

Technical Note 1

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Originated by:	Andy James
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1 Overview

This technical note has been prepared to present the overall strategy, global design philosophies and basic design parameters for the drainage design associated with the erection of 57 No. dwellings at land off Cringle Road, Levenshulme, Greater Manchester.

The document is also intended to support discharge of conditions 7 and 11 of the planning consent and address any queries or concerns raised by the local authority.

2 Proposed Development

The development comprises the construction of 57 No. residential properties on land off Cringle Road, Levenshulme which includes a mixture of 3 and 4-bedroom, two storey, semi-detached and detached units.

Levenshulme is an area of Manchester bordering Fallowfield, Longsight, Gorton, Burnage, Heaton Chapel and Reddish, approximately halfway between Stockport and Manchester city centre. The site itself lies on the boundary of Manchester and Stockport.

The gross development area measures approximately 1.66 hectares and is located on land previously used for stabling, grazing and exercising horses along with a former small community farm occupied by temporary buildings which were used for housing animals.

An outline application for the site was submitted in December 2018 (122042/OO/2018) with permission granted following appeal (APP/B4215/W/19/3230640) in October 2019.

3 Existing Drainage Strategy

ELLUC Projects were commissioned by Towerhouse Systems to prepare the Flood Risk Assessment and develop a drainage strategy which accompanied the outline application.

The proposed surface water drainage strategy, which was reviewed and accepted by the LLFA, was to discharge rainfall generated runoff to the existing public sewer network via a new connection to an existing 300mm diameter surface water sewer in Wilsthorpe Close to the south of the site.

Discharge from the site was to be restricted to an arbitrary greenfield runoff rate of 5.0 l/s/ha. Which across the gross development area equates to a total restricted discharge rate of 8.0 l/s.

Attenuation in the form of oversized pipework and an off-line geocellular attenuation tank, providing a total storage volume of circa 365m³ was proposed. No green SuDS were included in the scheme.

The proposed point of connection and restricted discharge were also accepted by United Utilities.

The following planning condition was included within the planning consent with respect to surface water drainage.

Condition 7

“The development shall not commence until a scheme for the drainage of surface water for the development has been submitted to and approved in writing by the local planning authority. This shall include:

- Details of surface water attenuation that offers a reduction in surface water runoff rate in line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, i.e. at least a 50% reduction in runoff rate compared to the existing rates, as the site is located within Conurbation Core Critical Drainage Area;
- 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;
- 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.
- Hydraulic calculation of the proposed drainage system;
- Construction details of flow control and SuDS elements.

The development shall then be constructed in accordance with the approved details, within an agreed timescale.”

Condition 11

Prior to the first occupation of the development hereby approved, details of the implementation, maintenance and management of the sustainable drainage scheme have been submitted for approval in writing by the local planning authority. For the avoidance of doubt the scheme shall include the following:

- 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.
- The approved scheme for phase one shall then be implemented in accordance with the details and thereafter managed and maintained for as long as the development remains in use.

4 Surface Water Drainage Strategy

DYSE were commissioned to undertake an Engineering Assessment for the development based on the latest masterplan which has been subject to a number of amendments post planning.

The assessment included the development of preliminary highway geometry and plot levels in conjunction with a review and update to the drainage strategy to suit the revised masterplan.

4.1 Pre-Development Surface Water Runoff

It is recognised that a discharge rate of 8.0 l/s has been agreed with the LLFA by ELLUC Projects as part of the previous outline application. However, this is based on an arbitrary 5 l/s/ha and therefore the actual greenfield runoff rate has been calculated using the Institute of Hydrology Report 124 Flood Estimation for Small Catchments (1994) via the greenfield runoff estimation tool on the UK SuDS Website www.uksuds.com.

The IH124 publication provides the essential design elements for determining the estimated Greenfield runoff rate which is based on the site area, soil type, and average annual rainfall, which is influenced by the location of the site within the United Kingdom. This methodology is recommended within the joint DEFRA & Environment Agency Technical Report SC030219 'Rainfall runoff management for development' (2013).

The IOH 124 equation to calculate runoff is:

$$Q_{bar} = 0.00108.AREA^{0.89}.SAAR^{1.17}.SOIL^{2.17}$$

Where:

$$Q_{bar} = \text{Mean Annual Flood (m}^3\text{/s). A return period in the region of 2.3 years.}$$

- Area = The area of the Catchment in km²
- SAAR = Standard Average Annual Rainfall (mm) for the period 1941 to 1970
- SOIL = Soil index value obtained from soil maps in the Flood Studies Report or the WRAP map of the Wallingford Procedure.

The analysis for determining the peak Greenfield discharge rate uses 50 ha in the formula and linearly interpolates the flow rate value based on the ratio of the development to 50ha.

The table below summarises the existing greenfield runoff rates generated by the development for a range of storm return periods.

Gross Area (ha)	Existing Greenfield Runoff (l/s)				Restricted Discharge (l/s)
	Q ₁	Q _{bar}	Q ₃₀	Q ₁₀₀	
1.66	9.03	10.38	17.64	21.58	10.38

Taking the above into consideration, it is intended to restrict development runoff to the Q_{bar} Greenfield Runoff rate of 10.38 l/s subject to agreement with the LLFA.

United Utilities previously agreed to a maximum discharge rate of 56 l/s being drained to the surface water network, as demonstrated by correspondence between ELLUC Projects dated 22nd February 2017. A copy of the correspondence is appended to this report.

4.2 Surface Water Management

There are three methods that have been reviewed for the management and discharge of surface water which are detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority as listed.

- Discharge via infiltration;
- Discharge to watercourse;
- Discharge to public sewerage system.

4.2.1 Discharge via Infiltration

It is understood based on the Phase 1 Geo-Environmental Site Assessment and preliminary intrusive investigations at the site, ground conditions primarily comprise made ground overlying significant depths of very stiff clay.

No infiltration testing has been undertaken at the site however, the recorded ground conditions clearly preclude the disposal of surface water from the development by infiltration

Taking the above into consideration, the method of surface water management has not been considered further.

4.2.2 Discharge to Watercourse

The nearest available watercourse to the development is Black Brook which is located circa 135m to the south of the site. Beyond the residential properties of Wilsthorpe Close.

There is no direct route to this watercourse as it is protected by the surrounding residential properties. A potential route exists along a footpath to the east of Wilsthorpe Close however this would require circa 250m of off-site connection through third party land outside of the control of the client.

Taking the above into consideration this option has not been considered further.

4.2.3 Discharge to Public Sewer

United Utilities sewer records indicate that the area surrounding the site is served by both foul and surface water sewers. Immediately adjacent to the proposed site access junction is a 300mm diameter surface water sewer which starts in Wilsthorpe Close and flows southward where it is understood to discharge to Black Brook.

A drainage survey has been undertaken by Invek Surveys which has established the invert level at 63.09mAOD.

Taking the above into consideration, and on the basis that both discharge via infiltration and direct to watercourse are not considered feasible, it is intended to discharge development runoff to the public surface water sewer network. This is in accordance with the previously drainage strategy developed by ELLUC Projects which was agreed in principle with the LLFA and United Utilities.

4.3 Restricted Discharge Rate

As indicated in 4.1 above, the pre-development greenfield runoff rate (Q_{bar}) has been calculated as 10.38 l/s which is a slight increase over the arbitrary 5l/s/ha previously agreed with the LLFA by ELLUC Projects.

The Manchester City Council LLFA guidance document 'SuDS Requirements for New Developments 2019' specifically references the DEFRA document 'The Non-Statutory Technical Standards for SuDS' and advises that drainage systems should be developed in line with this document and local policies DM1, EN08, EN14 and EN17 of the Core Strategy.

The DEFRA document advises the following with respect to 'Peak Flow Control' and 'Volume Control'.

S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.

S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

It is technically feasible within the DEFRA guidance document to restrict run-off from the site to the Q1 and Q100 greenfield runoff rate. However, by doing so would necessitate compliance with the runoff volume requirements S4 and S5 detailed above.

Given the constraints of the site this would be very difficult to achieve and therefore it is intended to restrict discharge to the existing Qbar rate of 10.38 l/s. This would ensure that surface water runoff from the development would be in line with the existing scenario and a betterment would be provided for larger return periods.

This represents a small increase over the previously agreed 8.0 l/s discharge rate.

4.4 Sustainable Drainage Systems

Current policy and best practice encourages the use of Sustainable Drainage Systems (SuDS) and in particular, infiltration systems.

As noted above, whilst permeability testing has not been undertaken, ground conditions at the site generally comprise made ground overlying heavy clays and therefore infiltration-based SuDS solutions are not considered to be technically viable.

Other non-infiltration techniques such as the use of swales and detention basins have been considered within the development of the drainage strategy however, space constraints within the masterplan do not permit the use of such solutions and it would not be commercially viable to reduce the number of residential units on the site to incorporate.

Furthermore, during discussions with planners at the council, there was a desire expressed that the development should not incorporate any open areas of shared land or visitor parking areas which severely limits any space available to introduce dry detention basins and such like for surface water attenuation.

Taking this into consideration, the proposed drainage scheme incorporates traditional drainage measures in the form of oversized pipework and an offline below ground attenuation tank to provide the required volume of attenuation.

Non-infiltration-based SuDS measures such as permeable driveways have been incorporated into each development plot and where possible, roof run-off is piped into these to help provide further attenuation and water quality benefits.

Finally, three number bio retention planters have been incorporated into the proposed highway network which will drain a significant portion of impermeable surface area. Again, this will provide both attenuation and water quality benefits.

4.5 Surface Water Drainage Strategy

As described above, the hierarchy for surface water disposal, as set out in Part H of the Building Regulations and the NPPF indicates that priority should be given to the use of infiltration systems, second priority to discharge to a watercourse and third priority to discharge to the public sewer.

However, the only practicable solution for the development is considered to be a discharge to the public surface water sewer system immediately adjacent to the site.

It is intended that discharge will be restricted to the pre-development greenfield runoff rate Q_{bar} which has been calculated at 10.38 l/s. This will be subject to agreement with the LLFA and United Utilities.

Based on the topography of the site and the relatively shallow nature of the surface water sewer some raising of site levels will be required to achieve a gravity connection.

The proposed restricted discharge rate and development runoff generated by proposed impermeable areas results in a storage requirement during periods of intense rainfall. This is intended to be accommodated through oversized pipework up to 0.9m diameter within the development access road and an off-line geocellular attenuation tank providing a further 107m³ of storage for storm events beyond the 30-year return period.

This storage volume is primarily to serve the proposed highway areas as further storage is provided on a plot level basis within the permeable driveways which are restricted by means of an orifice control manhole to a maximum 2 l/s discharge.

It is intended that the off-line geocellular tank and on plot surface water drainage systems will remain in private ownership with a suitable maintenance regime put in place with a management company. The proposed oversized pipework within the carriageway will be offered for adoption to United Utilities through a S104 agreement.

4.6 Climate Change

There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall.

The table below shows anticipated changes in extreme rainfall intensity in small and urban catchments. The Environment Agency recommend both the central and upper end allowances are assessed to understand the range of impact.

The proposed drainage design will be based on a 30% increase in peak rainfall in accordance with the ELLUC Projects FRA which was submitted with the consented application.

A further check of the drainage system will be made for a 40% increase in peak rainfall. However, should flooding occur this will only be catered for within the site levels to ensure it can safely follow exceedance flow paths and will not impact on development plots or adjacent third-party land. It will not be accommodated within the proposed attenuation systems.

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

4.7 Performance Criteria

The preliminary below ground surface water drainage network has been designed to satisfy the following performance criteria.

- No surcharging of pipes for the critical 1 in 2 year storm event;
- No flooding of the network for the critical 1 in 30 year storm event
- No flooding to areas that could impact on buildings for storm events up to the 100 year plus 30% climate return period.

The critical storm event has been determined based on the maximum water level within each pipe/ manhole resulting from storm durations ranging from 15 minutes to 24 hours.

4.8 Design Criteria

The following design criteria has been used for the design of the surface water drainage network.

M₅₋₆₀ (mm)	18.00
Rainfall Ratio (R)	0.360
Global Time of Entry (min)	4.0
Max. Rainfall (mm/hr)	100
Max. Time of Concentration (mm)	30
PIMP (%)	100
Volumetric Run-off Coeff. (Cv)	0.75
Min. Velocity (m/s)	1.0

Pipe Roughness (mm)	0.6
Climate Change Allowance	30%

4.9 Catchment Areas

Impermeable catchment areas considered within the surface water drainage system have been measured from the development masterplan and apportioned as required to suit proposed finished levels.

The total drained area has been measured as 0.911ha which includes a 10% allowance for Urban Creep in accordance with current best practice.

4.10 Hydraulic Design

Microdrainage has been used to design the proposed network including permeable pavements and end of pipe geocellular attenuation structure.

The system satisfies the performance criteria identified above and is able to retain all surface water below ground for the 100 year +30% return period.

Some flooding (21.4m³) occurs at the control manhole S1.28 during the 100 year +40% return period. This would leave site and be contained within the highway network, draining back into the United Utilities surface water drainage system via the existing road gully's.

The tables below summarise the critical storm events by maximum level for each return period considered within the design.

Whilst other pipes have been modelled to represent the permeable pavements and associated control chambers, the pipes highlighted below comprise the main adoptable system within the carriageway alongside the overflow to the attenuation tank.

Pipe Number	US/MH	Critical Event	Water Level (m)	Pipe Flow (l/s)
1.002	1.2	15 min 2 year Winter	63.910	14.7
1.003	1.4	120 min 2 year Winter	63.899	6.3
1.004	1.6	120 min 2 year Winter	63.899	7.7
1.005	1.8	120 min 2 year Winter	63.898	9.5
1.006	1.11	120 min 2 year Winter	63.898	17.1

8.002	1.13	120 min 2 year Winter	63.898	0.4
8.003	1.15	120 min 2 year Winter	63.898	1.3
1.007	1.18	120 min 2 year Winter	63.898	13.8
12.002	1.21	120 min 2 year Winter	63.898	7.4
1.008	1.22	120 min 2 year Winter	63.898	12.9
1.009	1.24	120 min 2 year Winter	63.897	12.6
15.000	TANK	15 min 2 year Winter	-	0.0
15.001	1.25	15 min 2 year Winter	-	0.0
1.010	1.26	120 min 2 year Winter	63.897	11.9
1.011	1.28	120 min 2 year Winter	63.896	10.4

2 Year Return Period Critical Summary of Results

Pipe Number	US/MH	Critical Event	Water Level (m)	Pipe Flow (l/s)
1.002	1.2	120 min 30 year Winter	64.281	9.6
1.003	1.4	120 min 30 year Winter	64.281	8.8
1.004	1.6	120 min 30 year Winter	64.281	9.8
1.005	1.8	120 min 30 year Winter	64.281	11.9
1.006	1.11	120 min 30 year Winter	64.281	23.4

8.002	1.13	120 min 30 year Winter	64.281	0.6
8.003	1.15	120 min 30 year Winter	64.281	1.3
1.007	1.18	120 min 30 year Winter	64.281	14.8
12.002	1.21	120 min 30 year Winter	64.280	14.4
1.008	1.22	120 min 30 year Winter	64.280	14.0
1.009	1.24	120 min 30 year Winter	64.280	13.8
15.000	TANK	120 min 30 year Winter	-	0.0
15.001	1.25	15 min 30 year Winter	-	0.0
1.010	1.26	120 min 30 year Winter	64.279	12.9
1.011	1.28	120 min 30 year Winter	64.279	10.4

30 Year Return Period Critical Summary of Results

Pipe Number	US/MH	Critical Event	Water Level (m)	Pipe Flow (l/s)
1.002	1.2	240 min 100 year Winter +30%	64.949	9.7
1.003	1.4	240 min 100 year Winter +30%	64.949	12.8
1.004	1.6	240 min 100 year Winter +30%	64.949	15.2
1.005	1.8	240 min 100 year Winter +30%	64.949	18.8
1.006	1.11	240 min 100 year Winter +30%	64.950	31.6

8.002	1.13	240 min 100 year Winter +30%	64.950	2.2
8.003	1.15	240 min 100 year Winter +30%	64.950	5.0
1.007	1.18	240 min 100 year Winter +30%	64.950	47.6
12.002	1.21	240 min 100 year Winter +30%	64.949	14.8
1.008	1.22	240 min 100 year Winter +30%	64.949	59.8
1.009	1.24	240 min 100 year Winter +30%	64.948	62.6
15.000	TANK	240 min 100 year Winter +30%	64.948	7.2
15.001	1.25	240 min 100 year Winter +30%	64.948	7.3
1.010	1.26	240 min 100 year Winter +30%	64.948	12.0
1.011	1.28	240 min 100 year Winter +30%	64.947	10.4

100 Year +30% Return Period Critical Summary of Results

Pipe Number	US/MH	Critical Event	Water Level (m)	Pipe Flow (l/s)
1.002	1.2	240 min 100 year Winter +40%	65.124	10.4
1.003	1.4	240 min 100 year Winter +40%	65.124	15.1
1.004	1.6	240 min 100 year Winter +40%	65.124	17.9
1.005	1.8	240 min 100 year Winter +40%	65.124	22.1
1.006	1.11	240 min 100 year Winter +40%	65.124	37.3

8.002	1.13	240 min 100 year Winter +40%	65.124	4.1
8.003	1.15	240 min 100 year Winter +40%	65.124	5.9
1.007	1.18	240 min 100 year Winter +40%	65.124	56.2
12.002	1.21	240 min 100 year Winter +40%	65.123	15.6
1.008	1.22	240 min 100 year Winter +40%	65.123	70.5
1.009	1.24	240 min 100 year Winter +40%	65.123	73.9
15.000	TANK	240 min 100 year Winter +40%	65.122	6.9
15.001	1.25	240 min 100 year Winter +40%	65.122	7.0
1.010	1.26	240 min 100 year Winter +40%	65.122	22.0
1.011	1.28	240 min 100 year Winter +40%	65.121	10.4

100 Year +40% Return Period Critical Summary of Results

5 LLFA Correspondence & Comments on Design

Initial consultation was undertaken with the LLFA prior to detailed design. An engineering assessment was completed which developed preliminary site levels and drainage proposals in line with the ELLUC drainage scheme that was consented at planning stage.

The following comments were received from the LLFA in respect to this submission.

1. Pursuant to Manchester's Core Strategy, Manchester City Council recognises the importance of green infrastructure and preservation of green spaces, and as such is required to build at least 90% of new houses on brownfield sites. When an applicant chooses to select greenfield land for their development application, they are expected to maximise retention of the greenfield characteristics through green infrastructure. This is stipulated in Policy EN 9 and is also stated in the Appeal Decision. While the Appeal Decision recognises the commitment to preserving green infrastructure pursuant to EN 9 with respect to the nearby Country Park, this does not negate the importance of applying EN 9 to the proposed site itself.

2. Infiltration testing is required on site as per the industry-standard Drainage Hierarchy. The applicant was also advised of this in the email response and attached developers' guidance issued by the LLFA on 28/08/2020. Conclusions cannot be drawn from desktop study or preliminary intrusive investigations without specific investigation into permeable strata at various depths and testing to BRE 365 standard. Infiltration as a discharge mechanism would best mimic the current drainage regime of the greenfield site and as such it will need to be extensively investigated before we are satisfied that the development's drainage mechanism can progress through the Hierarchy.
3. With regards to investigation into discharge to a proximal watercourse as per the hierarchy, we would typically advise the applicant to initiate discussions with the 3rd party landowner to make such a connection. However, in this case we are satisfied that, as a last resort, discharge into the surface water sewer would be acceptable on the premise that you present us with confirmation that it drains to the Black Brook.
4. Volume control is required as per the government-issued Non-Statutory Technical Guidance for SuDS and as advised in the developers' pack issued 22/08/2020. In the event that discharge is via the surface water sewer into the Black Brook, volume control will be required as per the national guidance and developer's pack. Prolonged peak flows during storm events can damage watercourse geomorphology and increase flood risk to 3rd party properties along the watercourse. It is not acceptable for the development of this greenfield site to omit volume control.
5. The applicant was made aware of the need to consider green SuDS by the email response and the attached developers' guidance issued by the LLFA on 28/08/2020. As the applicant has selected a greenfield site to develop, green SuDS solutions would best mimic the current natural drainage components of the greenfield site. The possibility of implementing green SuDS is unlikely to be restricted by the presence of contaminated land often found on brownfield sites in Manchester. Green SuDS components offer mechanisms to achieve volume reduction in line with the required volume control through bioretention and infiltration. Engineered soils can also be implemented to enhance infiltration in bioretentive components. There are a range of suitable components to suit every development; and the applicant is encouraged to review the Ciria SuDS Manual C753.

The following response was submitted by DYSE in respect of the above along with a SuDS strategy sketch.

1. The policy and decision is duly noted. However, it should be recognised that during the pre-app consultation process the LPA requested that no incidental shared / open space in the form of visitors parking areas or green public open space should be provided within the scheme. This severely restricts the opportunity to provide green SuDS infrastructure.
2. The Ground Investigation Report has stated that 'The information available from this ground investigation indicates that traditional soakaways are unlikely to be suitable for

use on this site due to low permeability/infiltration rate of the cohesive deposits present and the presence of relatively high groundwater levels. The sand horizons present within the clays are irregular and discontinuous and consequently unlikely to provide sustainable infiltration properties. The viability and sustainability of traditional soakaways on this site will be limited.'

The ground investigation report is summarised to this document. Based on the findings of the ground investigation report, infiltration is not deemed viable.

Should BRE 365 testing be required, we would be happy to undertake testing and provide the results.

3. Noted. Please see appended United Utilities asset records confirming that the surface water drainage discharges to Black Brook.
4. As stated in the SuDS Manual, an alternative approach to managing the extra runoff volume from extreme events separately from the main drainage system is to release ALL runoff from the site at a maximum rate of either 2 l/s/ha OR Q_{bar} ; whichever is higher.

Given the constraints of the site, it is not practicable to provide additional long-term storage and therefore by restricting the site discharge to Q_{bar} , the development automatically complies with the runoff volume requirement.

This approach is a generally accepted industry standard in the UK.

5. As advised under Response 1 above, during the pre-app consultation process the LPA requested that no incidental shared / open space should be provided within the scheme. This severely restricts the opportunity to provide significant green SuDS infrastructure as requested. The green SuDS included predominantly provides water quality benefits whilst slowing run off.

We have considered a number of available SuDS options in consultation with our client and detail these below with justification for provision/ non-provision.

Consideration of SuDS within the constraints of a dense urban environment	
Element	Viability
Green roofs rather than standard roof construction.	The roofs to the houses are pitched and are therefore not suitable for green roofs.
Runoff harvesting in tanks for non-potable use within buildings, such as toilet flushing.	The cost of implementing non-potable runoff harvesting within buildings on this scheme is not commercially viable.

Landscape irrigation and urban horticulture.	The cost of implementing harvesting for irrigation for the size of buildings and gardens within this scheme is not commercially viable.
Rainwater harvesting as a resource for water features and recreational play areas.	There are no shared spaces within the scheme.
Use of permeable surfaces and/or sub-bases.	The use of infiltration is not viable owing to the expected poor percolation of the clay ground conditions. However, non-infiltration based permeable driveways are proposed to each plot. Run-off from roof areas will also be piped to these and each will be restricted to 2l/s to provide attenuation alongside water quality benefits
Use of bioretention systems, open water amenity features and tree pits.	Within the scope of the scheme there is no shared space for inclusion of open water amenity features e.g. attenuation ponds, detention basins etc. However, it is intended that a number of tree pits/ bio-retention areas will be introduced into the scheme which will intercept some run-off from the highway. It should be noted that this will be subject to agreement with the Local Highway Authority who will need to adopt and maintain these features in conjunction with the traditional drainage measures i.e. road gully's.
Inclusion of tree pits, landscaping planters, rain gardens, bioretention systems or swales provide storage and treatment of runoff.	The site levels make the use of swales challenging. Their space requirements would also result in the reduction to the number of proposed properties which would affect the commercial viability of the site. As indicated above, a number of bio-retention areas will be introduced into the adopted highway to intercept areas of proposed highway. Subject to agreement with the Local Highway Authority.
Front or back gardens to be designed as bioretention planters to capture roof runoff or configured to include rainwater harvesting systems.	As indicated above, rainwater harvesting systems are not considered to be viable for the development Green roofs are also not considered viable. Roof run-off to be piped to permeable pavement sub-base to provide attenuation and water quality benefits.
Flow control devices included to store water and/or provide treatment in confined spaces.	The scheme proposed does include for a flow control device to restrict run-off to the pre-development scenario. Given the constraints of the site, an offline storage tank is proposed in lieu of any surface level SuDS solutions. Further attenuation and control is provided on a plot level basis through the permeable driveways.

