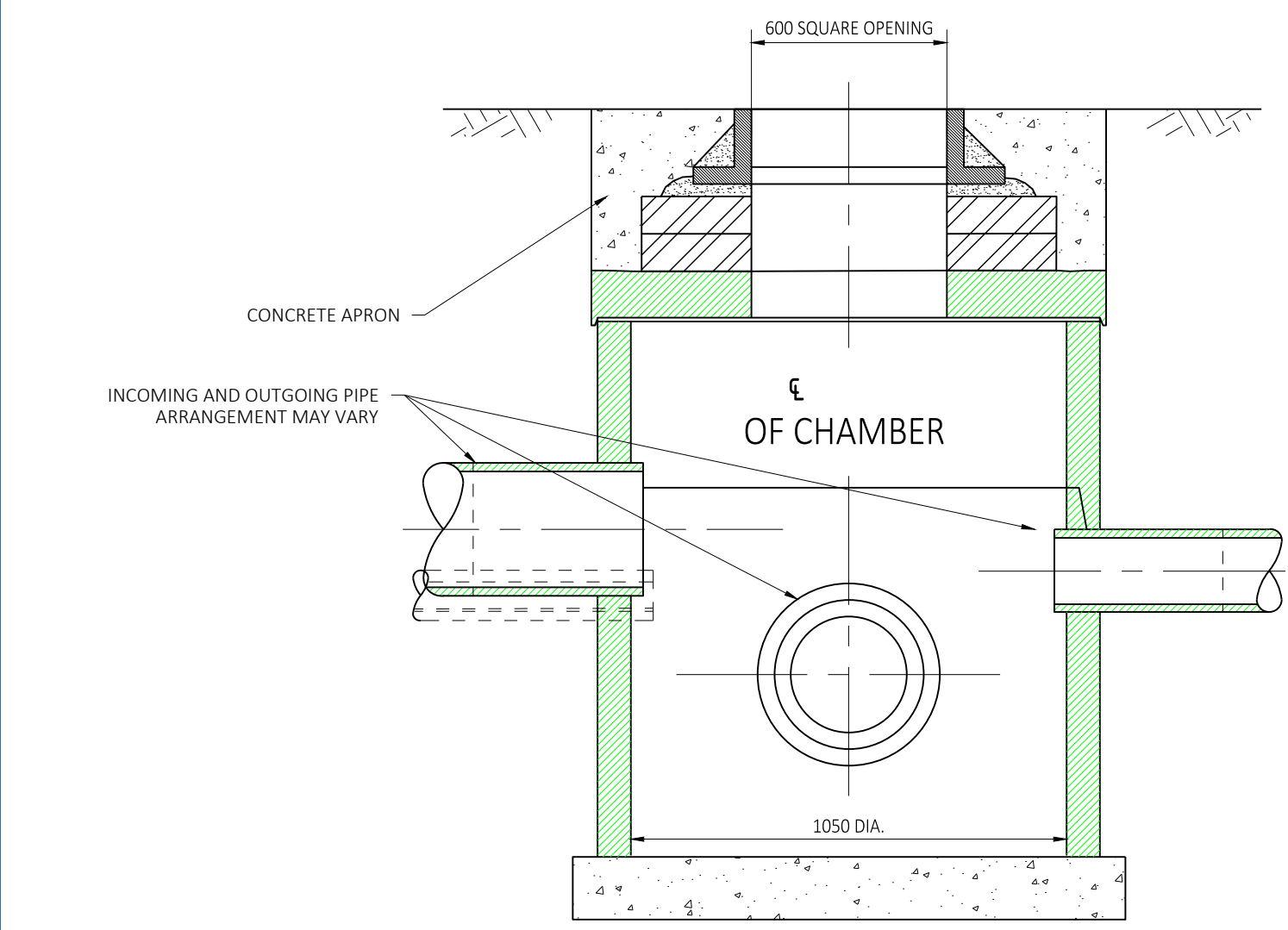
TITLE: Construction Details
SHEET 1 OF 2

SCALE AT A1: 1:20	DATE: 31/07/2024	DRAWN: CL	CHECKED: MN
PROJECT NO: MC0367	DRAWING NO: CIV-02		REVISION: P3

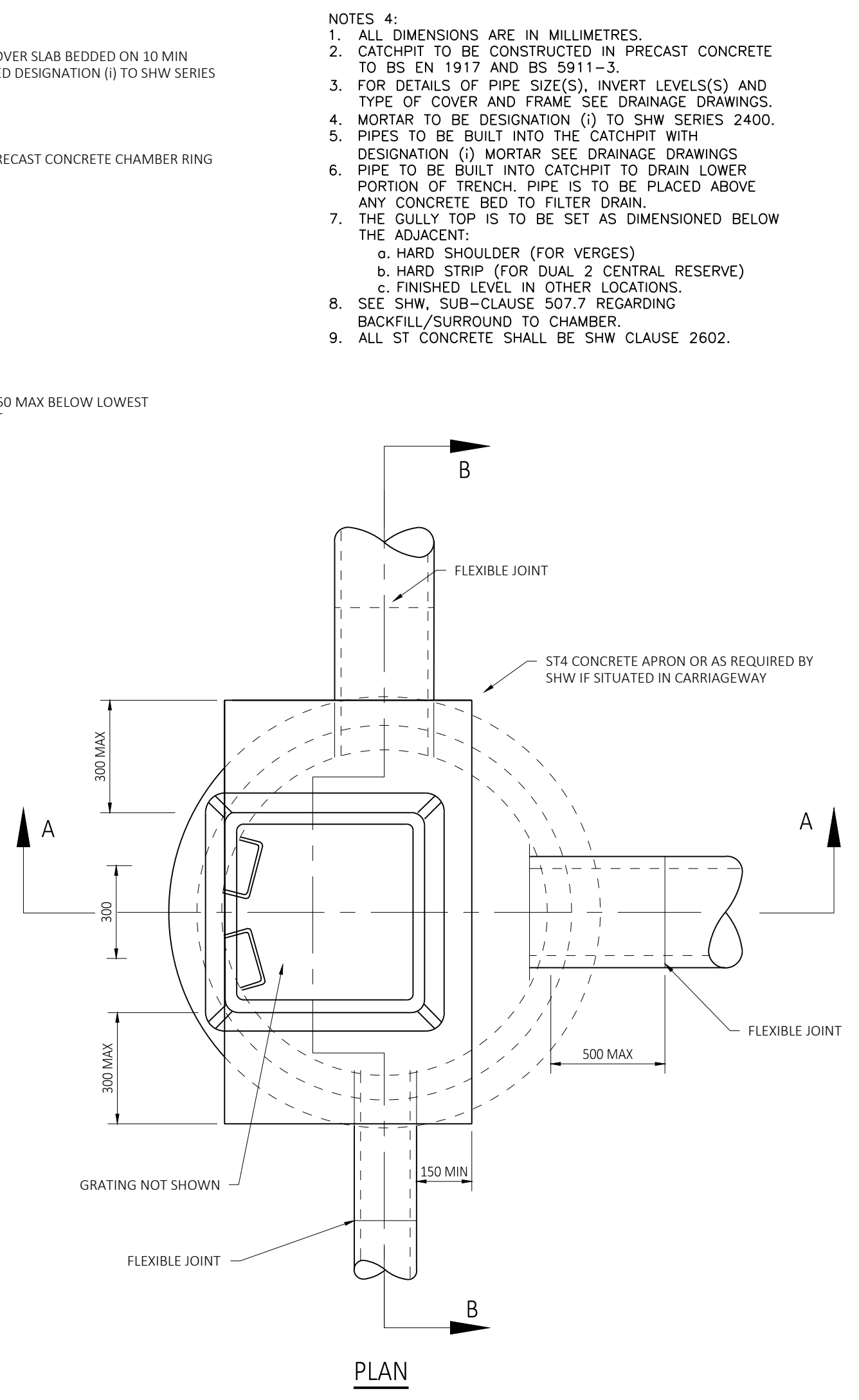




SECTION A-A

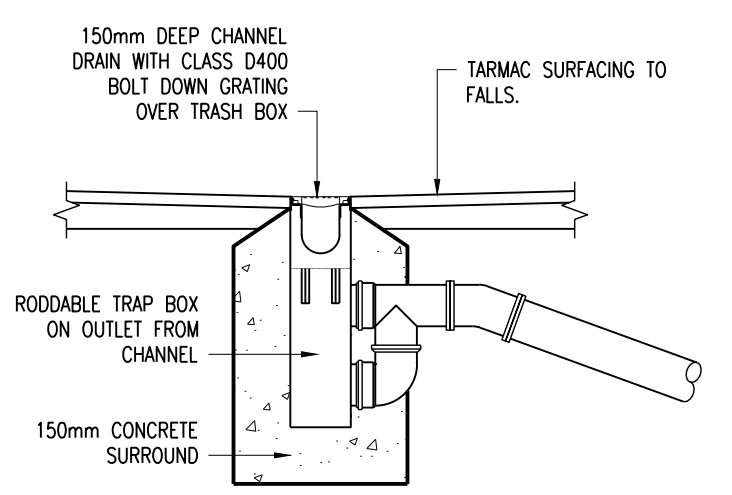


SECTION B-B



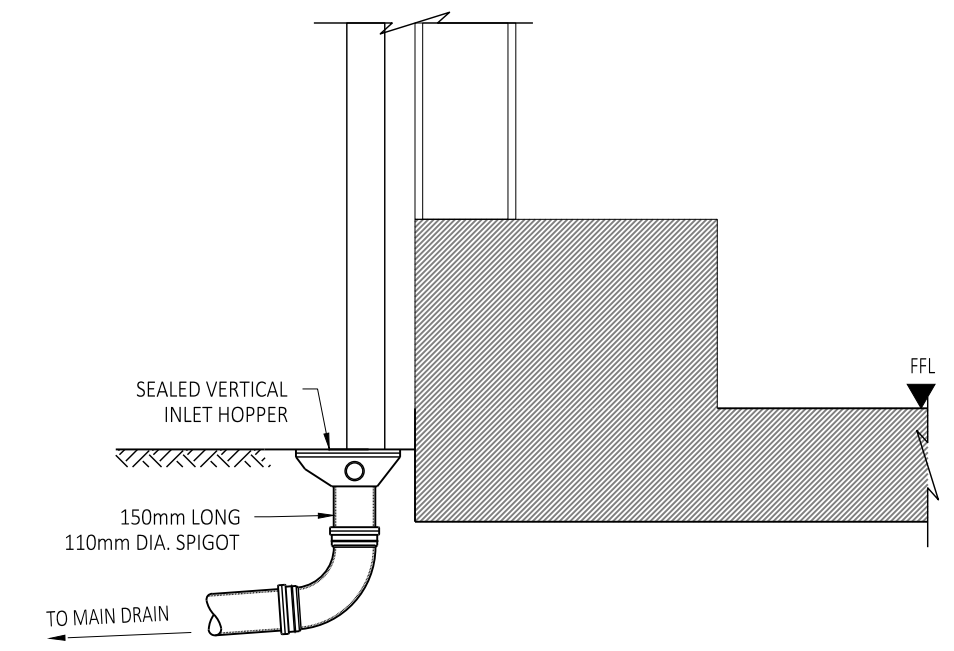
PLAN

CATCHPIT DETAIL.



