



Renaker Built Ltd

CROWN STREET, ZONE 2

RIBA Stage 4 Drainage Strategy





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1 RIBA STAGE 4 DRAINAGE STRATEGY

1.1 BACKGROUND

1.1.1. Following the submission of a hybrid planning application in April 2020, planning approval (with conditions) was granted for Crown Street Zone 2 in August 2020. The planning conditions which relate to foul and surface water drainage are as follows:

- Condition (6) - *Foul and surface water shall be drained on separate systems.*
- Condition (14) - *Prior to the commencement of development within Phase A, details of surface water drainage works in accordance with Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015), or any subsequent replacement national standards, shall be submitted to and approved in writing by the City Council as local planning authority. The approved scheme shall be implemented before first occupation of Phase A. The details shall include the following information:*
 - *Details of surface water attenuation that offers a reduction in surface water runoff rate to 49.4 l/s;*
 - *Evidence that the drainage system has been designed (unless an area is designated to hold and/or convey water as part of the design) so that flooding does not occur during a 1 in 100 year rainfall event with allowance for climate change in any part of a building. Hydraulic calculation of the proposed drainage system;*
 - *Assessment of overland flow routes for extreme events that is diverted away from buildings (including basements). Overland flow routes need to be designed to convey the flood water in a safe manner in the event of a blockage or exceedance of the proposed drainage system capacity including inlet structures. A layout with overland flow routes needs to be presented with appreciation of these overland flow routes with regards to the properties on site and adjacent properties off site;*
 - *Information to demonstrate that the designed system performs at all phases of a phased development and links together to form an effective system during each phase as well as on final completion;*
 - *Hydraulic calculation of the proposed drainage system;*
 - *Construction details of flow control and SuDS elements.*

1.1.2. The proposed drainage strategy which was submitted by WSP for planning as part of a flood risk assessment and drainage report (Ref: 70064035/FRA/001) has been developed further since submission of the planning application.

1.1.3. The purpose of this Stage 4 Drainage Strategy Report is to capture the developed design and provide all necessary up to date drawings and calculations to Manchester City Council in order that planning conditions (6) and (14) can be discharged.

1.2 DISPOSAL OF SURFACE WATER

- 1.2.1. The proposed drainage design has been carried out in due cognisance of the Non Statutory Technical Standards for Sustainable Drainage Systems (March 2015) and all other relevant national or local policy or guidance documents.
- 1.2.2. The method for removal of surface water from the site was selected in accordance with the hierarchy outlined in Building Regulations Part H as summarised below:
- Infiltration to the ground
 - Discharge to a watercourse
 - Connection to a surface water sewer
 - Connection to a combined sewer
- 1.2.3. Soakaways / other infiltration techniques were not considered to be suitable for the site given to the significant constraints spatially to accommodate soakaways.
- 1.2.4. A connection directly to the nearest watercourse, the River Medlock, was not considered to be feasible due to the distance from the watercourse and the disruption that would be caused to local highway networks if a new drain was laid from the site directly to the River Medlock.
- 1.2.5. Discharging runoff generated from the site to a surface water sewer or highway drain was considered was also considered but it was concluded and agreed with United Utilities (UU) that connections to the existing combined public sewer would be the most practical way to discharge surface water from the site.

1.3 SUDS

- 1.3.1. The provision of Sustainable Urban Drainage Systems (SUDS) has been considered and is to be incorporated into the site in the form of a blue roof attenuation system and filter drains along with below ground attenuation tanks and a small area of sedum (green) roof.
- 1.3.2. The most significant change in the surface water drainage strategy from when the planning application was submitted in April 2020 is that the originally proposed permeable pavement has now been changed to a blue roof system as instructed by the client (Renaker Build Ltd).
- 1.3.3. It is also noted that the development proposals include significant areas of soft landscaping and tree planting which will help to reduce the overall volume of water that discharges to the public sewer through evaporation.

1.4 GENERAL STRATEGY – POINTS OF CONNECTION

- 1.4.1. For details of the Stage 4 drainage proposals for the site, reference should be made to the WSP Drainage Layout Z1-WSP-G580-PL-XX-DR01 along with SuDS details drawing Z1-WSP-G580-DE-XX-DR02, which are appended this report.
- 1.4.2. The drainage strategy submitted for planning was subject to a client requirement that each phase of the development should have standalone foul and surface water drainage systems that work independently of other phases and do not cross land or buildings associated with other phases. This is no longer applicable and where considered to be the most practicable approach, the surface water drainage systems for individual phases have been combined and legal access rights have been sought so that foul and surface water pipework can now cross land associated with other phases.

- 1.4.3. The above change to the client's original brief does not hinder or impede the ability of designed systems to perform at all phases of a phased development and / or link together to form an effective system during each phase as well as on final completion.
- 1.4.4. The proposed blue roof system which takes runoff from phases A, B and C will be constructed during Phase A and the necessary infrastructure including inspection chambers and spurs for future connections from phase B externals and Phase C school building.
- 1.4.5. The updated surface water drainage strategy across the development can be summarised as follows:

PHASE A RESIDENTIAL TOWER (C4) & PHASE C SCHOOL BUILDING ALONG WITH PHASE A & B EXTERNAL AREAS / PUBLIC REALM

- It is proposed that surface water runoff generated from the Phase A and Phase C buildings along with runoff from the Phases A and B external areas will be drained to a blue roof surface water attenuation system located on the basement capping slab beneath the proposed public realm and vehicle drop area, at the lowest capping slab level of 32.040m AOD. The blue roof system will have 6 No. 100 mm diameter outlets which vertically penetrate the basement capping slab and each of these will have a flow control device to restrict discharge rates from the blue roof system to those presented in Table 1-2 – Maximum Peak Surface Water Runoff Rates. The blue roof outlet pipework will be conveyed at high level within the basement public car park and be discharged via 2 No. 150 mm diameter back drop connections to a new manhole MH C01 which is to be constructed on the existing 375mm diameter combined public sewer in Silvercroft Street.

PHASE B TOWER (C5) & PODIUM

- It is proposed that surface water runoff generated from the Phase B (C5 Tower) will be drained to a below ground Geo Cellular surface water attenuation tank located at the southern end of the rear access road in an area of soft dig off the basement structure. Surface water from Tower C5 and podium will discharge into the attenuation tank via 2 No. 225mm diameter horizontal connections from the C5 basement. The below ground attenuation tank will have a flow control device to restrict discharge rates from the tank to those presented in Table 1-2 – Maximum Peak Surface Water Runoff Rates. The outlet from the tank will discharge directly to MH C02 which is to be constructed on the existing 600mm (h) x 450mm (w) combined public sewer which crosses the site upstream of UU MH 1105 and which is to be abandoned upstream of new MH C02 as approved by United Utilities.

SERVICE YARD (REAR ACCESS ROAD)

- It is proposed that surface water runoff captured from the rear access road will be discharged to a filter drain / trench that will be used to convey (as well as treat and partially attenuate) the runoff to a downstream flow control chamber, which will restrict discharge rates from the filter drain system to those presented in Table 1-2 – Maximum Peak Surface Water Runoff Rates into MH C02 which is to be constructed on the existing 600mm (h) x 450mm (w) combined public sewer which crosses the site upstream of UU MH 1105 and which is to be abandoned upstream of new MH C02 as agreed by United Utilities. A second below ground Geo Cellular attenuation tank will be installed at the southern end of the rear access road to provide the required additional storage in the drainage system serving the rear access road.

ENTRANCE TO MULTI-STOREY CAR PARK

- It should be noted that due to the minimal depth of build up over the basement capping slab at the junction of Silvercroft Street (approx. 300mm), it is not possible install a conventional drainage system in this area with a connection into the blue roof system and discharge to the public sewer via a flow control device. It is therefore proposed that this area, which is approximately 310 square metres, will drain into existing highway gullies in Silvercroft Street and discharge to the public sewer unattenuated. The flow rate from this area has been calculated using the Rational Method with a rainfall intensity of 50 mm/hr. The total flow which will discharge into the public sewer unattenuated is presented in Table 1-2 – Maximum Peak Surface Water Runoff Rates and has been deducted from the overall allowable discharge rate from the site to ensure that the overall maximum discharge rate from the site is not exceeded.

UNCOVERED MULTI-STOREY CAR PARK RAMP

- It should also be noted that runoff from the uncovered multi-storey car park ramp is to be collected by an oversized drainage channel at the base of the ramp and discharged into a pump station basement level B2 before being pumped into the proposed new MH C01 at a maximum rate of 2 l/s as presented in Table 1-2 – Maximum Peak Surface Water Runoff Rates. This approach has been discussed and agreed in principle with the Manchester Lead Local Flood Authority (LLFA).
- The flow rate of 2 l/s has been calculated using the Rational Method with a rainfall intensity of 50 mm/hr and is based on a measured impermeable area of 140 m².
- The pump chamber has been designed to be 4m³ to cater for storm events up to and including the 100 year event plus a 40% allowance for climate change but does not include for any emergency storage. In the event of pump failure, a high-level alarm will be activated, and warnings will be sent automatically to the site management team. Excess water within the chamber will discharge via an overflow pipe and gully to the additional permanent pump and sump units at basement level B3 and be pumped to MH C01 in Silvercroft Street.

1.5 IMPERMEABLE AREAS

- 1.5.1. The total drained impermeable area of the existing site was measured as 0.783 Hectares.
- 1.5.2. The total drained impermeable areas of the various phases of the proposed development have been tabulated below.

Table 1-1 – Impermeable Areas

Phase	Impermeable area
Entrance to Multi Storey Car Park (Unrestricted Discharge)	310 m ²
Uncovered Multi Storey Car Park ramp	140 m ²
Phase A and Phase C buildings and Phase A and B external areas *	7075 m ²
Phase B (building)	1385 m ²

Rear Access Road *	1710 m ²
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* Indicates an allowance equal to 30% of the roof areas of the multi-storey residential towers for surface water runoff from large vertical surfaces.