This information was submitted to the LLFA (Laura Peacock) who responded on the 26th January 2021 stating:

“Many thanks for the detail and attached proposal. On this basis, I am satisfied that the green SuDS has been maximised and can proceed to technical design.”

Subsequent to completion of the detailed design, a package of drawings and calculations were submitted to the LLFA to support the discharge of conditions 7 and 11 as described in Section 3 of this document.

The following response was received from the LLFA:

1. Please provide a drainage strategy report/technical note for the submitted scheme.
2. Section 104 drawing // calcs indicate flow control 10.38 l/s; prev. submitted strategy (attached) during LLFA discussions was 2 l/s. Please explain within report/technical note.
3. Please present evidence of UU acceptance of proposed connection (if using previously obtained consent, please check in-date).
4. Prev. submitted strategy indicated simulation would be to 40% CC (attached). We would recommend that the simulation is run for 40% climate change (not 30%) to test the upper band in line with current guidance.

DYSE response to the above queries is as follows:

1. It is intended that this revised Technical Note will be used to close out the queries from the LLFA above and discharge the planning conditions.
2. The previously submitted Technical Note (Revision P01) and accompanying engineering assessment both made reference to a greenfield run-off rate of 10.38 l/s (Qbar). This is in accordance with local and national standards. Any reference to 2 l/s as a fixed discharge rate is in error. It would not be practicable to provide the necessary level of attenuation should discharge from the site be restricted to such a low figure.

We have complied with the necessary technical standards in setting the sites discharge to 10.38 l/s and this is the figure we seek approval to.

3. A copy of United Utilities correspondence consenting to the connection to the public sewer network up to a maximum discharge rate of 56 l/s is appended to this document.
4. The consented drainage strategy developed by ELLUC Projects alongside the subsequent DYSE engineering assessment and previous version of this report all made reference to a 30% allowance for climate change. The proposed design therefore has been based on this figure and demonstrates that all run-off is contained below ground without any surface flooding.

However, in line with the LLFA's request, the drainage model was also run with a 40% allowance for climate change. This resulted in circa 21m³ of flooding at the control chamber (S1.28) which is positioned at the boundary of the site,

This exceedance flow would not pose a risk to any property and would follow the highway corridor, entering the public sewer system via the existing road gullies.

6 Drainage Maintenance Strategy

The proposed drainage system for the development adopts a series of traditional drainage techniques to control the rate of surface water discharge. It is important that these are maintained to ensure that all elements operate effectively for their lifetime.

Maintenance is a necessary and important consideration of drainage design. If systems are properly monitored and maintained, any deterioration in performance can often be managed out.

Effective maintenance will help to ensure that the drainage system continues to function as intended and keep hydraulic capacity and pollutant removal efficiency of the systems at design levels.

The table below provides an overview on maintenance and management requirements for the drainage features proposed within the development.

Drainage Feature		Action Required	Typical Frequency
Gully's & Channels	Occasional Maintenance	Inspect cover and frame for any defects, repair and replace as necessary.	Quarterly
		Inspect channels for the build-up of silt and debris. Removal of silt and debris by means of vacuum suction and or jetting/ rodding.	
		Inspect sumps and outgoing pipework for the build-up of silt and debris. Removal of silt and debris by means of vacuum suction and or jetting/ rodding.	
Manholes/ Catchpits	Occasional Maintenance	Inspect chamber cover and frame for any defects, repair and replace as necessary.	Quarterly
		Inspect chamber interior and incoming/ outgoing pipes for the build-up of silt and debris. Removal of silt and debris by	

		means of vacuum suction and or jetting/rodding. Ensure manhole access steps/ ladders are secured and inspect for corrosion.	
Permeable Surfaces	Regular Maintenance	Remove litter (including leaf litter) and debris from the surface,	Monthly or as required
		Inspect permeable surfacing for clogging/ dirt/ silt/ weeds and clean any areas as necessary.	3 monthly or as required
	Occasional Maintenance	Make good any defects to the surface ensuring consistent even gradients	As required
		Check outfall structure to ensure it is free from blockage and operating as intended	6 monthly
Geocellular Attenuation	Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial actions	Monthly for 3 months then annually.
		Remove debris from the catchment surface i.e. hardstanding areas	Monthly
		Remove sediment from inlet manhole	Annually or as required
	Occasional Maintenance	Repair/ rehabilitate inlets, outlet, overflows and vents	As required
		Inspect/ check all inlets, outlets, vents and overflows to ensure they are in good conditions and operating as designed.	Annually
		Survey inside of tank for sediment build-up and remove if necessary	As required
Flow Control Devices	Regular Maintenance	Normally, little maintenance is required as there are no moving parts within the device. However, it is recommended that the unit should be inspected for debris or blockages	Monthly for 3 months then 6 monthly

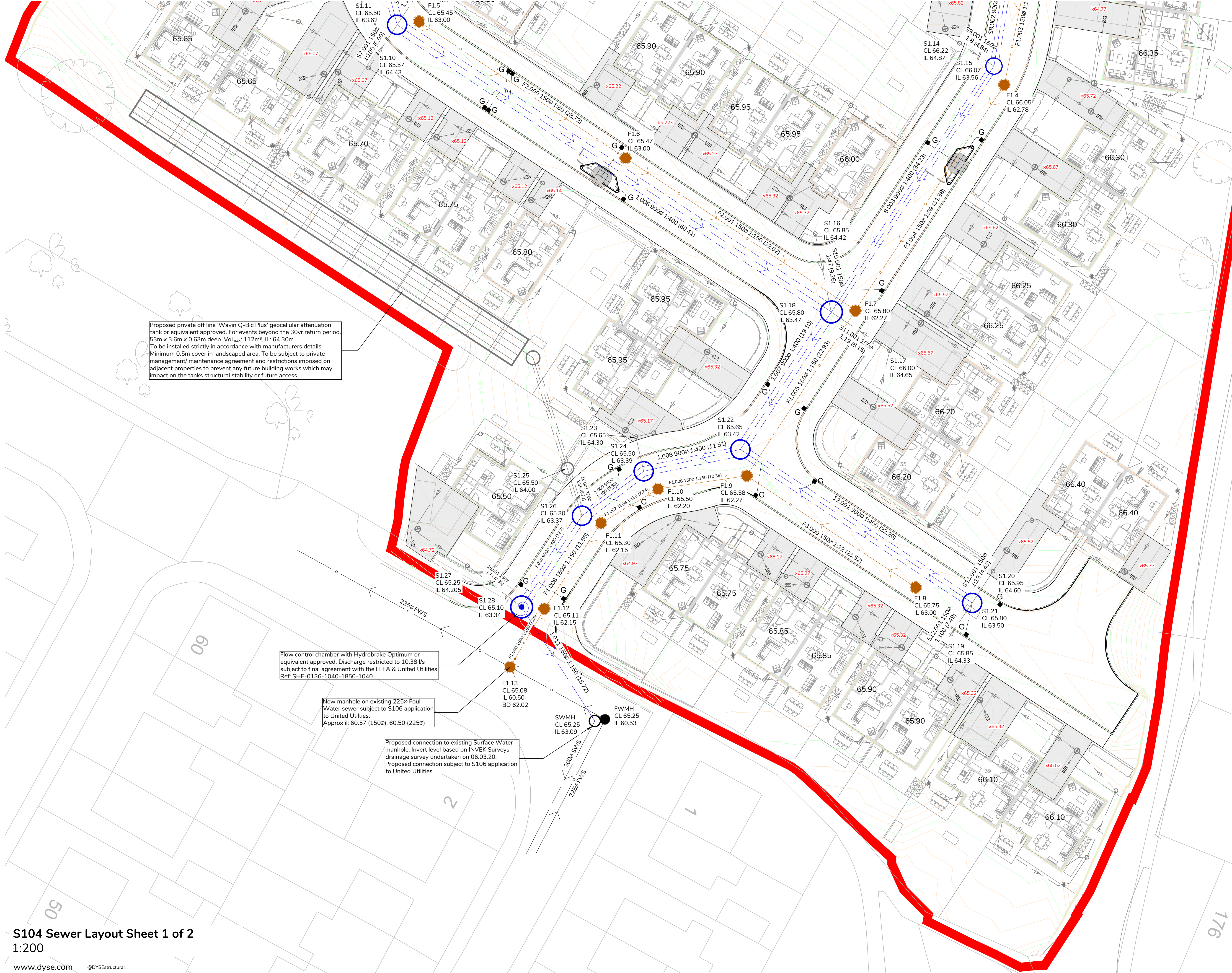
It is intended that piped drainage systems within the adopted highway areas on site will be offered for adoption to United Utilities through S104 of the Water Industry Act. In their duty

as a statutory undertaker they will be responsible for the maintenance of the drainage systems throughout the site.

The bio-retention features will be adopted by the local highway authority as part of the S38 agreement.

Any private drainage e.g. the attenuation tank and plot level drainage systems, will be the responsibility of a private management company put in place by the client. The residents at the site will all contribute to the ongoing costs associated with this.

Appendix A - S104 Drainage General Arrangement



Proposed private off line 'Wavin Q-Bic Plus' geocellular attenuation tank or equivalent approved. For events beyond the 30yr return period. 53m x 3.6m x 0.63m deep. Volume: 112m³. IL: 64.30m. To be installed strictly in accordance with manufacturers details. Minimum 0.5m cover in landscaped area. To be subject to private management/ maintenance agreement and restrictions imposed on adjacent properties to prevent any future building works which may impact on the tanks structural stability or future access

Flow control chamber with Hydrobrake Optimum or equivalent approved. Discharge restricted to 10.38 l/s subject to final agreement with the LLFA & United Utilities Ref: SHE-0136-1040-1850-1040

New manhole on existing 2250 Foul Water sewer subject to S106 application to United Utilities. Approx il: 60.57 (1500), 60.50 (2250)

Proposed connection to existing Surface Water manhole. Invert level based on INVEK Surveys drainage survey undertaken on 06.03.20. Proposed connection subject to S106 application to United Utilities

Residual Risks

These drawings should be read in conjunction with the designer's risk assessment (DRA) which communicates significant residual design risks that have been identified and suggests mitigating actions.

General Notes

- All dimensions are in metres unless stated otherwise.
- This drawing shall be read in conjunction with all other relevant engineering details, drawings and specifications.
- Any discrepancies should be reported to the engineer immediately so that clarification can be sought prior to the commencement of work.
- All work is to be carried out in accordance with the specification for highways works and local authority guidance.
- Underground services may be present in the area. Contractor is to confirm the precise line and depth of any services prior to the commencement of any excavation works

Legend

- Site Boundary
- Proposed Major Contour 250mm intervals
- Proposed Minor Contours 50mm intervals
- S104 Surface Water Sewer
- S104 Surface Water Manhole
- S104 Foul Water Sewer
- S104 Foul Water Manhole
- Existing Surface Water Sewer
- Existing Foul Water sewer
- Private Surface Water Drain
- Private Foul Water Drain
- 3000 Mini Access Chamber
- 4500 Inspection Chamber
- 6000 RIDGISTORMcheck Orifice Control Chamber. 2/s MAX
- Rodding Eye
- Surface Water Drainage Channel
- Polypipe Permavoid Rainwater Diffuser Unit
- Permeable Car Park with min 350mm Subbase Storage
- S38 Road Gully

P03	25/01/22	Pipe No's S1.005 & S.0006 corrected.	ARJ	BKD	JDY	JDY
P02	12/01/22	MH references corrected	ARJ	BKD	JDY	JDY
P01	14/12/21	First issue	ARJ	BKD	JDY	JDY
Rev	Date	Description	Drw	Chk	Rev'd	App

Status:

Preliminary

Client:

Towerhouse Systems

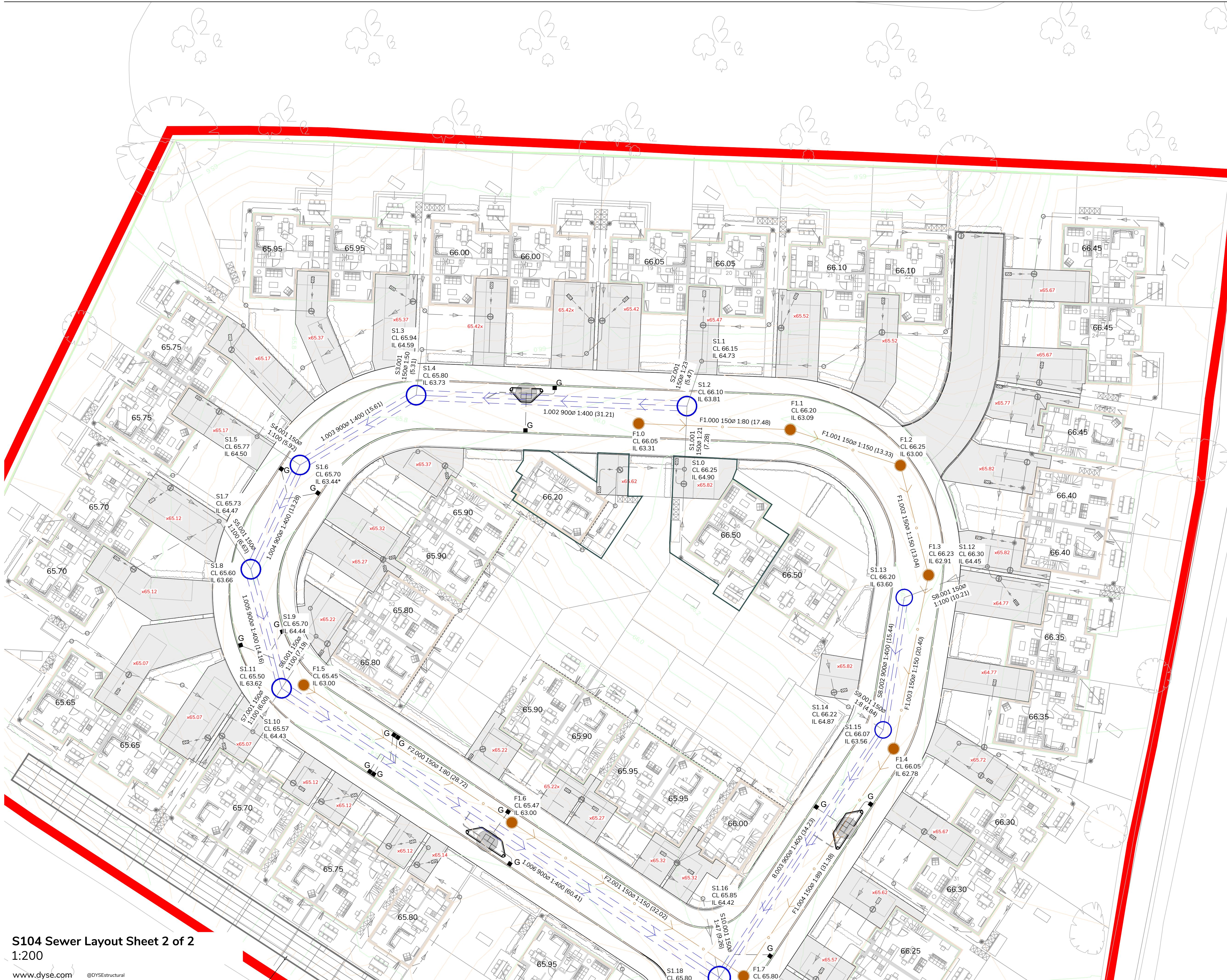
Project:

Cringle Road
Manchester

Drawing:

S104 Sewer Layout
Sheet 1 of 2

Drawing Number: LM20066-DYSE-XX-ZZ-DR-C-1120
Revision: P03



Residual Risks

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- 4. All work is to be carried out in accordance with the specification for highways works and local authority guidance.
- 5. Underground services may be present in the area. Contractor is to confirm the precise line and depth of any services prior to the commencement of any excavation works

Legend

- Site Boundary
- Proposed Major Contour 250mm intervals
- Proposed Minor Contours 50mm intervals
- S104 Surface Water Sewer
- S104 Surface Water Manhole
- S104 Foul Water Sewer
- S104 Foul Water Manhole
- Existing Surface Water Sewer
- Existing Foul Water sewer
- Private Surface Water Drain
- Private Foul Water Drain
- 300Ø Mini Access Chamber
- 450Ø Inspection Chamber
- 600Ø RIDGISTORMcheck Orifice Control Chamber. 2½s MAX.
- Rodding Eye
- Surface Water Drainage Channel
- Polypipe Permavoid Rainwater Diffuser Unit
- Permeable Car Park with min 350mm Subbase Storage
- S38 Road Gully

P03	25/01/22	Pipe No's S1.005 & S.0006 corrected.	ARJ	BKD	JDY	JDY
P02	12/01/22	MH references corrected	ARJ	BKD	JDY	JDY
P01	14/12/21	First issue	ARJ	BKD	JDY	JDY
Rev	Date	Description	Drw	Chk	Rev'd	App

Status:

Preliminary

Client:

Towerhouse Systems

Project:

Cringle Road
Manchester

Drawing:

S104 Sewer Layout
Sheet 2 of 2

Drawing Number:
LM20066-DYSE-XX-ZZ-DR-C-1121

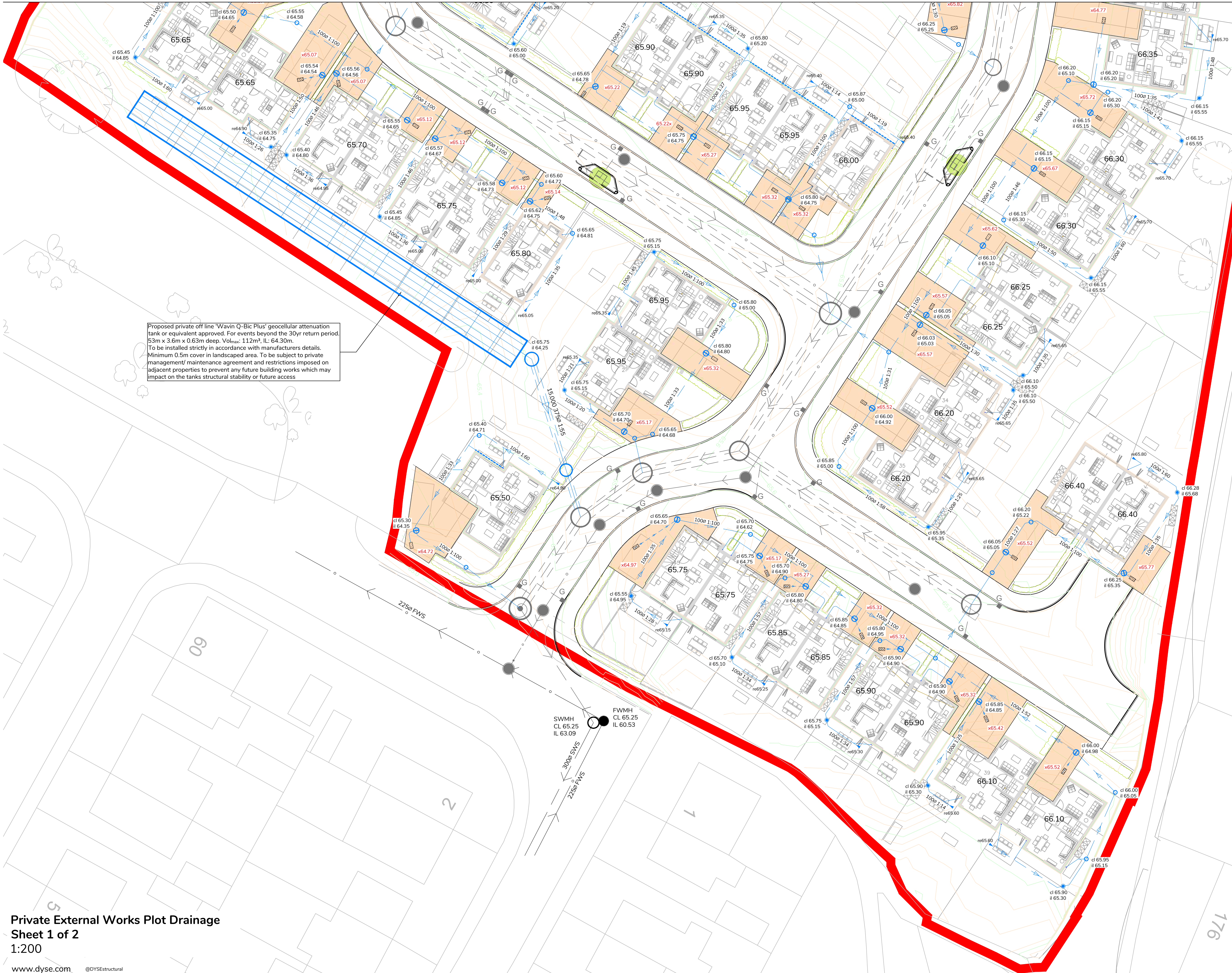
Revision:
P03



Appendix B - Surface Water Plot Drainage

Private External Works Plot Drainage
Sheet 1 of 2
1:200

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Residual Risks

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General Notes

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- All work is to be carried out in accordance with the specification for highways works and local authority guidance.
- Underground services may be present in the area. Contractor is to confirm the precise line and depth of any services prior to the commencement of any excavation works.
- Subbase depth of 350mm is the minimum required for loading, ground conditions and attenuation. Formation to be laid flat and therefore subbase depth will vary to suit proposed driveway gradients.

Legend

- Site Boundary
- Proposed Major Contour
250mm intervals
- Proposed Minor Contours
50mm intervals
- S104 Surface Water Sewer
- S104 Surface Water Manhole
- S104 Foul Water Sewer
- S104 Foul Water Manhole
- Existing Surface Water Sewer
- Existing Foul Water sewer
- Private Surface Water Drain
- Private Foul Water Drain
- 3000 Mini Access Chamber
- 4500 Inspection Chamber
- 6000 RIDGISTORMcheck Orifice
Control Chamber, 2/s MAX.
- Rodding Eye
- ACO Rain Drain
Surface Water Drainage Channel
- Polypipe Permavoid Rainwater
Diffuser Unit (1062x708x150mm)
- Permeable Driveway with min
350mm Subbase Storage
- Permeable Driveway
Subbase Formation Level
- S38 Road Gully

P01	17/12/21	First Issue	ARJ	BKD	JDY	JDY
Rev	Date	Description	Drw	Chk	Rev	App

Status:

Preliminary

Client:

Towerhouse Systems

Project:

Cringle Road
Manchester

Drawing:

Private External Works
Plot Drainage
Sheet 1 of 2

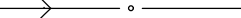
Drawing Number: LM20066-DYSE-XX-ZZ-DR-C-1130 P01

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General Notes

1. All dimensions are in metres unless stated otherwise.
2. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specifications.
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4. All work is to be carried out in accordance with the specification for highways works and local authority guidance.
5. Underground services may be present in the area. Contractor is to confirm the precise line and depth of any services prior to the commencement of any excavation works.
6. Subbase depth of 350mm is the minimum required for loading, ground conditions and attenuation. Formation to be laid flat and therefore subbase depth will vary to suit proposed driveway gradients.