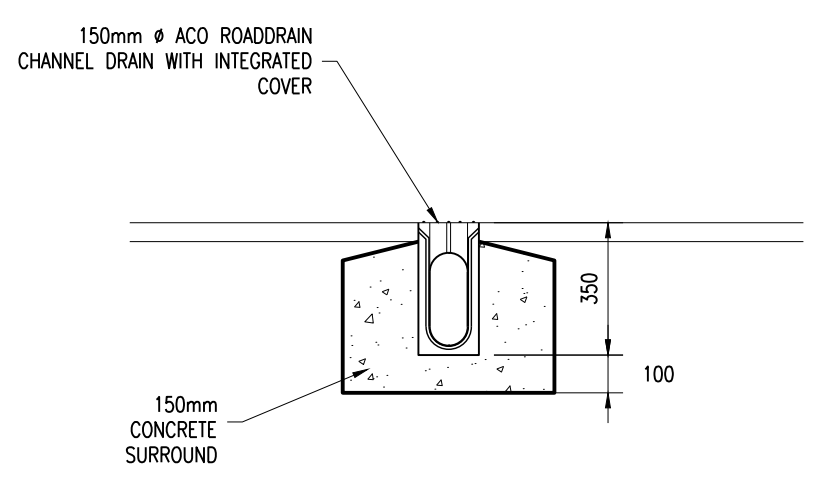
CHANNEL DRAIN OUTLET

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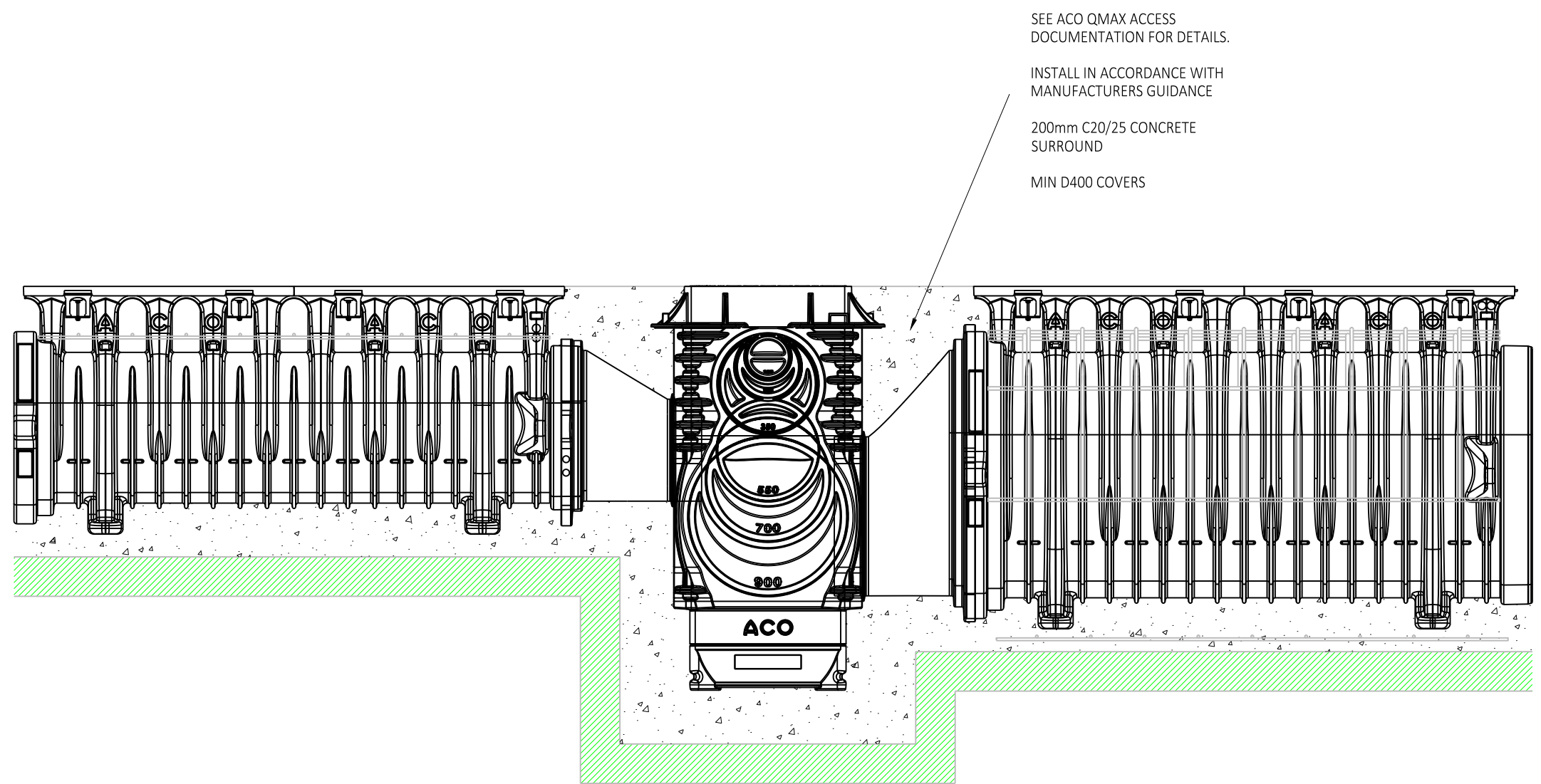
RWP CONNECTION
WORKSHOP BUILDING

(1:20)



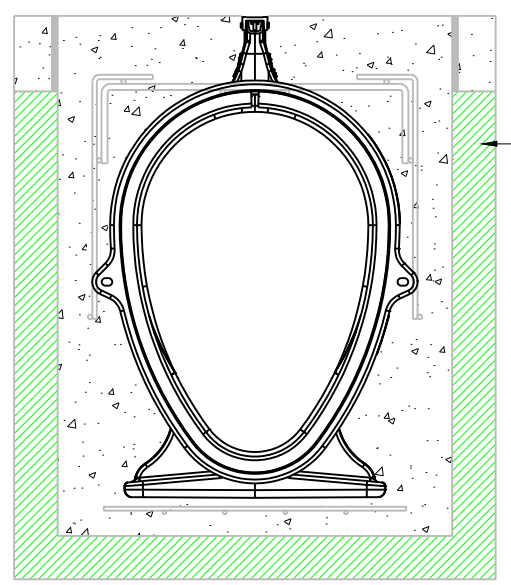
ACO ROAD DRAIN

(1:20)



ACO QMAX ACCESS
CHAMBER WITH
CONCRETE SURROUND

(1:20)

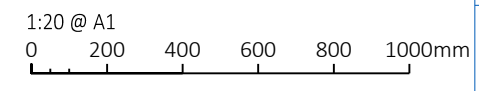


ACO QMAX 900 WITH
CONCRETE SURROUND

(1:20)

- GENERAL
- (i) WORK TO FIGURED DIMENSIONS ONLY.
- (ii) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
- (iii) ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
- (iv) THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
- (v) CDM REGULATIONS 2015. ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.
- (v) CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CRIA 752 SLDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.
2. DRAINAGE GENERAL
- (i) ALL FOUL AND STORM WATER DRAINS WHICH ARE NOT TO BE ADOPTED AS PUBLIC SEWERS UNDER A SECTION 104 AGREEMENT MUST BE CONSTRUCTED IN ACCORDANCE WITH THE BUILDING REGULATIONS, BS EN 752 AND WHERE APPROPRIATE THE RELEVANT AGREEMENT CERTIFICATES.
- (ii) MANHOLES, GULLIES, GULLY CONNECTIONS, SEWERS AND OTHER SEWERAGE STRUCTURES INTENDED TO CONVEY SURFACE WATER ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE WATER AUTHORITIES ASSOCIATION SPECIFICATION 'SEWERS FOR ADOPTION' 6TH EDITION AND RELEVANT COUNCIL DESIGN GUIDE.
- (iii) ALL CONCRETE USED IN DRAINAGE WORKS TO COMPLY WITH BRE DIGEST 363 FOR CLASS 2 SULPHATE CONDITIONS.
3. MANHOLE COVERS AND FRAMES
- (i) MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
- (ii) MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.
4. MANHOLE RINGS, COVER SLABS & TAPERS
- (i) PRECAST CONCRETE MANHOLE UNITS SHALL COMPLY WITH THE REQUIREMENTS OF BS 5911. THE RELEVANT ABSORPTION TESTS REQUIRED SHALL BE CARRIED OUT ON A SAMPLE OF THOSE RINGS AND SLABS USED UNLESS A CERTIFICATE OF TESTING IS SUPPLIED BY THE MANUFACTURER. COVER SLABS SITUATED UNDER CARRIAGEWAYS OR TRAFFICKED AREAS SHALL BE HEAVY DUTY AND THOSE ELSEWHERE SHALL BE LIGHT DUTY. MANHOLE UNITS SHALL BE COMPLETE WITH STEP IRONS IF REQUIRED.
5. PIPES
- (i) PLASTIC PIPES SHALL BE OF UNPLASTICISED POLYVINYL CHLORIDE (UPVC) COMPLYING WITH THE REQUIREMENTS OF BS EN 1401.
- (ii) CONCRETE PIPES SHALL BE SPUN BY A CENTRIFUGAL PROCESS OR BE VERTICALLY PRESSED. THEY SHALL POSSESS SELF INVERTING SOCKETS AND SHALL COMPLY WITH THE REQUIREMENTS OF AND BE TESTED IN ACCORDANCE WITH BS 5911.
- (iii) SOLID WALL CONCENTRIC EXTERNAL RIB-REINFORCED UNPLASTICISED PVC PIPE SHALL COMPLY WITH ASTM A978.
- (iv) ALL VITRIFIED CLAY PIPES TO BE IN ACCORDANCE WITH BS EN 295.
- (v) ALL PIPE CONNECTIONS TO MH'S AND CATCH PITS TO HAVE MIN 600MM ROCKER PIPE AS CLOSE AS PRACTICABLE TO CHAMBER WALL.
6. GULLY GRATES & FRAMES
- (i) GULLY GRATES AND FRAMES FOR CARRIAGEWAY GULLIES SHALL COMPLY WITH BS EN 142. GULLIES SHALL BE PATTERN GB4-325 FOR ROADS BELOW 50 DV AND PATTERN GA2-450 FOR ROADS ABOVE 50 DV. GULLY GRATES AND FRAMES FOR KERB SIDE GULLIES SHALL BE PATTERN GK-115 FOR ROADS BELOW 50 DV AND GK-165 FOR ROADS ABOVE 50 DV. CURVED BAR GULLY GRATES SHALL BE USED IN ROADS WHERE THE GRADIENT EXCEEDS 4%.

-	-	-	-
REV:	DESCRIPTION:	BY:	DATE:
STATUS: PRELIMINARY			
MERIDIAN CIVIL ENGINEERING CONSULTANCY			
CLIENT: PDE CONSULTING			
SITE: IMPERIAL WHARF DA11 0DY			
TITLE: Construction Details			
SCALE AT A1: 1:20	DATE: 21/05/2024	DRAWN: CL	CHECKED: MN
PROJECT NO: MC0367	DRAWING NO: CIV-03	REVISION: P1	



APPENDIX II Hydraulic Calculations

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	50	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.950	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)	Depth (m)
✓	13	0.026	4.00	5.900		1.000
✓	11	0.090	4.00	5.440		1.569
✓	10	0.069	4.00	5.750		1.000
✓	9	0.040	4.00	5.830		1.000
✓	7			5.440		1.027
✓	5	0.023	4.00	5.690		1.000
✓	4	0.053	4.00	5.810		1.000
✓	3	0.025	4.00	5.900		1.033
✓	14			5.400	600	1.357
✓	15	0.019	4.00	5.240		1.000
✓	16			5.400		1.000
✓	17			5.500		1.024
✓	18			5.510		1.000
✓	19	0.045	4.00	5.610		1.000
✓	20			5.830		1.018
✓	21			5.460	450	1.155
✓	22		4.00	5.500	450	1.000
✓	23			5.600	450	1.169
✓	24	0.009	4.00	5.740	450	1.240
✓	25			5.070		1.410
✓	26			5.040	1350	1.364

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)
✓	1.011	26	25	4.940	0.600	3.676	3.660	0.016	308.7	375	5.98	50.0
?	1.010	11	26	38.941	0.600	3.871	3.676	0.195	200.0	375	5.89	50.0
?	4.003	10	11	39.782	0.600	4.750	4.440	0.310	128.3	600	4.97	50.0
?	1.009	14	11	3.713	0.600	4.043	4.021	0.022	168.8	225	5.39	50.0
?	2.002	21	14	20.487	0.600	4.305	4.168	0.137	150.0	100	5.32	50.0
?	1.008	15	14	15.175	0.600	4.240	4.139	0.101	150.0	225	5.04	50.0
?	1.007	16	15	12.141	0.600	4.400	4.240	0.160	75.9	600	4.80	50.0
?	1.006	7	16	1.472	0.600	4.413	4.400	0.013	113.2	600	4.73	50.0
?	1.005	17	7	12.619	0.600	4.476	4.413	0.063	200.0	600	4.72	50.0
?	1.004	18	17	6.728	0.600	4.510	4.476	0.034	200.0	600	4.60	50.0
?	1.003	19	18	16.413	0.600	4.610	4.510	0.100	164.1	600	4.53	50.0
?	1.002	5	19	20.030	0.600	4.690	4.610	0.080	250.4	600	4.39	50.0
?	1.001	20	5	17.973	0.600	4.812	4.690	0.122	147.3	600	4.17	50.0
?	1.000	9	20	2.739	0.600	4.830	4.812	0.018	150.0	600	4.02	50.0

