

# Drainage Impact Assessment

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Edmiston House  
Rangers Football Club

Project: Edmiston House  
Client: Rangers Football Club  
Project No: 181065

| version | date           | description | author       | reviewed by    |
|---------|----------------|-------------|--------------|----------------|
| V1.10   | 04 August 2020 | Planning    | Craig Colvin | David Campbell |

Note: Version Status  
V1.00 series – draft issues  
V1.10 series – formal issues



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# 1.0 Introduction

## 1.1 Appointment and Brief

Woolgar Hunter has been appointed by Rangers Football Club to provide engineering consultancy services for a new purpose-built retail, conference, and museum building at the site of the existing Edmiston House.

## 1.2 Report Objectives

The purpose of this report is to demonstrate to Glasgow City Council as Planning Authority, and the relevant Planning Consultees, these being Scottish Water and the Scottish Environmental Protection Agency (SEPA), that the proposed development can be drained in a sustainable manner.

The report describes the proposed surface water management strategy for the site, in accordance with the Sustainable Drainage Systems (SuDS) Design Guidance and the National Planning Framework provided by Glasgow City Council and Scottish Government, respectively.

The report summarises the existing arrangement of foul and surface water drainage on the proposed development site; a brief description of the proposed development and describes how it will be drained once complete. Details of proposed surface water attenuation and treatment are included together with a drainage layout showing the proposed discharge points.

The report also provides recommended maintenance requirements for the surface water drainage network, including any SuDS, and identifies who is responsible for this maintenance.

Proposals described in this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

This report is based on, to a certain extent, on the interpretation and assessment of data from third parties. Woolgar Hunter cannot be held responsible for the accuracy of the third-party data or the conclusions that come from this information. The conclusions and findings of this report may change if the data provided is amended or updated after the date of consultation.



Existing Edmiston house



Edmiston Drive Looking West – Contextual Planning Image



Edmiston Drive Looking East – Contextual Planning Image



## 2.0 Drainage & Regulatory Context

### 2.1 Surface Water Drainage Regulatory Context

The governance of surface water is complex, with different legislation and different authorities responsible for different parts of the drainage system.

The main processes governing surface water management (drainage and flooding) in Scotland are Scottish Water's management of the sewer network; local authority management of the road network; and local authority management of surface water flooding, supported by SEPA.

The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) is the key piece of legislation controlling surface water drainage discharges to the water environment.

In Scotland, Sustainable Drainage Systems (SuDS) are a legal requirement for all developments draining to the water environment, with exception of single dwellings or discharges to coastal waters.

Other relevant legislation includes:

- Sewerage (Scotland) Act 1968
- Roads (Scotland) Act 1984
- Flood Risk Management (Scotland) Act 2009
- Climate Change (Scotland) Act (2009)
- Building (Scotland) Regulations 2004

### 2.2 SuDS Design & Best Practice

There are various design standards and industry best practice guides which ensure that drainage and SuDS are appropriately designed and implemented within new developments. These include:

- Scottish Building Standards 2019 Technical Handbooks – Non-Domestic Section 3 Environment
- BS EN 752-2017: Drain and Sewer Systems outside buildings
- Sewers for Scotland, 4th Edition
- Scottish Water's 'Surface Water Policy' document
- The SuDS Manual (CIR A C753)
- SEPA publication WAT-RM-08 'Sustainable Urban Drainage Systems'
- Planning Advice Note (PAN) 61: Planning and Sustainable Urban Drainage Systems

### 2.3 Drainage Impact Assessment (DIA) Requirements

When considering drainage assessments, the following basic scope of works should be followed, as outlined in 'Water Assessment and Drainage Assessment Guide' - produced on behalf of the Sustainable Urban Drainage Scottish Working Party (SUDSWP), detailed below:

- Identify sustainable methods for draining surface water, managing surface water flooding, and disposing of wastewater.
- Demonstrate appropriate infrastructure is in place to allow the above objectives to be met without having a detrimental effect on the environment.
- Engage with key stakeholders to discuss the details of what is likely to be required.