Legend

- | | |
|---|---|
|  | Site Boundary |
|  | Proposed Major Contour
250mm intervals |
|  | Proposed Minor Contours
50mm intervals |
|  | S104 Surface Water Sewer |
|  | S104 Surface Water Manhole |
|  | S104 Foul Water Sewer |
|  | S104 Foul Water Manhole |
|  | Existing Surface Water Sewer |
|  | Existing Foul Water sewer |
|  | Private Surface Water Drain |
|  | Private Foul Water Drain |
|  | 300Ø Mini Access Chamber |
|  | 450Ø Inspection Chamber |
|  | 600Ø RIDGISTORMcheck Office
Control Chamber: <u>2½s MAX.</u> |
|  | Rodding Eye |
|  | ACD Rain Drain
Surface Water Drainage Channel |
|  | Polypipe Permavoid Rainwater
Diffuser Unit (1062x708x1500mm) |
|  | Permeable Driveway with min
350mm Subbase Storage |
|  | Permeable Driveway
Subbase Formation Level |
|  | S38 Road Gully |

P01	17/12/21	First issue	ARJ	BKD	JDY
Rev	Date	Description	Drw	Chk	Rev'd

Status

Preliminary

Clerg

Towerhouse Systems

Project

Cringle Road
Manchester

Drawing

Private External Works
Plot Drainage
Sheet 2 of 2

Drawing Number

LM20066-DYSE-XX-ZZ-DR-C-1131 P01

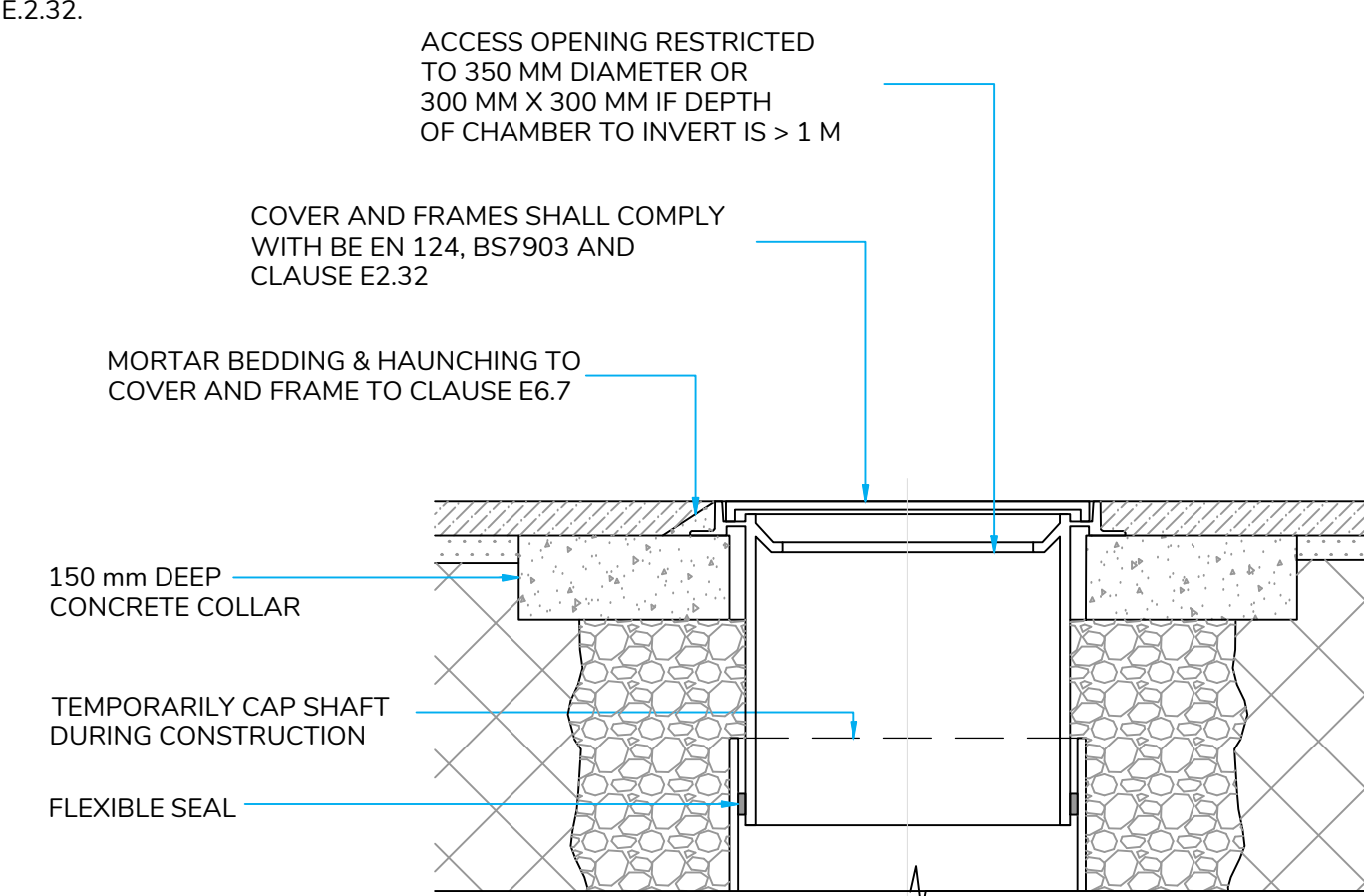
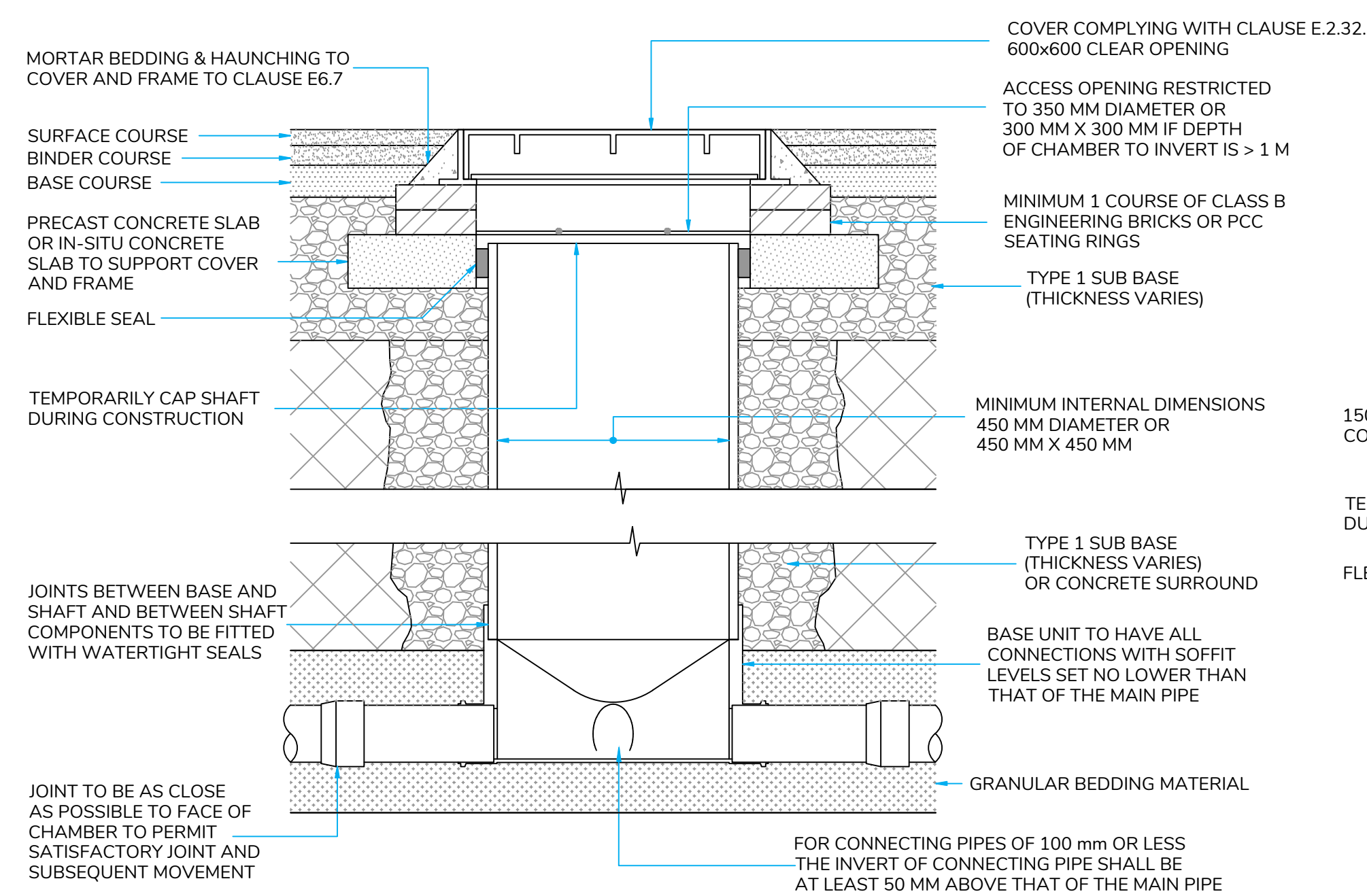
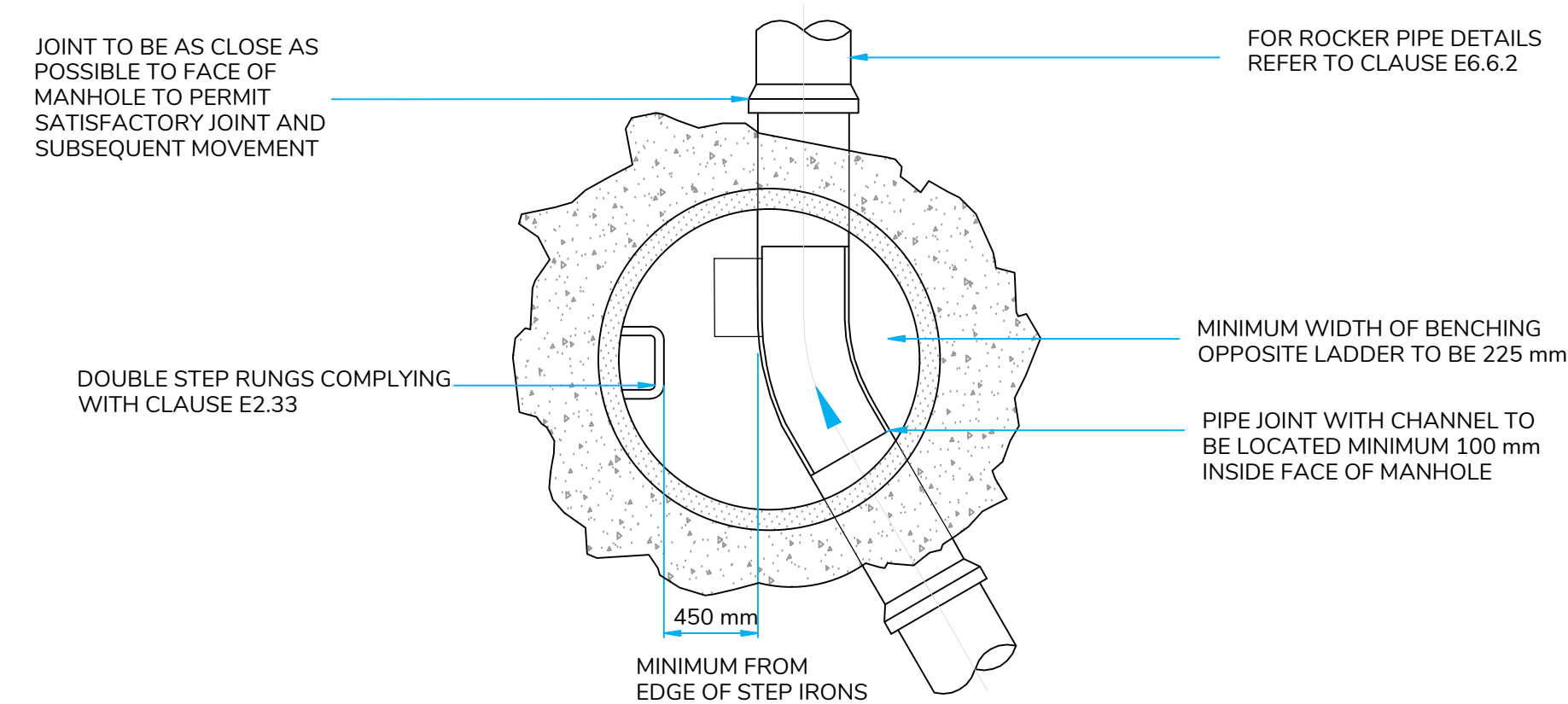
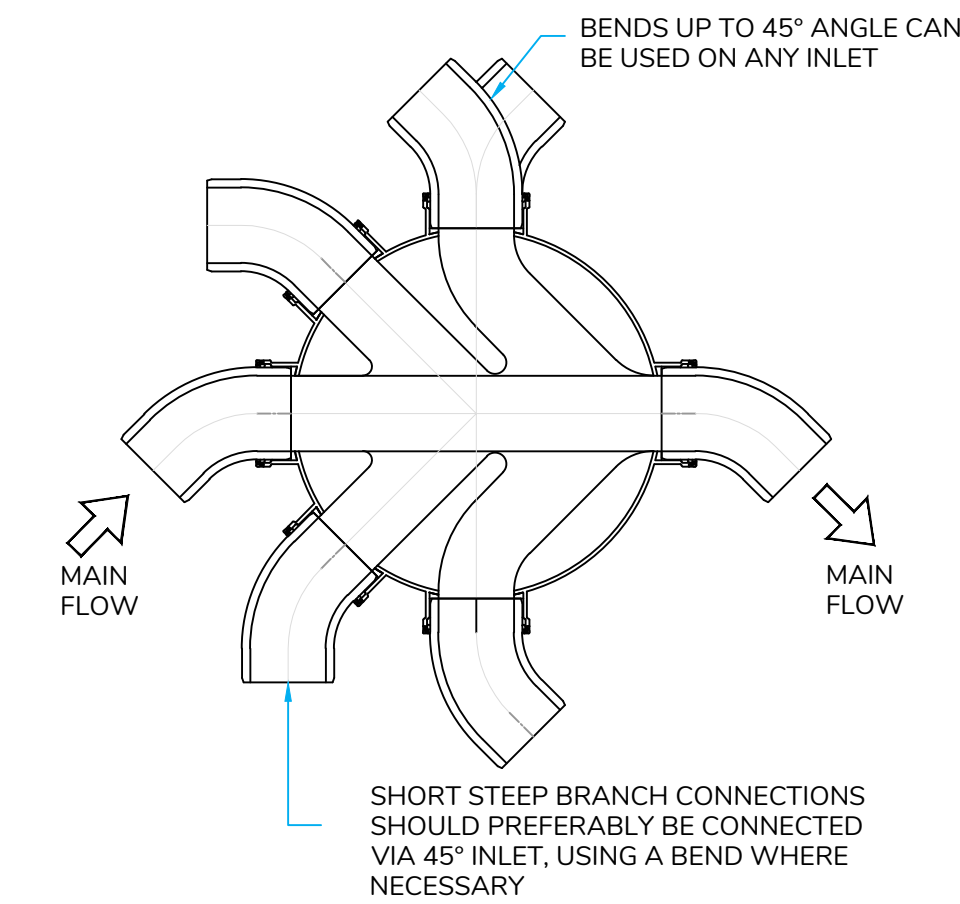
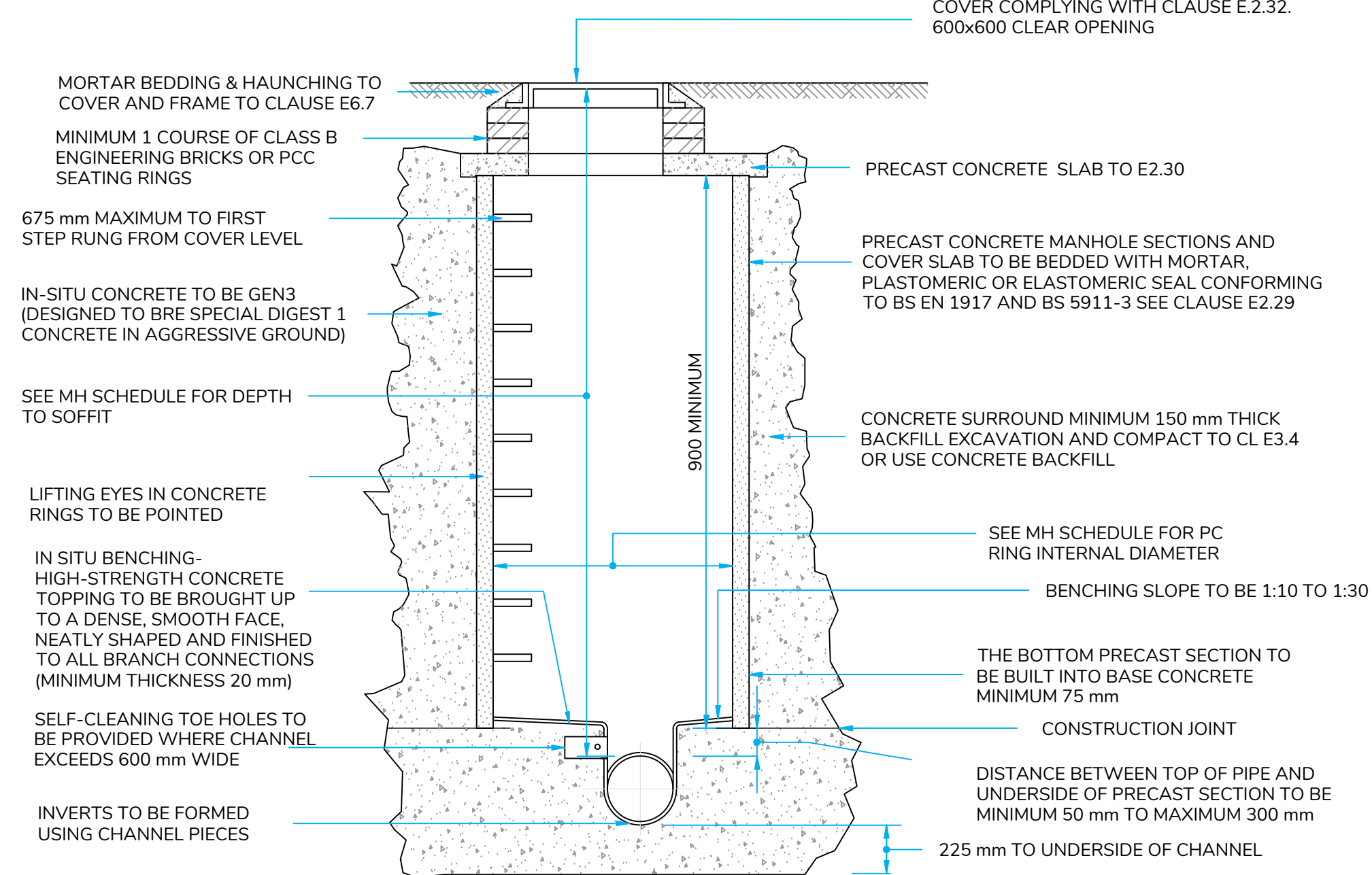
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STRUCTURAL ENGINEERS

ISO A1 (594x841mm) Do Not Scale © Copyright DYSE Ltd 20

Private External Works Plot Drainage
Sheet 2 of 2
1:200

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Appendix C - Drainage Details



These drawings should be read in conjunction with the designer's risk assessment (DRA) which communicates significant residual design risks that have been identified and suggests mitigating actions.

General Notes

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Legend

BS EN 1610:1998 ANNEX B TABLE B.15 COARSE AGGREGATE - PIPE BEDDING							
SIEVE SIZE (mm)	PERCENTAGE BY MASS PASSING BS SIEVES FOR NOMINAL SIZES						
	GRADED AGGREGATE (mm)			SINGLE-SIZED AGGREGATE (mm)			
	40 to 5	20 to 5	14 to 5	40	20	14	10
50.0	100	-----	-----	100	-----	-----	-----
37.5	90 - 100	100	-----	85 - 100	100	-----	-----
20.0	35 - 70	90 - 100	100	0 - 25	85 - 100	100	-----
14.0	-----	-----	90 - 100	-----	-----	85 - 100	100
10.0	10 - 40	30 - 60	50 - 85	0 - 5	0 - 25	0 - 50	85 - 100
5.0	0 - 5	0 - 10	0 - 10	-----	0 - 5	0 - 10	0 - 25
2.36	-----	-----	-----	-----	-----	-----	0 - 5

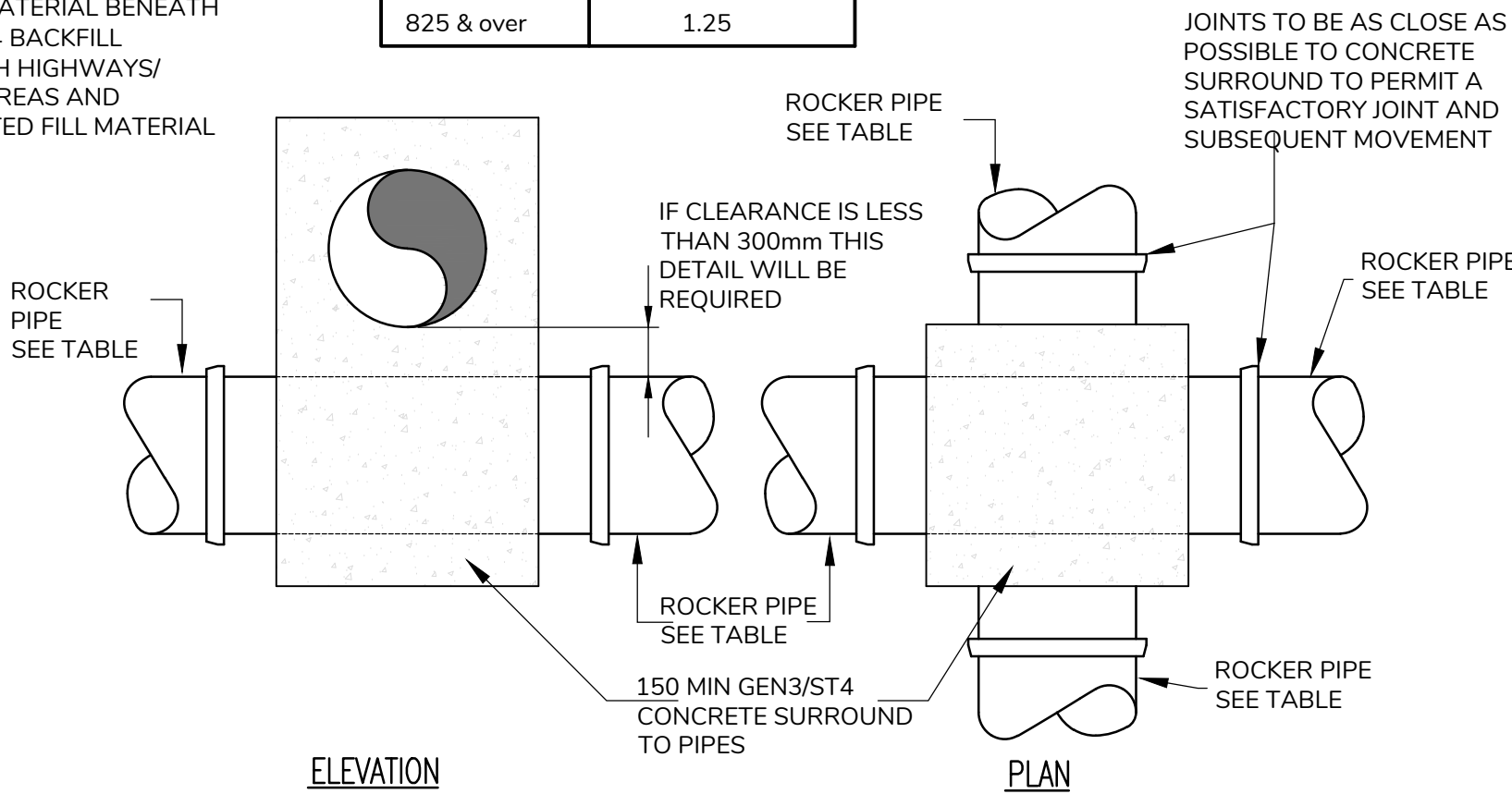
RIGID PIPES BEDDING GRADING

FOR RIGID PIPES THE BEDDING SHOULD BE SINGLE SIZE MATERIAL OR GRADED MATERIAL FROM 5mm UP TO A MAX SIZE OF 10mm FOR 100mm PIPES; 14mm FOR 150mm PIPES; 20mm FOR 225mm TO 600mm PIPES; 40mm FOR OVER 600mm PIPES

BS EN 13242, COARSE AGGREGATE (CLAUSE 4.3.2)		
CATEGORY FOR GENERAL GRADING REQUIREMENTS	Gc80-20	
CATEGORY FOR TOLERANCES AT MID-SIZE SIEVES	GTnr (NO REQUIREMENTS)	
CATEGORY PF MAXIMUM VALUES OF FINES CONTENTS	GRAVEL - F1.5 CRUSHED ROCK, RECYCLED AGGREGATE - F4	
NOMINAL PIPE DIAMETER, mm	AGGREGATE SIZE, mm	
	GRADED	SINGLE SIZED
NOT EXCEEDING 140	-	4/10
EXCEEDING 140 BUT NOT EXCEEDING 400	2/14 or 4/20	4/10, 6/14 or 10/20
EXCEEDING 400	2/14, 4/20 or 4/40	4/10, 6/14, 10/20 or 20/40

FLEXIBLE PIPE BEDDING, HAUNCHING AND SURROUND MATERIAL

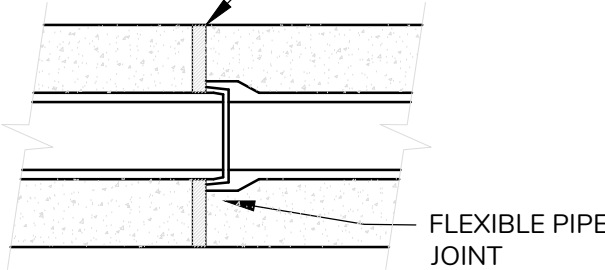
NOMINAL DIA. (mm)	EFFECTIVE LENGTH (m)
150 to 600	0.6
675 to 750	1.0
825 & over	1.25