	Name	US Node	DS Node	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)
	1.011	26	25	1.026	113.3	102.6	0.989	1.035	0.398	0.0	281	1.155
	1.010	11	26	1.277	141.1	102.6	1.194	0.989	0.398	0.0	238	1.388
	4.003	10	11	2.148	607.3	44.7	0.400	0.400	0.173	0.0	109	1.280
	1.009	14	11	1.003	39.9	34.8	1.132	1.194	0.135	0.0	163	1.126
	2.002	21	14	0.625	4.9	2.3	1.055	1.132	0.009	0.0	48	0.615
	1.008	15	14	1.065	42.3	32.5	0.775	1.036	0.126	0.0	148	1.171
	1.007	16	15	2.797	790.9	27.7	0.400	0.400	0.108	0.0	75	1.342
	1.006	7	16	2.288	646.9	27.7	0.427	0.400	0.108	0.0	83	1.167
	1.005	17	7	1.718	485.8	27.7	0.424	0.427	0.108	0.0	96	0.950
	1.004	18	17	1.718	485.8	27.7	0.400	0.424	0.108	0.0	96	0.950
	1.003	19	18	1.898	536.6	27.7	0.400	0.400	0.108	0.0	91	1.019
	1.002	5	19	1.534	433.8	16.2	0.400	0.400	0.063	0.0	78	0.750
	1.001	20	5	2.004	566.6	10.3	0.418	0.400	0.040	0.0	55	0.793
	1.000	9	20	1.986	561.5	10.3	0.400	0.418	0.040	0.0	55	0.786

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)
?	2.001	23	21	18.848	0.600	4.431	4.305	0.126	150.0	100	4.78	50.0
?	3.000	22	21	10.426	0.600	4.500	4.430	0.070	150.0	100	4.28	50.0
?	2.000	24	23	10.384	0.600	4.500	4.431	0.069	150.0	100	4.28	50.0
?	4.002	4	10	31.258	0.600	4.810	4.750	0.060	521.0	600	4.66	50.0
?	4.001	3	4	12.391	0.600	4.867	4.810	0.057	217.4	600	4.17	50.0
?	4.000	13	3	4.970	0.600	4.900	4.867	0.033	150.0	600	4.04	50.0

	Name	US Node	DS Node	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)
	2.001	23	21	0.625	4.9	2.3	1.069	1.055	0.009	0.0	48	0.615
	3.000	22	21	0.625	4.9	0.0	0.900	0.930	0.000	0.0	0	0.000
	2.000	24	23	0.625	4.9	2.3	1.140	1.069	0.009	0.0	48	0.615
	4.002	4	10	1.060	299.6	26.8	0.400	0.400	0.104	0.0	120	0.666
	4.001	3	4	1.647	465.8	13.2	0.433	0.400	0.051	0.0	68	0.742
	4.000	13	3	1.986	561.5	6.8	0.400	0.433	0.026	0.0	45	0.693

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)
1.011	4.940	308.7	375	SW_Dummy	5.040	3.676	0.989	5.070	3.660	1.035
1.010	38.941	200.0	375	SW_Standard	5.440	3.871	1.194	5.040	3.676	0.989
4.003	39.782	128.3	600	SW_Dummy	5.750	4.750	0.400	5.440	4.440	0.400
1.009	3.713	168.8	225	SW_Standard	5.400	4.043	1.132	5.440	4.021	1.194

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.011	26	1350	Manhole	SW_Standard	25		Junction	
1.010	11		Junction		26	1350	Manhole	SW_Standard
4.003	10		Junction		11		Junction	
1.009	14	600	Manhole	SW_Standard	11		Junction	

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)
2.002	20.487	150.0	100	SW_Standard	5.460	4.305	1.055	5.400	4.168	1.132
1.008	15.175	150.0	225	SW_Standard	5.240	4.240	0.775	5.400	4.139	1.036
1.007	12.141	75.9	600	SW_Dummy	5.400	4.400	0.400	5.240	4.240	0.400
1.006	1.472	113.2	600	SW_Dummy	5.440	4.413	0.427	5.400	4.400	0.400
1.005	12.619	200.0	600	SW_Dummy	5.500	4.476	0.424	5.440	4.413	0.427
1.004	6.728	200.0	600	SW_Dummy	5.510	4.510	0.400	5.500	4.476	0.424
1.003	16.413	164.1	600	SW_Dummy	5.610	4.610	0.400	5.510	4.510	0.400
1.002	20.030	250.4	600	SW_Dummy	5.690	4.690	0.400	5.610	4.610	0.400
1.001	17.973	147.3	600	SW_Dummy	5.830	4.812	0.418	5.690	4.690	0.400
1.000	2.739	150.0	600	SW_Dummy	5.830	4.830	0.400	5.830	4.812	0.418
2.001	18.848	150.0	100	SW_Standard	5.600	4.431	1.069	5.460	4.305	1.055
3.000	10.426	150.0	100	SW_Standard	5.500	4.500	0.900	5.460	4.430	0.930
2.000	10.384	150.0	100	SW_Standard	5.740	4.500	1.140	5.600	4.431	1.069
4.002	31.258	521.0	600	SW_Dummy	5.810	4.810	0.400	5.750	4.750	0.400
4.001	12.391	217.4	600	SW_Dummy	5.900	4.867	0.433	5.810	4.810	0.400

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.002	21	450	Manhole	SW_Standard	14	600	Manhole	SW_Standard
1.008	15		Junction		14	600	Manhole	SW_Standard
1.007	16		Junction		15		Junction	
1.006	7		Junction		16		Junction	
1.005	17		Junction		7		Junction	
1.004	18		Junction		17		Junction	
1.003	19		Junction		18		Junction	
1.002	5		Junction		19		Junction	
1.001	20		Junction		5		Junction	
1.000	9		Junction		20		Junction	
2.001	23	450	Manhole	SW_Standard	21	450	Manhole	SW_Standard
3.000	22	450	Manhole	SW_Standard	21	450	Manhole	SW_Standard
2.000	24	450	Manhole	SW_Standard	23	450	Manhole	SW_Standard
4.002	4		Junction		10		Junction	
4.001	3		Junction		4		Junction	

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)
4.000	4.970	150.0	600	SW_Dummy	5.900	4.900	0.400	5.900	4.867	0.433

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	13		Junction		3		Junction	

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.950	Drain Down Time (mins)	1440	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0	Check Discharge Volume	x
Summer CV	0.950	Skip Steady State	x	Starting Level (m)			

Storm Durations

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

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	114.502	32.400	2 year 120 minute winter	24.016	9.553
2 year 15 minute winter	80.352	32.400	2 year 180 minute summer	29.154	7.502
2 year 30 minute summer	74.921	21.200	2 year 180 minute winter	18.951	7.502
2 year 30 minute winter	52.576	21.200	2 year 240 minute summer	23.500	6.210
2 year 60 minute summer	50.706	13.400	2 year 240 minute winter	15.613	6.210
2 year 60 minute winter	33.688	13.400	2 year 360 minute summer	18.045	4.644
2 year 120 minute summer	36.148	9.553	2 year 360 minute winter	11.730	4.644

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 480 minute summer	14.137	3.736	30 year 1440 minute summer	10.906	2.923
2 year 480 minute winter	9.392	3.736	30 year 1440 minute winter	7.330	2.923
2 year 600 minute summer	11.501	3.146	30 year +45% CC 15 minute summer	423.650	119.878
2 year 600 minute winter	7.858	3.146	30 year +45% CC 15 minute winter	297.298	119.878
2 year 720 minute summer	10.186	2.730	30 year +45% CC 30 minute summer	281.313	79.602
2 year 720 minute winter	6.845	2.730	30 year +45% CC 30 minute winter	197.413	79.602
2 year 960 minute summer	8.287	2.182	30 year +45% CC 60 minute summer	190.944	50.461
2 year 960 minute winter	5.489	2.182	30 year +45% CC 60 minute winter	126.858	50.461
2 year 1440 minute summer	5.955	1.596	30 year +45% CC 120 minute summer	118.764	31.386
2 year 1440 minute winter	4.002	1.596	30 year +45% CC 120 minute winter	78.904	31.386
30 year 15 minute summer	292.172	82.675	30 year +45% CC 180 minute summer	90.548	23.301
30 year 15 minute winter	205.033	82.675	30 year +45% CC 180 minute winter	58.859	23.301
30 year 30 minute summer	194.009	54.898	30 year +45% CC 240 minute summer	70.682	18.679
30 year 30 minute winter	136.147	54.898	30 year +45% CC 240 minute winter	46.960	18.679
30 year 60 minute summer	131.685	34.801	30 year +45% CC 360 minute summer	52.370	13.477
30 year 60 minute winter	87.489	34.801	30 year +45% CC 360 minute winter	34.042	13.477
30 year 120 minute summer	81.906	21.645	30 year +45% CC 480 minute summer	40.176	10.617
30 year 120 minute winter	54.417	21.645	30 year +45% CC 480 minute winter	26.692	10.617
30 year 180 minute summer	62.447	16.070	30 year +45% CC 600 minute summer	32.204	8.808
30 year 180 minute winter	40.592	16.070	30 year +45% CC 600 minute winter	22.004	8.808
30 year 240 minute summer	48.746	12.882	30 year +45% CC 720 minute summer	28.196	7.557
30 year 240 minute winter	32.386	12.882	30 year +45% CC 720 minute winter	18.949	7.557
30 year 360 minute summer	36.117	9.294	30 year +45% CC 960 minute summer	22.545	5.937
30 year 360 minute winter	23.477	9.294	30 year +45% CC 960 minute winter	14.935	5.937
30 year 480 minute summer	27.708	7.322	30 year +45% CC 1440 minute summer	15.814	4.238
30 year 480 minute winter	18.408	7.322	30 year +45% CC 1440 minute winter	10.628	4.238
30 year 600 minute summer	22.209	6.075	100 year 15 minute summer	361.319	102.241
30 year 600 minute winter	15.175	6.075	100 year 15 minute winter	253.557	102.241
30 year 720 minute summer	19.445	5.212	100 year 30 minute summer	242.151	68.520
30 year 720 minute winter	13.068	5.212	100 year 30 minute winter	169.931	68.520
30 year 960 minute summer	15.549	4.094	100 year 60 minute summer	165.907	43.844
30 year 960 minute winter	10.300	4.094	100 year 60 minute winter	110.225	43.844

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 120 minute summer	100.854	26.653	100 year +45% CC 30 minute winter	246.399	99.355
100 year 120 minute winter	67.005	26.653	100 year +45% CC 60 minute summer	240.565	63.574
100 year 180 minute summer	76.110	19.586	100 year +45% CC 60 minute winter	159.826	63.574
100 year 180 minute winter	49.474	19.586	100 year +45% CC 120 minute summer	146.239	38.647
100 year 240 minute summer	59.128	15.626	100 year +45% CC 120 minute winter	97.158	38.647
100 year 240 minute winter	39.283	15.626	100 year +45% CC 180 minute summer	110.360	28.399
100 year 360 minute summer	43.708	11.248	100 year +45% CC 180 minute winter	71.737	28.399
100 year 360 minute winter	28.411	11.248	100 year +45% CC 240 minute summer	85.736	22.657
100 year 480 minute summer	33.515	8.857	100 year +45% CC 240 minute winter	56.961	22.657
100 year 480 minute winter	22.267	8.857	100 year +45% CC 360 minute summer	63.377	16.309
100 year 600 minute summer	26.867	7.349	100 year +45% CC 360 minute winter	41.196	16.309
100 year 600 minute winter	18.357	7.349	100 year +45% CC 480 minute summer	48.597	12.843
100 year 720 minute summer	23.530	6.306	100 year +45% CC 480 minute winter	32.287	12.843
100 year 720 minute winter	15.814	6.306	100 year +45% CC 600 minute summer	38.957	10.656
100 year 960 minute summer	18.831	4.959	100 year +45% CC 600 minute winter	26.618	10.656
100 year 960 minute winter	12.474	4.959	100 year +45% CC 720 minute summer	34.118	9.144
100 year 1440 minute summer	13.233	3.547	100 year +45% CC 720 minute winter	22.930	9.144
100 year 1440 minute winter	8.893	3.547	100 year +45% CC 960 minute summer	27.305	7.190
100 year +45% CC 15 minute summer	523.913	148.249	100 year +45% CC 960 minute winter	18.087	7.190
100 year +45% CC 15 minute winter	367.658	148.249	100 year +45% CC 1440 minute summer	19.188	5.143
100 year +45% CC 30 minute summer	351.119	99.355	100 year +45% CC 1440 minute winter	12.895	5.143