This report has been prepared in accordance with the requirements set out in the 'Water Assessment and Drainage Assessment Guide' and associated local Planning authority guidance, including Glasgow City Council's 'Flood Risk Assessment and Drainage Impact Assessment Planning Guidance for Developers'.





## 3.0 Existing Site

### 3.1 Site Location & Description

The proposed site is located in Govan, Glasgow adjacent to Ibrox Stadium. The site is approximately 0.31 ha in size and is currently occupied by the existing Eomiston House, which is no longer in use, and temporary parking.

The site is bounded to the north by an existing car park accessed off Harrison Street and to the South by Edmiston Drive. Immediately to the East is terraced housing located on Copland Road and to the West is Ibrox Stadium.

Please refer to the adjacent location plan

### 3.2 Topography & Watercourses

There is a significant level change from Edmiston Drive, 11.00m AOD, rising to the North to a level of 12.15m AOD before falling back down to 9.00m AOD at the entrance to the existing car park on Harrison Street. There is also a fall across the site from west to east. There is existing retention along the western elevation of the existing Eomiston House, which will need to be retained or replaced in the proposed development.

The River Clyde is the closest watercourse to the development site, flowing westerly approximately 1km north of the site.

### 3.3 Ground Conditions

The site investigation has involved a desktop study followed by an on-site intrusive investigation and laboratory analysis. The ground conditions encountered consisted of a mantle of made ground underlain by superficial deposits consistent with River Terrace deposits underlain by Glacial Till deposits.

Groundwater monitoring was also carried out by Mason Evans which concluded that inconsistent and low productivity groundwater underlies the site at depths from 2.00m to 4.00m below ground level.



Location Plan



### 3.4 Existing Drainage & Sewers

Scottish Water record plans show that the existing site is served by a series of combined sewers, located in all directions around the perimeter as well as a 525mm diameter combined sewer which dissects the proposed site. There are small local surface water sewers to the south and east of our site, however these all tie into the combined sewer.

The adjacent image is an extract from Scottish Water's GIS database, and the full drawings is provided within Appendix A.

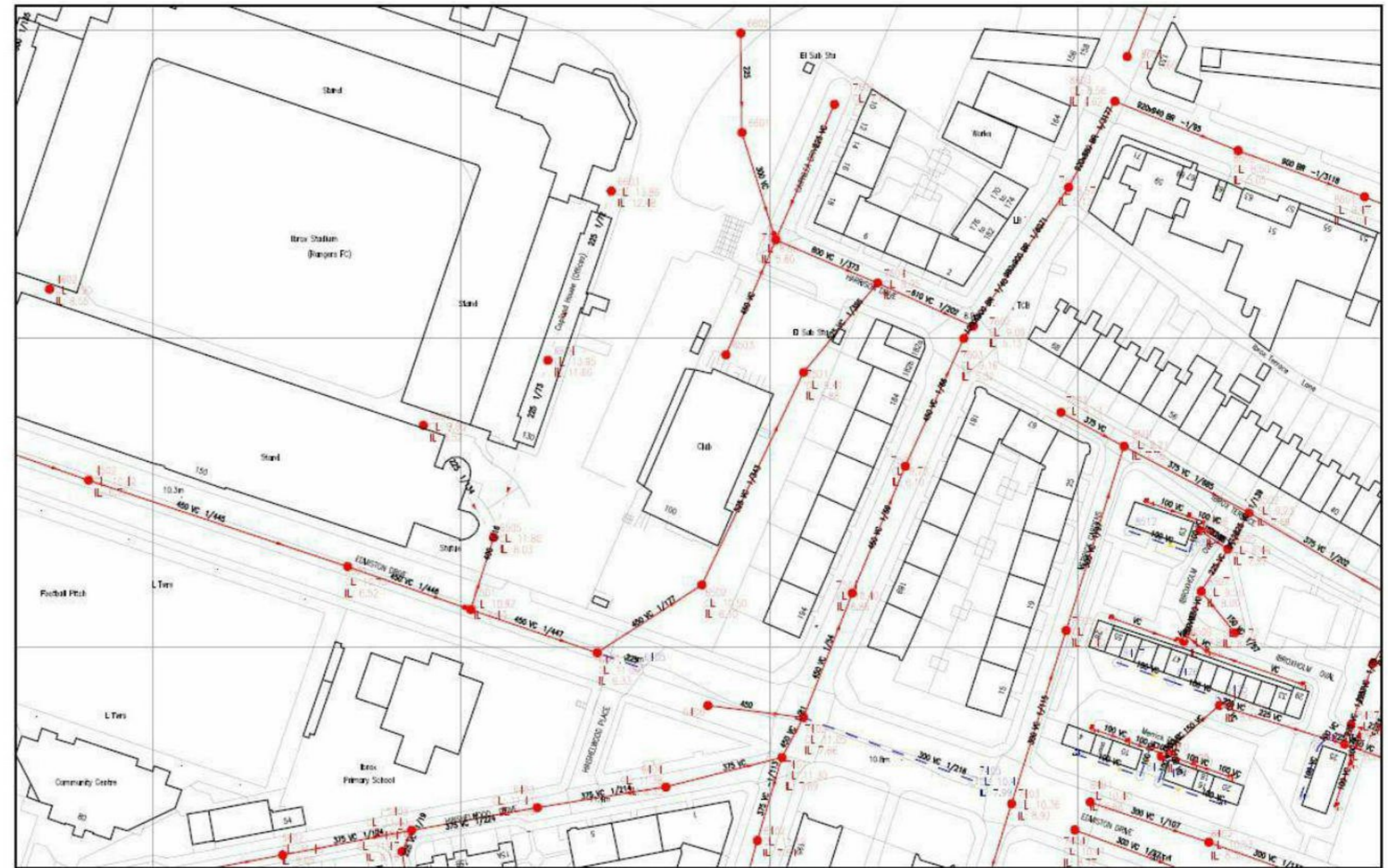
A GPR survey been carried out within the site boundary, these shown some local drainage, which serves the existing Edmiston House. These drains all tie into the existing combined sewer. These existing drains are shown on the proposed drainage layout, which is included within Appendix A.