SPECIAL PIPE CROSSOVER DETAIL

REQUIRED IF CLEARANCE BETWEEN PIPES CROSSING EACH OTHER IS LESS THAN 300mm

COMPRESSIBLE BOARD OR PREFORMED JOINT FILLER FOR FULL THICKNESS OF CONCRETE BED OR SURROUND



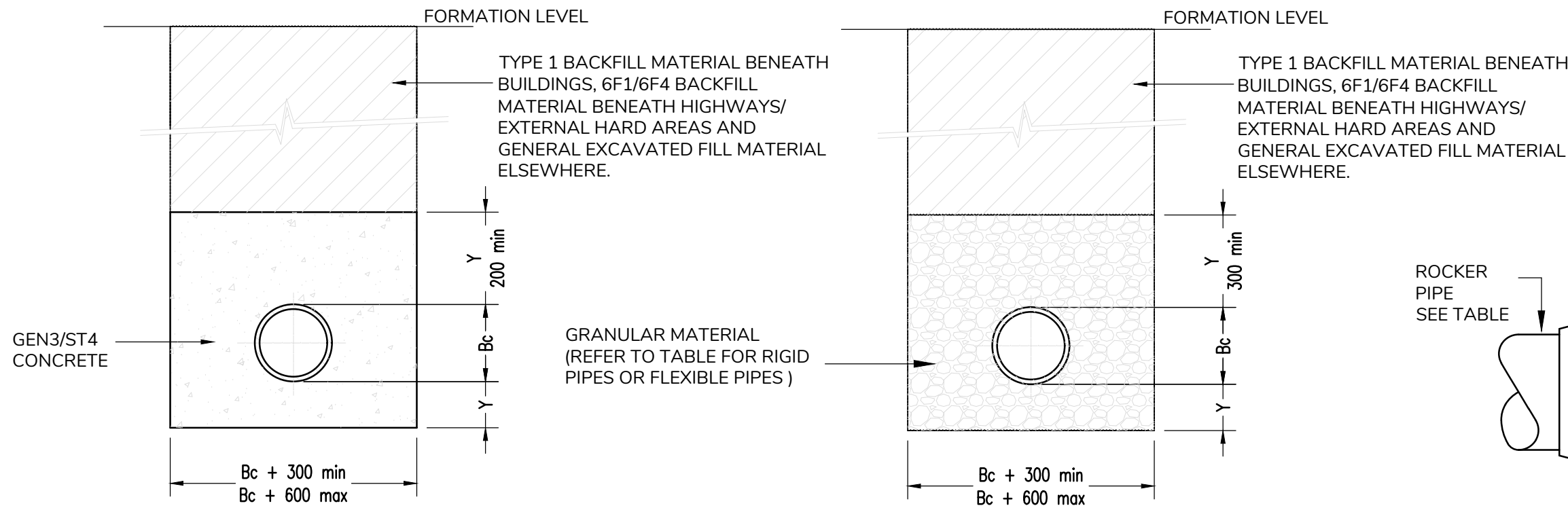
JOINTS FOR CONCRETE SURROUND TO PIPES

(AT EACH PIPE JOINT)

PIPE Ø	JOINT THICKNESS
< 450	18mm
450 - 1200	36mm
>1200	54mm

COMPRESSIBLE FILLER TABLE

(BITUMEN IMPREGNATED INSULATING BOARD TO BS EN 622-1 AND BS EN 622-4)

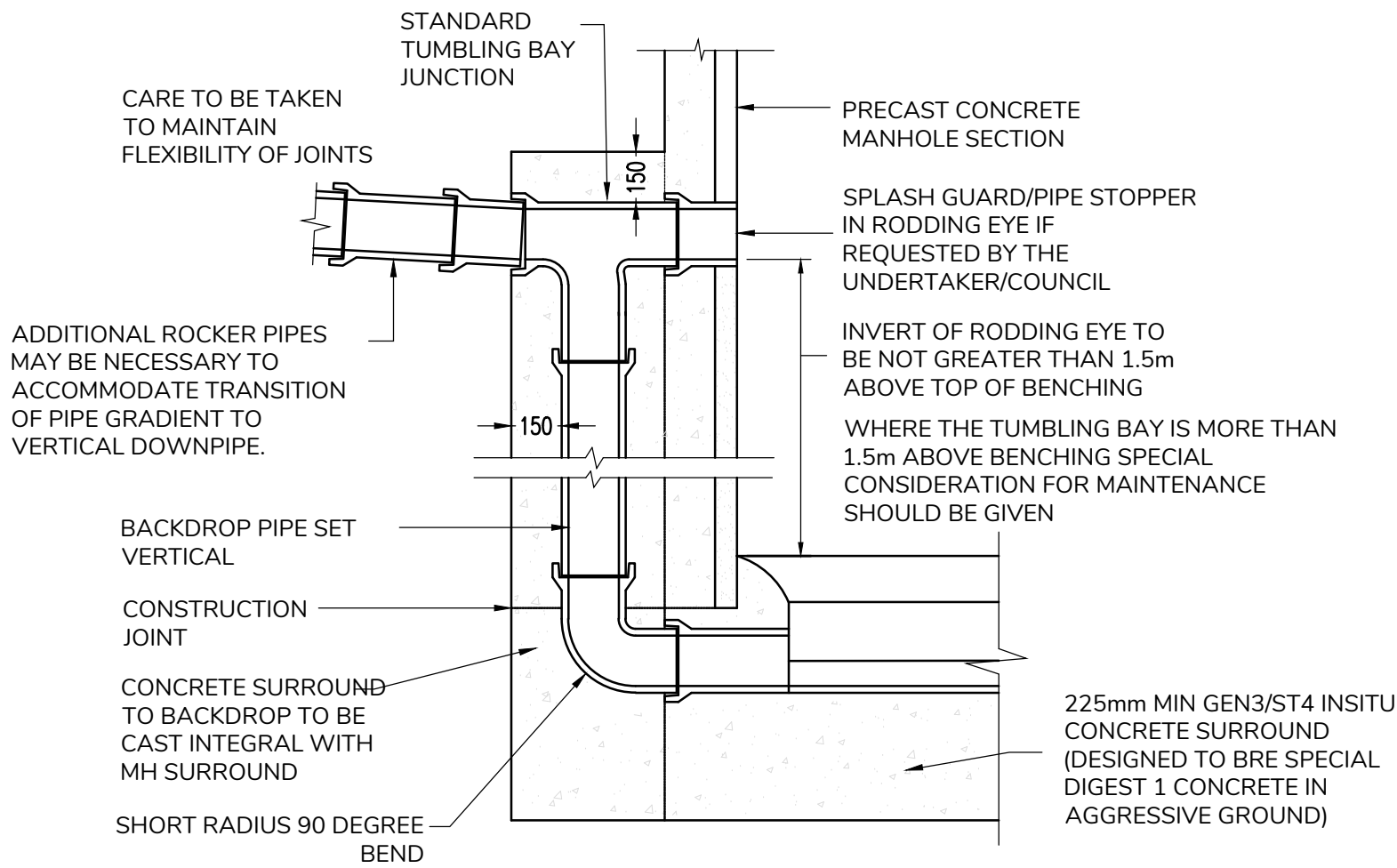


CLASS S BEDDING DETAIL

Y VALUE:
HARD SPOTS/IRREGULAR TRENCH BOTTOM BC/4 (200mm MIN)
EVEN TRENCH BOTTOM BC/6 (100mm MIN)
BC = OUTSIDE PIPE DIAMETER

CLASS Z BEDDING DETAIL

Y VALUE:
HARD SPOTS/IRREGULAR TRENCH BOTTOM BC/4 (200mm MIN)
EVEN TRENCH BOTTOM BC/6 (100mm MIN)
BC = OUTSIDE PIPE DIAMETER



MINIMUM DIMENSIONS REQUIRED TO CONSTRUCT BACKDROP	
PIPE DIA. (mm)	MIN DIMENSION (mm)
100	530
150	630
225	915
300	1170

TYPICAL VERTICAL BACKDROP DETAIL

P02	12/01/22	Sheet numbering updated.	ARJ	BKD	JDY	JDY
P01	14/12/21	First issue	ARJ	BKD	JDY	JDY
Rev	Date	Description	Drw	Chk	Revd	App

Status:

Preliminary

Client:

Towerhouse Systems

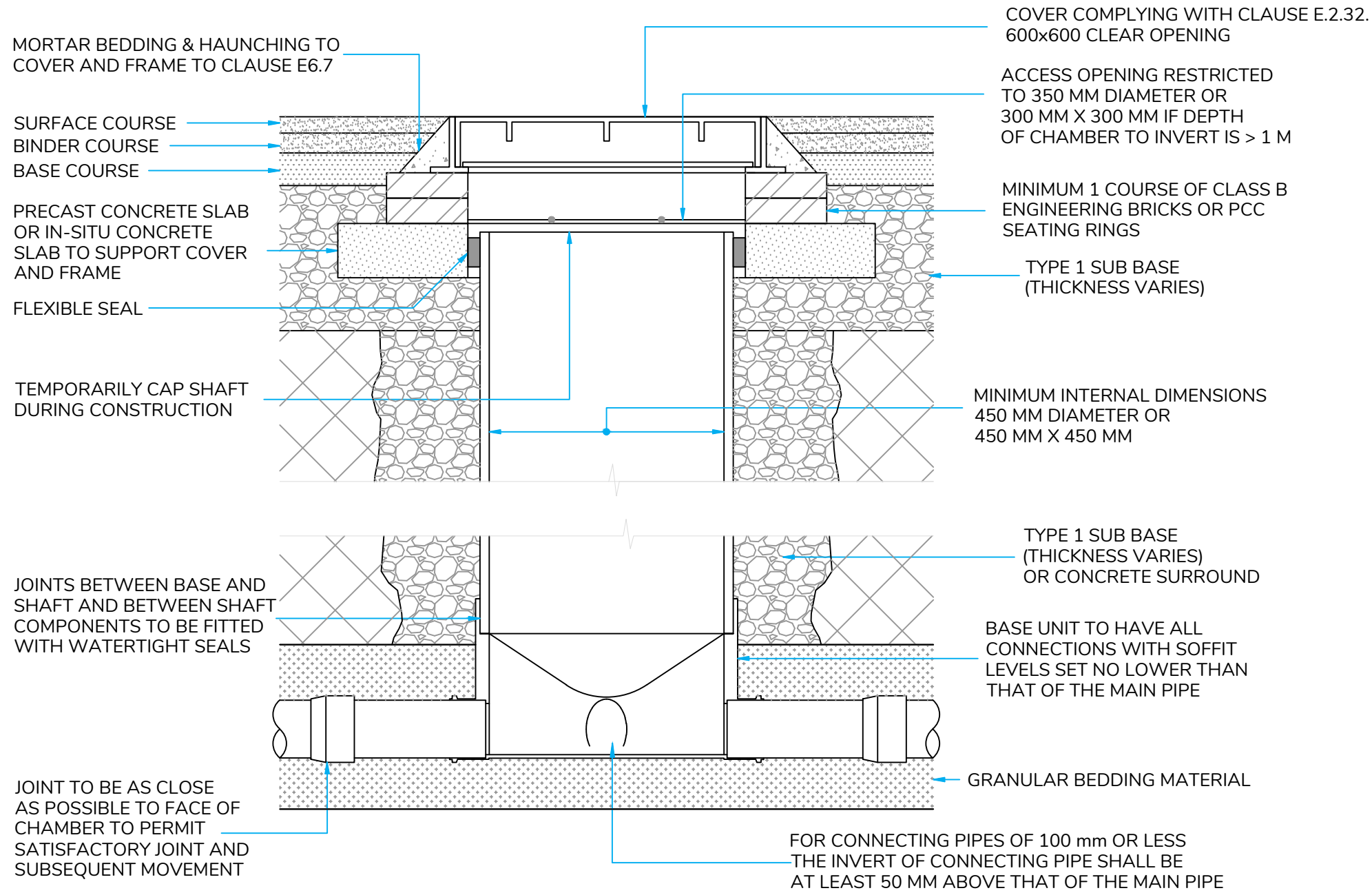
Project:

Cringles Road
Manchester

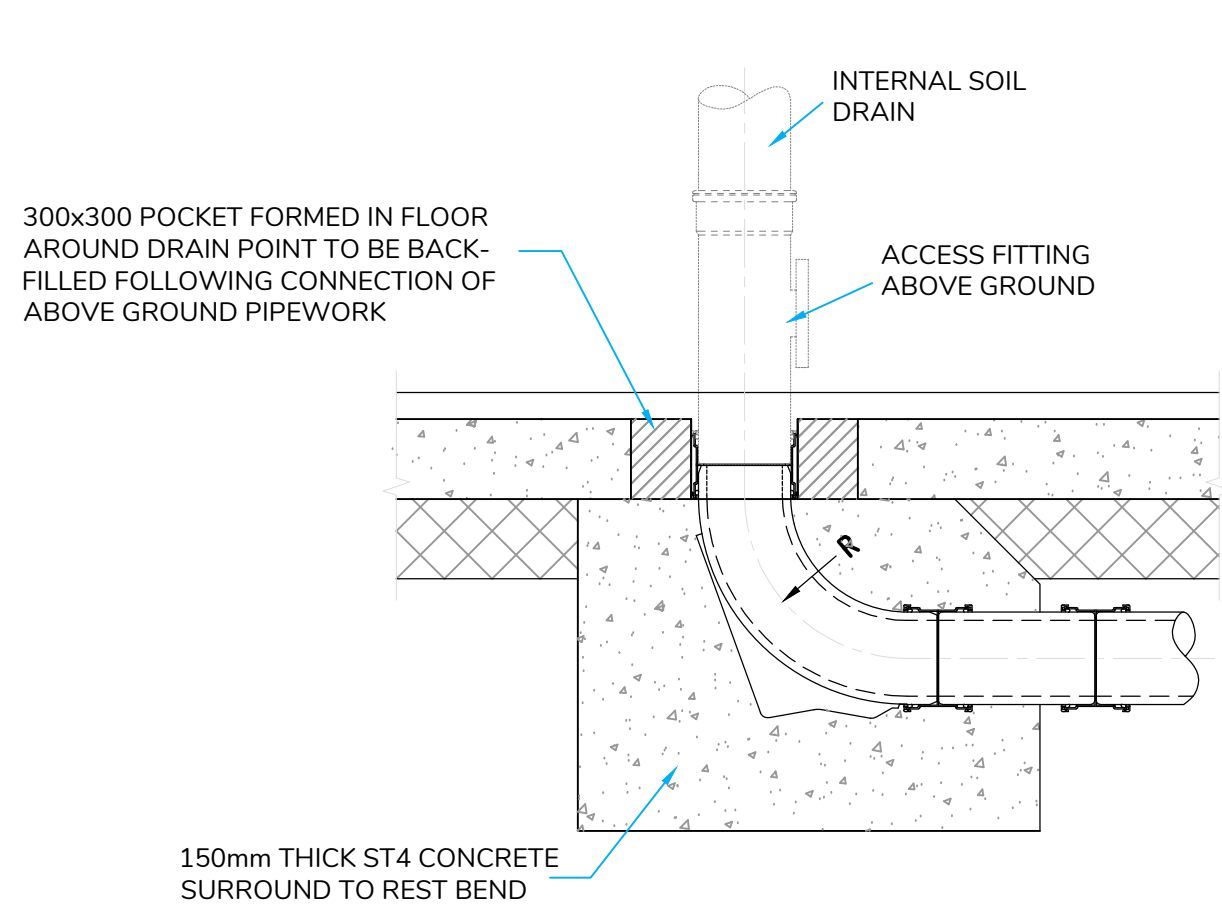
Drawing:

S104 Construction Details
Sheet 2 of 4

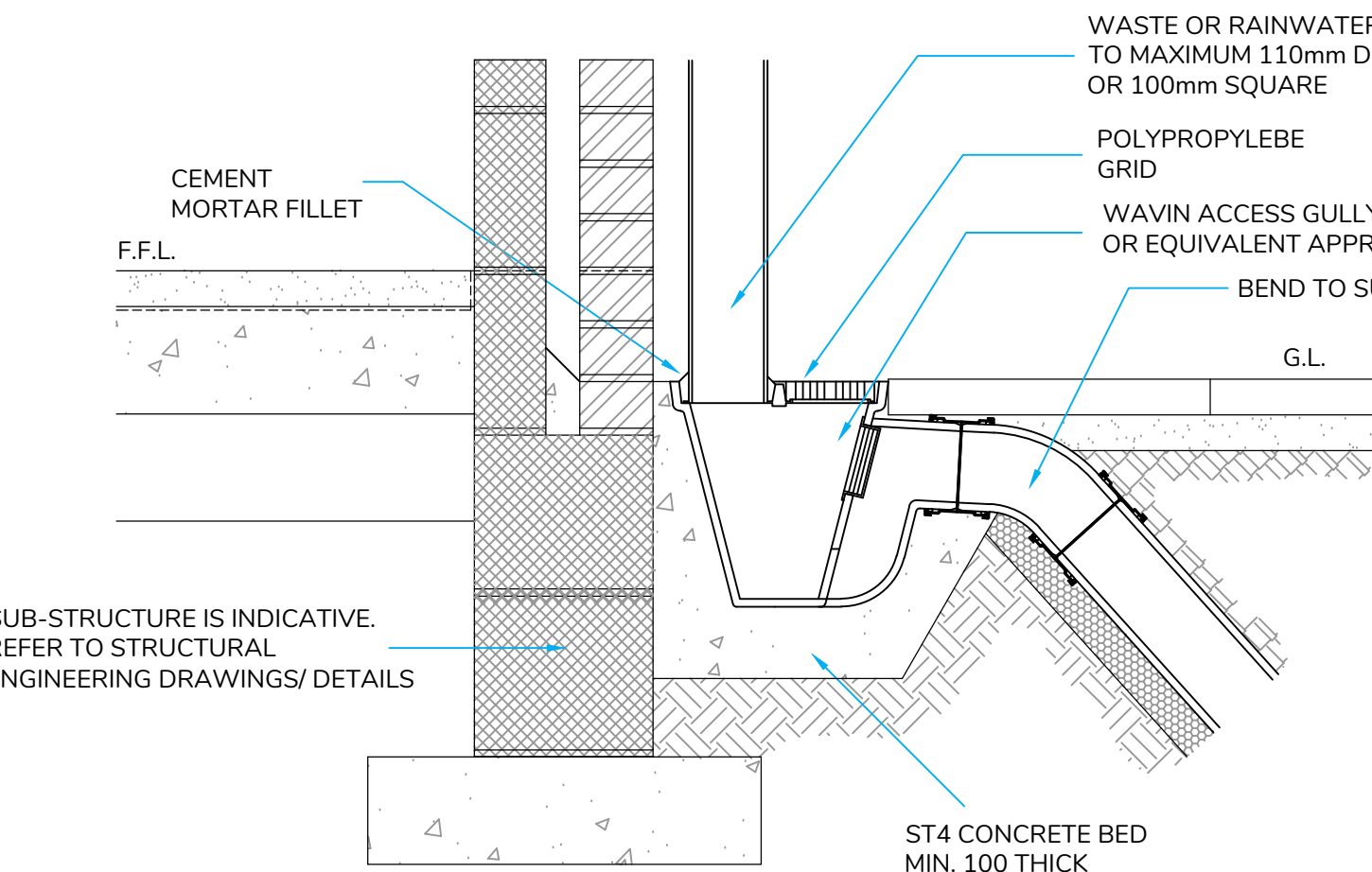
Drawing Number:	Revision:
LM20066-DYSE-XX-ZZ-DR-C-1127	P02



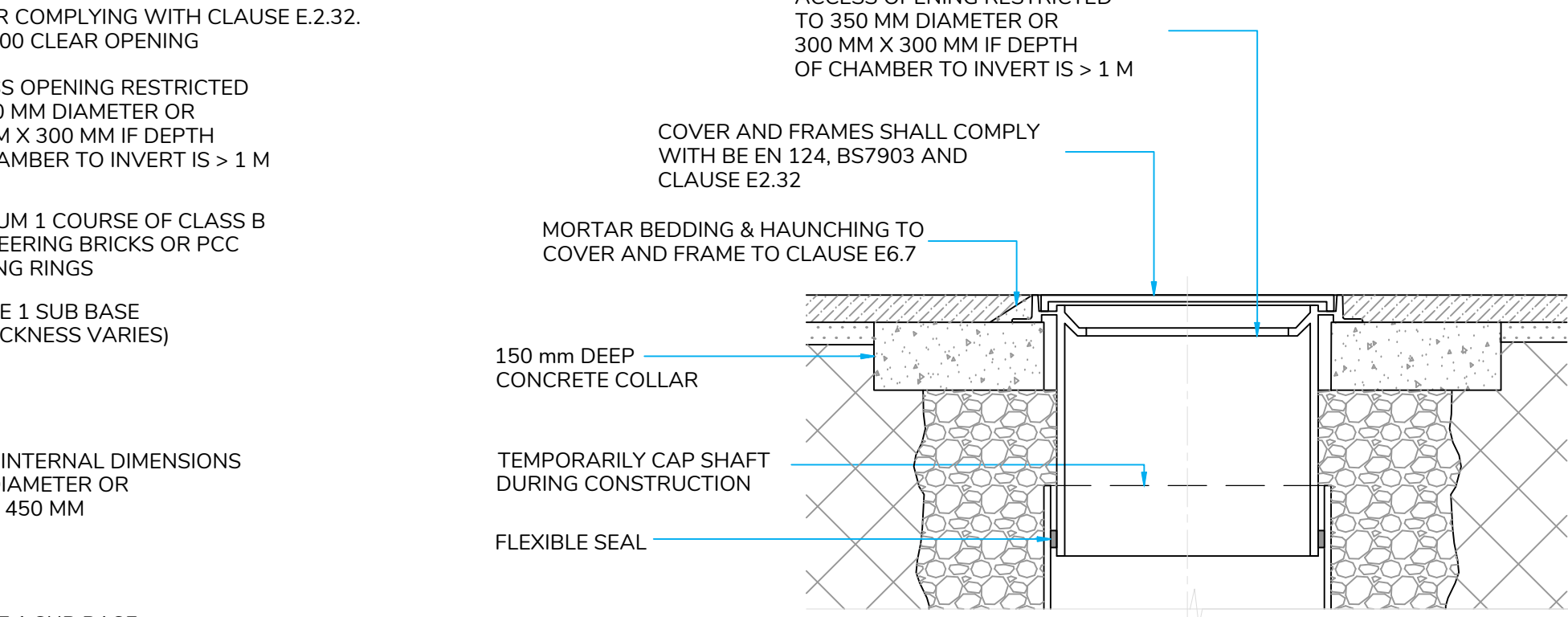
INSPECTION CHAMBER DETAIL - TYPE D
(DEPTH TO SOFFIT 3m) D400 COVER
SCALE - NTS