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	4.941	0.041	5.2	0.0000	0.0000	OK
15 minute summer	11	10	4.068	0.197	74.0	0.0000	0.0000	OK
15 minute summer	10	10	4.844	0.094	34.2	0.0000	0.0000	OK
15 minute summer	9	10	4.879	0.049	7.9	0.0000	0.0000	OK
15 minute summer	7	10	4.485	0.072	20.6	0.0000	0.0000	OK
15 minute summer	5	10	4.758	0.068	12.4	0.0000	0.0000	OK
15 minute summer	4	10	4.914	0.104	20.5	0.0000	0.0000	OK
15 minute summer	3	10	4.927	0.060	10.1	0.0000	0.0000	OK
15 minute summer	14	11	4.183	0.140	25.8	0.0396	0.0000	OK
15 minute summer	15	11	4.365	0.125	23.9	0.0000	0.0000	OK
15 minute summer	16	11	4.466	0.066	20.4	0.0000	0.0000	OK
15 minute summer	17	10	4.559	0.083	20.9	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	4.000	3	5.2	0.465	0.009	0.0565	
15 minute summer	11	1.010	26	74.5	1.190	0.528	2.4385	
15 minute summer	10	4.003	11	33.0	1.192	0.054	1.1093	
15 minute summer	9	1.000	20	7.9	0.737	0.014	0.0296	
15 minute summer	7	1.006	16	20.4	1.153	0.032	0.0262	
15 minute summer	5	1.002	19	12.3	0.619	0.028	0.3979	
15 minute summer	4	4.002	10	20.5	0.679	0.069	0.9463	
15 minute summer	3	4.001	4	10.1	0.438	0.022	0.2920	
15 minute summer	14	1.009	11	25.8	1.039	0.648	0.0923	
15 minute summer	15	1.008	14	24.1	1.089	0.570	0.3364	
15 minute summer	16	1.007	15	20.6	0.726	0.026	0.3591	
15 minute summer	17	1.005	7	20.6	0.975	0.042	0.2675	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	18	10	4.593	0.083	21.0	0.0000	0.0000	OK
15 minute summer	19	10	4.690	0.080	21.1	0.0000	0.0000	OK
15 minute summer	20	10	4.861	0.049	7.9	0.0000	0.0000	OK
15 minute summer	21	11	4.346	0.041	1.8	0.0065	0.0000	OK
15 minute summer	22	1	4.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	23	10	4.474	0.043	1.8	0.0068	0.0000	OK
15 minute summer	24	10	4.543	0.043	1.8	0.0069	0.0000	OK
15 minute summer	25	11	3.860	0.200	75.1	0.0000	0.0000	OK
15 minute summer	26	11	3.896	0.220	74.5	0.3145	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	18	1.004	17	20.9	0.890	0.043	0.1576	
15 minute summer	19	1.003	18	21.0	0.921	0.039	0.3744	
15 minute summer	20	1.001	5	7.9	0.565	0.014	0.2548	
15 minute summer	21	2.002	14	1.7	0.562	0.338	0.0606	
15 minute summer	22	3.000	21	0.0	0.000	0.000	0.0000	
15 minute summer	23	2.001	21	1.8	0.608	0.359	0.0572	
15 minute summer	24	2.000	23	1.8	0.566	0.366	0.0333	
15 minute summer	26	1.011	25	75.1	1.183	0.663	0.3135	30.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	4.969	0.069	13.3	0.0000	0.0000	OK
15 minute summer	11	10	4.386	0.515	177.3	0.0000	0.0000	SURCHARGED
15 minute summer	10	10	4.901	0.151	87.8	0.0000	0.0000	OK
15 minute summer	9	10	4.907	0.077	20.2	0.0000	0.0000	OK
15 minute summer	7	12	4.594	0.181	53.0	0.0000	0.0000	OK
15 minute summer	5	10	4.799	0.109	31.7	0.0000	0.0000	OK
15 minute summer	4	10	4.973	0.163	52.4	0.0000	0.0000	OK
15 minute summer	3	10	4.970	0.103	25.8	0.0000	0.0000	OK
15 minute summer	14	11	4.456	0.413	64.7	0.1169	0.0000	SURCHARGED
15 minute summer	15	11	4.678	0.438	128.5	0.0000	0.0000	SURCHARGED
15 minute summer	16	11	4.599	0.199	116.0	0.0000	0.0000	OK
15 minute summer	17	11	4.617	0.141	54.3	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)
15 minute summer	13	4.000	3	13.3	0.553	0.024	0.1243	
15 minute summer	11	1.010	26	176.8	1.603	1.253	4.2940	
15 minute summer	10	4.003	11	87.1	1.576	0.143	2.1995	
15 minute summer	9	1.000	20	20.2	0.978	0.036	0.0569	
15 minute summer	7	1.006	16	116.0	1.770	0.179	0.1006	
15 minute summer	5	1.002	19	31.8	0.813	0.073	0.7843	
15 minute summer	4	4.002	10	52.9	0.901	0.176	1.8350	
15 minute summer	3	4.001	4	25.8	0.555	0.055	0.5833	
15 minute summer	14	1.009	11	62.3	1.568	1.562	0.1477	
15 minute summer	15	1.008	14	59.9	1.508	1.415	0.6035	
15 minute summer	16	1.007	15	123.8	0.988	0.157	1.8346	
15 minute summer	17	1.005	7	53.0	1.252	0.109	0.7654	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	18	10	4.642	0.132	54.4	0.0000	0.0000	OK
15 minute summer	19	10	4.737	0.127	54.4	0.0000	0.0000	OK
15 minute summer	20	10	4.888	0.076	20.2	0.0000	0.0000	OK
15 minute summer	21	11	4.492	0.187	4.0	0.0297	0.0000	SURCHARGED
15 minute summer	22	1	4.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	23	11	4.552	0.121	4.5	0.0192	0.0000	SURCHARGED
15 minute summer	24	10	4.581	0.081	4.5	0.0128	0.0000	OK
15 minute summer	25	10	3.968	0.308	176.3	0.0000	0.0000	OK
15 minute summer	26	10	4.053	0.377	176.8	0.5395	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	18	1.004	17	54.3	1.177	0.112	0.3211	
15 minute summer	19	1.003	18	54.4	1.216	0.101	0.7347	
15 minute summer	20	1.001	5	20.2	0.736	0.036	0.4988	
15 minute summer	21	2.002	14	4.8	0.740	0.969	0.1603	
15 minute summer	22	3.000	21	0.0	0.000	0.000	0.0266	
15 minute summer	23	2.001	21	3.9	0.721	0.801	0.1475	
15 minute summer	24	2.000	23	4.5	0.690	0.913	0.0746	
15 minute summer	26	1.011	25	176.3	1.671	1.557	0.5114	77.8

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	4.998	0.098	19.3	0.0000	0.0000	OK
15 minute summer	11	11	4.663	0.792	220.0	0.0000	0.0000	SURCHARGED
15 minute summer	10	10	4.933	0.183	127.1	0.0000	0.0000	OK
15 minute summer	9	10	4.922	0.092	29.2	0.0000	0.0000	OK
15 minute summer	7	11	4.832	0.419	78.2	0.0000	0.0000	OK
15 minute summer	5	12	4.860	0.170	45.8	0.0000	0.0000	OK
15 minute summer	4	10	5.006	0.196	76.2	0.0000	0.0000	OK
15 minute summer	3	10	5.003	0.136	37.4	0.0000	0.0000	OK
15 minute summer	14	11	4.681	0.638	84.4	0.1807	0.0000	SURCHARGED
15 minute summer	15	12	4.948	0.708	146.9	0.0000	0.0000	FLOOD RISK
15 minute summer	16	11	4.851	0.451	169.5	0.0000	0.0000	OK
15 minute summer	17	13	4.854	0.378	89.3	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)
15 minute summer	13	4.000	3	19.3	0.551	0.034	0.1921	
15 minute summer	11	1.010	26	221.6	2.010	1.571	4.2951	
15 minute summer	10	4.003	11	128.1	1.664	0.211	3.2402	
15 minute summer	9	1.000	20	29.2	1.091	0.052	0.0736	
15 minute summer	7	1.006	16	169.5	1.466	0.262	0.3218	
15 minute summer	5	1.002	19	45.9	0.874	0.106	1.6062	
15 minute summer	4	4.002	10	76.4	1.001	0.255	2.3873	
15 minute summer	3	4.001	4	37.5	0.594	0.081	0.7917	
15 minute summer	14	1.009	11	83.0	2.088	2.081	0.1477	
15 minute summer	15	1.008	14	78.2	1.965	1.846	0.6035	
15 minute summer	16	1.007	15	144.5	0.905	0.183	3.0854	
15 minute summer	17	1.005	7	73.6	1.245	0.151	2.4736	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	18	11	4.838	0.328	78.7	0.0000	0.0000	OK
15 minute summer	19	12	4.833	0.223	78.6	0.0000	0.0000	OK
15 minute summer	20	10	4.903	0.091	29.2	0.0000	0.0000	OK
15 minute summer	21	12	4.743	0.438	5.4	0.0696	0.0000	SURCHARGED
15 minute summer	22	12	4.746	0.246	3.5	0.0392	0.0000	SURCHARGED
15 minute summer	23	12	4.828	0.397	5.2	0.0631	0.0000	SURCHARGED
15 minute summer	24	12	4.872	0.372	6.6	0.0592	0.0000	SURCHARGED
15 minute summer	25	11	3.996	0.336	221.7	0.0000	0.0000	OK
15 minute summer	26	11	4.125	0.449	221.6	0.6425	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	18	1.004	17	89.3	1.217	0.184	1.1361	
15 minute summer	19	1.003	18	78.7	1.310	0.147	2.0169	
15 minute summer	20	1.001	5	29.2	0.812	0.052	0.7490	
15 minute summer	21	2.002	14	6.4	0.812	1.294	0.1603	
15 minute summer	22	3.000	21	-3.5	-0.442	-0.705	0.0816	
15 minute summer	23	2.001	21	4.1	0.729	0.832	0.1475	
15 minute summer	24	2.000	23	5.2	0.716	1.056	0.0812	
15 minute summer	26	1.011	25	221.7	2.012	1.958	0.5299	113.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	4.984	0.084	16.5	0.0000	0.0000	OK
15 minute summer	11	10	4.526	0.655	198.8	0.0000	0.0000	SURCHARGED
15 minute summer	10	10	4.918	0.168	108.5	0.0000	0.0000	OK
15 minute summer	9	10	4.915	0.085	24.9	0.0000	0.0000	OK
15 minute summer	7	12	4.774	0.361	69.6	0.0000	0.0000	OK
15 minute summer	5	10	4.811	0.121	39.1	0.0000	0.0000	OK
15 minute summer	4	10	4.991	0.181	64.9	0.0000	0.0000	OK
15 minute summer	3	10	4.988	0.121	31.9	0.0000	0.0000	OK
15 minute summer	14	11	4.575	0.532	81.1	0.1506	0.0000	SURCHARGED
30 minute summer	15	20	4.839	0.599	168.6	0.0000	0.0000	SURCHARGED
15 minute summer	16	12	4.806	0.406	178.5	0.0000	0.0000	OK
15 minute summer	17	11	4.772	0.296	64.8	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)
15 minute summer	13	4.000	3	16.5	0.553	0.029	0.1592	
15 minute summer	11	1.010	26	200.0	1.813	1.418	4.2951	
15 minute summer	10	4.003	11	108.0	1.677	0.178	2.5614	
15 minute summer	9	1.000	20	24.9	1.042	0.044	0.0659	
15 minute summer	7	1.006	16	178.5	1.674	0.276	0.2797	
15 minute summer	5	1.002	19	39.2	0.855	0.090	0.9212	
15 minute summer	4	4.002	10	65.3	0.959	0.218	2.1292	
15 minute summer	3	4.001	4	31.9	0.576	0.069	0.6941	
15 minute summer	14	1.009	11	72.8	1.831	1.825	0.1477	
30 minute summer	15	1.008	14	69.5	1.749	1.642	0.6035	
15 minute summer	16	1.007	15	127.5	0.870	0.161	2.5519	
15 minute summer	17	1.005	7	69.6	1.336	0.143	1.8063	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	18	12	4.763	0.253	66.8	0.0000	0.0000	OK
15 minute summer	19	10	4.753	0.143	67.1	0.0000	0.0000	OK
15 minute summer	20	10	4.896	0.084	24.9	0.0000	0.0000	OK
15 minute summer	21	12	4.620	0.315	6.3	0.0500	0.0000	SURCHARGED
15 minute summer	22	12	4.623	0.123	2.0	0.0196	0.0000	SURCHARGED
15 minute summer	23	12	4.694	0.263	5.1	0.0417	0.0000	SURCHARGED
15 minute summer	24	12	4.729	0.229	5.6	0.0365	0.0000	SURCHARGED
15 minute summer	25	10	3.985	0.325	200.9	0.0000	0.0000	OK
15 minute summer	26	10	4.095	0.419	200.0	0.5994	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	18	1.004	17	64.8	1.223	0.133	0.7625	
15 minute summer	19	1.003	18	66.8	1.258	0.125	1.2545	
15 minute summer	20	1.001	5	24.9	0.778	0.044	0.5809	
15 minute summer	21	2.002	14	5.9	0.755	1.203	0.1603	
15 minute summer	22	3.000	21	-2.0	-0.356	-0.397	0.0816	
15 minute summer	23	2.001	21	4.7	0.710	0.966	0.1475	
15 minute summer	24	2.000	23	5.1	0.703	1.035	0.0812	
15 minute summer	26	1.011	25	200.9	1.829	1.773	0.5231	96.6