A CCTV survey has been commissioned to confirm the pipe conditions drainage routes within the site boundary. This survey is currently being carried out, however at the time of writing this report we await the results.

#### Drainage Diversions / Abandonment

As mentioned above, there is a 525mm combined sewer which passes beneath the location of the new facility. Part of the drainage proposals is to divert this sewer, the proposed route is shown on the Proposed Drainage Layout within Appendix A. Initial discussions have taken place with Scottish Water on this diversion and we expect to make the formal application to divert permanently.

The drains which serve the existing building will become redundant and as such they will be disconnected, sealed, and grubbed up as part of the demolition works.



Existing Scottish Water Drainage Infrastructure



## 4.0 Proposed Drainage

### 4.1 Proposed Development

The proposed development of Edmiston House consists of a new retail, museum, café, and event hub located beside Ibrox Stadium.

A copy of the proposed site layout is provided in Appendix A.

The development will require new separate foul and surface water drainage infrastructure.

### 4.2 Surface Water Drainage

#### Surface Water Management Strategy

The overall philosophy for the design of the surface water drainage system for the proposed development is to manage surface water sustainably at source and to ensure that discharged waters do not constitute a pollution risk.

The surface water drainage strategy has been developed with reference to Glasgow City Councils 'Flood Risk Assessment and Drainage Impact Assessment Planning Guidance for Developers' and aims to maximise the benefits of surface water management including controlling the quantity of runoff; managing the quality of runoff and prevent pollution; creation of better places for nature; and creation of beautiful places for people.

Through discussion with the wider project team the initial SuDS strategy has been developed and this seeks store and re-use the groundwater which falls on the building by including rainwater harvesting – coupled with below ground conveyance and attenuation features.

A copy of the Proposed Drainage Layout is provided in Appendix A.

#### Surface Water Disposal

To minimise the impact of the scheme on the existing drainage infrastructure and downstream catchment, disposal of surface water was considered in terms of the following hierarchy:

- Re-use, i.e. rainwater harvesting
- Infiltration / soakaway
- Watercourse
- Surface Water sewer
- Combined sewer

It is proposed that surface water is discharged to the diverted combined sewer within the site, subject to Scottish Water approval.