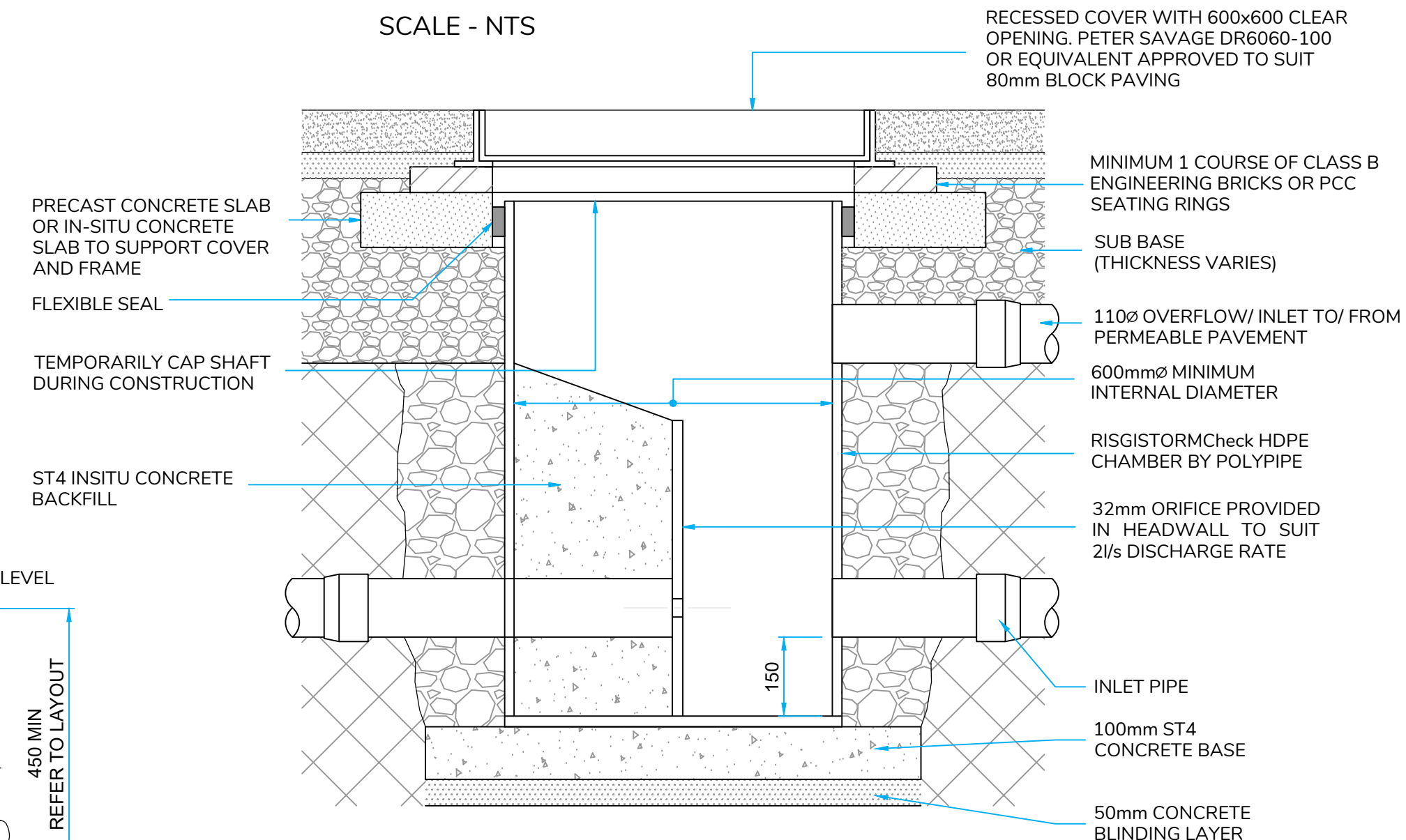
TYPICAL SOIL PIPE BASE DETAIL
SCALE - 1:10



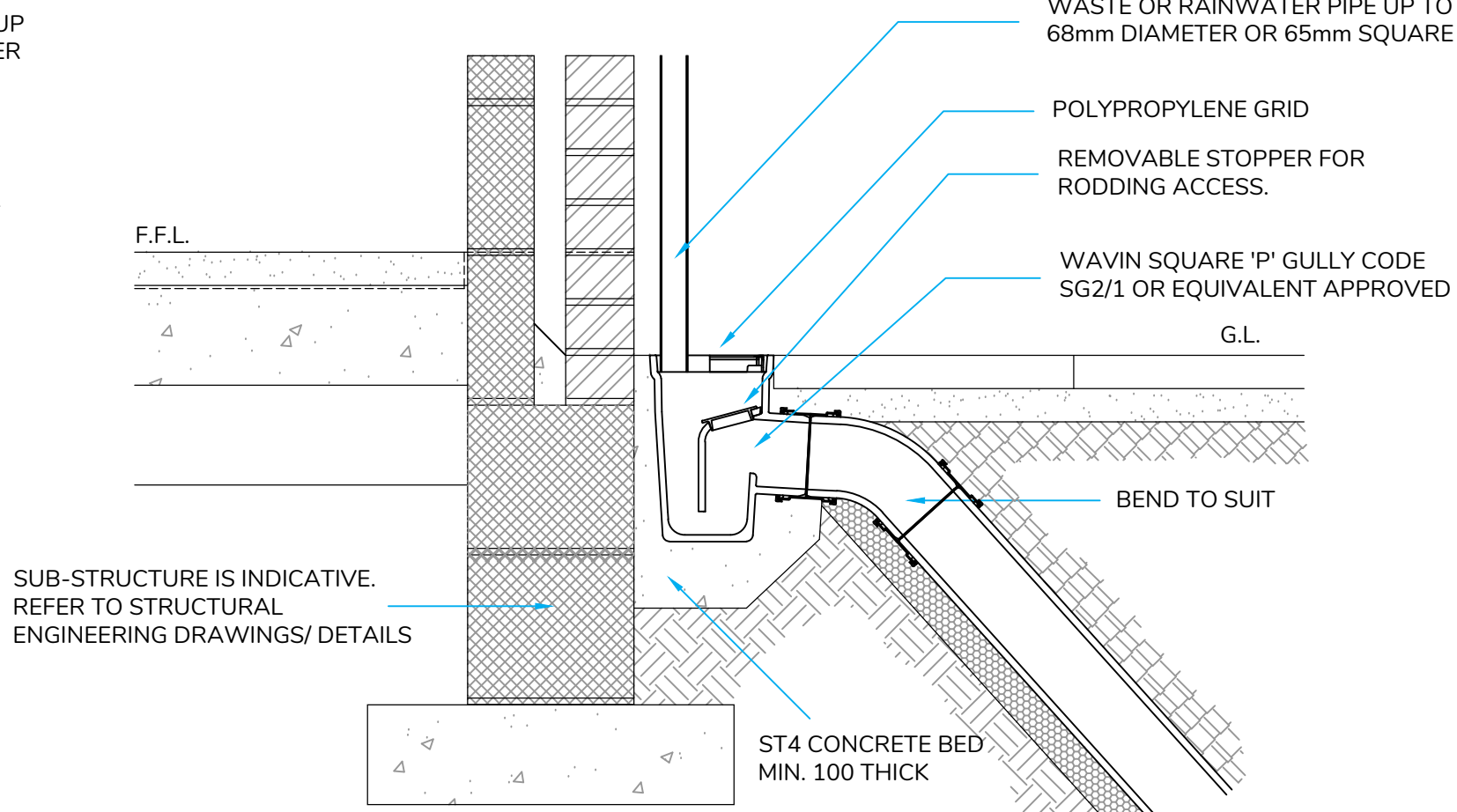
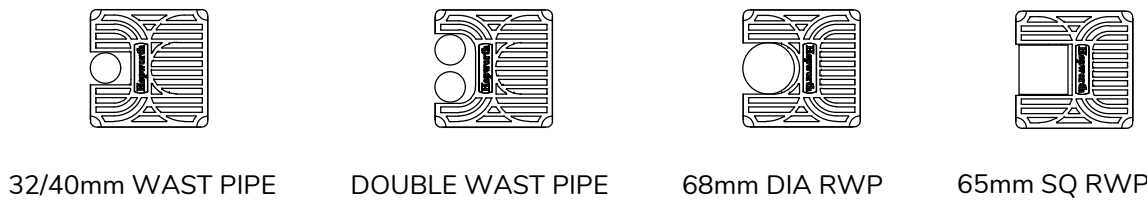
ACCESS GULLY CONNECTION
DETAIL TYPE A
SCALE - NTS



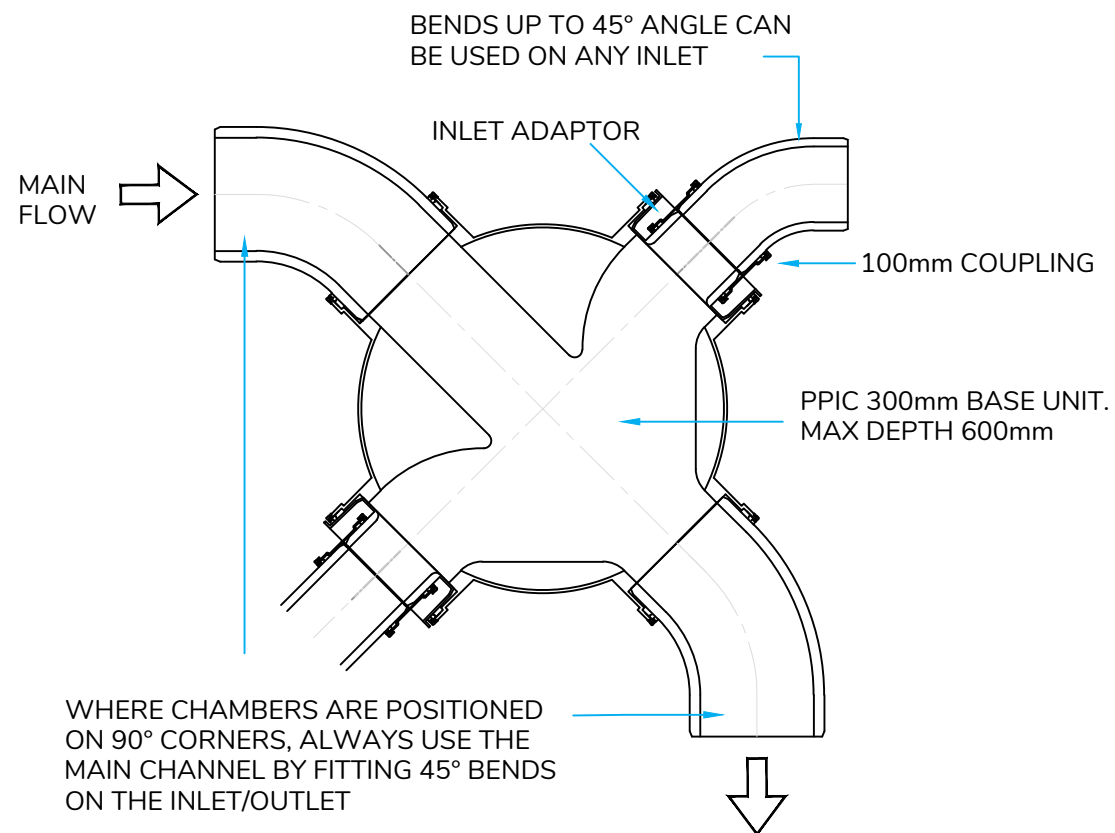
INSPECTION CHAMBER DETAIL - TYPE D
B125 COVER
SCALE - NTS



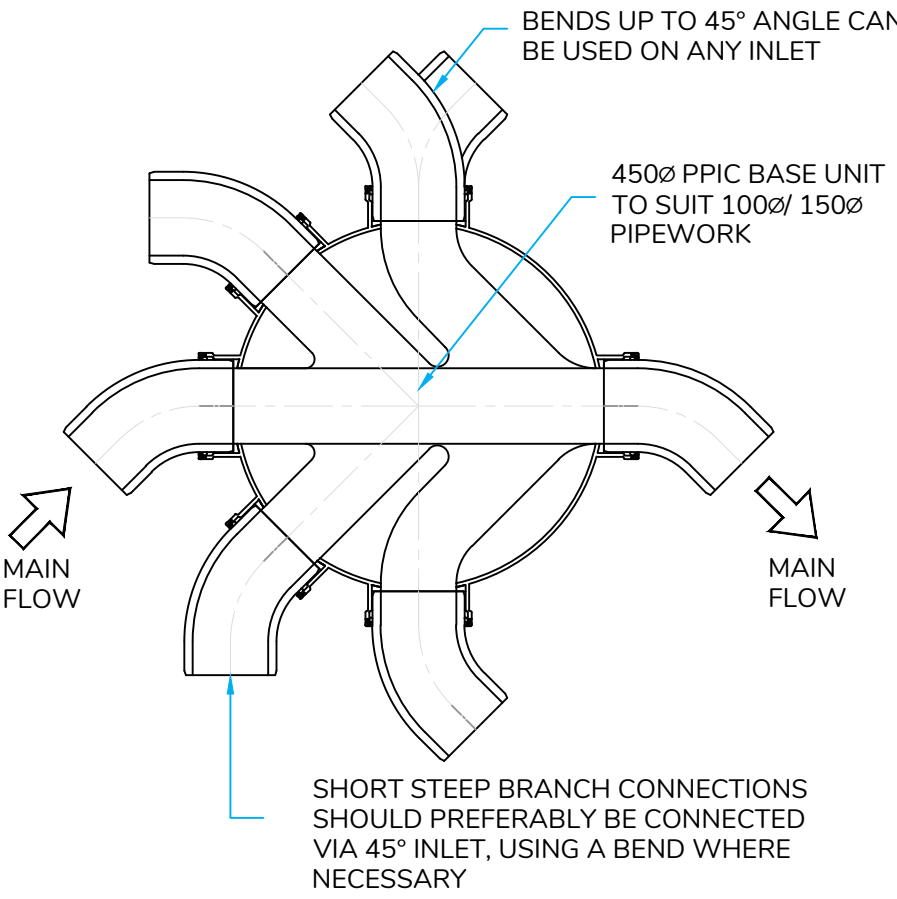
POLYPIPE RISGISTORMCheck
ORIFICE CONTROL CHAMBER
SCALE - 1:10



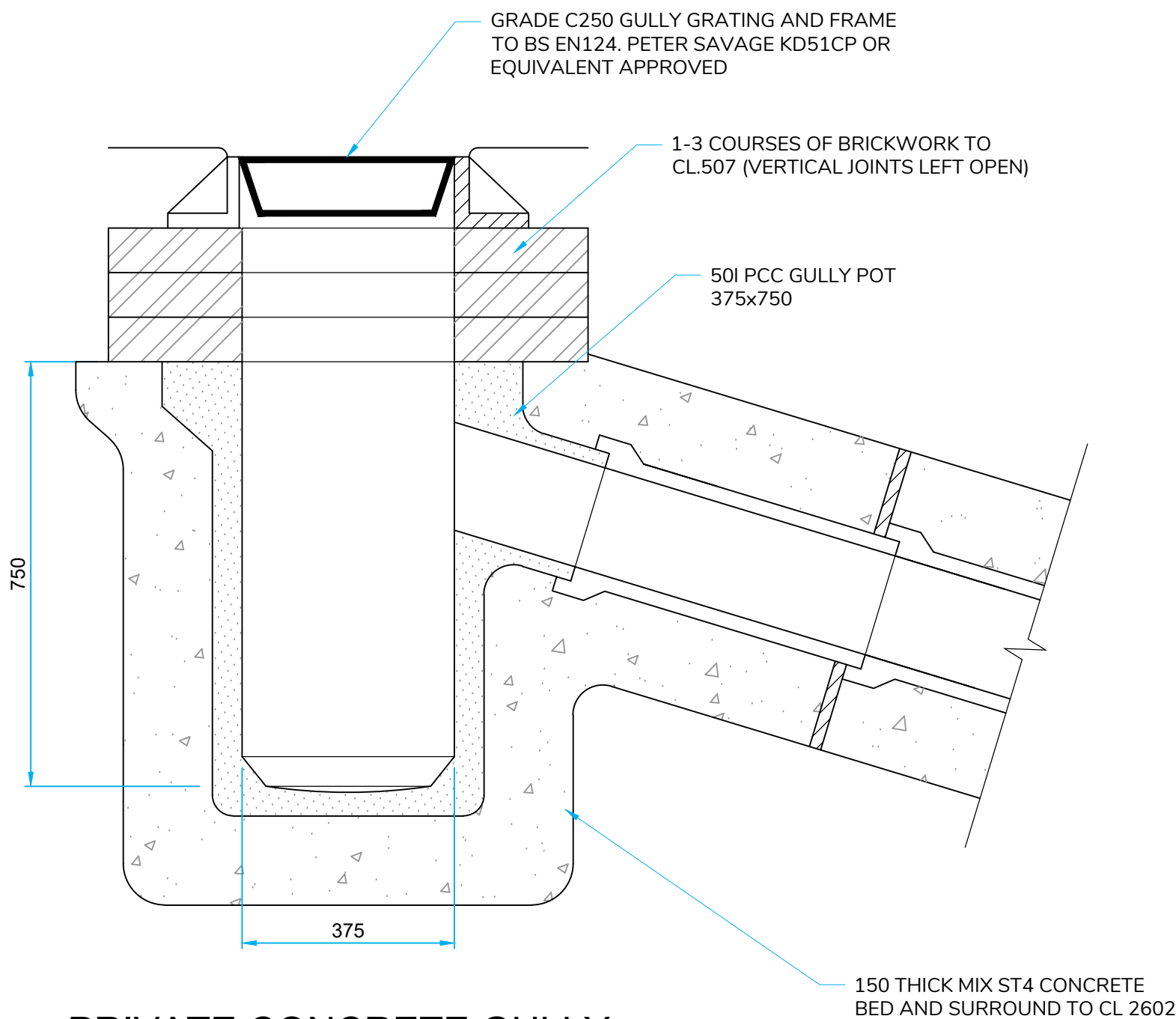
ACCESS GULLY CONNECTION
DETAIL TYPE B
SCALE - NTS



MINI PPIC BASE DETAIL
SCALE - NTS



TYPE D INSPECTION CHAMBER
BASE DETAIL
SCALE - NTS



PRIVATE CONCRETE GULLY
WITH SPIGOT OUTLET (375x750)
SCALE - 1:10

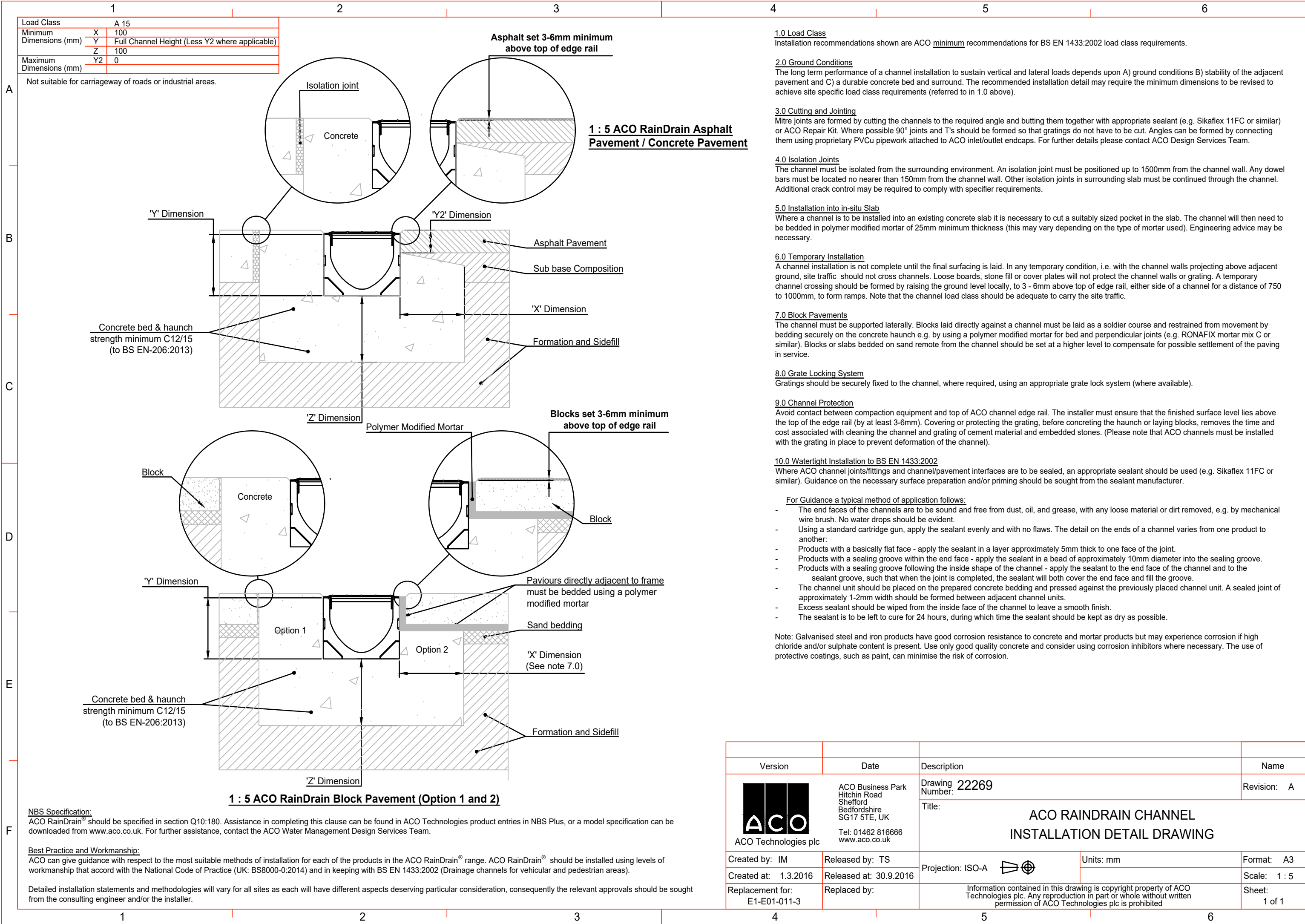
Residual Risks

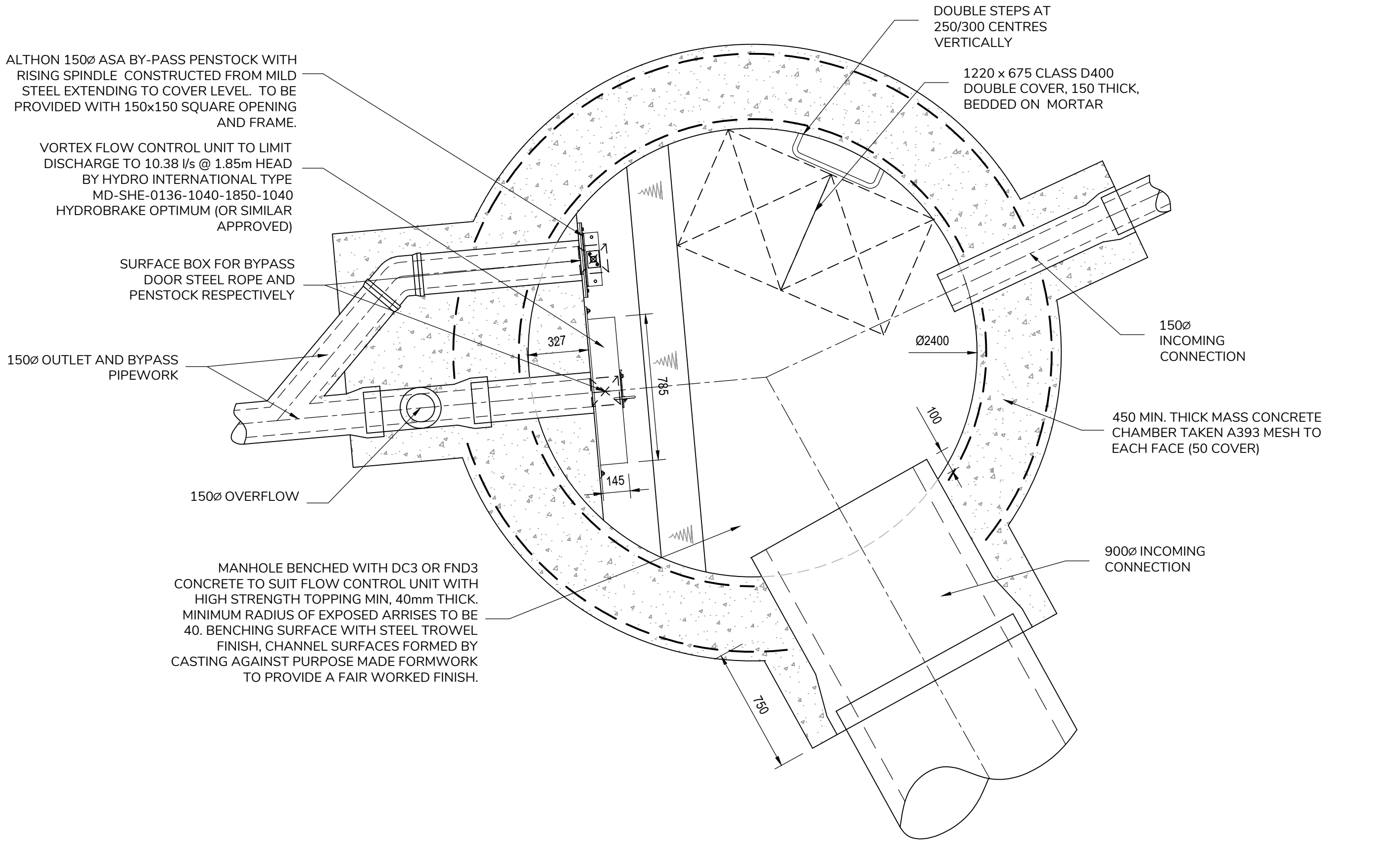
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General Notes