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	13	10	5.021	0.121	23.9	0.0000	0.0000	OK
15 minute summer	11	11	4.844	0.973	272.1	0.0000	0.0000	SURCHARGED
15 minute summer	10	10	4.955	0.205	157.3	0.0000	0.0000	OK
15 minute winter	9	13	4.965	0.135	32.3	0.0000	0.0000	OK
15 minute summer	7	12	4.992	0.579	67.9	0.0000	0.0000	OK
15 minute summer	5	13	5.010	0.320	56.6	0.0000	0.0000	OK
15 minute summer	4	10	5.030	0.220	94.4	0.0000	0.0000	OK
15 minute summer	3	10	5.026	0.159	46.5	0.0000	0.0000	OK
15 minute summer	14	11	4.875	0.832	88.5	0.2355	0.0000	SURCHARGED
30 minute summer	15	20	5.039	0.799	93.4	0.0000	0.0000	FLOOD RISK
15 minute winter	16	11	4.983	0.583	88.1	0.0000	0.0000	OK
15 minute summer	17	12	4.980	0.504	83.7	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	13	4.000	3	24.1	0.555	0.043	0.2490	
15 minute summer	11	1.010	26	249.1	2.258	1.766	4.2951	
15 minute summer	10	4.003	11	159.3	1.552	0.262	5.5807	
15 minute winter	9	1.000	20	32.3	1.122	0.058	0.1374	
15 minute summer	7	1.006	16	112.1	1.573	0.173	0.4069	
15 minute summer	5	1.002	19	58.4	0.906	0.135	3.4916	
15 minute summer	4	4.002	10	94.6	1.060	0.316	2.7891	
15 minute summer	3	4.001	4	46.6	0.622	0.100	0.9491	
15 minute summer	14	1.009	11	91.5	2.301	2.294	0.1477	
30 minute summer	15	1.008	14	79.3	1.994	1.872	0.6035	
15 minute winter	16	1.007	15	108.7	0.973	0.137	3.4044	
15 minute summer	17	1.005	7	67.9	1.337	0.140	3.3513	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.88%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	18	12	4.994	0.484	89.6	0.0000	0.0000	OK
15 minute summer	19	12	5.025	0.415	98.8	0.0000	0.0000	OK
15 minute summer	20	12	4.973	0.161	36.1	0.0000	0.0000	OK
15 minute summer	21	12	4.923	0.618	6.1	0.0983	0.0000	SURCHARGED
15 minute summer	22	12	4.922	0.422	3.1	0.0671	0.0000	SURCHARGED
15 minute summer	23	12	5.015	0.584	5.4	0.0928	0.0000	SURCHARGED
15 minute summer	24	12	5.073	0.573	8.1	0.0912	0.0000	SURCHARGED
15 minute summer	25	11	4.008	0.348	249.2	0.0000	0.0000	OK
15 minute summer	26	11	4.163	0.487	249.1	0.6965	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	18	1.004	17	83.7	1.230	0.172	1.6688	
15 minute summer	19	1.003	18	89.6	1.277	0.167	3.7070	
15 minute summer	20	1.001	5	36.0	0.862	0.064	1.9123	
15 minute summer	21	2.002	14	7.3	0.934	1.488	0.1603	
15 minute summer	22	3.000	21	-3.1	-0.512	-0.629	0.0816	
15 minute summer	23	2.001	21	4.5	0.704	0.925	0.1475	
15 minute summer	24	2.000	23	5.4	0.713	1.103	0.0812	
15 minute summer	26	1.011	25	249.2	2.259	2.200	0.5361	139.5

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	50	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	0.950	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)	Depth (m)
✓	5	0.094	4.00	5.300		1.300
✓	4	0.028	4.00	5.300		1.443
✓	3			4.500		0.800
✓	2			4.500	1200	0.832
✓	1			4.400		0.785
✓	6			4.500	450	0.320
✓	7	0.015	4.00	4.500		0.300
✓	8			5.000	450	0.718
✓	9		4.00	5.000		0.700

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)
?	1.002	2	1	8.913	0.600	3.668	3.615	0.053	168.2	225	4.90	50.0
?	1.001	8	2	33.190	0.600	4.282	3.947	0.335	99.0	100	4.75	50.0
?	3.001	6	2	20.639	0.600	4.180	4.042	0.138	150.0	150	4.43	50.0
?	2.002	3	2	1.587	0.600	3.700	3.668	0.032	50.0	225	4.51	50.0
?	2.001	4	3	27.709	0.600	3.857	3.700	0.157	176.5	225	4.49	50.0
?	2.000	5	4	2.936	0.600	4.000	3.857	0.143	20.5	150	4.02	50.0
?	3.000	7	6	1.143	0.600	4.200	4.180	0.020	57.1	150	4.01	50.0
?	1.000	9	8	1.780	0.600	4.300	4.282	0.018	99.0	100	4.04	50.0

	Name	US Node	DS Node	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)
	1.002	2	1	1.005	40.0	35.3	0.607	0.560	0.137	0.0	165	1.131
	1.001	8	2	0.773	6.1	0.0	0.618	0.453	0.000	0.0	0	0.000
	3.001	6	2	0.818	14.5	3.9	0.170	0.308	0.015	0.0	53	0.694
	2.002	3	2	1.854	73.7	31.4	0.575	0.607	0.122	0.0	102	1.781
	2.001	4	3	0.981	39.0	31.4	1.218	0.575	0.122	0.0	153	1.088
	2.000	5	4	2.232	39.4	24.2	1.150	1.293	0.094	0.0	85	2.346
	3.000	7	6	1.333	23.6	3.9	0.150	0.170	0.015	0.0	41	0.990
	1.000	9	8	0.773	6.1	0.0	0.600	0.618	0.000	0.0	0	0.000

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)
1.002	8.913	168.2	225	SW_Standard	4.500	3.668	0.607	4.400	3.615	0.560
1.001	33.190	99.0	100	SW_Standard	5.000	4.282	0.618	4.500	3.947	0.453
3.001	20.639	150.0	150	SW_Standard	4.500	4.180	0.170	4.500	4.042	0.308
2.002	1.587	50.0	225	SW_Standard	4.500	3.700	0.575	4.500	3.668	0.607
2.001	27.709	176.5	225	SW_Standard	5.300	3.857	1.218	4.500	3.700	0.575
2.000	2.936	20.5	150	SW_Standard	5.300	4.000	1.150	5.300	3.857	1.293
3.000	1.143	57.1	150	SW_Standard	4.500	4.200	0.150	4.500	4.180	0.170
1.000	1.780	99.0	100	SW_Standard	5.000	4.300	0.600	5.000	4.282	0.618

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.002	2	1200	Manhole	SW_HB	1		Junction	
1.001	8	450	Manhole	SW_Standard	2	1200	Manhole	SW_HB
3.001	6	450	Manhole	SW_Standard	2	1200	Manhole	SW_HB
2.002	3		Junction		2	1200	Manhole	SW_HB
2.001	4		Junction		3		Junction	
2.000	5		Junction		4		Junction	
3.000	7		Junction		6	450	Manhole	SW_Standard
1.000	9		Junction		8	450	Manhole	SW_Standard

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.950	Drain Down Time (mins)	1440	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0	Check Discharge Volume	x
Summer CV	0.950	Skip Steady State	x	Starting Level (m)			

Storm Durations

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

Node 2 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.002	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0051-1300-1200-1300
Invert Level (m)	3.668	Min Outlet Diameter (m)	0.075
Design Depth (m)	1.200	Min Node Diameter (mm)	1200
Design Flow (l/s)	1.3		

Node 5 Online Depth/Flow Control

Flap Valve	x	Downstream Link	2.000	Replaces Downstream Link	✓	Invert Level (m)	4.000
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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.001	0.700	4.000	0.700

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	3.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	915

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	100.0	0.0	0.400	100.0	0.0	0.401	0.0	0.0

Node 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	4.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	0

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	2000.0	0.0	1.000	2000.0	0.0	1.001	0.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	114.502	32.400	30 year 60 minute summer	131.685	34.801
2 year 15 minute winter	80.352	32.400	30 year 60 minute winter	87.489	34.801
2 year 30 minute summer	74.921	21.200	30 year 120 minute summer	81.906	21.645
2 year 30 minute winter	52.576	21.200	30 year 120 minute winter	54.417	21.645
2 year 60 minute summer	50.706	13.400	30 year 180 minute summer	62.447	16.070
2 year 60 minute winter	33.688	13.400	30 year 180 minute winter	40.592	16.070
2 year 120 minute summer	36.148	9.553	30 year 240 minute summer	48.746	12.882
2 year 120 minute winter	24.016	9.553	30 year 240 minute winter	32.386	12.882
2 year 180 minute summer	29.154	7.502	30 year 360 minute summer	36.117	9.294
2 year 180 minute winter	18.951	7.502	30 year 360 minute winter	23.477	9.294
2 year 240 minute summer	23.500	6.210	30 year 480 minute summer	27.708	7.322
2 year 240 minute winter	15.613	6.210	30 year 480 minute winter	18.408	7.322
2 year 360 minute summer	18.045	4.644	30 year 600 minute summer	22.209	6.075
2 year 360 minute winter	11.730	4.644	30 year 600 minute winter	15.175	6.075
2 year 480 minute summer	14.137	3.736	30 year 720 minute summer	19.445	5.212
2 year 480 minute winter	9.392	3.736	30 year 720 minute winter	13.068	5.212
2 year 600 minute summer	11.501	3.146	30 year 960 minute summer	15.549	4.094
2 year 600 minute winter	7.858	3.146	30 year 960 minute winter	10.300	4.094
2 year 720 minute summer	10.186	2.730	30 year 1440 minute summer	10.906	2.923
2 year 720 minute winter	6.845	2.730	30 year 1440 minute winter	7.330	2.923
2 year 960 minute summer	8.287	2.182	30 year +45% CC 15 minute summer	423.650	119.878
2 year 960 minute winter	5.489	2.182	30 year +45% CC 15 minute winter	297.298	119.878
2 year 1440 minute summer	5.955	1.596	30 year +45% CC 30 minute summer	281.313	79.602
2 year 1440 minute winter	4.002	1.596	30 year +45% CC 30 minute winter	197.413	79.602
30 year 15 minute summer	292.172	82.675	30 year +45% CC 60 minute summer	190.944	50.461
30 year 15 minute winter	205.033	82.675	30 year +45% CC 60 minute winter	126.858	50.461
30 year 30 minute summer	194.009	54.898	30 year +45% CC 120 minute summer	118.764	31.386
30 year 30 minute winter	136.147	54.898	30 year +45% CC 120 minute winter	78.904	31.386