- 1.5.3. It should be noted that any proposed soft landscaped areas over the basement have been taken as 100% impermeable as they drain into the proposed drainage system.

1.6 DISCHARGE RATES

- 1.6.1. The maximum discharge rate from all phases of the proposed development is 49.4 litres per second. This has been confirmed and agreed through the planning process and represents a 55% reduction in peak runoff rates when compared to pre-development rates.
- 1.6.2. The maximum peak surface water discharge rate has been proportioned between the proposed surface water discharge points as tabulated below.

Table 1-2 - Maximum Peak Surface Water Runoff Rates

Phase	Peak surface water runoff rate
Entrance to Multi Storey Car Park (Unrestricted Discharge)	4.3 l/s
Uncovered Multi Storey Car Park ramp	2 l/s
Phase A & C buildings and Phase A & B external areas	12 l/s
Phase B (building)	13.9 l/s
Rear Access Road	17.2 l/s
Total	49.4 l/s

1.7 ATTENUATION STORAGE

- 1.7.1. All on site surface water attenuation systems have been designed to ensure that surface water runoff for storm events up to and including the 100 year storm plus a 40% allowance for climate change, can be contained within the site safely without causing a risk of flooding to property or a risk of flooding elsewhere in the catchment.
- 1.7.2. Detailed MicroDrainage calculations have been carried out and are appended to this report.

1.8 EXCEEDANCE - OVERLAND FLOW ROUTES

- 1.8.1. Reference should be made to the WSP drawing Z1-WSP-G580-PL-XX-DR03 Exceedance - Overland Flow Routes that is appended to this report and which identifies the direction that overland flows would be safely routed away from the development including basement areas in the event of failure or design exceedance of the proposed site drainage system.

1.9 FUTURE MAINTENANCE

- 1.9.1. Reference should be made to the Drainage Inspection and Maintenance Schedule which is appended to this report.
- 1.9.2. It should be noted that the inspection and maintenance schedule does not include the blue roof system, which is to be confirmed by the blue roof supplier.
- 1.9.3. Planning condition (15) is a pre occupation condition and relates to the future management and maintenance of the proposed site drainage system and SuDS scheme. Planning condition (15) states that:
- *No development within Phase A shall be occupied until details of the implementation, maintenance and management of the sustainable drainage scheme have been submitted to and approved in writing by the City Council as local planning authority. The approved scheme shall be implemented before first occupation of Phase A and thereafter managed and maintained in accordance with the approved details. Those details shall include:*
 - *Verification report providing photographic evidence of construction as per design drawings;*
 - *As built construction drawings if different from design construction drawings;*
 - *Management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public body or statutory undertaker, or any other arrangements to secure the operation of the sustainable drainage scheme throughout its lifetime.*
- 1.9.4. The requested information including associated evidence is to be accumulated by the client during the course of the construction phase of the development.

2 FOUL DRAINAGE STRATEGY

2.1 GENERAL STRATEGY

- 2.1.1. Foul drainage from Tower C4 and the School is to be discharged via separate connections from the basement to proposed manhole MH C01 in Silvercroft Street.
- 2.1.2. The populations associated with each apartment type and total population for Towers C4 & C5 has been assumed as tabulated below.

Apartment type	People per apartment type	Tower C4 No	Tower C4 – Population / Apartment Type	Tower C5 No.	People per apartment type	Total People / Apartment Type
1 bed	2	131	262	151	2	302
2 bed	3	263	789	259	3	777
3 bed	4	15	60	36	4	154
Duplex	3	10	30	4	3	12
Total Population			1141			1245

2.2 ESTIMATED FOUL FLOWS

- 2.2.1. The total foul flows from Towers C4 and C5 have been estimated using the 'Population Method' as described in BS EN 16933.
- 2.2.2. BS EN 16933 details two methods of calculating foul flows but states that the 'Population Method, "may be used for the design of gravity foul drains and sewers where the upstream population is greater than approximately 500".
- 2.2.3. A daily foul flow of 150 litres per person per day has been taken from The British Water Flows and Loads 4 Code.
- 2.2.4. For the commercial space, a foul flow rate of 300 litres per day per 100 m² has been used based on Surveyor, 1992. Tower C4 has 262 m² of commercial space and Tower C5 has 226 m² of commercial space
- 2.2.5. The anticipated peak foul flow from the Phase C school has been calculated based on the guidance set out in Flows and Loads - 4 (British Water, 2013), which stipulates a figure of 90 l/day/person for non-residential schools with canteen cooking on site.
- 2.2.6. A peaking factor of 6 has been used to calculate the anticipated peak foul flows.

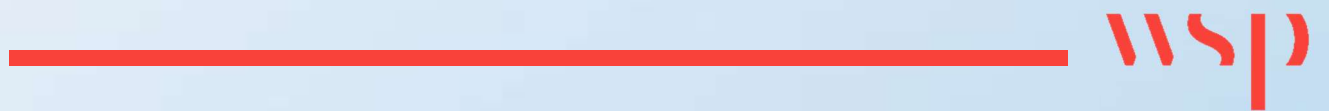
Table 2-1 – Peak Foul Discharge Rates

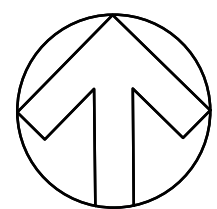
Building	Total Population	Total foul flow based on population (150 l/p/d)	Area of commercial space	Total commercial foul flow	Total foul flow with peaking factor of 6
Tower C4	1141	1.98	262 m ²	0.01 l/s	11.94 l/s
Tower C5	1245	2.16	226 m ²	0.008 l/s	13.02 l/s
School	296		-		1.85 l/s

- 2.2.7. United Utilities have confirmed that foul drainage from the development can be discharged to the combined public sewer at an unrestricted rate.

Appendix A

SURFACE WATER DRAINAGE DRAWINGS





SPECIALIST DESIGN ITEM (1) –

BLUE ROOF SLOPS ATTENUATION SYSTEM BY WATERSHED.
WSP PERFORMANCE CRITERIA AS FOLLOWS:

SURFACE WATER RUNOFF FROM PHASES A & C BUILDINGS AND PHASES A & B PUBLIC REALM TO BE DRAINED BLUE ROOF ATTENUATION SYSTEM WITHIN AREA HATCHED BLUE SURROUNDED BY A CONCRETE UPSTAND.

TOTAL DRAINED IMPERMEABLE AREA – 7075 m²
TOTAL PLAN AREA AVAILABLE FOR BLUE ROOF CRATE SYSTEM – 2400 m²
DISCHARGE RATE AGREED WITH WATERSHED – 12 L/S.

MAXIMUM HALF DRAIN TIME – 720 MINS (12 HOURS)

TOTAL DEPTH OF STORAGE CRATES TO BE 200mm (MAX). CONCRETE UPSTAND TO ALSO BE 200mm (MAX) – CURRENT PROPOSAL BASED ON A FLAT SLAB TBC / AGREED BY RENAKER.

BLUE ROOF TO PROVIDE SUFFICIENT STORAGE FOR 100 YR STORM EVENT PLUS A 40% ALLOWANCE FOR CLIMATE CHANGE.

NUMBER AND LOCATION OF BLUE ROOF OUTLETS, FINALISED FLOW RATES, COMPATIBLE INSPECTION CHAMBERS, TRANSFER OF RUNOFF FROM VEHICULAR AREA TO ATTENUATION CRATES TO BE FINALISED WITH BLUE ROOF SUPPLIER (WATERSHED).

SPECIALIST DESIGN ITEM (2) –

BASEMENT PUMP SYSTEM TO DRAIN RUNOFF FROM UNCOVERED CAR PARK RAMP – PERFORMANCE CRITERIA:

SURFACE WATER RUNOFF FROM UNCOVERED BASEMENT CAR PARK RAMP TO BE DRAINED TO PUMP CHAMBER IN BASEMENT BEFORE BEING PUMPED TO MH001 AT SILVERCROFT STREET JUNCTION.

TOTAL DRAINED IMPERMEABLE AREA – 140 m²
RUNOFF BASED ON RATIONAL METHOD (50mm/hr) – 2 L/S
PUMP CHAMBER TO BE MINIMUM 4m x 3 TO CATER FOR STORM EVENTS UP TO AND INCLUDING THE 100 YR EVENT PLUS A 40% ALLOWANCE FOR CLIMATE CHANGE. THIS DOES NOT INCLUDE FOR ANY EMERGENCY STORAGE. IN THE EVENT OF PUMP FAILURE, A HIGH LEVEL ALARM WILL BE ACTIVATED AND WARNINGS WILL BE SENT AUTOMATICALLY TO THE SITE MANAGEMENT TEAM. EXCESS WATER WITHIN THE CHAMBER WILL DISCHARGE VIA AN OVERFLOW PIPE AND GULLY TO THE ADDITIONAL PERMANENT PUMP AND SUMP UNITS AT BASEMENT LEVEL B3 AND BE PUMPED TO MH001 IN SILVERCROFT STREET. PUMP DETAILS BASED ON A 1.5m DIA CHAMBER, 2.25M HEIGHT.

MAX PUMP DISCHARGE RATE – 2 L/S
PUMP SWITCH ON / OFF (DEPTH ABOVE INVERT) – 0.7m (ON), 0.3m (OFF)
PUMP ARRANGEMENT – DUTY / STAND BY
HIGH LEVEL ALARM TELEMETRY WARNING – REQUIRED
BACK UP POWER SUPPLY – TO BE AGREED

PUMP CHAMBER TO BE POSITIONED AT BASEMENT LEVEL B2 IN ABOVE GROUND CHAMBER. CHAMBER DESIGN, INCOMING / OUTGOING PIPEWORK, POWER SUPPLY, TELEMETRY AND ALL OTHER MECHANICAL AND ELECTRICAL REQUIREMENTS TO BE SPECIFIED BY MEP DESIGN. REFERENCE SHOULD BE MADE TO MEP DRAWING Z3-MEP-580-PL-B2-002 FOR DETAILS.