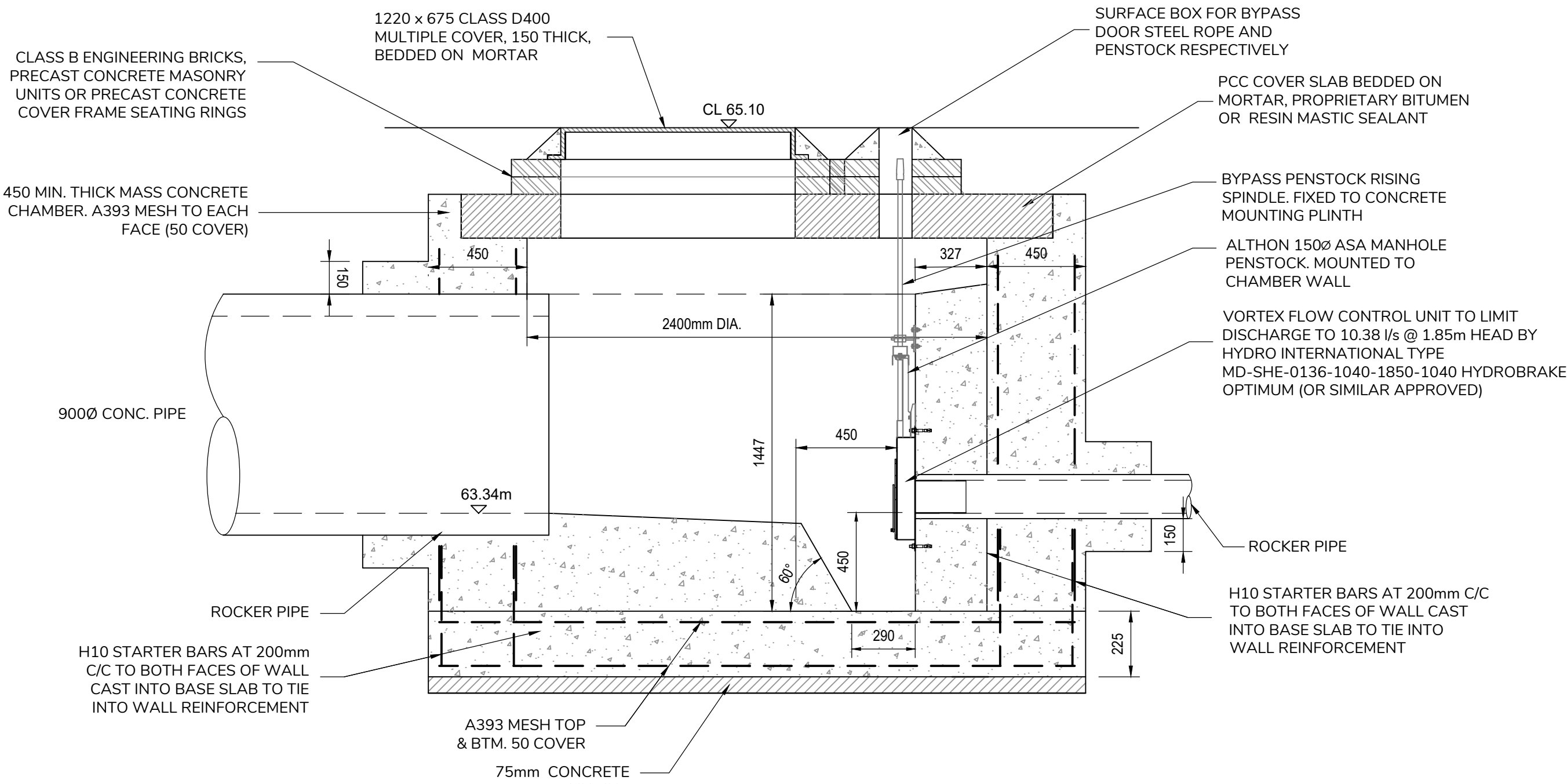
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Legend





FLOW CONTROL MANHOLE S1.28
PLAN



FLOW CONTROL MANHOLE S1.28
SECTION

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.850	10.400
Flush-Flo™	0.541	10.387
Kick-Flo	1.122	8.216
Mean Flow		9.099

Hydro-Brake Optimum Flow Control including:

- 3 mm grade 304L stainless steel integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

IMPORTANT: LIMIT OF HYDRO INTERNATIONAL SUPPLY THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL ALL CIVIL AND INSTALLATION WORK BY OTHERS * WHERE SUPPLIED HYDRO-BRAKE FLOW CONTROL & HYDRO-BRAKE OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE	The head/flow characteristics of this SHE-0136-31040-1850-1040 Hydro-Brake Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve. The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.	
DATE		SHE-0136-1040-1850-1040 Hydro-Brake Optimum
SITE	Cringle Road, Manchester	
DESIGNER	Andy James	
REF	LM20066	

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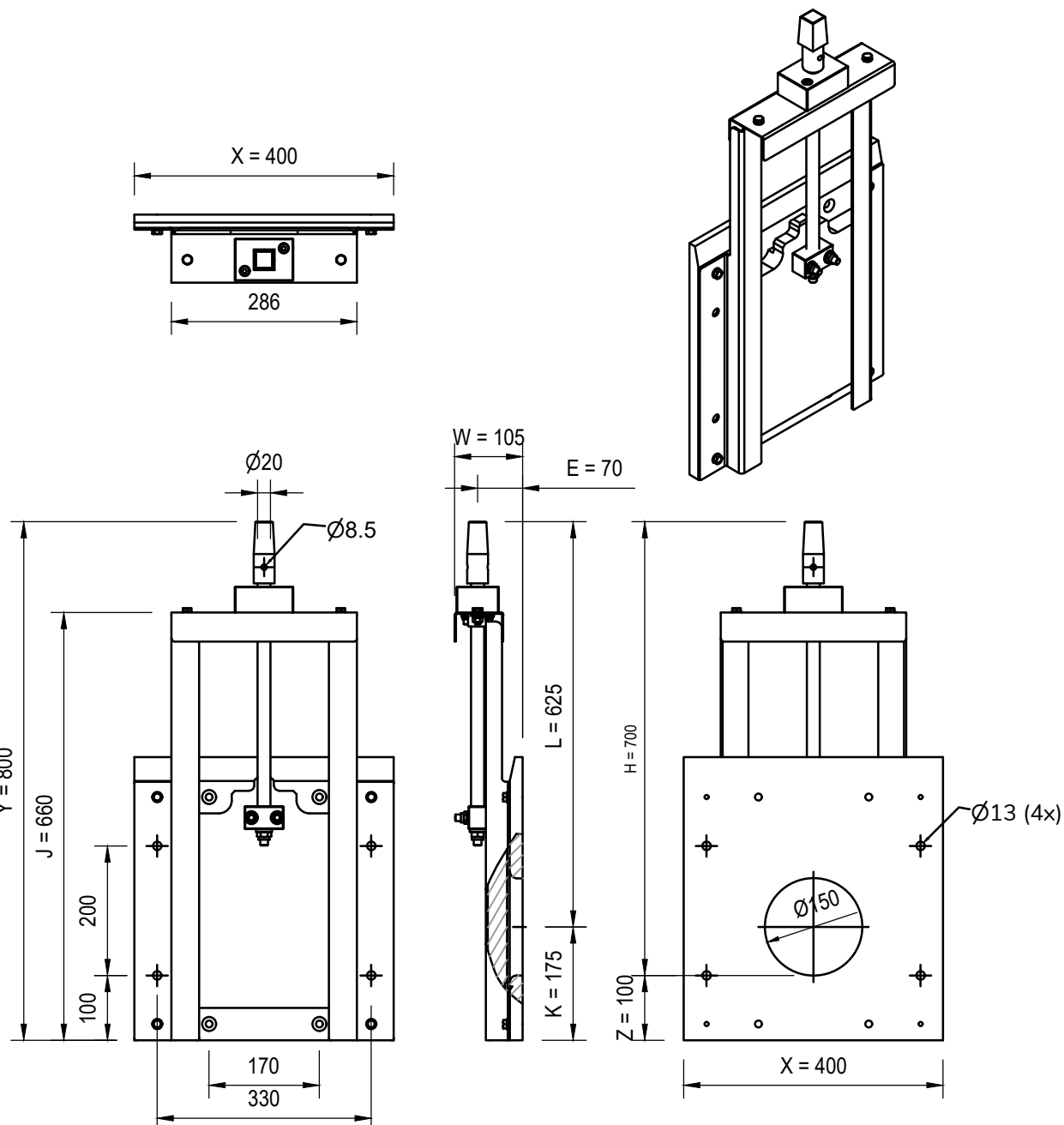
Residual Risks

These drawings should be read in conjunction with the designer's risk assessment (DRA) which communicates significant residual design risks that have been identified and suggests mitigating actions.

General Notes

- All dimensions are in metres unless stated otherwise.
- This drawing shall be read in conjunction with all other relevant engineering details, drawings and specifications.
- Any discrepancies should be reported to the engineer immediately so that clarification can be sought prior to the commencement of work.
- All work is to be carried out in accordance with the specification for highways works and local authority guidance.
- Underground services may be present in the area. Contractor is to confirm the precise line and depth of any services prior to the commencement of any excavation works

Legend



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SCALE 1:10

P01	12/01/22	First issue	ARJ	BKD	JDY	JDY
Rev	Date	Description	Drw	Chk	Rev'd	App

Status:

Preliminary

Client:

Towerhouse Systems

Project:

Cringle Road
Manchester

Drawing:

S104 Flow Control Details

Drawing Number:

LM20066-DYSE-XX-ZZ-DR-C-1135 P01

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Appendix D - Microdrainage Model Details

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Design Criteria for S104 SW

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for S104 SW

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.578	4-8	0.333

Total Area Contributing (ha) = 0.911

Total Pipe Volume (m³) = 176.029

Network Design Table for S104 SW

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	7.434	0.150	49.6	0.018	4.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	7.269	0.073	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	4.121	0.170	24.2	0.036	4.00	0.0	0.600	o	100	Pipe/Conduit	
S2.001	5.469	0.168	32.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	31.213	0.078	400.0	0.051	0.00	0.0	0.600	o	900	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	100.00	4.11	65.100	0.018	0.0	0.0	0.0	1.10	8.6	4.9
S1.001	100.00	4.12	64.900	0.000	4.0	0.0	0.0	1.00	17.8	4.0
S2.000	100.00	4.04	64.950	0.036	0.0	0.0	0.0	1.57	12.4	9.7
S2.001	100.00	4.05	64.730	0.000	6.0	0.0	0.0	1.77	31.3	6.0
S1.002	100.00	4.45	63.812	0.051	10.0	0.0	0.0	1.56	992.7	23.8



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Network Design Table for S104 SW

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	8.744	0.230	38.0	0.037	4.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S3.001	5.305	0.106	50.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S1.003	15.606	0.039	400.1	0.020	0.00	0.0	0.600	o	900	Pipe/Conduit	🟢
S4.000	5.234	0.096	54.5	0.030	4.00	0.0	0.600	o	100	Pipe/Conduit	🟢
S4.001	5.919	0.059	100.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S1.004	13.276	0.033	400.0	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	🟢
S5.000	6.786	0.072	94.3	0.026	4.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S5.001	6.630	0.066	100.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S1.005	14.162	0.035	400.0	0.019	0.00	0.0	0.600	o	900	Pipe/Conduit	🟢
S6.000	3.287	0.032	102.7	0.035	4.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S6.001	7.190	0.072	99.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟡
S7.000	3.624	0.074	49.0	0.064	4.00	0.0	0.600	o	150	Pipe/Conduit	🟢
S7.001	6.004	0.060	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🟡

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	100.00	4.09	64.870	0.037	0.0	0.0	0.0	1.64	28.9	10.0
S3.001	100.00	4.06	64.590	0.000	6.0	0.0	0.0	1.43	25.2	6.0
S1.003	100.00	4.62	63.734	0.071	16.0	0.0	0.0	1.56	992.5	35.2
S4.000	100.00	4.08	64.650	0.030	0.0	0.0	0.0	1.05	8.2	8.1
S4.001	100.00	4.10	64.504	0.000	8.0	0.0	0.0	1.00	17.7	8.0
S1.004	100.00	4.76	63.695	0.071	24.0	0.0	0.0	1.56	992.7	43.2
S5.000	100.00	4.11	64.600	0.026	0.0	0.0	0.0	1.04	18.3	7.0
S5.001	100.00	4.11	64.478	0.000	4.0	0.0	0.0	1.00	17.7	4.0
S1.005	100.00	4.91	63.662	0.090	28.0	0.0	0.0	1.56	992.7	52.4
S6.000	100.00	4.06	64.530	0.035	0.0	0.0	0.0	0.99	17.5	9.5
S6.001	100.00	4.12	64.448	0.000	8.0	0.0	0.0	1.01	17.8	8.0
S7.000	100.00	4.04	64.560	0.064	0.0	0.0	0.0	1.44	25.5	17.3
S7.001	100.00	4.10	64.436	0.000	14.0	0.0	0.0	1.00	17.8	14.0



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Network Design Table for S104 SW

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.006	60.408	0.151	400.0	0.066	0.00	0.0	0.600	o	900	Pipe/Conduit	
S8.000	2.656	0.698	3.8	0.082	4.00	0.0	0.600	o	100	Pipe/Conduit	
S8.001	10.213	0.102	100.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.002	15.441	0.039	400.0	0.015	0.00	0.0	0.600	o	900	Pipe/Conduit	
S9.000	2.337	0.330	7.1	0.010	4.00	0.0	0.600	o	100	Pipe/Conduit	
S9.001	4.810	0.559	8.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S8.003	34.229	0.086	398.0	0.039	0.00	0.0	0.600	o	900	Pipe/Conduit	
S10.000	5.174	0.280	18.5	0.041	4.00	0.0	0.600	o	100	Pipe/Conduit	
S10.001	9.258	0.195	47.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S11.000	6.780	0.220	30.8	0.088	4.00	0.0	0.600	o	150	Pipe/Conduit	
S11.001	8.139	0.425	19.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.007	19.104	0.048	398.0	0.011	0.00	0.0	0.600	o	900	Pipe/Conduit	
S12.000	3.942	0.317	12.4	0.074	4.00	0.0	0.600	o	150	Pipe/Conduit	
S12.001	7.485	0.075	99.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.006	100.00	5.56	63.626	0.156	50.0	0.0	0.0	1.56	992.7	92.2
S8.000	100.00	4.01	65.200	0.082	0.0	0.0	0.0	3.99	31.4	22.2
S8.001	100.00	4.17	64.452	0.000	14.0	0.0	0.0	1.00	17.7	14.0
S8.002	100.00	4.33	63.600	0.015	14.0	0.0	0.0	1.56	992.7	18.1
S9.000	100.00	4.01	65.250	0.010	0.0	0.0	0.0	2.92	23.0	2.7
S9.001	100.00	4.02	64.870	0.000	2.0	0.0	0.0	3.46	61.1	2.0
S8.003	100.00	4.70	63.561	0.054	16.0	0.0	0.0	1.56	995.2	30.6
S10.000	100.00	4.05	64.750	0.041	0.0	0.0	0.0	1.81	14.2	11.1
S10.001	100.00	4.11	64.420	0.000	10.0	0.0	0.0	1.46	25.9	10.0
S11.000	100.00	4.06	64.920	0.088	0.0	0.0	0.0	1.82	32.2	23.8
S11.001	100.00	4.06	64.700	0.000	14.0	0.0	0.0	2.31	40.9	14.0
S1.007	100.00	5.76	63.475	0.221	90.0	0.0	0.0	1.56	995.2	149.9
S12.000	100.00	4.02	64.700	0.074	0.0	0.0	0.0	2.87	50.8	20.0
S12.001	100.00	4.12	64.383	0.000	16.0	0.0	0.0	1.01	17.8	16.0



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Network Design Table for S104 SW

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S13.000	2.852	0.400	7.1	0.020	4.00	0.0	0.600	o	100	Pipe/Conduit	
S13.001	4.417	0.342	12.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.002	32.261	0.081	400.0	0.060	0.00	0.0	0.600	o	900	Pipe/Conduit	
S1.008	11.506	0.029	396.8	0.000	0.00	0.0	0.600	o	900	Pipe/Conduit	
S14.000	3.814	0.350	10.9	0.021	4.00	0.0	0.600	o	100	Pipe/Conduit	
S14.001	4.112	0.152	27.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.009	8.827	0.022	401.2	0.015	0.00	0.0	0.600	o	900	Pipe/Conduit	
S15.000	13.464	0.245	55.0	0.000	4.00	0.0	0.600	o	375	Pipe/Conduit	
S15.001	5.719	0.104	55.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.010	12.695	0.032	396.7	0.020	0.00	0.0	0.600	o	900	Pipe/Conduit	
S16.000	7.175	0.095	75.5	0.013	4.00	0.0	0.600	o	100	Pipe/Conduit	
S16.001	7.903	0.111	71.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.011	15.717	0.105	149.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S13.000	100.00	4.02	65.050	0.020	0.0	0.0	0.0	2.91	22.9	5.4
S13.001	100.00	4.03	64.600	0.000	4.0	0.0	0.0	2.82	49.8	4.0
S12.002	100.00	4.47	63.508	0.060	20.0	0.0	0.0	1.56	992.7	36.2
S1.008	100.00	5.88	63.427	0.281	110.0	0.0	0.0	1.57	996.8	186.1
S14.000	100.00	4.03	64.700	0.021	0.0	0.0	0.0	2.35	18.5	5.7
S14.001	100.00	4.04	64.300	0.000	4.0	0.0	0.0	1.94	34.3	4.0
S1.009	100.00	5.98	63.398	0.296	114.0	0.0	0.0	1.56	991.2	194.2
S15.000	100.00	4.09	64.250	0.000	0.0	0.0	0.0	2.45	270.4	0.0
S15.001	100.00	4.13	64.005	0.000	0.0	0.0	0.0	2.45	270.4	0.0
S1.010	100.00	6.11	63.376	0.316	114.0	0.0	0.0	1.57	996.8	199.6
S16.000	100.00	4.13	64.350	0.013	0.0	0.0	0.0	0.89	7.0	3.5
S16.001	100.00	4.11	64.205	0.000	2.0	0.0	0.0	1.19	21.1	2.0
S1.011	100.00	4.32	63.344	0.000	10.3	0.0	0.0	0.82	14.5	10.3



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Area Summary for S104 SW

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.018	0.018	0.018
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.036	0.036	0.036
2.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.051	0.051	0.051
3.000	-	-	100	0.037	0.037	0.037
3.001	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.020	0.020	0.020
4.000	-	-	100	0.030	0.030	0.030
4.001	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.026	0.026	0.026
5.001	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.019	0.019	0.019
6.000	-	-	100	0.035	0.035	0.035
6.001	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.064	0.064	0.064
7.001	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.066	0.066	0.066
8.000	-	-	100	0.082	0.082	0.082
8.001	-	-	100	0.000	0.000	0.000
8.002	-	-	100	0.015	0.015	0.015
9.000	-	-	100	0.010	0.010	0.010
9.001	-	-	100	0.000	0.000	0.000
8.003	-	-	100	0.039	0.039	0.039
10.000	-	-	100	0.041	0.041	0.041
10.001	-	-	100	0.000	0.000	0.000
11.000	-	-	100	0.088	0.088	0.088
11.001	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.011	0.011	0.011
12.000	-	-	100	0.074	0.074	0.074
12.001	-	-	100	0.000	0.000	0.000
13.000	-	-	100	0.020	0.020	0.020
13.001	-	-	100	0.000	0.000	0.000
12.002	-	-	100	0.060	0.060	0.060
1.008	-	-	100	0.000	0.000	0.000
14.000	-	-	100	0.021	0.021	0.021
14.001	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.015	0.015	0.015
15.000	-	-	100	0.000	0.000	0.000
15.001	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.020	0.020	0.020
16.000	-	-	100	0.013	0.013	0.013
16.001	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.911	0.911	0.911

DYSE		Page 6
		
Date 14/02/2022 14:25 File 211214 SW-FW.MDX	Designed by andyj Checked by	
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Free Flowing Outfall Details for S104 SW

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
S1.011	S	65.250	63.239	0.000	0	0

Simulation Criteria for S104 SW

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	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	16
Number of Online Controls	16	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

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DYSE		Page 7
		
Date 14/02/2022 14:25 File 211214 SW-FW.MDX	Designed by andyj Checked by	
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<u>Online Controls for S104 SW</u>		
<u>Orifice Manhole: S1.0, DS/PN: S1.001, Volume (m³): 0.3</u> Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 64.900 <u>Orifice Manhole: S1.1, DS/PN: S2.001, Volume (m³): 0.3</u> Diameter (m) 0.064 Discharge Coefficient 0.600 Invert Level (m) 64.730 <u>Orifice Manhole: S1.3, DS/PN: S3.001, Volume (m³): 0.4</u> Diameter (m) 0.064 Discharge Coefficient 0.600 Invert Level (m) 64.590 <u>Orifice Manhole: S1.5, DS/PN: S4.001, Volume (m³): 0.2</u> Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 64.504 <u>Orifice Manhole: S1.7, DS/PN: S5.001, Volume (m³): 0.3</u> Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 64.478 <u>Orifice Manhole: S1.9, DS/PN: S6.001, Volume (m³): 0.2</u> Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 64.448 <u>Orifice Manhole: S1.10, DS/PN: S7.001, Volume (m³): 0.2</u> Diameter (m) 0.099 Discharge Coefficient 0.600 Invert Level (m) 64.436 <u>Orifice Manhole: S1.12, DS/PN: S8.001, Volume (m³): 0.3</u> Diameter (m) 0.099 Discharge Coefficient 0.600 Invert Level (m) 64.452 <u>Orifice Manhole: S1.14, DS/PN: S9.001, Volume (m³): 0.2</u> Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 64.870 <u>Orifice Manhole: S1.16, DS/PN: S10.001, Volume (m³): 0.3</u> Diameter (m) 0.084 Discharge Coefficient 0.600 Invert Level (m) 64.420 <u>Orifice Manhole: S1.17, DS/PN: S11.001, Volume (m³): 0.3</u> Diameter (m) 0.099 Discharge Coefficient 0.600 Invert Level (m) 64.700		
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 <u>Orifice Manhole: S1.19, DS/PN: S12.001, Volume (m³): 0.3</u> Diameter (m) 0.107 Discharge Coefficient 0.600 Invert Level (m) 64.383 <u>Orifice Manhole: S1.20, DS/PN: S13.001, Volume (m³): 0.2</u> Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 64.600 <u>Orifice Manhole: S1.23, DS/PN: S14.001, Volume (m³): 0.2</u> Diameter (m) 0.052 Discharge Coefficient 0.600 Invert Level (m) 64.300 <u>Orifice Manhole: S1.27, DS/PN: S16.001, Volume (m³): 0.2</u> Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 64.205 <u>Hydro-Brake® Optimum Manhole: S1.28, DS/PN: S1.011, Volume (m³): 12.9</u> <table><tr><td>Unit Reference</td><td>MD-SHE-0136-1040-1850-1040</td></tr><tr><td>Design Head (m)</td><td>1.850</td></tr><tr><td>Design Flow (l/s)</td><td>10.4</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td></tr><tr><td>Application</td><td>Surface</td></tr><tr><td>Sump Available</td><td>Yes</td></tr><tr><td>Diameter (mm)</td><td>136</td></tr><tr><td>Invert Level (m)</td><td>63.344</td></tr><tr><td>Minimum Outlet Pipe Diameter (mm)</td><td>150</td></tr><tr><td>Suggested Manhole Diameter (mm)</td><td>1500</td></tr></table> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.850</td><td>10.4</td></tr><tr><td>Flush-Flo™</td><td>0.541</td><td>10.4</td></tr><tr><td>Kick-Flo®</td><td>1.122</td><td>8.2</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>9.1</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>4.9</td><td>1.200</td><td>8.5</td><td>3.000</td><td>13.1</td><td>7.000</td><td>19.6</td></tr><tr><td>0.200</td><td>8.9</td><td>1.400</td><td>9.1</td><td>3.500</td><td>14.1</td><td>7.500</td><td>20.2</td></tr><tr><td>0.300</td><td>9.8</td><td>1.600</td><td>9.7</td><td>4.000</td><td>15.0</td><td>8.000</td><td>20.9</td></tr><tr><td>0.400</td><td>10.2</td><td>1.800</td><td>10.3</td><td>4.500</td><td>15.8</td><td>8.500</td><td>21.5</td></tr><tr><td>0.500</td><td>10.4</td><td>2.000</td><td>10.8</td><td>5.000</td><td>16.7</td><td>9.000</td><td>22.1</td></tr><tr><td>0.600</td><td>10.4</td><td>2.200</td><td>11.3</td><td>5.500</td><td>17.4</td><td>9.500</td><td>22.7</td></tr><tr><td>0.800</td><td>10.1</td><td>2.400</td><td>11.8</td><td>6.000</td><td>18.2</td><td></td><td></td></tr><tr><td>1.000</td><td>9.2</td><td>2.600</td><td>12.2</td><td>6.500</td><td>18.9</td><td></td><td></td></tr></table>			Unit Reference	MD-SHE-0136-1040-1850-1040	Design Head (m)	1.850	Design Flow (l/s)	10.4	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	136	Invert Level (m)	63.344	Minimum Outlet Pipe Diameter (mm)	150	Suggested Manhole Diameter (mm)	1500	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.850	10.4	Flush-Flo™	0.541	10.4	Kick-Flo®	1.122	8.2	Mean Flow over Head Range	-	9.1	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	4.9	1.200	8.5	3.000	13.1	7.000	19.6	0.200	8.9	1.400	9.1	3.500	14.1	7.500	20.2	0.300	9.8	1.600	9.7	4.000	15.0	8.000	20.9	0.400	10.2	1.800	10.3	4.500	15.8	8.500	21.5	0.500	10.4	2.000	10.8	5.000	16.7	9.000	22.1	0.600	10.4	2.200	11.3	5.500	17.4	9.500	22.7	0.800	10.1	2.400	11.8	6.000	18.2			1.000	9.2	2.600	12.2	6.500	18.9		
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DYSE		Page 9
		