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +45% CC 180 minute summer	90.548	23.301	100 year 600 minute summer	26.867	7.349
30 year +45% CC 180 minute winter	58.859	23.301	100 year 600 minute winter	18.357	7.349
30 year +45% CC 240 minute summer	70.682	18.679	100 year 720 minute summer	23.530	6.306
30 year +45% CC 240 minute winter	46.960	18.679	100 year 720 minute winter	15.814	6.306
30 year +45% CC 360 minute summer	52.370	13.477	100 year 960 minute summer	18.831	4.959
30 year +45% CC 360 minute winter	34.042	13.477	100 year 960 minute winter	12.474	4.959
30 year +45% CC 480 minute summer	40.176	10.617	100 year 1440 minute summer	13.233	3.547
30 year +45% CC 480 minute winter	26.692	10.617	100 year 1440 minute winter	8.893	3.547
30 year +45% CC 600 minute summer	32.204	8.808	100 year +45% CC 15 minute summer	523.913	148.249
30 year +45% CC 600 minute winter	22.004	8.808	100 year +45% CC 15 minute winter	367.658	148.249
30 year +45% CC 720 minute summer	28.196	7.557	100 year +45% CC 30 minute summer	351.119	99.355
30 year +45% CC 720 minute winter	18.949	7.557	100 year +45% CC 30 minute winter	246.399	99.355
30 year +45% CC 960 minute summer	22.545	5.937	100 year +45% CC 60 minute summer	240.565	63.574
30 year +45% CC 960 minute winter	14.935	5.937	100 year +45% CC 60 minute winter	159.826	63.574
30 year +45% CC 1440 minute summer	15.814	4.238	100 year +45% CC 120 minute summer	146.239	38.647
30 year +45% CC 1440 minute winter	10.628	4.238	100 year +45% CC 120 minute winter	97.158	38.647
100 year 15 minute summer	361.319	102.241	100 year +45% CC 180 minute summer	110.360	28.399
100 year 15 minute winter	253.557	102.241	100 year +45% CC 180 minute winter	71.737	28.399
100 year 30 minute summer	242.151	68.520	100 year +45% CC 240 minute summer	85.736	22.657
100 year 30 minute winter	169.931	68.520	100 year +45% CC 240 minute winter	56.961	22.657
100 year 60 minute summer	165.907	43.844	100 year +45% CC 360 minute summer	63.377	16.309
100 year 60 minute winter	110.225	43.844	100 year +45% CC 360 minute winter	41.196	16.309
100 year 120 minute summer	100.854	26.653	100 year +45% CC 480 minute summer	48.597	12.843
100 year 120 minute winter	67.005	26.653	100 year +45% CC 480 minute winter	32.287	12.843
100 year 180 minute summer	76.110	19.586	100 year +45% CC 600 minute summer	38.957	10.656
100 year 180 minute winter	49.474	19.586	100 year +45% CC 600 minute winter	26.618	10.656
100 year 240 minute summer	59.128	15.626	100 year +45% CC 720 minute summer	34.118	9.144
100 year 240 minute winter	39.283	15.626	100 year +45% CC 720 minute winter	22.930	9.144
100 year 360 minute summer	43.708	11.248	100 year +45% CC 960 minute summer	27.305	7.190
100 year 360 minute winter	28.411	11.248	100 year +45% CC 960 minute winter	18.087	7.190
100 year 480 minute summer	33.515	8.857	100 year +45% CC 1440 minute summer	19.188	5.143
100 year 480 minute winter	22.267	8.857	100 year +45% CC 1440 minute winter	12.895	5.143

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute summer	5	192	4.007	0.007	5.8	14.2763	0.0000	OK
15 minute summer	4	10	3.924	0.067	6.2	0.0000	0.0000	OK
360 minute winter	3	328	3.788	0.088	2.5	8.3868	0.0000	OK
480 minute summer	2	336	3.791	0.123	3.5	0.1391	0.0000	OK
15 minute summer	1	1	3.615	0.000	0.9	0.0000	0.0000	OK
15 minute summer	6	10	4.227	0.047	3.0	0.0074	0.0000	OK
15 minute summer	7	10	4.243	0.043	3.0	0.0000	0.0000	OK
15 minute summer	8	1	4.282	0.000	0.0	0.0000	0.0000	OK
15 minute summer	9	1	4.300	0.000	0.0	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)
240 minute summer	5	Depth/Flow	4	0.7				
15 minute summer	4	2.001	3	6.3	1.320	0.161	0.1534	
360 minute winter	3	2.002	2	3.8	0.402	0.051	0.0288	
480 minute summer	2	Hydro-Brake®	1	1.0				38.9
15 minute summer	6	3.001	2	2.9	0.637	0.203	0.0949	
15 minute summer	7	3.000	6	3.0	0.722	0.127	0.0050	
15 minute summer	8	1.001	2	0.0	0.000	0.000	0.0000	
15 minute summer	9	1.000	8	0.0	0.000	0.000	0.0000	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	5	236	4.018	0.018	8.0	36.9490	0.0000	OK
15 minute summer	4	9	3.957	0.100	14.8	0.0000	0.0000	OK
360 minute winter	3	344	3.888	0.188	2.4	17.8442	0.0000	OK
360 minute winter	2	360	3.887	0.219	3.5	0.2478	0.0000	OK
15 minute summer	1	1	3.615	0.000	1.0	0.0000	0.0000	OK
15 minute summer	6	10	4.259	0.079	7.6	0.0126	0.0000	OK
15 minute summer	7	10	4.276	0.076	7.6	0.0000	0.0000	OK
15 minute summer	8	1	4.282	0.000	0.0	0.0000	0.0000	OK
15 minute summer	9	1	4.300	0.000	0.0	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)
240 minute winter	5	Depth/Flow	4	0.7				
15 minute summer	4	2.001	3	14.9	1.524	0.383	0.3071	
360 minute winter	3	2.002	2	3.5	0.372	0.047	0.0594	
360 minute winter	2	Hydro-Brake®	1	1.0				72.6
15 minute summer	6	3.001	2	7.5	0.815	0.521	0.1907	
15 minute summer	7	3.000	6	7.6	0.864	0.322	0.0105	
15 minute summer	8	1.001	2	0.0	0.000	0.000	0.0000	
15 minute summer	9	1.000	8	0.0	0.000	0.000	0.0000	

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	5	352	4.029	0.029	8.5	58.5318	0.0000	OK
600 minute winter	4	585	3.986	0.129	2.3	0.0000	0.0000	OK
600 minute winter	3	585	3.986	0.286	2.6	27.1441	0.0000	SURCHARGED
600 minute winter	2	585	3.986	0.318	3.5	0.3593	0.0000	SURCHARGED
15 minute summer	1	1	3.615	0.000	1.0	0.0000	0.0000	OK
15 minute summer	6	10	4.282	0.102	11.0	0.0162	0.0000	OK
15 minute summer	7	10	4.298	0.098	11.0	0.0000	0.0000	OK
15 minute summer	8	1	4.282	0.000	0.0	0.0000	0.0000	OK
15 minute summer	9	1	4.300	0.000	0.0	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)
360 minute winter	5	Depth/Flow	4	0.7				
600 minute winter	4	2.001	3	2.3	0.583	0.059	0.8763	
600 minute winter	3	2.002	2	3.3	0.403	0.044	0.0631	
600 minute winter	2	Hydro-Brake®	1	1.0				114.3
15 minute summer	6	3.001	2	10.9	0.881	0.753	0.2550	
15 minute summer	7	3.000	6	11.0	0.924	0.466	0.0143	
15 minute summer	8	1.001	2	0.0	0.000	0.000	0.0000	
15 minute summer	9	1.000	8	0.0	0.000	0.000	0.0000	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	5	352	4.023	0.023	7.1	46.7506	0.0000	OK
15 minute summer	4	9	3.968	0.111	18.1	0.0000	0.0000	OK
360 minute winter	3	352	3.933	0.233	2.8	22.0997	0.0000	SURCHARGED
360 minute winter	2	360	3.932	0.264	3.5	0.2983	0.0000	SURCHARGED
15 minute summer	1	1	3.615	0.000	1.0	0.0000	0.0000	OK
15 minute summer	6	10	4.271	0.091	9.4	0.0145	0.0000	OK
15 minute summer	7	10	4.288	0.088	9.4	0.0000	0.0000	OK
15 minute summer	8	1	4.282	0.000	0.0	0.0000	0.0000	OK
15 minute summer	9	1	4.300	0.000	0.0	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)
360 minute winter	5	Depth/Flow	4	0.7				
15 minute summer	4	2.001	3	18.2	1.566	0.468	0.3721	
360 minute winter	3	2.002	2	3.5	0.399	0.048	0.0631	
360 minute winter	2	Hydro-Brake®	1	1.0				87.7
15 minute summer	6	3.001	2	9.3	0.855	0.644	0.2249	
15 minute summer	7	3.000	6	9.4	0.899	0.398	0.0125	
15 minute summer	8	1.001	2	0.0	0.000	0.000	0.0000	
15 minute summer	9	1.000	8	0.0	0.000	0.000	0.0000	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.96%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	5	352	4.037	0.037	10.2	73.2395	0.0000	OK
600 minute summer	4	600	4.062	0.205	3.6	0.0000	0.0000	OK
600 minute summer	3	600	4.062	0.362	4.0	34.4188	0.0000	SURCHARGED
600 minute summer	2	600	4.062	0.394	3.4	0.4459	0.0000	SURCHARGED
15 minute summer	1	1	3.615	0.000	1.0	0.0000	0.0000	OK
15 minute summer	6	10	4.301	0.121	13.6	0.0193	0.0000	OK
15 minute summer	7	10	4.318	0.118	13.6	0.0000	0.0000	OK
15 minute summer	8	1	4.282	0.000	0.0	0.0000	0.0000	OK
15 minute summer	9	1	4.300	0.000	0.0	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)
360 minute winter	5	Depth/Flow	4	0.7				
600 minute summer	4	2.001	3	3.6	0.616	0.092	1.0781	
600 minute summer	3	2.002	2	3.2	0.354	0.043	0.0631	
600 minute summer	2	Hydro-Brake®	1	1.0				117.8
15 minute summer	6	3.001	2	13.4	0.928	0.926	0.2968	
15 minute summer	7	3.000	6	13.6	0.961	0.576	0.0172	
15 minute summer	8	1.001	2	0.0	0.000	0.000	0.0000	
15 minute summer	9	1.000	8	0.0	0.000	0.000	0.0000	

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	0.950	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)	Depth (m)
✓	French Drain	0.091	4.00	5.980		0.530
✓	1			5.950		0.625
✓	2			5.690	100	1.200

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)
?	1.001	1	2	9.794	0.600	5.325	4.490	0.835	11.7	225	4.11	50.0
?	1.000	French Drain	1	5.101	0.600	5.450	5.400	0.050	102.0	225	4.07	50.0

	Name	US Node	DS Node	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)
	1.001	1	2	3.842	152.7	21.9	0.400	0.975	0.091	0.0	58	2.757
	1.000	French Drain	1	1.294	51.5	21.9	0.305	0.325	0.091	0.0	102	1.243

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)
1.001	9.794	11.7	225	SW_Standard	5.950	5.325	0.400	5.690	4.490	0.975
1.000	5.101	102.0	225	SW_Standard	5.980	5.450	0.305	5.950	5.400	0.325

Link	US Node	Node Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	1	Junction	2	100	Manhole	SW_Junction
1.000	French Drain	Junction	1		Junction	

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.950	Drain Down Time (mins)	1440	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Normal	Additional Storage (m ³ /ha)	0.0	Check Discharge Volume	x
Summer CV	0.950	Skip Steady State	x	Starting Level (m)			

Storm Durations

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

Node 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.001	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0054-1000-0500-1000
Invert Level (m)	5.325	Min Outlet Diameter (m)	0.075
Design Depth (m)	0.500	Min Node Diameter (mm)	1200
Design Flow (l/s)	1.0		

Node French Drain Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.450
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	4

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	112.5	0.0	0.450	112.5	0.0	0.451	0.0	0.0