SPECIFICATION OF PAVEMENT MATERIALS FOR PROPOSED PEDESTRIAN FOOTPATH AND VEHICULAR AREAS TO BE PROVIDED BY TPM. PERMEABLE / IMPERMEABLE CONSTRUCTION TO BE AGREED WITH TPM / RBL. ALLOW FOR DRAINAGE CHANNEL. ACO DRAIN OR SIMILAR ALONG FULL LENGTH OF FOOTPATH IF IMPERMEABLE CONSTRUCTION.

DETAILS FOR COLLECTION OF SURFACE WATER RUNOFF FROM MAIN VEHICULAR AREA AND CONNECTION TO BLUE ROOF SYSTEM TO BE AGREED WITH RBL, TPM & BLUE ROOF SUPPLIER. IF IMPERMEABLE CONSTRUCTION IS USED, A FILTER DRAIN OR SIMILAR RAINFALL COLLECTION FEATURE WILL BE REQUIRED ALONG THE INTERFACE BETWEEN HARVESTING VEHICULAR AREA AND SOFT LANDSCAPED PUBLIC REALM.

DUE TO MINIMAL DEPTH OF BUILD UP FROM BASEMENT SLAB LEVEL TO FINISHED GROUND LEVEL IN THIS AREA, IT IS NOT POSSIBLE TO COLLECT ALL RUNOFF AT SURFACE LEVEL AND DISCHARGE THROUGH BLUE ROOF SYSTEM.

TOTAL EXTENT OF CONCRETE UPSTAND (HATCHED BLUE) AT SILVERCROFT STREET SHOWN AS AGREED WITH TPM / RBL. AREA OUTSIDE CONCRETE UPSTAND (310 m², HATCHED PURPLE) TO DRAIN FREELY INTO EXISTING DRAINAGE IN SILVERCROFT STREET. ALLOWANCE OF 4.3 L/S FOR THIS AREA BASED ON RATIONAL METHOD (50mm/hr RAINFALL) TAKEN FROM OVERALL OFF SITE DISCHARGE RATE.

PROPOSED 450mm (w) FILTER TRENCH TO ALLOW EXCESS MOISTURE IN ROAD SUB BASE OVER BASEMENT SLAB TO INFILTRATE INTO SOFT GROUND. TYPE B FILTER MEDIA TO SHW CLAUSE 505.

225mm DIA CONNECTION THROUGH BASEMENT WALL FROM BLUE ROOF OUTLETS 1, 2, 3 & 4.

REQUIREMENT FOR ADDITIONAL INSPECTION CHAMBERS AT THE POINT AT WHICH FOUL AND SURFACE WATER CONNECTION LEAVE THE BUILDING TO BE AGREED WITH RENAKER.

PHASE A, PHASE C AND PHASE B (PUBLIC REALM) SURFACE WATER DRAINAGE TO DISCHARGE TO PROPOSED MH C01 WHICH IS TO BE BUILT OVER EXISTING PRIVATE SEWER IN SILVERCROFT STREET SUBJECT TO SECTION 106 APPROVAL FROM UNITED UTILITIES. REFERENCE SHOULD BE MADE TO WSP DWG Z1-WSP-580-DE-XX-DR01 FOR DETAILS OF PROPOSED MH C01.

100mm DIA PUMPED OUTLET FOR FOR B2 LEVEL PUMPING SURFACE WATER PUMP STATION.

225mm DIA CONNECTION THROUGH BASEMENT WALL FROM BLUE ROOF OUTLETS 5 & 6.

SPECIFICATION OF PAVEMENT MATERIALS FOR PROPOSED PEDESTRIAN FOOTPATH AND VEHICULAR AREAS TO BE PROVIDED BY TPM. PERMEABLE / IMPERMEABLE CONSTRUCTION TO BE AGREED WITH TPM / RBL. ALLOW FOR DRAINAGE CHANNEL. ACO DRAIN OR SIMILAR ALONG FULL LENGTH OF FOOTPATH IF IMPERMEABLE CONSTRUCTION.

DETAILS FOR COLLECTION OF SURFACE WATER RUNOFF FROM MAIN VEHICULAR AREA AND CONNECTION TO BLUE ROOF SYSTEM TO BE AGREED WITH RBL, TPM & BLUE ROOF SUPPLIER. IF IMPERMEABLE CONSTRUCTION IS USED, A FILTER DRAIN OR SIMILAR RAINFALL COLLECTION FEATURE WILL BE REQUIRED ALONG THE INTERFACE BETWEEN HARVESTING VEHICULAR AREA AND SOFT LANDSCAPED PUBLIC REALM.

SURFACE WATER RUNOFF FROM BASEMENT RAMP IS TO BE COLLECTED BY AN OVERSIZED DRAINAGE CHANNEL AT BASE OF RAMP AND DISCHARGED INTO A PUMP STATION (SPECIALIST DESIGN ITEM 2) AT BASEMENT LEVEL B2. THIS APPROACH HAS BEEN DISCUSSED AND AGREED IN PRINCIPLE WITH THE MANCHESTER LFA.

WATERPROOFING DETAILS FOR ALL DRAINAGE PENETRATIONS IN STRUCTURE TO BE PROVIDED BY MEP DESIGN / SHIP ARCHITECTS.

BASEMENT CAPPING SLAB +22.040 (350mm THICKNESS) B1 FLOOR SLAB +29.800

DETAILED COORDINATION REQUIRED BETWEEN TPM (LANDSCAPE ARCHITECT) AND BLUE ROOF SUPPLIER (WATERSHED) TO INCLUDE COORDINATION OF TREE ROOTS / PITS WITH BLUE ROOF SYSTEM. INTERFACE OF LANDSCAPE BUILD UPS WITH BLUE ROOF SYSTEM (PERMEABLE GEO-TEXTILE), MINIMUM DEPTH OF TOPSOIL / PLANTING ZONES ETC.

PROPOSED SURFACE WATER CONNECTIONS FROM TOWER C4 TO BE UNDERSLAB AT HIGH LEVEL WITHIN BASEMENT AND EXIT BASEMENT HORIZONTALLY AT STEP IN SLAB BEFORE CONNECTING INTO BLUE ROOF SYSTEM VIA INSPECTION CHAMBER.

REFERENCE SHOULD BE MADE TO MEP DRAWING 19-021-23-MEP-580-PL-B1-B3-001 FOR DETAILS OF ABOVE GROUND FOUL AND SURFACE WATER CONNECTIONS FROM C4 TOWER.

REFERENCE SHOULD BE MADE TO MEP DRAWING 19-021-21-MEP-580-PL-B3-001 FOR DETAILS OF ABOVE GROUND FOUL AND SURFACE WATER CONNECTIONS FROM C4 TOWER.

PROPOSED GEO CELLULAR STORAGE TANK, ALDERBURGH OR SIMILAR APPROVED, TO PROVIDE SUFFICIENT STORAGE TO MITIGATE ALL STORM EVENTS UP TO AND INCLUDING THE 100 YR STORM EVENT INCLUDING A 40 % ALLOWANCE FOR CLIMATE CHANGE. DIMENSIONS 1.5m (w) x 1.3m (h) x 13m (l)

MH REF: SW06 HYDROBRANE MH Q = 13.9 L/S CL: 33.000 (TBC) IL: 30.088 INCOMING 115'S (BACK-SPOUT CONNECTIONS) FROM BUILDING DRAINAGE – 31.400 (TBC)

PROPOSED GEO CELLULAR STORAGE TANK, ALDERBURGH OR SIMILAR APPROVED, TO PROVIDE SUFFICIENT STORAGE TO MITIGATE ALL STORM EVENTS UP TO AND INCLUDING THE 100 YR STORM EVENT INCLUDING A 40 % ALLOWANCE FOR CLIMATE CHANGE. DIMENSIONS 2m (w) x 1.1m (h) x 8.5m (l)

MH REF: SW07 HYDROBRANE MH Q = 17.2 L/S CL: 33.000 (TBC) IL: 30.055

LOCATION OF EXISTING 450mm (w) x 600mm (h) COMBINED PUBLIC SEWER SHOWN AS FOR RENAKER TOPO SURVEY.

EXISTING PUBLIC SEWER IN MELBOURNE STREET TO BE ABANDONED AND GROUNDED UP IN ACCORDANCE WITH METHOD AGREED WITH UNITED UTILITIES AS PART OF THE APPROVED SECTION 116 SEWER ABANDONMENT AGREEMENT.

1 FILTER DRAIN NOTE: FILTER DRAIN TO HAVE 150mm LAYER OF SINGLE SIZED STONE SEPARATED FROM THE MAIN FILTER MATERIAL BELOW WITH A PERMEABLE GEOTEXTILE MEMBRANE. 150mm LAYER OF SINGLE SIZED STONE IS SACRIFICIAL AND SHOULD BE REPLACED AT REGULAR INTERVALS AS PART OF THE ONGOING MAINTENANCE STRATEGY FOR THE SITE FOR THE AVOIDANCE OF CLOGGING / SILTATION OF THE FILTER DRAIN. INTERVALS OF REPLACEMENT OF 150mm LAYER AND ASSOCIATED GEOTEXTILE TO BE AGREED. FILTER DRAIN TO BE REGULARLY MAINTAINED AND TO BE KEPT CLEAR OF LEAVES AND OTHER DEBRIS WHICH MAY IMPEDE THE FLOW OF RUNOFF INTO THE DRAIN.

PROPOSED TURNING HEAD FINISHED SITE LEVELS TO BE CONFIRMED BY TPM – FINAL POSITION OF / EXTENT OF DRAINAGE CHANNEL(S) TO BE CONFIRMED ONCE COORDINATION OF LEVELS IS COMPLETE.

PROPOSED 450mm (w) FILTER TRENCH WITH PERMEABLE GEOTEXTILE SURROUND TO ALLOW EXCESS MOISTURE IN ROAD SUB BASE OVER BASEMENT SLAB TO INFILTRATE INTO SOFT GROUND. TYPE B FILTER MEDIA TO SHW CLAUSE 505.