Scottish Water's 'Surface Water Policy' which reflects their 'Surface Water management Strategy' can be summarized as:

- No new surface water shall drain to their combined sewer network.
- They will work with developers and regulatory bodies moving forward on removing surface water from their existing combined sewer network; and
- They shall undertake the above whilst supporting economic growth.

This policy places a duty on all relevant stakeholders to work together to manage surface water flooding more sustainably, by relying less on pipes and using sustainable urban drainage techniques.

Whilst it is Scottish Water's policy to generally not accept surface water connections into the combined sewer system, this may be considered in exceptional circumstances for brownfield sites, where compliance with zero net detriment requirements can be demonstrated.

The provision of rainwater harvesting means that rainwater which falls on the building will be stored and re-used. Only the external hardstanding areas and an overflow from the rainwater harvesting system are proposed to drain to the combined sewer. We believe that the inclusion of rainwater harvesting, coupled with SuDS, a flow control and attenuation storage, will allow us to demonstrate that the drainage scheme will provide significant betterment to the existing scenario.

We appreciate the recommendation within the Flood Risk Assessment for the FFL to be set 300mm above road levels. However, as the building is close to Edmiston Drive and the full area between is hardstanding, which needs to be DDA compliant, this is difficult to achieve.

We have designed the levels to ensure falls are away from the building. Should any flooding occur on the nearest road, Edmiston Drive, the overland flood flow route would be to the west past Ibrox Stadium and therefore would not pose a risk to Edmiston House. Please refer to overland flow route drawing in Appendix A.



Extract from Proposed Drainage Layout



### Surface Water Quantity

Glasgow City Council's 'Flood Risk Assessment and Drainage Impact Assessment Planning Guidance for Developers' requires that surface water drainage is designed to conform to the relevant specification in Sewers for Scotland and General Binding Rules (GBRs).

As such, the criteria for surface water drainage are:

- 1) Discharge Rate should be no greater than the lesser of:
  - a. 1:2-year greenfield runoff.
  - b. 4.5l/s/ha of impermeable or positively drained area.  
\* subject to a minimum 3l/s
- 2) accommodate the 1:30 year plus 30% climate change below ground and that the 1:200 year plus 30% climate change remains on site and does not pose a flood risk to property.

Provision of a flow control device (to limit peak discharge rate) and associated attenuation storage will be required. Based on preliminary estimate, allowance should be made for the following:

| Site Area (Ha) | Discharge Rate (l/s) | Attenuation Storage estimate (m <sup>3</sup> ) |            |
|----------------|----------------------|--|------------|
|                |                      | 1:30 year                                      | 1:200 year |
| 0.310          | 3.0*                 | 140  | 215        |

Table 1 – Water Runoff & Attenuation Storage Estimate

\* minimum recommended discharge rate

It is proposed that attenuation storage be provided within the rainwater harvesting system as well as within a cellular storage tank located beneath the external hardstanding.

A copy of design calculations is provided in Appendix B.

The provision of rainwater harvesting will provide interception reducing the rate and volume of surface water runoff.

### Surface Water Quality

Glasgow City Council requires that SuDS provide the level of treatment recommended in the SuDS Manual and as required by SEPA. Accordingly, SuDS components will be designed in accordance with the Simple Index Approach. Whilst this does not strictly apply to this scheme as we are discharging to the combined sewer, we have followed these principles as best practice.

Suitable pollution hazard indices for proposed land use are determined from SuDS Manual, refer to Table 2.

| Land Use                      | Pollution Hazard Level | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
|-------------------------------|------------------------|------------------------------|--------|--------------|
| Commercial / Industrial Roofs | Low                    | 0.3                          | 0.2    | 0.05         |

Table 2 – Pollution Hazard Indices for different land use classifications

To deliver adequate treatment the selected SuDS components must have a total pollution mitigation index that is greater than, or equal to, the pollution hazard indices. Pollution mitigation indices for various SuDS components are presented in Table 3.

| Type of SuDS Component | Mitigation Indices           |        |              |
|------------------------|------------------------------|--------|--------------|
|                        | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
| Filter Strip           | 0.4                          | 0.4    | 0.5          |
| Filter Drain           | 0.4                          | 0.4    | 0.4          |

Table 3 – SuDS Mitigation Indices (for discharges to surface waters)

### Exceedance

In event of blockage of surface water drainage system, or rainfall event in excess of design capacities then surface water will flow overland. Where possible, levels will be set to direct overland flow away from and around buildings.