Node 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Width (m)	30.000	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	5.400	Length (m)	30.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	512	Slope (1:X)	9999.0		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	114.502	32.400	2 year 600 minute winter	7.858	3.146
2 year 15 minute winter	80.352	32.400	2 year 720 minute summer	10.186	2.730
2 year 30 minute summer	74.921	21.200	2 year 720 minute winter	6.845	2.730
2 year 30 minute winter	52.576	21.200	2 year 960 minute summer	8.287	2.182
2 year 60 minute summer	50.706	13.400	2 year 960 minute winter	5.489	2.182
2 year 60 minute winter	33.688	13.400	2 year 1440 minute summer	5.955	1.596
2 year 120 minute summer	36.148	9.553	2 year 1440 minute winter	4.002	1.596
2 year 120 minute winter	24.016	9.553	30 year 15 minute summer	292.172	82.675
2 year 180 minute summer	29.154	7.502	30 year 15 minute winter	205.033	82.675
2 year 180 minute winter	18.951	7.502	30 year 30 minute summer	194.009	54.898
2 year 240 minute summer	23.500	6.210	30 year 30 minute winter	136.147	54.898
2 year 240 minute winter	15.613	6.210	30 year 60 minute summer	131.685	34.801
2 year 360 minute summer	18.045	4.644	30 year 60 minute winter	87.489	34.801
2 year 360 minute winter	11.730	4.644	30 year 120 minute summer	81.906	21.645
2 year 480 minute summer	14.137	3.736	30 year 120 minute winter	54.417	21.645
2 year 480 minute winter	9.392	3.736	30 year 180 minute summer	62.447	16.070
2 year 600 minute summer	11.501	3.146	30 year 180 minute winter	40.592	16.070

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 240 minute summer	48.746	12.882	30 year +45% CC 720 minute summer	28.196	7.557
30 year 240 minute winter	32.386	12.882	30 year +45% CC 720 minute winter	18.949	7.557
30 year 360 minute summer	36.117	9.294	30 year +45% CC 960 minute summer	22.545	5.937
30 year 360 minute winter	23.477	9.294	30 year +45% CC 960 minute winter	14.935	5.937
30 year 480 minute summer	27.708	7.322	30 year +45% CC 1440 minute summer	15.814	4.238
30 year 480 minute winter	18.408	7.322	30 year +45% CC 1440 minute winter	10.628	4.238
30 year 600 minute summer	22.209	6.075	100 year 15 minute summer	361.319	102.241
30 year 600 minute winter	15.175	6.075	100 year 15 minute winter	253.557	102.241
30 year 720 minute summer	19.445	5.212	100 year 30 minute summer	242.151	68.520
30 year 720 minute winter	13.068	5.212	100 year 30 minute winter	169.931	68.520
30 year 960 minute summer	15.549	4.094	100 year 60 minute summer	165.907	43.844
30 year 960 minute winter	10.300	4.094	100 year 60 minute winter	110.225	43.844
30 year 1440 minute summer	10.906	2.923	100 year 120 minute summer	100.854	26.653
30 year 1440 minute winter	7.330	2.923	100 year 120 minute winter	67.005	26.653
30 year +45% CC 15 minute summer	423.650	119.878	100 year 180 minute summer	76.110	19.586
30 year +45% CC 15 minute winter	297.298	119.878	100 year 180 minute winter	49.474	19.586
30 year +45% CC 30 minute summer	281.313	79.602	100 year 240 minute summer	59.128	15.626
30 year +45% CC 30 minute winter	197.413	79.602	100 year 240 minute winter	39.283	15.626
30 year +45% CC 60 minute summer	190.944	50.461	100 year 360 minute summer	43.708	11.248
30 year +45% CC 60 minute winter	126.858	50.461	100 year 360 minute winter	28.411	11.248
30 year +45% CC 120 minute summer	118.764	31.386	100 year 480 minute summer	33.515	8.857
30 year +45% CC 120 minute winter	78.904	31.386	100 year 480 minute winter	22.267	8.857
30 year +45% CC 180 minute summer	90.548	23.301	100 year 600 minute summer	26.867	7.349
30 year +45% CC 180 minute winter	58.859	23.301	100 year 600 minute winter	18.357	7.349
30 year +45% CC 240 minute summer	70.682	18.679	100 year 720 minute summer	23.530	6.306
30 year +45% CC 240 minute winter	46.960	18.679	100 year 720 minute winter	15.814	6.306
30 year +45% CC 360 minute summer	52.370	13.477	100 year 960 minute summer	18.831	4.959
30 year +45% CC 360 minute winter	34.042	13.477	100 year 960 minute winter	12.474	4.959
30 year +45% CC 480 minute summer	40.176	10.617	100 year 1440 minute summer	13.233	3.547
30 year +45% CC 480 minute winter	26.692	10.617	100 year 1440 minute winter	8.893	3.547
30 year +45% CC 600 minute summer	32.204	8.808	100 year +45% CC 15 minute summer	523.913	148.249
30 year +45% CC 600 minute winter	22.004	8.808	100 year +45% CC 15 minute winter	367.658	148.249

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 30 minute summer	351.119	99.355	100 year +45% CC 360 minute winter	41.196	16.309
100 year +45% CC 30 minute winter	246.399	99.355	100 year +45% CC 480 minute summer	48.597	12.843
100 year +45% CC 60 minute summer	240.565	63.574	100 year +45% CC 480 minute winter	32.287	12.843
100 year +45% CC 60 minute winter	159.826	63.574	100 year +45% CC 600 minute summer	38.957	10.656
100 year +45% CC 120 minute summer	146.239	38.647	100 year +45% CC 600 minute winter	26.618	10.656
100 year +45% CC 120 minute winter	97.158	38.647	100 year +45% CC 720 minute summer	34.118	9.144
100 year +45% CC 180 minute summer	110.360	28.399	100 year +45% CC 720 minute winter	22.930	9.144
100 year +45% CC 180 minute winter	71.737	28.399	100 year +45% CC 960 minute summer	27.305	7.190
100 year +45% CC 240 minute summer	85.736	22.657	100 year +45% CC 960 minute winter	18.087	7.190
100 year +45% CC 240 minute winter	56.961	22.657	100 year +45% CC 1440 minute summer	19.188	5.143
100 year +45% CC 360 minute summer	63.377	16.309	100 year +45% CC 1440 minute winter	12.895	5.143

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	French Drain	11	5.531	0.081	18.0	2.7270	0.0000	OK
180 minute summer	1	144	5.440	0.115	6.4	10.3988	0.0000	OK
15 minute summer	2	1	4.490	0.000	1.0	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	French Drain	1.000	1	14.4	1.122	0.279	0.0653	
180 minute summer	1	Hydro-Brake®	2	1.0				19.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	French Drain	11	5.598	0.148	45.9	4.9929	0.0000	OK
180 minute winter	1	176	5.513	0.188	9.6	30.2070	0.0000	OK
15 minute summer	2	1	4.490	0.000	1.0	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	French Drain	1.000	1	40.3	1.454	0.783	0.1413	
180 minute winter	1	Hydro-Brake®	2	1.0				41.6

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 99.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	French Drain	11	5.651	0.201	66.5	6.7737	0.0000	OK
240 minute winter	1	240	5.576	0.251	15.9	47.0060	0.0000	SURCHARGED
15 minute summer	2	1	4.490	0.000	1.0	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	French Drain	1.000	1	57.4	1.546	1.116	0.1895	
240 minute winter	1	Hydro-Brake®	2	1.0				64.4

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.37%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	French Drain	11	5.624	0.174	56.7	5.8693	0.0000	OK
240 minute winter	1	228	5.543	0.218	10.1	38.0730	0.0000	OK
15 minute summer	2	1	4.490	0.000	1.0	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	French Drain	1.000	1	49.4	1.498	0.960	0.1681	
240 minute winter	1	Hydro-Brake®	2	1.0				54.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.37%

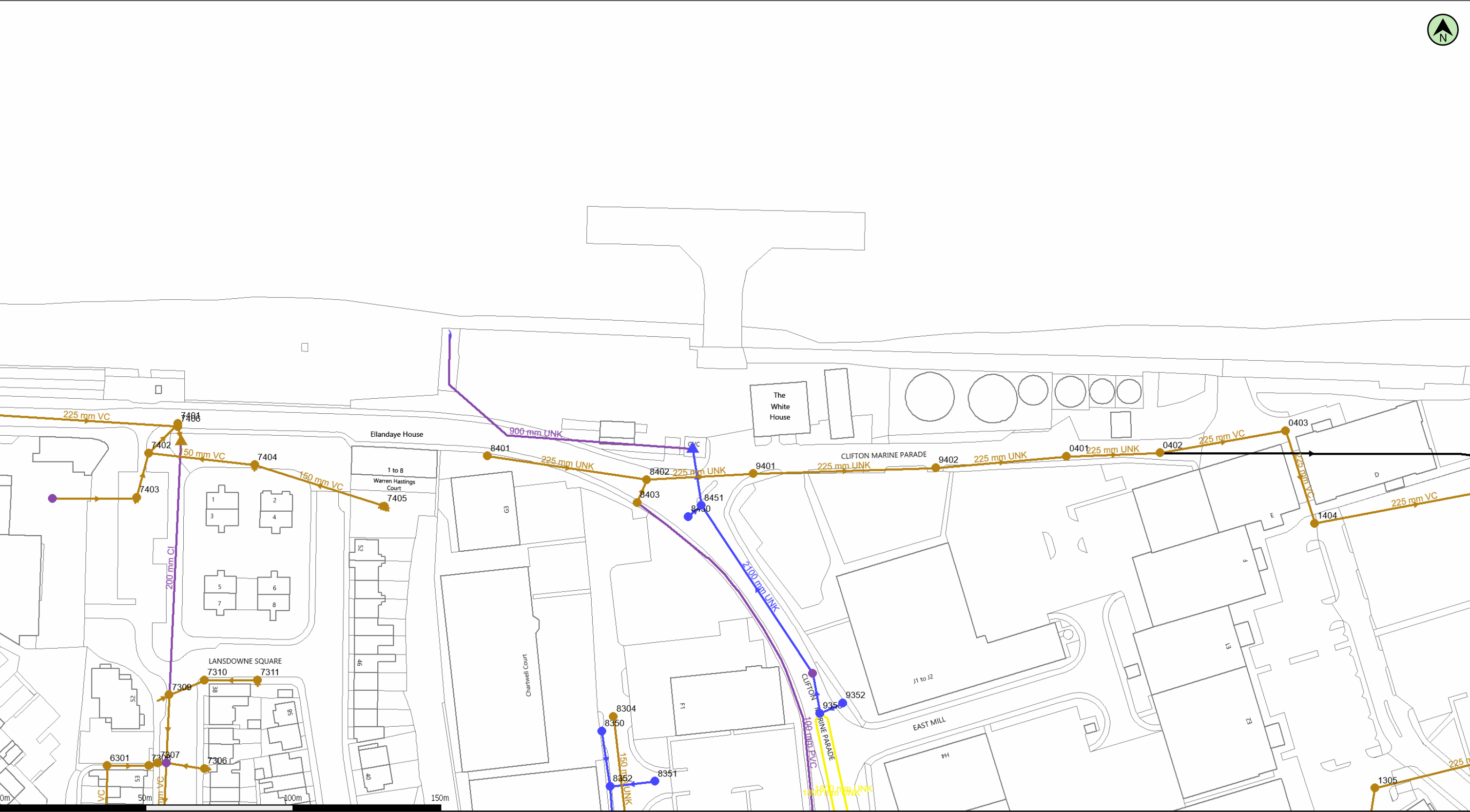
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	French Drain	11	5.700	0.250	82.2	8.4348	0.0000	FLOOD RISK
240 minute winter	1	236	5.621	0.296	16.8	59.2663	0.0000	SURCHARGED
15 minute summer	2	1	4.490	0.000	1.0	0.0000	0.0000	OK

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	French Drain	1.000	1	67.0	1.685	1.302	0.1990	
240 minute winter	1	Hydro-Brake®	2	1.0				78.3

Water Quality

Area (ha)	Intended Land Use	Entering via Node or Link	Name	SuDS Component	Pollution hazard indices			Pollution mitigation indices			Cumulative pollution hazard indices		
					TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons
		Node	French Drain	Filter Strip				0.4	0.4	0.5			
		Node	2								Sufficient	Sufficient	Sufficient