DETAILS OF DRAINAGE FOR BASEMENT LEVEL CAR PARK ENTRANCE / EXIT STRUCTURE ALONG WITH BIN STORE TO BE AGREED WITH SHIP SHIP TO CONFIRM PITCH OF RAMP, TPM TO CONFIRM ROAD LEVELS.

SITE WIDE FOUL & SURFACE WATER DRAINAGE STRATEGY

TOTAL EXISTING IMPERMEABLE AREA: 0.783 HECTARES
EXISTING SURFACE WATER RUNOFF RATE FROM THE SITE: 108.8 l/s (USING THE MODIFIED RATIONAL METHOD WITH A RAINFALL INTENSITY OF 50 mm/hr)

PEAK DISCHARGE RATE FROM THE DEVELOPED SITE: 54.4 l/s (50% REDUCTION IN ACCORDANCE WITH THE MCR, SALFORD AND TRAFFORD SFRA)

PROPOSED PEAK DISCHARGE FROM THE SITE: 49.4 l/s (OVERALL BETTERMENT OF 55% FOLLOWING LOCAL COUNCIL DECLARING A CLIMATE EMERGENCY)

310 m² UNRESTRICTED DISCHARGE: 4.3 l/s
140 m² BASEMENT ENTRANCE: 2 l/s

PHASE A & C BUILDING PLUS PHASES A & B PUBLIC REALM DISCHARGE (BLUE ROOF): 12 l/s

PHASE B BUILDING DISCHARGE: 13.9 l/s
REAR ACCESS ROAD (SERVICE YARD) SURFACE WATER DISCHARGE RATE: 17.2 l/s

TOTAL PEAK SURFACE WATER DISCHARGE RATE: 49.4 l/s

PHASE A PEAK FOUL DISCHARGE RATE: 11.94 l/s
PHASE B PEAK FOUL DISCHARGE RATE: 13.02 l/s
PHASE C PEAK FOUL DISCHARGE RATE: 1.85 l/s

TOTAL PEAK FOUL DISCHARGE RATE: 26.81 l/s

PHASES A AND C (BUILDING) & PHASE A & B PUBLIC REALM BLUE ROOF

IMPERMEABLE AREAS DRAINING TO ATTENUATION RESERVOIR:

- C4: 1623 m² (INC. 30% ROOF ALLOWANCE FOR VERTICAL SURFACES)
- SCHOOL: 695 m²
- EXTERNAL AREAS PHASE A: 2668 m² (EXCLUDES 310 m² UNRESTRICTED, INCLUDES SERVICE ROAD TURNING HEAD 370 m²)
- EXTERNAL AREAS PHASE B: 1703 m²
- 30% C5 ROOF ALLOWANCE FOR VERTICAL SURFACES: 280 m²

TOTAL IMPERMEABLE AREA DRAINING TO BLUE ROOF – 6970 m²

PHASE B BUILDING

IMPERMEABLE AREAS DRAINING ATTENUATION TANK:

- BUILDING: 1385 m²

REAR ACCESS ROAD (SERVICE YARD)

IMPERMEABLE AREAS DRAINING ATTENUATION TANK:

- ROAD: 1030 m²
- 30% ROOF AREA FOR VERTICAL SURFACES: 530 m²
- MISC: 150 m²

TOTAL IMPERMEABLE AREA DRAINING TO REAR ACCESS ROAD SYSTEM – 1710 m²

DO NOT SCALE

KEY

- EXTENT OF BASEMENT
- EXISTING COMBINED PUBLIC SEWER
- EXISTING COMBINED PUBLIC SEWER TO BE ABANDONED
- EXISTING HIGHWAY DRAIN
- PROPOSED SURFACE WATER DRAIN
- PROPOSED FOUL WATER DRAIN
- ABOVE GROUND FOUL DRAINAGE (BY OTHERS)
- ABOVE GROUND SW DRAINAGE (BY OTHERS)
- PROPOSED CHANNEL DRAIN
- PROPOSED FILTER DRAIN
- PROPOSED FILTER TRENCH
- EXISTING MANHOLE
- PROPOSED PRIVATE FOUL MANHOLE
- PROPOSED PRIVATE SURFACE WATER MANHOLE
- PROPOSED COMBINED SEWER
- PROPOSED PRIVATE SURFACE WATER CATCHPIT
- PROPOSED BLUE ROOF OUTLET
- RODDING POINT WITH GULLY GRATING
- PROPOSED ROAD GULLY
- PROPOSED BLUE ROOF EXTENT
- LAND TO DRAIN UNRESTRICTED TO EXISTING DRAINAGE IN SILVERCROFT STREET
- ATTENUATION TANK
- DIRECTION OF FALL (GROUND LEVEL)
- DIRECTION OF FALL (BASEMENT SLAB)

P08	14/01/21	JAM	NOTES UPDATED TO CROSS REFERENCE. FILTER DRAIN REVERTED	SM	SM
P07	14/12/20	JAM	ACO'S SPEC, FILTER DRAIN UPDATED	SM	SM
P06	09/11/20	JAM	FILTER DRAIN EXTENTS AND INVERTS UPDATED	SM	SM
P05	03/11/20	JAM	FILTER DRAIN UPDATED	SM	SM
P04	23/10/20	JAM	STAGE 4 ISSUE	SM	SM
P03	02/10/20	JAM	DISCHARGE PLANNING CONDITIONS	SM	SM
P02	16/09/20	JAM	ADDED MH REF'S / MH C01 AND ADDITIONAL COORDINATION NOTES	SM	SM
P01	04/09/20	JAM	FIRST ISSUE FOR COORDINATION	SM	SM
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS: **S3 - FOR REVIEW**

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wsp.com

CLIENT: **RENAKER BUILD LTD**

ARCHITECT: **SIMPSON HAUGH**

SITE/PROJECT: **CROWN STREET, ZONE 2**

TITLE: **PROPOSED DRAINAGE LAYOUT**

SCALE @ A1: 1:250

CHECKED: **SM** APPROVED: **SM**

PROJECT NO: **70064036** DESIGNED: **JAM** DRAWN: **JAM** DATE: **January 21**

DRAWING NO: **Z1-WSP-580-PL-XX-DR02** REV: **P08**

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DO NOT SCALE

KEY

OVERLAND SURFACE WATER FLOW ROUTE

NOTE THAT LEVELS ARE RAISED WHERE THERE ARE TREE'S TO ALLOW FOR TREE PIT INSTALLATION.

BASEMENT ENTRANCE RAMP IS NOT COVERED. SURFACE RUNOFF FROM RAMP IS TO BE COLLECTED BY AN OVERSIZED DRAINAGE CHANNEL AT BASE OF RAMP AND CONNECTED INTO PUMP INSTALLATION AT BASEMENT LEVEL B3. THIS APPROACH HAS BEEN DISCUSSED AND AGREED IN PRINCIPLE WITH THE MANCHESTER LLFA. FOR DETAILS AND SPECIFICATION OF DRAINAGE CHANNEL AND BASEMENT PUMP REFER TO MEP DRAWINGS Z3-MEP-G590-PL-B1-003 AND Z3-MEP-G590-PL-B2-002.

EXCEEDANCE - OVERLAND FLOW ROUTES

IN THE EVENT OF STORMS THAT EXCEED THE 1 IN 100 YEAR PLUS 40% (CLIMATE CHANGE), THE ARROWS SHOW THE DIRECTION OF OVERLAND FLOWS WHICH WILL BE ROUTED AWAY FROM BUILDINGS (INCLUDING BASEMENTS) TO THE EXISTING PUBLIC HIGHWAY IN SILVERCROFT STREET AND / OR MELBOURNE STREET / MANCUNION WAY.

P03	14/01/21	JAM	CROSS REFERENCES UPDATED	SM	SM
P02	07/12/20	JAM	UPDATED TO SUIT COMMENTS FROM LLFA	SM	SM
P01	02/10/20	JAM	FIRST ISSUE	SM	SM
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS: S2 - FOR INFORMATION