Date 14/02/2022 14:25	Designed by andyj	
File 211214 SW-FW.MDX	Checked by	
XP Solutions		Network 2020.1
<u>Storage Structures for S104 SW</u>		
<u>Porous Car Park Manhole: SFC1, DS/PN: S1.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 4.8
Membrane Percolation (mm/hr)	1000	Length (m) 10.0
Max Percolation (l/s)	13.3	Slope (1:X) 0.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	65.650	Membrane Depth (mm) 0
<u>Porous Car Park Manhole: SFC2, DS/PN: S2.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 3.5
Membrane Percolation (mm/hr)	1000	Length (m) 37.4
Max Percolation (l/s)	36.4	Slope (1:X) 0.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	65.480	Cap Volume Depth (m) 0.350
<u>Porous Car Park Manhole: SFC3, DS/PN: S3.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 3.5
Membrane Percolation (mm/hr)	1000	Length (m) 37.7
Max Percolation (l/s)	36.7	Slope (1:X) 0.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	64.400	Cap Volume Depth (m) 0.350
<u>Porous Car Park Manhole: SFC4, DS/PN: S4.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 3.5
Membrane Percolation (mm/hr)	1000	Length (m) 58.0
Max Percolation (l/s)	56.4	Slope (1:X) 0.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	65.180	Cap Volume Depth (m) 0.350
<u>Porous Car Park Manhole: SFC5, DS/PN: S5.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Width (m) 3.5
Membrane Percolation (mm/hr)	1000	Length (m) 33.0
Max Percolation (l/s)	32.1	Slope (1:X) 0.0
Safety Factor	2.0	Depression Storage (mm) 5
Porosity	0.30	Evaporation (mm/day) 3
Invert Level (m)	65.130	Cap Volume Depth (m) 0.350
<u>Porous Car Park Manhole: SFC6, DS/PN: S6.000</u>		
Infiltration Coefficient Base (m/hr)	0.00000	Max Percolation (l/s) 36.9
Membrane Percolation (mm/hr)	1000	Safety Factor 2.0
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DYSE		Page 10
		
Date 14/02/2022 14:25	Designed by andyj	
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<u>Porous Car Park Manhole: SFC6, DS/PN: S6.000</u> Porosity 0.30 Slope (1:X) 0.0 Invert Level (m) 65.280 Depression Storage (mm) 5 Width (m) 3.5 Evaporation (mm/day) 3 Length (m) 38.0 Cap Volume Depth (m) 0.350 <u>Porous Car Park Manhole: SFC7, DS/PN: S7.000</u> Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.5 Membrane Percolation (mm/hr) 1000 Length (m) 61.0 Max Percolation (l/s) 59.3 Slope (1:X) 0.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 65.090 Cap Volume Depth (m) 0.350 <u>Porous Car Park Manhole: SFC8, DS/PN: S8.000</u> Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.5 Membrane Percolation (mm/hr) 1000 Length (m) 112.0 Max Percolation (l/s) 108.9 Slope (1:X) 0.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 64.730 Cap Volume Depth (m) 0.350 <u>Porous Car Park Manhole: SFC9, DS/PN: S9.000</u> Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 4.8 Membrane Percolation (mm/hr) 1000 Length (m) 4.6 Max Percolation (l/s) 6.1 Slope (1:X) 0.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 64.780 Cap Volume Depth (m) 0.350 <u>Porous Car Park Manhole: SFC10, DS/PN: S10.000</u> Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.5 Membrane Percolation (mm/hr) 1000 Length (m) 32.0 Max Percolation (l/s) 31.1 Slope (1:X) 0.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 65.330 Cap Volume Depth (m) 0.350 <u>Porous Car Park Manhole: SFC11, DS/PN: S11.000</u> Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 3.5 Membrane Percolation (mm/hr) 1000 Length (m) 75.0 Max Percolation (l/s) 72.9 Slope (1:X) 0.0 Safety Factor 2.0 Depression Storage (mm) 5 Porosity 0.30 Evaporation (mm/day) 3 Invert Level (m) 65.530 Cap Volume Depth (m) 0.350		
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DYSE		Page 11																																																																																																																														
																																																																																																																																
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Porous Car Park Manhole: SFC12, DS/PN: S12.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>3.5</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>62.0</td></tr><tr><td>Max Percolation (l/s)</td><td>60.3</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>65.180</td><td>Membrane Depth (mm)</td><td>0</td></tr></table> Porous Car Park Manhole: SFC13, DS/PN: S13.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>3.5</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>57.0</td></tr><tr><td>Max Percolation (l/s)</td><td>55.4</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>65.580</td><td>Cap Volume Depth (m)</td><td>0.350</td></tr></table> Porous Car Park Manhole: SFC14, DS/PN: S14.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>3.5</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>20.0</td></tr><tr><td>Max Percolation (l/s)</td><td>19.4</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>65.230</td><td>Cap Volume Depth (m)</td><td>0.350</td></tr></table> Cellular Storage Manhole: STANK, DS/PN: S15.000 <table><tr><td>Invert Level (m)</td><td>64.300</td><td>Safety Factor</td><td>2.0</td></tr><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Porosity</td><td>0.95</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.00000</td><td></td><td></td></tr></table> <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>190.8</td><td>190.8</td><td>0.632</td><td>0.0</td><td>258.7</td></tr><tr><td>0.631</td><td>190.8</td><td>258.7</td><td></td><td></td><td></td></tr></table> Porous Car Park Manhole: SFC15, DS/PN: S16.000 <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Width (m)</td><td>3.5</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Length (m)</td><td>15.0</td></tr><tr><td>Max Percolation (l/s)</td><td>14.6</td><td>Slope (1:X)</td><td>0.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Porosity</td><td>0.30</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Invert Level (m)</td><td>64.830</td><td>Cap Volume Depth (m)</td><td>0.350</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.5	Membrane Percolation (mm/hr)	1000	Length (m)	62.0	Max Percolation (l/s)	60.3	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	65.180	Membrane Depth (mm)	0	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.5	Membrane Percolation (mm/hr)	1000	Length (m)	57.0	Max Percolation (l/s)	55.4	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	65.580	Cap Volume Depth (m)	0.350	Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.5	Membrane Percolation (mm/hr)	1000	Length (m)	20.0	Max Percolation (l/s)	19.4	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	65.230	Cap Volume Depth (m)	0.350	Invert Level (m)	64.300	Safety Factor	2.0	Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95	Infiltration Coefficient Side (m/hr)	0.00000			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	190.8	190.8	0.632	0.0	258.7	0.631	190.8	258.7				Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	3.5	Membrane Percolation (mm/hr)	1000	Length (m)	15.0	Max Percolation (l/s)	14.6	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	64.830	Cap Volume Depth (m)	0.350
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Appendix E - Microdrainage Results

DYSE

Page 3

Date 14/02/2022 14:27
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for S104 SW

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.006	S1.11	120 Winter	2	+0%	100/30 Summer			
S8.000	SFC8	1440 Winter	2	+0%				
S8.001	S1.12	960 Summer	2	+0%	100/30 Winter			
S8.002	S1.13	120 Winter	2	+0%	100/30 Summer			
S9.000	SFC9	1440 Winter	2	+0%	100/60 Winter			
S9.001	S1.14	1440 Winter	2	+0%	100/30 Winter			
S8.003	S1.15	120 Winter	2	+0%	100/30 Summer			
S10.000	SFC10	15 Winter	2	+0%	30/15 Summer			
S10.001	S1.16	15 Winter	2	+0%	2/15 Summer			
S11.000	SFC11	15 Winter	2	+0%	2/15 Summer			
S11.001	S1.17	15 Winter	2	+0%	2/15 Summer			
S1.007	S1.18	120 Winter	2	+0%	100/30 Summer			
S12.000	SFC12	15 Winter	2	+0%	30/15 Summer			
S12.001	S1.19	15 Summer	2	+0%	2/15 Summer			
S13.000	SFC13	30 Winter	2	+0%	30/15 Summer			
S13.001	S1.20	30 Winter	2	+0%	2/15 Winter			
S12.002	S1.21	120 Winter	2	+0%	100/30 Summer			
S1.008	S1.22	120 Winter	2	+0%	100/15 Winter			
S14.000	SFC14	15 Winter	2	+0%	30/15 Summer			
S14.001	S1.23	15 Winter	2	+0%	2/15 Summer			
S1.009	S1.24	120 Winter	2	+0%	100/15 Winter			
S15.000	STANK	15 Summer	2	+0%	100/60 Winter			
S15.001	S1.25	15 Summer	2	+0%	100/30 Summer			
S1.010	S1.26	120 Winter	2	+0%	30/120 Winter			
S16.000	SFC15	15 Winter	2	+0%	2/15 Summer			
S16.001	S1.27	15 Winter	2	+0%	2/15 Summer			
S1.011	S1.28	120 Winter	2	+0%	2/15 Summer	100/180 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Half Drain Overflow (l/s)	Pipe Time (mins)	Pipe Flow (l/s)	Status
S1.006	S1.11	63.898	-0.628	0.000	0.02			17.1	OK
S8.000	SFC8	64.930	-0.370	0.000	0.00			0.0	OK
S8.001	S1.12	64.454	-0.148	0.000	0.00			0.0	OK
S8.002	S1.13	63.898	-0.602	0.000	0.00			0.4	OK
S9.000	SFC9	65.251	-0.099	0.000	0.00			0.0	OK
S9.001	S1.14	64.882	-0.138	0.000	0.00			0.0	OK
S8.003	S1.15	63.898	-0.563	0.000	0.00			1.3	OK
S10.000	SFC10	64.803	-0.047	0.000	0.55		5	6.8	OK
S10.001	S1.16	64.680	0.110	0.000	0.30			6.8	SURCHARGED
S11.000	SFC11	65.295	0.225	0.000	0.51		3	14.0	SURCHARGED
S11.001	S1.17	65.235	0.385	0.000	0.39			13.9	SURCHARGED
S1.007	S1.18	63.898	-0.477	0.000	0.02			13.8	OK
S12.000	SFC12	64.761	-0.089	0.000	0.35		5	12.4	OK
S12.001	S1.19	64.709	0.176	0.000	0.81			12.4	SURCHARGED
S13.000	SFC13	65.080	-0.070	0.000	0.14		7	2.4	OK

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for S104 SW

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
S13.001	S1.20	64.818	0.068	0.000	0.07		2.4	SURCHARGED
S12.002	S1.21	63.898	-0.510	0.000	0.01		7.4	OK
S1.008	S1.22	63.898	-0.429	0.000	0.03		12.9	OK
S14.000	SFC14	64.732	-0.068	0.000	0.22	5	3.5	OK
S14.001	S1.23	64.703	0.253	0.000	0.14		3.4	SURCHARGED
S1.009	S1.24	63.897	-0.401	0.000	0.03		12.6	OK
S15.000	STANK	64.250	-0.375	0.000	0.00		0.0	OK
S15.001	S1.25	64.005	-0.375	0.000	0.00		0.0	OK
S1.010	S1.26	63.897	-0.379	0.000	0.02		11.9	OK
S16.000	SFC15	64.558	0.108	0.000	0.30	4	1.9	SURCHARGED
S16.001	S1.27	64.546	0.191	0.000	0.09		1.6	SURCHARGED
S1.011	S1.28	63.896	0.402	0.000	0.77		10.4	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.006	S1.11	
S8.000	SFC8	
S8.001	S1.12	
S8.002	S1.13	
S9.000	SFC9	
S9.001	S1.14	
S8.003	S1.15	
S10.000	SFC10	
S10.001	S1.16	
S11.000	SFC11	
S11.001	S1.17	
S1.007	S1.18	
S12.000	SFC12	
S12.001	S1.19	
S13.000	SFC13	
S13.001	S1.20	
S12.002	S1.21	
S1.008	S1.22	
S14.000	SFC14	
S14.001	S1.23	
S1.009	S1.24	
S15.000	STANK	
S15.001	S1.25	
S1.010	S1.26	
S16.000	SFC15	
S16.001	S1.27	
S1.011	S1.28	4



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Date 14/02/2022 14:28
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for S104 SW

		Water	Surcharged	Flooded				Half Drain	Pipe	
	US/MH	Level	Depth	Volume	Flow /	Overflow	Time	Flow		
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status	
S1.000	SFC1	65.653	0.453	0.000	0.60		3	4.7	SURCHARGED	
S1.001	S1.0	65.603	0.553	0.000	0.30			4.6	SURCHARGED	
S2.000	SFC2	65.499	0.449	0.000	0.66		4	7.0	SURCHARGED	
S2.001	S1.1	65.426	0.546	0.000	0.27			7.0	SURCHARGED	
S1.002	S1.2	64.281	-0.431	0.000	0.01			9.6	OK	
S3.000	SFC3	64.883	-0.137	0.000	0.02			0.4	OK	
S3.001	S1.3	64.624	-0.116	0.000	0.02			0.4	OK	
S1.003	S1.4	64.281	-0.353	0.000	0.02			8.8	OK	
S4.000	SFC4	65.181	0.431	0.000	1.16		4	8.4	SURCHARGED	
S4.001	S1.5	65.051	0.397	0.000	0.57			8.4	SURCHARGED	
S1.004	S1.6	64.281	-0.314	0.000	0.02			9.8	OK	
S5.000	SFC5	65.147	0.397	0.000	0.34		5	5.2	SURCHARGED	
S5.001	S1.7	65.274	0.646	0.000	0.30			4.5	SURCHARGED	
S1.005	S1.8	64.281	-0.281	0.000	0.02			11.9	OK	
S6.000	SFC6	65.280	0.600	0.000	0.91		4	10.2	SURCHARGED	
S6.001	S1.9	65.260	0.662	0.000	0.67			10.2	SURCHARGED	
S7.000	SFC7	65.104	0.394	0.000	0.85		4	14.5	SURCHARGED	
S7.001	S1.10	65.052	0.466	0.000	0.97			14.4	SURCHARGED	

PN	US/MH Name	Level Exceeded
S1.000	SFC1	
S1.001	S1.0	
S2.000	SFC2	
S2.001	S1.1	
S1.002	S1.2	
S3.000	SFC3	
S3.001	S1.3	
S1.003	S1.4	
S4.000	SFC4	
S4.001	S1.5	
S1.004	S1.6	
S5.000	SFC5	
S5.001	S1.7	
S1.005	S1.8	
S6.000	SFC6	
S6.001	S1.9	
S7.000	SFC7	
S7.001	S1.10	

DYSE		Page 3
		
Date 14/02/2022 14:28 File 211214 SW-FW.MDX	Designed by andyj Checked by	
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for S104 SW

PN	US/MH			Return	Climate	First (X)		First (Y)	First (Z)	Overflow
	Name	Storm		Period	Change	Surcharge		Flood	Overflow	Act.
S1.006	S1.11	120	Winter	30	+0%	100/30	Summer			
S8.000	SFC8	1440	Winter	30	+0%					
S8.001	S1.12	1440	Winter	30	+0%	100/30	Winter			
S8.002	S1.13	120	Winter	30	+0%	100/30	Summer			
S9.000	SFC9	240	Winter	30	+0%	100/60	Winter			
S9.001	S1.14	240	Winter	30	+0%	100/30	Winter			
S8.003	S1.15	120	Winter	30	+0%	100/30	Summer			
S10.000	SFC10	15	Winter	30	+0%	30/15	Summer			
S10.001	S1.16	15	Winter	30	+0%	2/15	Summer			
S11.000	SFC11	15	Winter	30	+0%	2/15	Summer			
S11.001	S1.17	15	Winter	30	+0%	2/15	Summer			
S1.007	S1.18	120	Winter	30	+0%	100/30	Summer			
S12.000	SFC12	15	Winter	30	+0%	30/15	Summer			
S12.001	S1.19	15	Winter	30	+0%	2/15	Summer			
S13.000	SFC13	15	Winter	30	+0%	30/15	Summer			
S13.001	S1.20	15	Winter	30	+0%	2/15	Winter			
S12.002	S1.21	120	Winter	30	+0%	100/30	Summer			
S1.008	S1.22	120	Winter	30	+0%	100/15	Winter			
S14.000	SFC14	15	Winter	30	+0%	30/15	Summer			
S14.001	S1.23	15	Summer	30	+0%	2/15	Summer			
S1.009	S1.24	120	Winter	30	+0%	100/15	Winter			
S15.000	STANK	120	Winter	30	+0%	100/60	Winter			
S15.001	S1.25	120	Winter	30	+0%	100/30	Summer			
S1.010	S1.26	120	Winter	30	+0%	30/120	Winter			
S16.000	SFC15	15	Winter	30	+0%	2/15	Summer			
S16.001	S1.27	15	Winter	30	+0%	2/15	Summer			
S1.011	S1.28	120	Winter	30	+0%	2/15	Summer	100/180	Winter	

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)	
S1.006	S1.11	64.281	-0.245	0.000	0.03			23.4	OK
S8.000	SFC8	65.204	-0.096	0.000	0.01			0.2	OK
S8.001	S1.12	64.474	-0.128	0.000	0.01			0.2	OK
S8.002	S1.13	64.281	-0.219	0.000	0.00			0.6	OK
S9.000	SFC9	65.261	-0.089	0.000	0.03			0.4	OK
S9.001	S1.14	64.916	-0.104	0.000	0.01			0.4	OK
S8.003	S1.15	64.281	-0.180	0.000	0.00			1.3	OK
S10.000	SFC10	65.332	0.482	0.000	0.94		3	11.6	SURCHARGED
S10.001	S1.16	65.086	0.516	0.000	0.51			11.6	SURCHARGED
S11.000	SFC11	65.554	0.484	0.000	0.63		4	17.3	SURCHARGED
S11.001	S1.17	65.466	0.616	0.000	0.49			17.3	SURCHARGED
S1.007	S1.18	64.281	-0.094	0.000	0.02			14.8	OK
S12.000	SFC12	65.190	0.340	0.000	0.52		3	18.3	SURCHARGED
S12.001	S1.19	65.105	0.572	0.000	1.19			18.2	SURCHARGED
S13.000	SFC13	65.473	0.323	0.000	0.29		3	5.1	SURCHARGED

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for S104 SW

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
S13.001	S1.20	65.438	0.688	0.000	0.14		5.0	SURCHARGED
S12.002	S1.21	64.280	-0.128	0.000	0.02		14.4	OK
S1.008	S1.22	64.280	-0.047	0.000	0.03		14.0	OK
S14.000	SFC14	65.233	0.433	0.000	0.34	3	5.4	SURCHARGED
S14.001	S1.23	65.195	0.745	0.000	0.21		5.2	SURCHARGED
S1.009	S1.24	64.280	-0.018	0.000	0.03		13.8	OK
S15.000	STANK	64.279	-0.346	0.000	0.00	10	0.1	OK
S15.001	S1.25	64.279	-0.101	0.000	0.00		0.3	OK
S1.010	S1.26	64.279	0.003	0.000	0.03		12.9	SURCHARGED
S16.000	SFC15	64.845	0.395	0.000	0.39	5	2.5	SURCHARGED
S16.001	S1.27	64.836	0.481	0.000	0.12		2.2	SURCHARGED
S1.011	S1.28	64.279	0.785	0.000	0.77		10.4	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.006	S1.11	
S8.000	SFC8	
S8.001	S1.12	
S8.002	S1.13	
S9.000	SFC9	
S9.001	S1.14	
S8.003	S1.15	
S10.000	SFC10	
S10.001	S1.16	
S11.000	SFC11	
S11.001	S1.17	
S1.007	S1.18	
S12.000	SFC12	
S12.001	S1.19	
S13.000	SFC13	
S13.001	S1.20	
S12.002	S1.21	
S1.008	S1.22	
S14.000	SFC14	
S14.001	S1.23	
S1.009	S1.24	
S15.000	STANK	
S15.001	S1.25	
S1.010	S1.26	
S16.000	SFC15	
S16.001	S1.27	
S1.011	S1.28	4


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File 211214 SW-FW.MDX
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100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for S104 SW

PN	US/MH Name	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)		
S1.000	SFC1	0.516	0.000	0.62		6	4.8	SURCHARGED	
S1.001	S1.0	0.609	0.000	0.32			4.8	SURCHARGED	
S2.000	SFC2	0.507	0.000	0.69		7	7.2	SURCHARGED	
S2.001	S1.1	0.597	0.000	0.28			7.2	SURCHARGED	
S1.002	S1.2	0.237	0.000	0.01			9.7	SURCHARGED	
S3.000	SFC3	-0.054	0.000	0.12			3.1	OK	
S3.001	S1.3	0.225	0.000	0.15			3.0	SURCHARGED	
S1.003	S1.4	0.315	0.000	0.02			12.8	SURCHARGED	
S4.000	SFC4	0.455	0.000	1.18		5	8.5	SURCHARGED	
S4.001	S1.5	0.417	0.000	0.58			8.5	SURCHARGED	
S1.004	S1.6	0.355	0.000	0.03			15.2	SURCHARGED	
S5.000	SFC5	0.448	0.000	0.35		11	5.5	SURCHARGED	
S5.001	S1.7	0.704	0.000	0.31			4.6	SURCHARGED	
S1.005	S1.8	0.388	0.000	0.04			18.8	SURCHARGED	
S6.000	SFC6	0.641	0.000	0.96		5	10.8	SURCHARGED	
S6.001	S1.9	0.746	0.000	0.68			10.4	SURCHARGED	
S7.000	SFC7	0.452	0.000	0.89		7	15.2	SURCHARGED	
S7.001	S1.10	0.517	0.000	1.02			15.2	SURCHARGED	

DYSE								Page 3
Date 14/02/2022 17:50 File 211214 SW-FW.MDX Designed by andyj Checked by								
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for S104 SW								
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Water Level (m)
S1.006	S1.11	240 Winter	100	+30%	100/30 Winter			64.950
S8.000	SFC8	600 Winter	100	+30%				65.226
S8.001	S1.12	240 Winter	100	+30%	100/30 Winter			64.965
S8.002	S1.13	240 Winter	100	+30%	100/30 Winter			64.950
S9.000	SFC9	60 Winter	100	+30%				65.317
S9.001	S1.14	60 Winter	100	+30%	100/30 Winter			65.312
S8.003	S1.15	240 Winter	100	+30%	100/30 Winter			64.950
S10.000	SFC10	15 Winter	100	+30%	100/15 Summer			65.390
S10.001	S1.16	15 Winter	100	+30%	100/15 Summer			65.128
S11.000	SFC11	15 Winter	100	+30%	100/15 Summer			65.625
S11.001	S1.17	15 Winter	100	+30%	100/15 Summer			65.529
S1.007	S1.18	240 Winter	100	+30%	100/30 Summer			64.950
S12.000	SFC12	15 Winter	100	+30%	100/15 Summer			65.252
S12.001	S1.19	15 Winter	100	+30%	100/15 Summer			65.160
S13.000	SFC13	15 Winter	100	+30%	100/15 Summer			65.595
S13.001	S1.20	15 Summer	100	+30%	100/15 Summer			65.563
S12.002	S1.21	240 Winter	100	+30%	100/30 Summer			64.949
S1.008	S1.22	240 Winter	100	+30%	100/30 Summer			64.949
S14.000	SFC14	15 Winter	100	+30%	100/15 Summer			65.286
S14.001	S1.23	15 Winter	100	+30%	100/15 Summer			65.244
S1.009	S1.24	240 Winter	100	+30%	100/30 Summer			64.948
S15.000	STANK	240 Winter	100	+30%	100/60 Winter			64.948
S15.001	S1.25	240 Winter	100	+30%	100/30 Summer			64.948
S1.010	S1.26	240 Winter	100	+30%	100/15 Winter			64.948
S16.000	SFC15	240 Winter	100	+30%	100/15 Summer			64.928
S16.001	S1.27	240 Winter	100	+30%	100/15 Summer			64.928
S1.011	S1.28	240 Winter	100	+30%	100/15 Summer			64.947
PN	US/MH Name	Depth (m)	Surcharged Volume (m³)	Flooded Flow / Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.006	S1.11	0.424	0.000	0.04		31.6	SURCHARGED	
S8.000	SFC8	-0.074	0.000	0.13		3.1	OK	
S8.001	S1.12	0.363	0.000	0.13		2.1	SURCHARGED	
S8.002	S1.13	0.450	0.000	0.00		2.2	SURCHARGED	
S9.000	SFC9	-0.033	0.000	0.13		2.1	OK	
S9.001	S1.14	0.292	0.000	0.04		1.9	SURCHARGED	
S8.003	S1.15	0.489	0.000	0.01		5.0	SURCHARGED	
S10.000	SFC10	0.540	0.000	0.97	5	12.0	SURCHARGED	
S10.001	S1.16	0.558	0.000	0.53		12.0	SURCHARGED	
S11.000	SFC11	0.555	0.000	0.66	7	18.1	SURCHARGED	
S11.001	S1.17	0.679	0.000	0.51		18.1	SURCHARGED	
S1.007	S1.18	0.575	0.000	0.07		47.6	SURCHARGED	
S12.000	SFC12	0.402	0.000	0.54	6	19.0	SURCHARGED	
S12.001	S1.19	0.627	0.000	1.24		19.0	SURCHARGED	
S13.000	SFC13	0.445	0.000	0.34	5	6.0	SURCHARGED	