APPENDIX III Sewer records



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WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

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

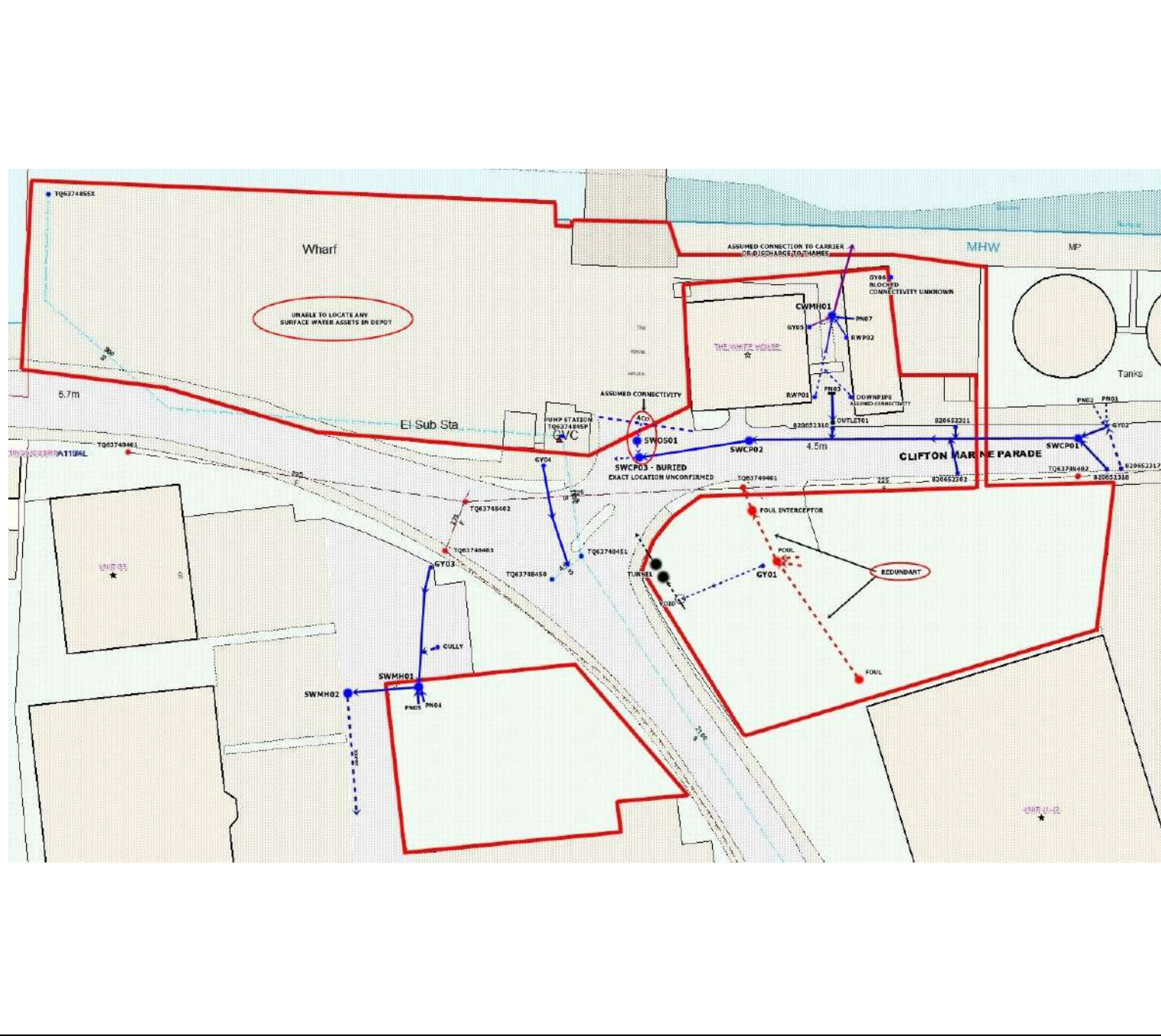
ambiental.consultancy@rhdhv.com	
6303	



APPENDIX IV CCTV Survey

Project Name	Project Number	Project Date
FMC1134 FMC IMPERIAL WHARF GRAVESEND DA11 0DY CZD LW	-	11/03/2024

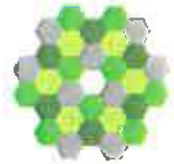
Project Drawing, Page 'FMC1134 FMC IMPERIAL WHARF GRAVESEND DA11



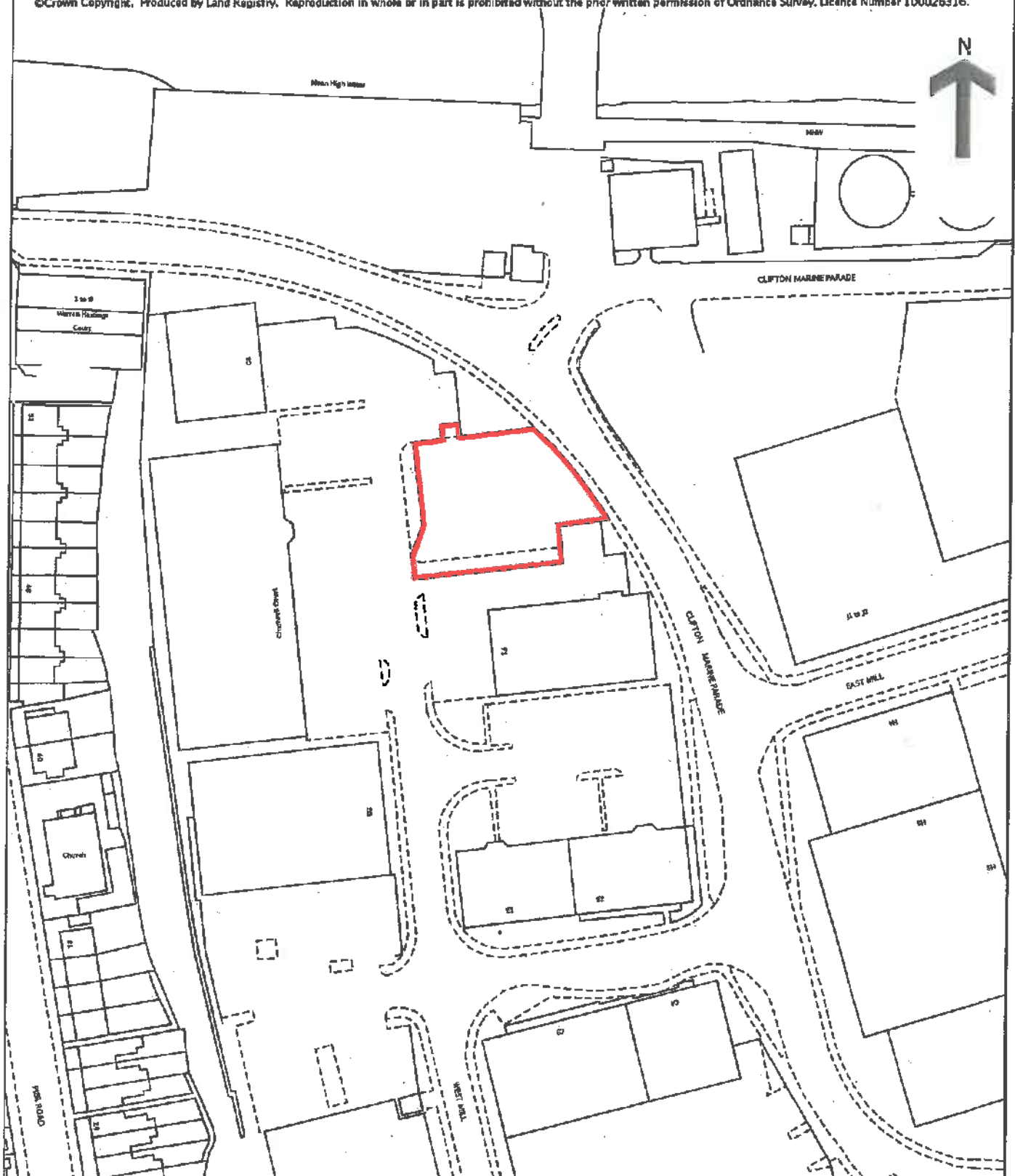
APPENDIX V Ownership plans

Land Registry
Official copy of
title plan

Title number **K821918**
Ordnance Survey map reference **TQ6374SE**
Scale **1:1250**
Administrative area **Kent : Gravesham**



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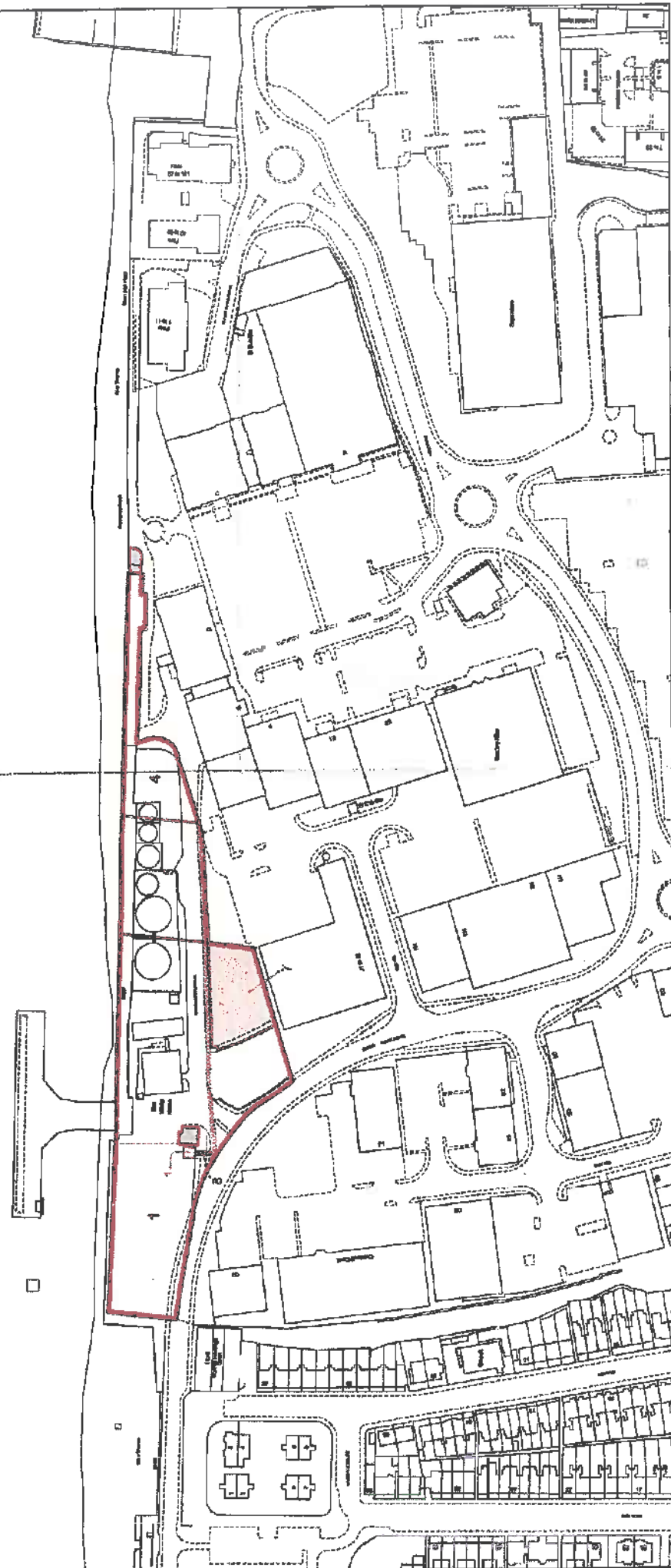




Land Registry
Official copy of
title plan

This number 1172833
Corrections Survey map reference T044748W
Scale 1:1250
Administrative use: Mast @marmelade

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This official copy issued on 28 November 2018 shows the state of the land as at 28 November 2018. It is submitted in evidence to the court as the original (s.87 Land Registration Act 2002). This plan shows the general position, not the exact line, of the boundaries. It may be subject to alterations in scale. Measurements scaled from this plan may not match measurements taken on the ground. This title is dealt with by Land Registry, Durham Office.