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CLIENT: RENAKER BUILD LTD

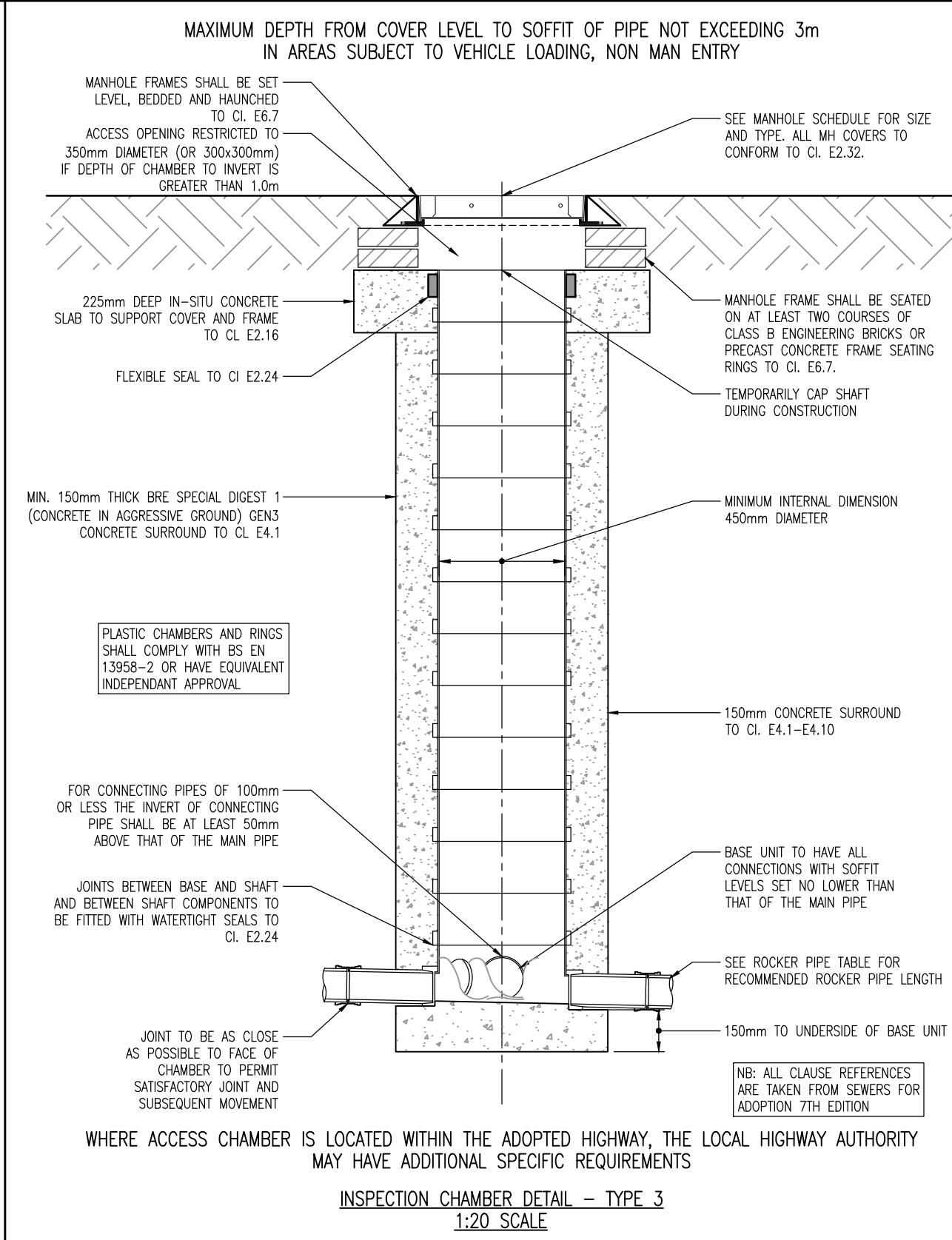
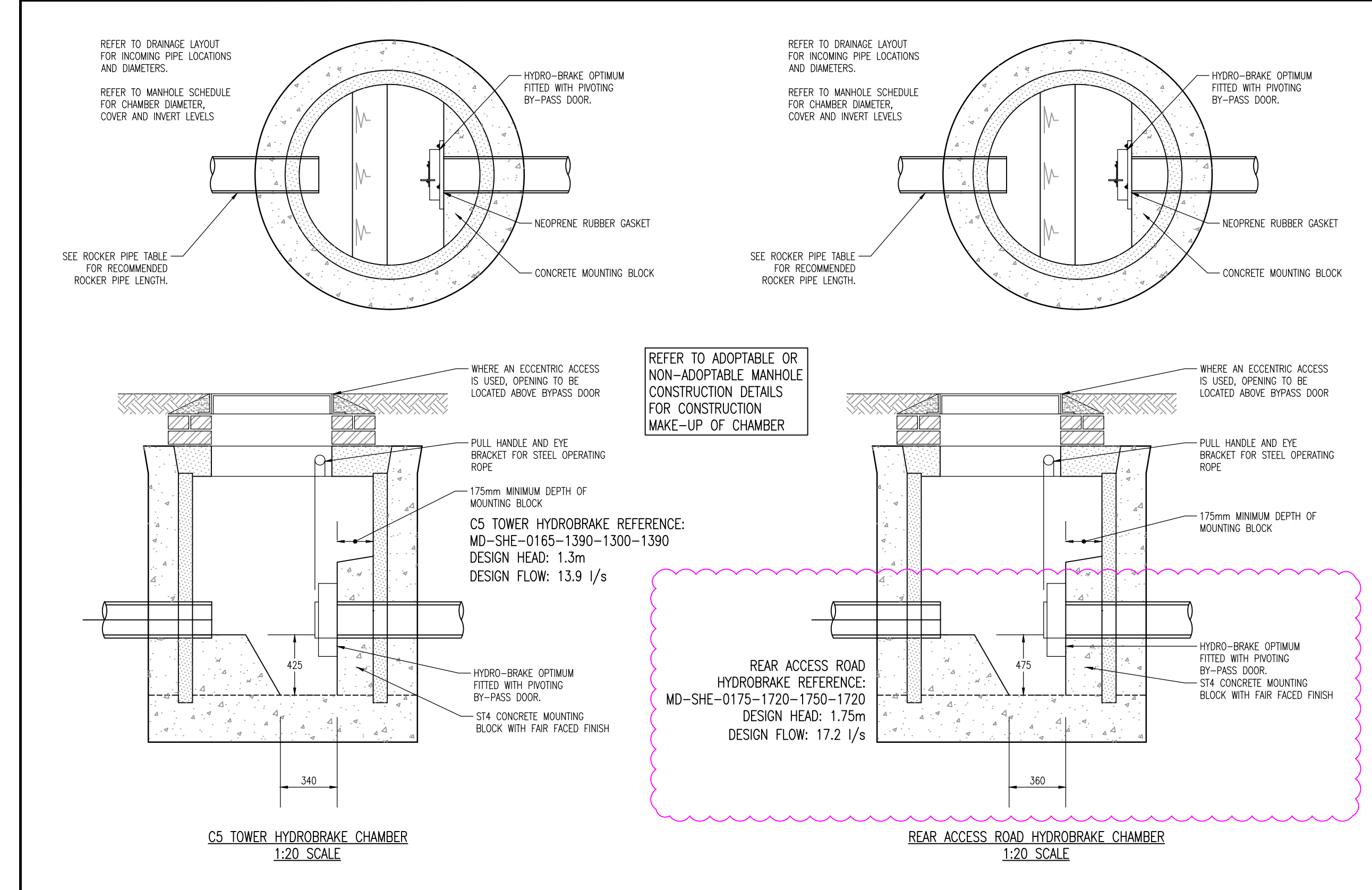
ARCHITECT: SIMPSON HAUGH

SITE/PROJECT: CROWN STREET, ZONE 2

TITLE: EXCEEDANCE - OVERLAND FLOW ROUTES

SCALE @ A1: 1:250	CHECKED: SM	APPROVED: SM
PROJECT NO: 70064036	DESIGNED: JAM	DRAWN: JAM
DRAWING NO: Z1-WSP-580-PL-XX-DR03	DATE: December 20	REV: P03
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File name: \\UK.VSPGROUP\COMMON\DATA\PROJECTS\70064036\04036 - CROWN STREET INCR. DRAINAGE\03 WPCV CIVIL ENGINEERING\03 DRAWINGS\WORKING\Z1-WSP-G580-DE-XX-DR02.DWG, printed on 15 January 2021 11:53:03 by McGowan, Jordan



PIPE BEDDING HATCHINGS			
HATCH	SPECIFICATION FOR HIGHWAY WORKS (SHW)	SEWERS FOR ADOPTION 7th EDITION (SFA7)	NON-ADOPTABLE WORKS (DOC. H)
	TRENCH BACKFILL TO SHW CL 505	20-200mm UNIFORM GRADED MATERIAL TO SFA7 CL E.3.4*	SELECTED FILL OR GRANULAR FILL FREE FROM STONES>40mm
	CLASS B MATERIAL TO SHW CL 503.3 (iv)	SELECTED BACKFILL MATERIAL IN ACCORDANCE WITH SFA7 CL E.3.4*	SELECTED FILL FREE FROM STONES>40mm, LUMPS OF CLAY>100mm, TIMBER, FROZEN MATERIAL OR VEGETABLE MATTER
	CONCRETE TO SHW CL 503.3 (ii)	GEN3 (C16/C20) CONCRETE TO SFA7 CL E.5.3	ST4 CONCRETE TO BS 8500-2
	GRANULAR MATERIAL TO SHW CL 503.3 (i)	GRANULAR OR AS-DUG MATERIAL TO WS 4-08-02 - REFER TO TABLE BELOW	GRANULAR OR AS-DUG MATERIAL TO BS EN 1295-1 - REFER TO TABLE BELOW
	TYPE B FILTER MEDIA TO SHW CL 505	N/A	20/40mm SIZE CLEAN GRANULAR MATERIAL
	TYPE A OR C FILTER MATERIAL TO SHW CL 505 OR GRANULAR MATERIAL TO SHW CL 503.3 (i)	N/A	0/20mm SIZE CLEAN GRANULAR MATERIAL
	TURF OR SEED ON TOPSOIL AS DESCRIBED IN SHW APPENDIX 5/1	N/A	TURF OR SEED ON TOPSOIL AS PER LANDSCAPE ARCHITECT'S SPECIFICATION
	GRANULAR MATERIAL TO SHW CL 503.3 (i) e.g. SAND	N/A	0-4mm FINE AGGREGATE OR SHARP SAND

WHERE SFA7 SEWERS ARE LOCATED INSIDE OR WITHIN 1m OF ADOPTED CARRIAGEWAYS (FUTURE OR EXISTING), BACKFILL AND REINSTATEMENT SHALL BE IN ACCORDANCE WITH THE RELEVANT HIGHWAY REINSTATEMENT SPECIFICATION.

NOMINAL BORE OF PIPE	SIZE (mm)	
	SINGLE SIZED	GRADED
100-125	10	-
150-200	10 OR 14	14 TO 5
225-300	10, 14 OR 20	14 TO 5
		OR
375-500	14 OR 20	14 TO 5
		OR
EXCEEDING 500	14, 20 OR 40	20 TO 5
		OR
		40 TO 5

TABLE: SIZE OF GRANULAR MATERIAL FOR PIPE BEDDING COMPLIES WITH - GEN 4-11-02, WS 4-08-02, BS EN 1510 AND THE TBRU DOCUMENT "STRUCTURAL DESIGN OF BURIED RIGID PIPES", 1983; REFERRED BY BS 1295-1.