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100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for S104 SW

		Surcharged	Flooded			Half Drain	Pipe		
	US/MH	Depth	Volume	Flow /	Overflow	Time	Flow		Level
PN	Name	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded
S1.000	SFC1	0.530	0.000	0.62		6	4.9	SURCHARGED	
S1.001	S1.0	0.622	0.000	0.32			4.9	SURCHARGED	
S2.000	SFC2	0.520	0.000	0.69		8	7.3	SURCHARGED	
S2.001	S1.1	0.608	0.000	0.28			7.3	SURCHARGED	
S1.002	S1.2	0.412	0.000	0.01			10.4	SURCHARGED	
S3.000	SFC3	0.130	0.000	0.14			3.6	SURCHARGED	
S3.001	S1.3	0.408	0.000	0.17			3.5	SURCHARGED	
S1.003	S1.4	0.490	0.000	0.03			15.1	SURCHARGED	
S4.000	SFC4	0.461	0.000	1.19		6	8.6	SURCHARGED	
S4.001	S1.5	0.484	0.000	0.23			3.4	SURCHARGED	
S1.004	S1.6	0.529	0.000	0.04			17.9	SURCHARGED	
S5.000	SFC5	0.459	0.000	0.35		9	5.4	SURCHARGED	
S5.001	S1.7	0.717	0.000	0.31			4.6	SURCHARGED	
S1.005	S1.8	0.562	0.000	0.04			22.1	SURCHARGED	
S6.000	SFC6	0.651	0.000	0.98		5	11.0	SURCHARGED	
S6.001	S1.9	0.794	0.000	0.68			10.4	SURCHARGED	
S7.000	SFC7	0.464	0.000	0.90		6	15.3	SURCHARGED	
S7.001	S1.10	0.552	0.000	0.48			7.2	SURCHARGED	



Designed by andyj
Checked by

Network 2020.1

1) for S104 SW

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status
							Time (mins)	Flow (l/s)	
S1.006	S1.11	65.124	0.598	0.000	0.04			37.3	SURCHARGED
S8.000	SFC8	65.234	-0.066	0.000	0.17			3.9	OK
S8.001	S1.12	65.148	0.546	0.000	0.25			3.9	SURCHARGED
S8.002	S1.13	65.124	0.624	0.000	0.01			4.1	SURCHARGED
S9.000	SFC9	65.423	0.073	0.000	0.13			2.1	SURCHARGED
S9.001	S1.14	65.417	0.397	0.000	0.04			2.1	SURCHARGED
S8.003	S1.15	65.124	0.663	0.000	0.01			5.9	SURCHARGED
S10.000	SFC10	65.404	0.554	0.000	0.97		5	12.1	SURCHARGED
S10.001	S1.16	65.139	0.569	0.000	0.20			4.6	SURCHARGED
S11.000	SFC11	65.640	0.570	0.000	0.67		8	18.2	SURCHARGED
S11.001	S1.17	65.542	0.692	0.000	0.51			18.2	SURCHARGED
S1.007	S1.18	65.124	0.749	0.000	0.09			56.2	SURCHARGED
S12.000	SFC12	65.266	0.416	0.000	0.54		7	19.2	SURCHARGED
S12.001	S1.19	65.172	0.639	0.000	1.25			19.2	SURCHARGED
S13.000	SFC13	65.599	0.449	0.000	0.33		6	5.8	SURCHARGED



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Date 14/02/2022 14:29
File 211214 SW-FW.MDX
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Designed by andyj
Checked by

XP Solutions

Network 2020.1

100 year Return Period Summary of Critical Results by Maximum Level (Rank
1) for S104 SW

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)	
S13.001	S1.20	65.569	0.819	0.000	0.15			5.5	SURCHARGED
S12.002	S1.21	65.123	0.715	0.000	0.02			15.6	SURCHARGED
S1.008	S1.22	65.123	0.796	0.000	0.15			70.5	SURCHARGED
S14.000	SFC14	65.298	0.498	0.000	0.35		7	5.5	SURCHARGED
S14.001	S1.23	65.255	0.805	0.000	0.22			5.4	SURCHARGED
S1.009	S1.24	65.123	0.825	0.000	0.17			73.9	FLOOD RISK
S15.000	STANK	65.122	0.497	0.000	0.04		217	6.9	SURCHARGED
S15.001	S1.25	65.122	0.742	0.000	0.06			7.0	SURCHARGED
S1.010	S1.26	65.122	0.846	0.000	0.04			22.0	FLOOD RISK
S16.000	SFC15	65.123	0.673	0.000	0.16		84	1.0	FLOOD RISK
S16.001	S1.27	65.123	0.768	0.000	0.05			1.0	FLOOD RISK
S1.011	S1.28	65.121	1.627	21.410	0.77			10.4	FLOOD

PN	US/MH Name	Level Exceeded
S1.006	S1.11	
S8.000	SFC8	
S8.001	S1.12	
S8.002	S1.13	
S9.000	SFC9	
S9.001	S1.14	
S8.003	S1.15	
S10.000	SFC10	
S10.001	S1.16	
S11.000	SFC11	
S11.001	S1.17	
S1.007	S1.18	
S12.000	SFC12	
S12.001	S1.19	
S13.000	SFC13	
S13.001	S1.20	
S12.002	S1.21	
S1.008	S1.22	
S14.000	SFC14	
S14.001	S1.23	
S1.009	S1.24	
S15.000	STANK	
S15.001	S1.25	
S1.010	S1.26	
S16.000	SFC15	
S16.001	S1.27	
S1.011	S1.28	4

Appendix F - Exceedance Flow Paths



Residual Risks

These drawings should be read in conjunction with the designer's risk assessment (DRA) which communicates significant residual design risks that have been identified and suggests mitigating actions.

General Notes

- All dimensions are in metres unless stated otherwise.
- This drawing shall be read in conjunction with all other relevant engineering details, drawings and specifications.
- Any discrepancies should be reported to the engineer immediately so that clarification can be sought prior to the commencement of work.
- All work is to be carried out in accordance with the specification for highways works and local authority guidance.
- Underground services may be present in the area. Contractor is to confirm the precise line and depth of any services prior to the commencement of any excavation works

Legend

- Site Boundary
- Proposed Major Contour 250mm intervals
- Proposed Minor Contours 50mm intervals
- S104 Surface Water Sewer
- S104 Surface Water Manhole
- S104 Foul Water Sewer
- S104 Foul Water Manhole
- Existing Surface Water Sewer
- Existing Foul Water sewer
- Private Surface Water Drain
- Private Foul Water Drain
- 300Ø Mini Access Chamber
- 450Ø Inspection Chamber
- 600Ø RIDGISTORMcheck Orifice Control Chamber. 2/s MAX
- Rodding Eye
- Surface Water Drainage Channel
- Polypipe Permeavoid Rainwater Diffuser Unit
- Permeable Car Park with min 350mm Subbase Storage
- S38 Road Gully
- Flood Flow Route
- Exceedance Events beyond the 100yr +40% Return Period

Rev	Date	First Issue	Description	ARI	BKD	JDY	JDY
				Drw	Chk	Rev'd	App

Status:

Preliminary

Client:

Towerhouse Systems

Project:

Cringle Road
Manchester

Drawing:

Exceedance Flow Paths

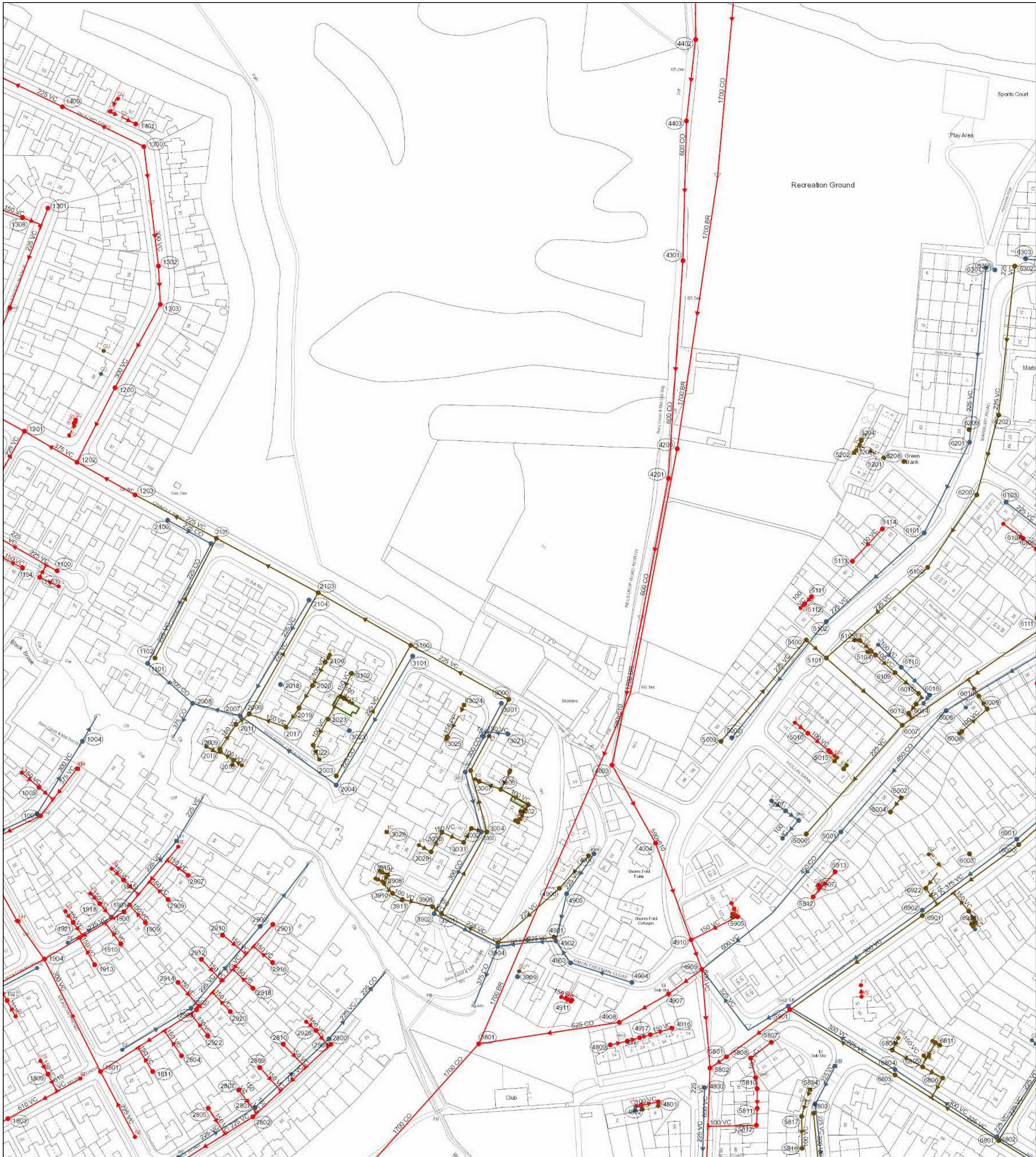
Drawing Number:
LM20066-DYSE-XX-ZZ-DR-C-1136

Revision:
P01



Exceedance Flow Paths
1:300

Appendix G - Sewer Records



Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
6201	67.96	SW	65.47	225	VC	55.6017	VC	55.6017	1 in 24
5802	65.05	CO	63.19	600	VC	141.2693	VC	141.2693	1 in 24
6015		FO		100	VC	7.870824	VC	7.870824	
4003	66.16	FO	67.71	150	BR	49.2479	BR	49.2479	
6808	64.76	SW	62.77	150	VC	19.15431	VC	19.15431	
2801	67.29	FO	63.98	225	VC	55.97321	VC	55.97321	1 in 79
2904	63.96	SW	62.04	225	VC	24.78829	VC	24.78829	1 in 83
6303		SW	0	225	VC	61.29437	VC	61.29437	1 in 38
6302	67.83	FO	65.46	225	VC	62.85442	VC	62.85442	
6202		FO		225	VC	46.60702	VC	46.60702	
2020		FO		100	VC	14.36158	VC	14.36158	
4802		CO		100	VC	9.697773	VC	9.697773	
6014		FO		100	VC	6.621807	VC	6.621807	
3007		FO		100	VC	2.318419	VC	2.318419	
2007	62.37	SW	59.3	300	CO	27.03885	CO	27.03885	1 in 129
1302	63.04	SW	59.81	300	VC	21.0238	VC	21.0238	1 in 131
2103	64.22	FO	59.85	225	VC	63.52052	VC	63.52052	1 in 159
1103		FO		150	VC	7.874804	VC	7.874804	
6006		FO		100	VC	18.59739	VC	18.59739	
6109		FO		100	VC	17.32414	VC	17.32414	
6918		FO		150	VC	13.11501	VC	13.11501	
1909		FO		150	VC	12.91722	VC	12.91722	
1201	62.33	CO	58.42	375	VC	33.12098	VC	33.12098	1 in 127
4800	65.01	SW	63.38	225	VC	68.0294	VC	68.0294	
3804	65.71	SW	64.11	225	VC	54.33231	VC	54.33231	1 in 151
4804	63.87	SW	62.51	225	VC	35.78514	VC	35.78514	1 in 74
6103	67.57	SW	0	225	VC	73.40981	VC	73.40981	
2022		FO		100	VC	8.54182	VC	8.54182	
1300	62.56	CO	60.31	225	VC	33.24154	VC	33.24154	1 in 88
2010		FO		100	VC	8.469398	VC	8.469398	
3002	65.14	FO	60.82	225	VC	44.29447	VC	44.29447	1 in 130
2104	64.14	FO	61.85	225	VC	37.21598	VC	37.21598	1 in 64
2106		FO		100	VC	11.14257	VC	11.14257	
3100	64.64	FO	60.22	225	VC	58.88856	VC	58.88856	1 in 163
1301	62.15	CO	60.3	225	VC	58.87275	VC	58.87275	1 in 97
2102	63.48	SW	61.45	225	CO	74.70609	CO	74.70609	1 in 66
3021		SW		150	VC	11.55687	VC	11.55687	
6200	67.71	FO	64.7	225	VC	48.25971	VC	48.25971	
4809		FO		600	VC	54.47087	VC	54.47087	
1203	63.07	CO	59.05	375	VC	36.71512	VC	36.71512	1 in 118
1102	61.81	FO	59.73	225	VC	74.42684	VC	74.42684	1 in 285
1304	62.1	CO	59.68	225	VC	56.0823	VC	56.0823	1 in 84
4402		FO		600	VC	45.27682	VC	45.27682	
2009		FO		100	VC	16.26989	VC	16.26989	
2100	63.29	SW	0	225	CO	27.29469	CO	27.29469	
1918		FO		150	VC	10.91623	VC	10.91623	
2003	62.8	FO	60.56	225	VC	82.85529	VC	82.85529	1 in 259
4203		FO		1700	BR	347.174	BR	347.174	
2013		FO		100	VC	1.52687	VC	1.52687	
5803	65.72	FO	63.79	300	VC	103.4877	VC	103.4877	1 in 211
3003	65.12	SW	62.78	300	VC	34.20536	VC	34.20536	1 in 122
6101	67.66	SW	0	225	VC	72.91776	VC	72.91776	
2008	62.07	SW	59.07	375	VC	21.65665	VC	21.65665	
3904	64.47	SW	61.62	375	CO	34.53983	CO	34.53983	1 in 60
2017		FO		150	VC	21.57868	VC	21.57868	
2914		CO		0	VC	17.78422	VC	17.78422	
4911		CO		150	VC	5.631601	VC	5.631601	
4301		CO		600	VC	120.2664	VC	120.2664	
5913		CO		100	VC	18.35069	VC	18.35069	
3101	64.73	CO	62.59	225	CO	82.40242	CO	82.40242	1 in 37
5902	65.25	SW	0	300	VC	25.72006	VC	25.72006	
4903	64.92	SW	62.34	225	VC	14.4222	VC	14.4222	
4917		CO		150	VC	12.51699	VC	12.51699	
4201		CO		600	VC	80.41145	VC	80.41145	
6803	65.93	FO	62.35	225	VC	68.29419	VC	68.29419	1 in 116
2900	63.47	SW	60.76	225	VC	44.20407	VC	44.20407	
6209		FO		100	VC	8.854448	VC	8.854448	
4901	65.38	FO	62.9	225	VC	31.14482	VC	31.14482	1 in 43
2902	64.03	SW	61.84	225	VC	58.9922	VC	58.9922	1 in 68
5010		CO		100	VC	14.87276	VC	14.87276	
6008	66.16	SW	0	450	VC	88.61716	VC	88.61716	
2011		FO		100	VC	8.18973	VC	8.18973	
5104		FO		100	VC	14.57512	VC	14.57512	
3902	63.32	SW	61.97	375	VC	39.39734	VC	39.39734	1 in 116
2015		FO		100	VC	14.48214	VC	14.48214	
4907		CO		100	VC	78.63334	VC	78.63334	
4403		CO		600	VC	77.92597	VC	77.92597	
3903	64.53	SW	62.16	225	VC	34.85553	VC	34.85553	1 in 47
3005	64.66	SW	62.48	300	VC	51.97115	VC	51.97115	1 in 106
2805		CO		150	VC	17.05151	VC	17.05151	
1303	63.2	CO	62.3456	300	VC	62.3456	VC	62.3456	1 in 181
4909		CO		525	VC	22.84772	VC	22.84772	
4902	65.37	SW	62.02	225	VC	16.93102	VC	16.93102	1 in 115
6811		FO		150	VC	15.23617	VC	15.23617	
2102	63.53	FO	59.44	225	VC	51	VC	51	1 in 178
5901	65.29	CO	61.82	300	VC	43.60046	VC	43.60046	
5805		FO		150	VC	28.69146	VC	28.69146	
3001	65.24	SW	63.05	300	VC	42.84165	VC	42.84165	1 in 172
3000	65.24	FO	60.48	225	VC	61.73738	VC	61.73738	1 in 247
6002		FO		150	VC	8.89255	VC	8.89255	
4908		CO		525	VC	78.24241	VC	78.24241	
4004		CO		600	VC	17.3376	VC	17.3376	
6100		FO		225	VC	75.0733	VC	75.0733	
1101	61.76	SW	59.39	300	VC	33.23699	VC	33.23699	1 in 107
4001	65.95	SW	64.45	225	VC	26.62705	VC	26.62705	1 in 40
3910		FO		100	VC	23.41379	VC	23.41379	
6801	66.36	FO	63.1	225	VC	67.41662	VC	67.41662	1 in 94
1400	62.21	CO	59.54	225	VC	55.4617	VC	55.4617	1 in 88
5801		FO		100	VC	10.61665	VC	10.61665	
2019		FO		100	VC	12.89248	VC	12.89248	
1004		FO		300	VC	16.12452	VC	16.12452	
5003	66.78	FO	64.67	225	VC	73.1095	VC	73.1095	
5006		SW		150	VC	13.30623	VC	13.30623	
6805		FO		150	VC	12.89248	VC	12.89248	
3006		FO		100	VC	12.75033	VC	12.75033	
3006	63.53	FO	61.61	150	VC	6.24418	VC	6.24418	1 in 104
3018		FO		100	UN	2.152776	UN	2.152776	
5001		CO		450	VC	59.26514	VC	59.26514	
6013		FO		100	VC	3.416851	VC	3.416851	
6802	66.35	SW	0	300	VC	67.11629	VC	67.11629	
1005		FO		150	VC	10.26247	VC	10.26247	
1200	62.96	CO	59.14	300	VC	46.06517	VC	46.06517	1 in 125
4000	66.87	FO	64.08	225	VC	24.98119	VC	24.98119	1 in 29
2004	62.74	SW	60.25	225	CO	65.23438	CO	65.23438	1 in 69
4900		FO		150	VC	9.5462	VC	9.5462	
1002	61.55	SW	0	300	VC	47.16991	VC	47.16991	
6010		FO		100	VC	10.91632	VC	10.91632	
6902	65.96	SW	0	375	VC	91.82197	VC	91.82197	
6804	65.9	SW	63.09	300	VC	68.00299	VC	68.00299	
4907		CO		525	VC	31.37078	VC	31.37078	
2023		FO		100	VC	16.46059	VC	16.46059	
4905	65.41	SW	63.77	225	VC	26.65333	VC	26.65333	1 in 148
6301		SW		225	VC	96.42095	VC	96.42095	
6007	66.1	FO	63.19	225	VC	80.95623	VC	80.95623	
4002		FO		100	VC	17.27533	VC	17.27533	
6901	65.95	FO	62.49	300	VC	89.2701	VC	89.2701	1 in 103
4800	65.68	FO	62.2	225	VC	45.34314	VC	45.34314	1 in 45
4809		FO		150	VC	7.041515	VC	7.041515	
5015		FO		100	VC	4.687787	VC	4.687787	
4918		FO		150	VC	6.149882	VC	6.149882	
3004	64.69	FO	35.1701	225	VC	35.1701	VC	35.1701	1 in 178
5817		FO		100	VC	17.59005	VC	17.59005	
6806		FO		150	VC	12.59962	VC	12.59962	
5100	67.19	FO	0	225	VC	14.86607	VC	14.86607	
1913		FO		150	VC	16.96955	VC	16.96955	
3801		CO		1700	VC	196.7213	VC	196.7213	
1927		CO		150	VC	10.15165	VC	10.15165	
1308		FO		150	VC	11.5903	VC	11.5903	
4004		CO		600	VC	55.78092	VC	55.78092	
5007		SW		100	VC	8.825373	VC	8.825373	
3901	63.45	FO	61.41	225	VC	51.47815	VC	51.47815	1 in 143
3025		FO		150	PP	1.353132	PP	1.353132	
6110		SW		100	VC	22.0707	VC	22.0707	
6001	66.2	SW	0	375	VC	65	VC	65	1 in 208
2006	62.98	FO							

Appendix H - United Utilities Correspondence

Tracee Winstone - Elluc Projects

From: Charles Townsend - Elluc Projects
Sent: 24 February 2017 15:56
To: Tracee Winstone - Elluc Projects
Subject: FW: REPEAT 1 DE3114 FW: Cringle Road, Manchester - DUE: 31/01/17

From: Charles Townsend - Elluc Projects
Sent: 22 February 2017 16:29
To: 'Wastewater Developer Services' <WastewaterDeveloperServices@uuplc.co.uk>
Subject: RE: REPEAT 1 DE3114 FW: Cringle Road, Manchester - DUE: 31/01/17

Hi Neil,

Thank you very much for your response and talk soon.

Kind regards
Charles

Charles Townsend
Senior Hydrologist

ELLUC Projects Ltd
760 Mandarin Court
Centre Park
Warrington
Cheshire
WA1 1GG

Tel: (01925) 243333

Email: charles@ellucprojects.co.uk
Web: www.ellucprojects.co.uk

Also offices in:

ELLUC Projects Ltd (Midlands)
7 Regents Courts, Far Moor Lane, Redditch, West Midlands, B98 0SD



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From: Wastewater Developer Services [<mailto:WastewaterDeveloperServices@uuplc.co.uk>]

Sent: 22 February 2017 16:26

To: Charles Townsend - Elluc Projects <charles@ellucprojects.co.uk>

Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>

Subject: REPEAT 1 DE3114 FW: Cringle Road, Manchester - DUE: 31/01/17

Charles,

There are a number of surface water sewer to the south of the site. UU not object to 56l/s being drain to this surface water network. However, UU require the site to make at least two connection. One would need to be to the 300mm SWS in Wilthorpe Close at 30l/s the other connection(s) can be convenient to yourself.

Regards

Neil