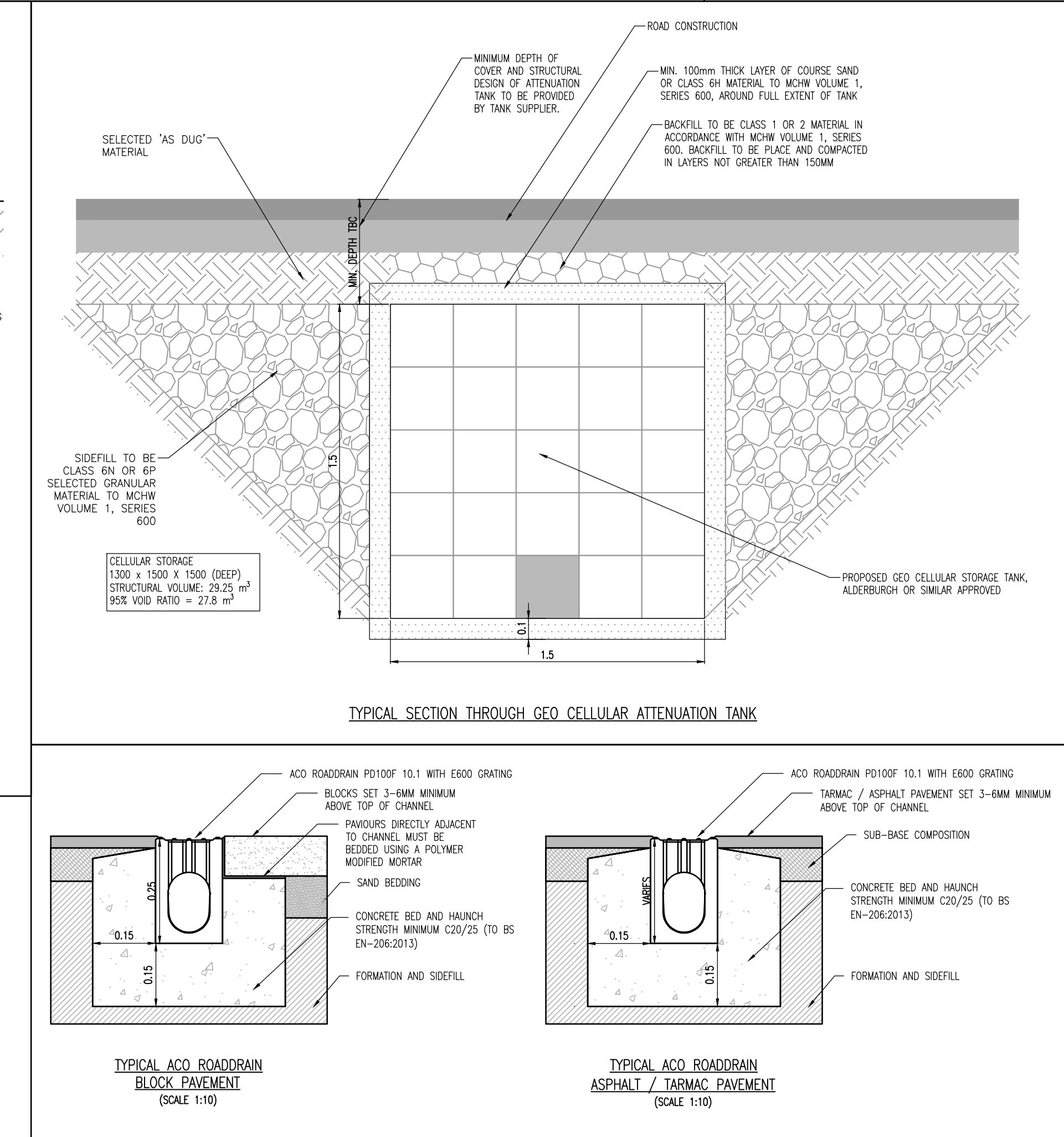
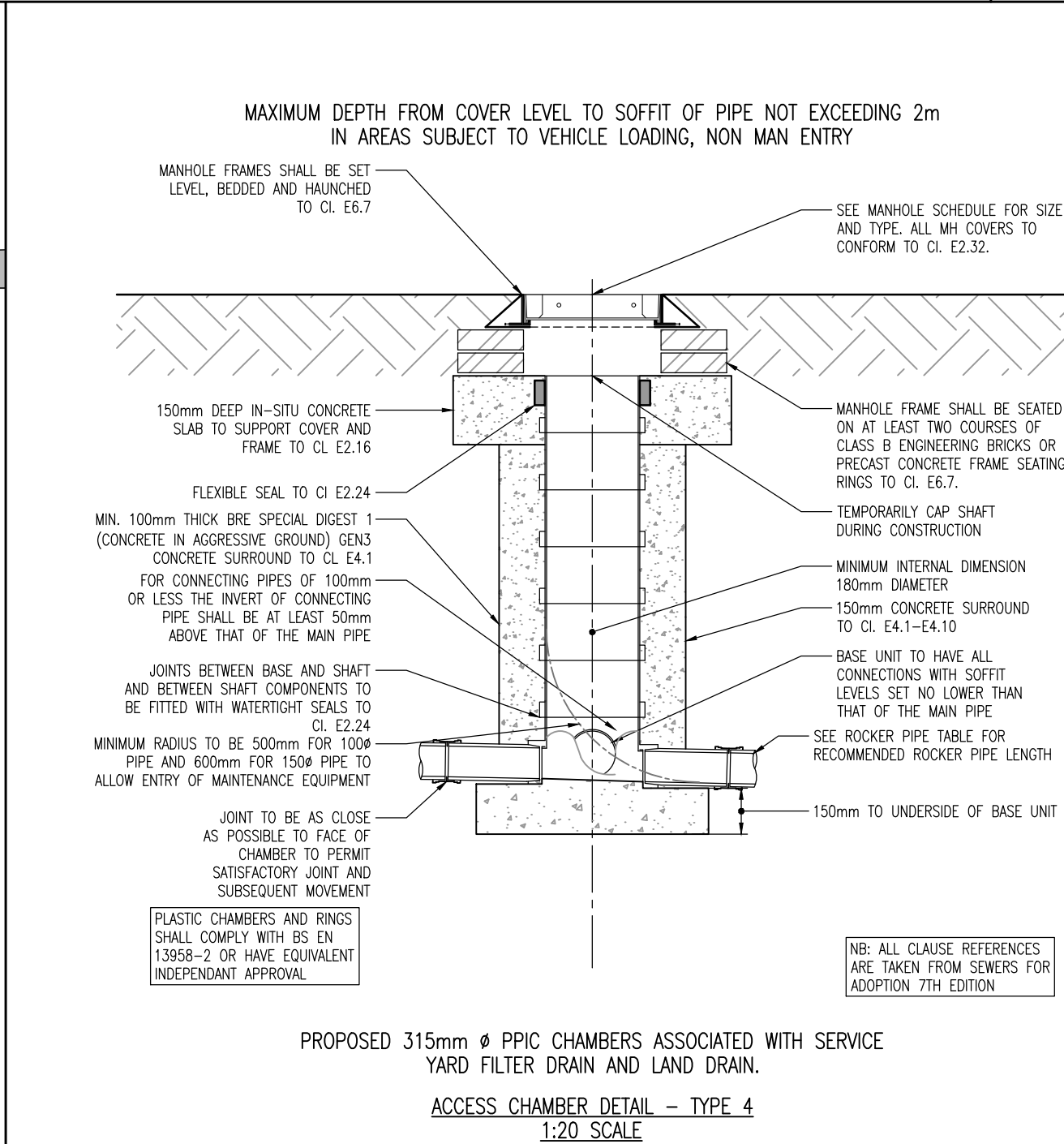
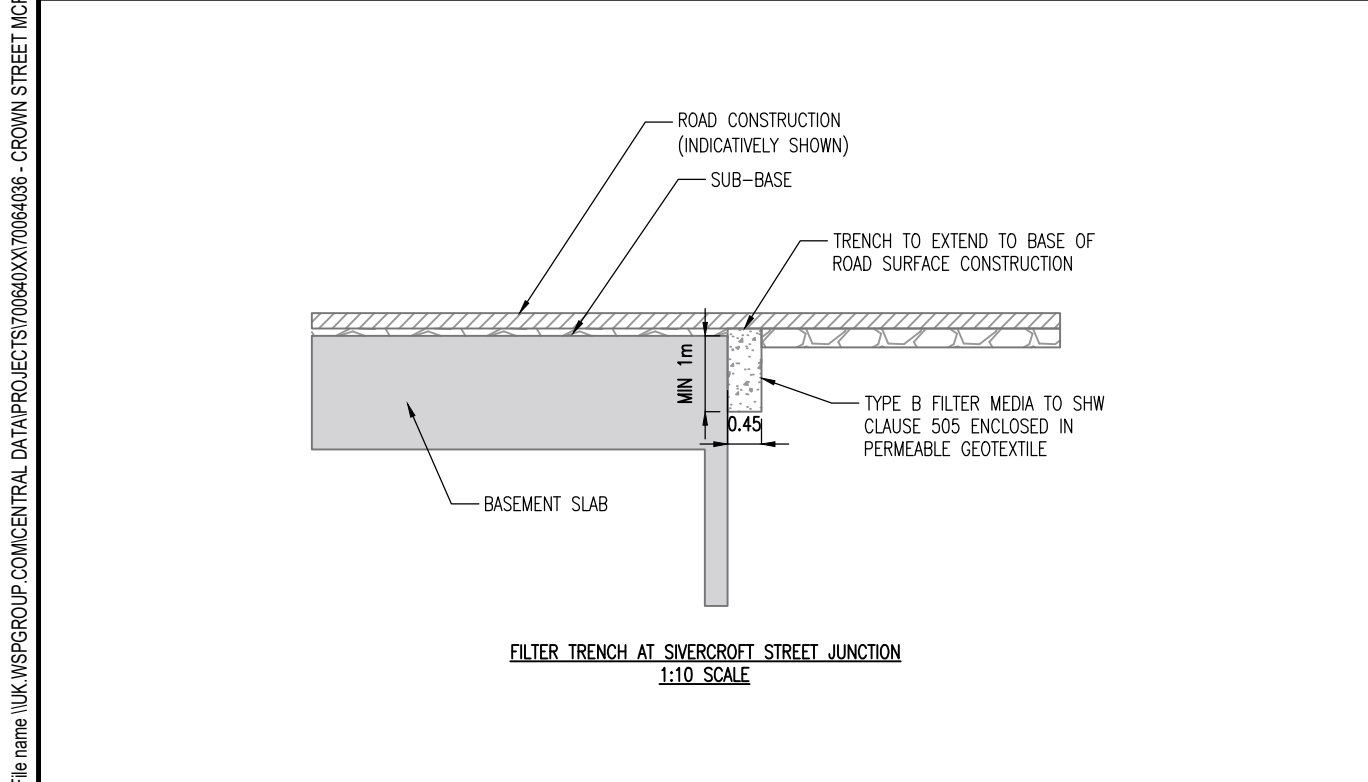
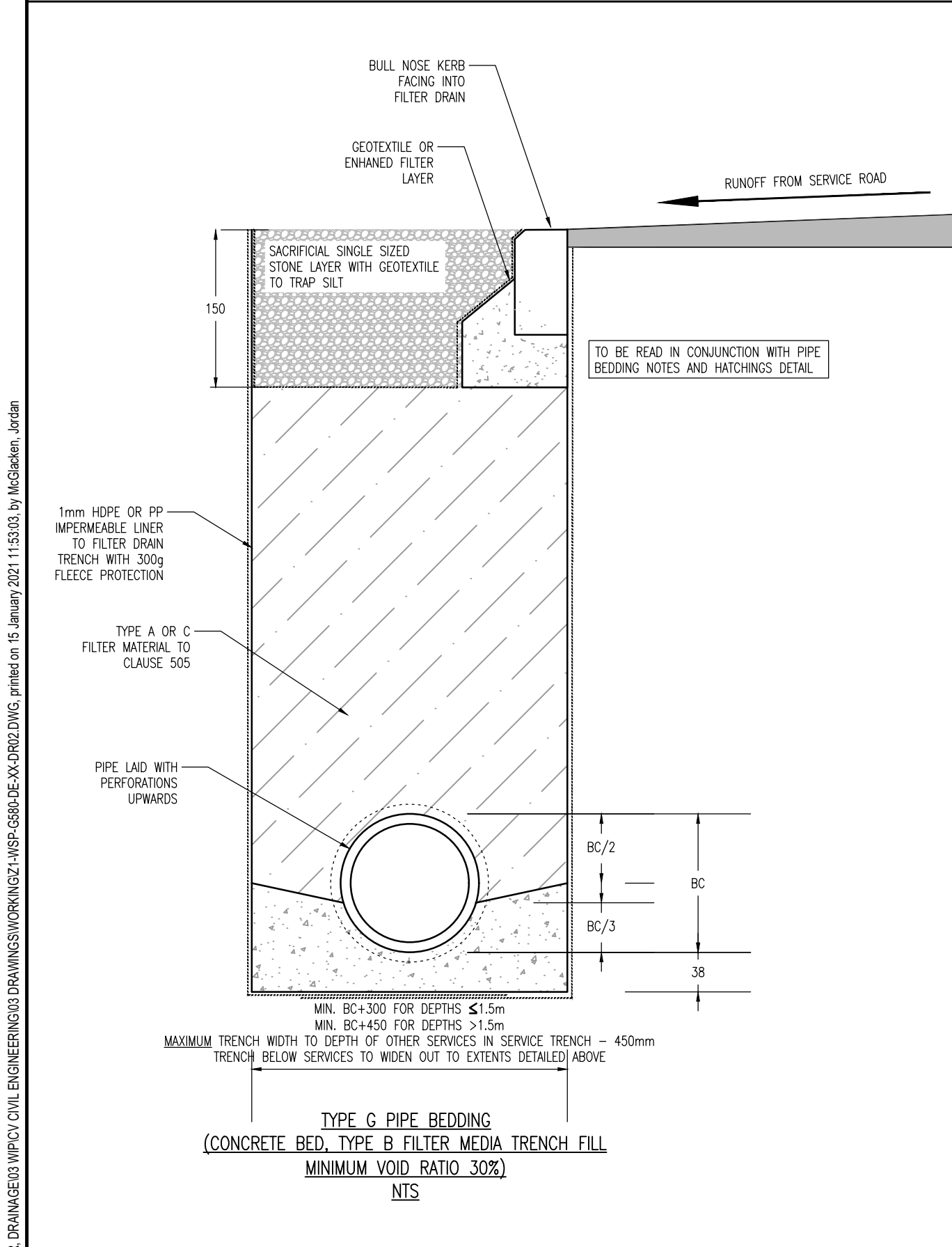
"BC" REFERS TO PIPE OUTER BARREL DIAMETER, EXCLUDING SOCKET SECTIONS

DIMENSION Y		
CLASS	MACHINE DUG UNIFORM SOIL	ROCK OR MIXED SOILS
N.F.B & S	NOTE (i)	NOTE (ii)
A & Z	NOTE (i)	NOTE (ii)

(i) Y=BC/6, WITH MIN 100mm UNDER BARRELS (50mm IF SLEEVE JOINTED) AND MIN 50mm UNDER SOCKETS, WHICHEVER IS THE GREATER

(ii) Y=BC/4, WITH MIN 200 UNDER BARRELS (150 FOR SLEEVE JOINTED) AND MIN 150 UNDER SOCKETS, WHICHEVER IS THE GREATER

DO NOT SCALE

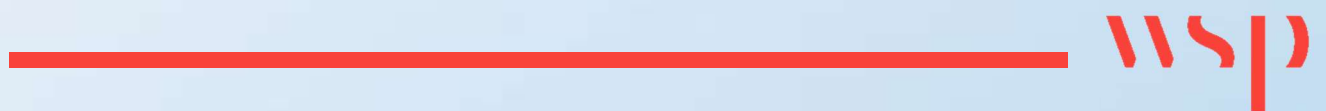


P04	15/01/2021	JAM	FILTER DRAIN HYDRO-BRAKE SPEC UPDATED	SM	SM
P03	11/12/2020	JAM	DETAILS ADDED	SM	SM
P02	23/10/2020	JAM	DETAILS ADDED	SM	SM
P01	02/10/2020	JAM	FIRST ISSUE	SM	SM
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:					
S2 - FOR INFORMATION					
					
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CLIENT: RENAKER BUILD LTD					
ARCHITECT: SIMPSON HAUGH					
SITE/PROJECT: CROWN STREET, ZONE 2					
TITLE: TYPICAL SUSTAINABLE URBAN DRAINAGE (SUDS) CONSTRUCTION DETAILS					
SCALE @ A1:		CHECKED: SM		APPROVED: SM	
PROJECT NO: 70064036		DESIGNED: JAM	DRAWN: JAM	DATE: December 20	
DRAWING NO: Z1-WSP-G580-DE-XX-DR02				REV: P04	
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Appendix B

HYDRAULIC MODELLING RESULTS



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. . .																																			
Date 14/12/2020 08:31	Designed by UKJAG005																																		
File CROWN ST_BLUE ROOF FINA...	Checked by																																		
XP Solutions		Source Control 2019.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.358</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.708 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>5</td> <td>0.708</td> </tr> </tbody> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Shortest Storm (mins)	15	Ratio R	0.358	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	5	0.708
Rainfall Model	FSR	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.750																																
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From:	To:	(ha)																																	
0	5	0.708																																	
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. . .		
Date 14/12/2020 08:31	Designed by UKJAG005	
File CROWN ST_BLUE ROOF FINA...	Checked by	
XP Solutions		Source Control 2019.1

Model Details

Storage is Online Cover Level (m) 32.300

Cellular Storage Structure

Invert Level (m) 32.040 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.85

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	2400.0	0.0	0.201	0.0	0.0
0.200	2400.0	0.0			

Orifice Outflow Control

Diameter (m) 0.124 Discharge Coefficient 0.600 Invert Level (m) 32.040

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. . .		
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File 70064036_CROWN STREET C...	Checked by	
XP Solutions		Network 2019.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.069	0.069	0.069
3.000	-	-	100	0.070	0.070	0.070
1.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.139	0.139	0.139

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

1.002		33.000	30.065	0.000	0	0
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WSP Group Ltd		Page 4
. . .		Micro Drainage
Date 23/10/2020 13:11	Designed by UKJAG005	
File 70064036_CROWN STREET C...	Checked by	
XP Solutions	Network 2019.1	
Online Controls for Storm		
Hydro-Brake® Optimum Manhole: SW 06, DS/PN: 1.002, Volume (m³): 4.1		
Unit Reference MD-SHE-0170-1480-1300-1480 Design Head (m)1.300 Design Flow (l/s)14.8 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)170 Invert Level (m)30.088 Minimum Outlet Pipe Diameter (mm)225 Suggested Manhole Diameter (mm)1500		
Control Points Head (m)Flow (l/s) Design Point (Calculated)1.30014.8 Flush-Flo™0.38914.8 Kick-Flo®0.85412.1 Mean Flow over Head Range-12.8		
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated		
Depth (m)Flow (l/s) Depth (m)Flow (l/s) Depth (m)Flow (l/s) Depth (m)Flow (l/s) 0.1006.0 0.20013.7 0.30014.6 0.40014.8 0.50014.6 0.60014.4 0.80013.0 1.00013.1 1.20014.2 1.40015.3 1.60016.3 1.80017.3 2.00018.2 2.20019.0 2.40019.8 2.60020.6 3.00022.0 3.50023.7 4.00025.3 4.50026.8 5.00028.2 5.50029.5 6.00030.7 6.50032.0 7.00033.1 7.50034.2 8.00035.3 8.50036.4 9.00037.4 9.50038.4		
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WSP Group Ltd		Page 5
		Micro Drainage
Date 23/10/2020 13:11	Designed by UKJAG005	
File 70064036_CROWN STREET C...	Checked by	
XP Solutions	Network 2019.1	
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for Storm

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

```
Margin for Flood Risk Warning (mm) 300.0      DVD Status ON
      Analysis Timestep    Fine Inertia Status ON
      DTS Status          ON
```

Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Water	Surcharged	Flooded	Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		
1.000	SW 06A	30.535	0.104	0.000	0.01	0.6	SURCHARGED	
1.001	DUMMY NODE	30.535	0.147	0.000	0.22	12.6	SURCHARGED	
2.000	AGDR CONNCTN 1	32.123	-0.102	0.000	0.57	20.4	OK	
3.000	AGDR CONNCTN 2	32.124	-0.101	0.000	0.58	20.7	OK	
1.002	SW 06	30.540	0.227	0.000	0.53	14.7	SURCHARGED	

WSP Group Ltd		Page 4
. . .		
Date 15/01/2021 10:34	Designed by UKJAG005	
File 70064036_Crown St, Rear...	Checked by	
XP Solutions		Network 2019.1

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW 06, DS/PN: 1.006, Volume (m³): 3.1

Unit Reference	MD-SHE-0175-1720-1750-1720
Design Head (m)	1.750
Design Flow (l/s)	17.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	175
Invert Level (m)	30.655
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.750	17.2
Flush-Flo™	0.511	17.2
Kick-Flo®	1.093	13.8
Mean Flow over Head Range	-	15.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.2	1.200	14.4	3.000	22.2	7.000	33.4
0.200	14.9	1.400	15.5	3.500	23.9	7.500	34.5
0.300	16.4	1.600	16.5	4.000	25.5	8.000	35.6
0.400	17.0	1.800	17.4	4.500	27.0	8.500	36.7
0.500	17.2	2.000	18.3	5.000	28.4	9.000	37.7
0.600	17.1	2.200	19.2	5.500	29.7	9.500	38.7
0.800	16.5	2.400	20.0	6.000	31.0		
1.000	15.1	2.600	20.8	6.500	32.2		

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Date 15/01/2021 10:34	Designed by UKJAG005	
File 70064036_Crown St, Rear...	Checked by	
XP Solutions		Network 2019.1
<u>Storage Structures for Storm</u>		
<u>Filter Drain Manhole: FD 01, DS/PN: 1.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m) 0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m) 0.100
Safety Factor	2.0	Number of Pipes 1
Porosity	0.30	Slope (1:X) 303.0
Invert Level (m)	32.150	Cap Volume Depth (m) 0.000
Trench Width (m)	0.4	Cap Infiltration Depth (m) 0.000
Trench Length (m)	10.0	
<u>Filter Drain Manhole: DUMMY NODE, DS/PN: 1.002</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m) 0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m) 0.100
Safety Factor	2.0	Number of Pipes 1
Porosity	0.30	Slope (1:X) 306.3
Invert Level (m)	32.110	Cap Volume Depth (m) 0.000
Trench Width (m)	0.4	Cap Infiltration Depth (m) 0.000
Trench Length (m)	49.0	
<u>Filter Drain Manhole: FD 02, DS/PN: 1.003</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m) 0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m) 0.100
Safety Factor	2.0	Number of Pipes 1
Porosity	0.30	Slope (1:X) 386.7
Invert Level (m)	31.950	Cap Volume Depth (m) 0.000
Trench Width (m)	0.4	Cap Infiltration Depth (m) 0.000
Trench Length (m)	29.0	
<u>Filter Drain Manhole: FD 03, DS/PN: 1.004</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m) 0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m) 0.100
Safety Factor	2.0	Number of Pipes 1
Porosity	0.30	Slope (1:X) 400.0
Invert Level (m)	31.875	Cap Volume Depth (m) 0.000
Trench Width (m)	0.4	Cap Infiltration Depth (m) 0.000
Trench Length (m)	3.0	
<u>Filter Drain Manhole: FD 04, DS/PN: 2.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m) 0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m) 0.100
Safety Factor	2.0	Number of Pipes 1
Porosity	0.30	Slope (1:X) 303.3
Invert Level (m)	31.920	Cap Volume Depth (m) 0.000
Trench Width (m)	0.4	Cap Infiltration Depth (m) 0.000
Trench Length (m)	6.3	
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Filter Drain Manhole: FD 05, DS/PN: 2.001

Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.225
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.100
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	295.9
Invert Level (m)	31.824	Cap Volume Depth (m)	0.000
Trench Width (m)	0.4	Cap Infiltration Depth (m)	0.000
Trench Length (m)	9.4		

Cellular Storage Manhole: DUMMY, DS/PN: 3.001

Invert Level (m)	30.655	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	17.0	0.0	1.101	0.0	0.0
1.100	17.0	0.0			

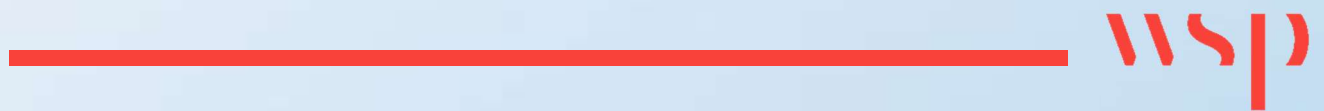
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Area Summary for Storm <table><thead><tr><th>Pipe Number</th><th>PIMP Type</th><th>PIMP Name</th><th>PIMP (%)</th><th>Gross Area (ha)</th><th>Imp. Area (ha)</th><th>Pipe Total (ha)</th></tr></thead><tbody><tr><td>1.000</td><td>-</td><td>-</td><td>100</td><td>0.014</td><td>0.014</td><td>0.014</td></tr><tr><td>1.001</td><td>-</td><td>-</td><td>100</td><td>0.000</td><td>0.000</td><td>0.000</td></tr><tr><td colspan="4"></td><td>Total</td><td>Total</td><td>Total</td></tr><tr><td colspan="4"></td><td>0.014</td><td>0.014</td><td>0.014</td></tr></tbody></table> Simulation Criteria for Storm <table><tbody><tr><td>Volumetric Runoff Coeff</td><td>0.750</td><td>Additional Flow - % of Total Flow</td><td>0.000</td></tr><tr><td>Areal Reduction Factor</td><td>1.000</td><td>MADD Factor * 10m³/ha Storage</td><td>2.000</td></tr><tr><td>Hot Start (mins)</td><td>0</td><td>Inlet Coeffiecient</td><td>0.800</td></tr><tr><td>Hot Start Level (mm)</td><td>0</td><td>Flow per Person per Day (l/per/day)</td><td>0.000</td></tr><tr><td>Manhole Headloss Coeff (Global)</td><td>0.500</td><td>Run Time (mins)</td><td>60</td></tr><tr><td>Foul Sewage per hectare (l/s)</td><td>0.000</td><td>Output Interval (mins)</td><td>1</td></tr><tr><td colspan="2">Number of Input Hydrographs</td><td>0</td><td>Number of Storage Structures</td><td>1</td></tr><tr><td colspan="2">Number of Online Controls</td><td>1</td><td>Number of Time/Area Diagrams</td><td>0</td></tr><tr><td colspan="2">Number of Offline Controls</td><td>0</td><td>Number of Real Time Controls</td><td>0</td></tr></tbody></table> Synthetic Rainfall Details <table><tbody><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>18.000</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.363</td><td colspan="2"></td></tr></tbody></table>						Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)	1.000	-	-	100	0.014	0.014	0.014	1.001	-	-	100	0.000	0.000	0.000					Total	Total	Total					0.014	0.014	0.014	Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000	Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000	Hot Start (mins)	0	Inlet Coeffiecient	0.800	Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000	Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60	Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1	Number of Input Hydrographs		0	Number of Storage Structures	1	Number of Online Controls		1	Number of Time/Area Diagrams	0	Number of Offline Controls		0	Number of Real Time Controls	0	Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.000	Storm Duration (mins)	30	Ratio R	0.363		
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Appendix C

DRAINAGE INSPECTION AND MAINTENANCE SCHEDULE





CROWN STREET - DRAINAGE INSPECTION & MAINTENANCE SCHEDULE

Maintenance Schedule	Required Action	Typical Frequency
Below Ground Drainage Pipes, Manholes, etc		
Regular maintenance	Lift covers and inspect manholes for evidence of debris and silt deposits and evidence of blockages (standing water). Carry out CCTV survey if required	Quarterly
Remedial actions	High pressure jetting and/or remove minor blockages and silt build up	As required – 20% loss of pipe cross-section
	Replace broken access covers, remove major blockages, repair structurally defective pipework	As required
Flow Control Chamber		
Regular maintenance	Lift covers and inspect chamber for evidence of debris and silt deposits and evidence of blockages. Test bypass door operating correctly.	Quarterly
Remedial actions	Replace broken access covers, remove major blockages, repair/replace defective flow control devices	As required
	High pressure jetting and/or remove minor blockages and silt build up	As required
Linear Channel Drains and Gullies		
Regular maintenance	Lift access covers and inspect for silt/debris accumulation	Quarterly
Remedial actions	High pressure jetting and or remove minor blockages and silt build up	As required
	Replace broken access covers, gratings	As required
Rainwater Pipes		
Regular maintenance	Inspect rainwater goods for evidence of leaking pipework	Quarterly
Occasional maintenance	Remove rodding eyes and carry out high pressure jetting to remove any debris	Annually
Remedial actions	Replace cracked/leaking pipework	As required
Filter Drains		
Regular maintenance	Remove litter and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockage	As required
Attenuation tank		
Regular maintenance	The majority of inspection and maintenance requirements are in the flow control downstream of the system.	See above
	Internal inspection and debris removal can be achieved via entry into the attenuation structure via manhole at basement level B1.	As required
Blue Roof Maintenance – Details TBC by Supplier / Manufacturer		



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