Finished levels will be engineered to ensure falls are away from buildings and building access points where possible to provide positive drainage to prevent ponding. The risk of accumulation of standing water against the buildings would therefore be minimised.

### Flood Risk

A detailed Flood Risk Assessment (FRA) has been undertaken by Kaya Consulting and reference should be made to this for details of flood risk.



### 4.3 Foul Water Drainage

#### Foul Water Drainage Strategy

The site has an established network of combined sewers around the site. It is proposed that new foul drainage from the building is collected in a below ground pipe network, laid to achieve minimum falls to ensure self-cleansing velocities.

Subject to Scottish Water approval, it is proposed to discharge the foul drainage to the diverted combined sewer to the west of the site.

A Pre-Development Enquiry (PDE) has been submitted to Scottish Water in order to confirm capacity. At the time of writing this report a response has not yet been received.

The calculations submitted to Scottish Water are presented within Appendix B, however a summary of the proposed foul flows is shown below.

The post development flow has been calculated based on the recommendation that 90% of the water demand will discharge from the site

| Average Daily Water Demand |                 |        |       |
|----------------------------|-----------------|--------|-------|
| Unit Type                  | Number of Units | Litres | Total |
| Basin                      | 25              | 90     | 2250  |
| Sink                       | 7               | 90     | 630   |
| Bath                       | 0               | 900    | 0     |
| WC                         | 23              | 180    | 4140  |
| Shower                     | 0               | 140    | 0     |
| Urinal                     | 8               | 110    | 880   |
| Total                      |                 |        | 7900  |

Therefore:

7900 l / day

Foul Discharge (90% of water demand) = 7110 l / day

Average Flow Rate =  $7110 / 86400 = 0.082 \text{ l / s}$

Peak flow rate = 2.5 x average flow rate

Peak flow rate =  $0.205 \text{ l / s}$

### 4.4 Maintenance

#### Adoption

All new drainage will remain private. As such operation and maintenance of the surface water drainage and SuDS features will remain the responsibility of the landowner and any appointed factors.

#### Maintenance

All drainage systems, including SuDS components, should be regularly inspected, and maintained. This will ensure efficient operation and prevent failure. SuDS components are usually on or near the surface and many can be managed using landscape maintenance techniques.

Typically, a SuDS maintenance plan will include routine and occasional activities, along with long-term remedial actions. Copies of recommended maintenance schedules for the proposed SuDS features are provided in Appendix C.



## 5.0 Construction Phase

### 5.1 General

During the construction it is important that the risk of pollution from the site be kept to a minimum.

The contractor must ensure that discharges of water run-off from that site to the water environment do not cause pollution.

Safeguards shall be implemented during the construction phase to minimise the risk of pollution and detrimental effects to the water environment.

Prior to the commencement of construction, the contractor should prepare and submit method statements detailing how pollution prevention management will be implemented.

Works on site shall generally follow the best practice guidelines outlined in Section 5 and 6 of CIRIA C532 – Control of Water Pollution from Construction Sites; and SEPA publication "Engineering in the Water Environment Good Practice Guide".

Due to the location of existing drainage features, care should be taken to ensure that any excavation works and control of groundwater, which may be necessary to facilitate the works, does not result in mobilization of silts leading to contamination of any watercourses.

The works should be managed and sequenced to ensure that the risk of contaminated runoff or groundwater from the site entering the drainage systems is kept to a minimum. On site facilities for containment and controlled release of runoff and groundwater to the existing drainage system should be implemented. These facilities should be designed to trap debris and allow settlement and collection of silt.

### General Water Pollution Mitigation

It is recommended that the contractor adopts the following general mitigation measures:

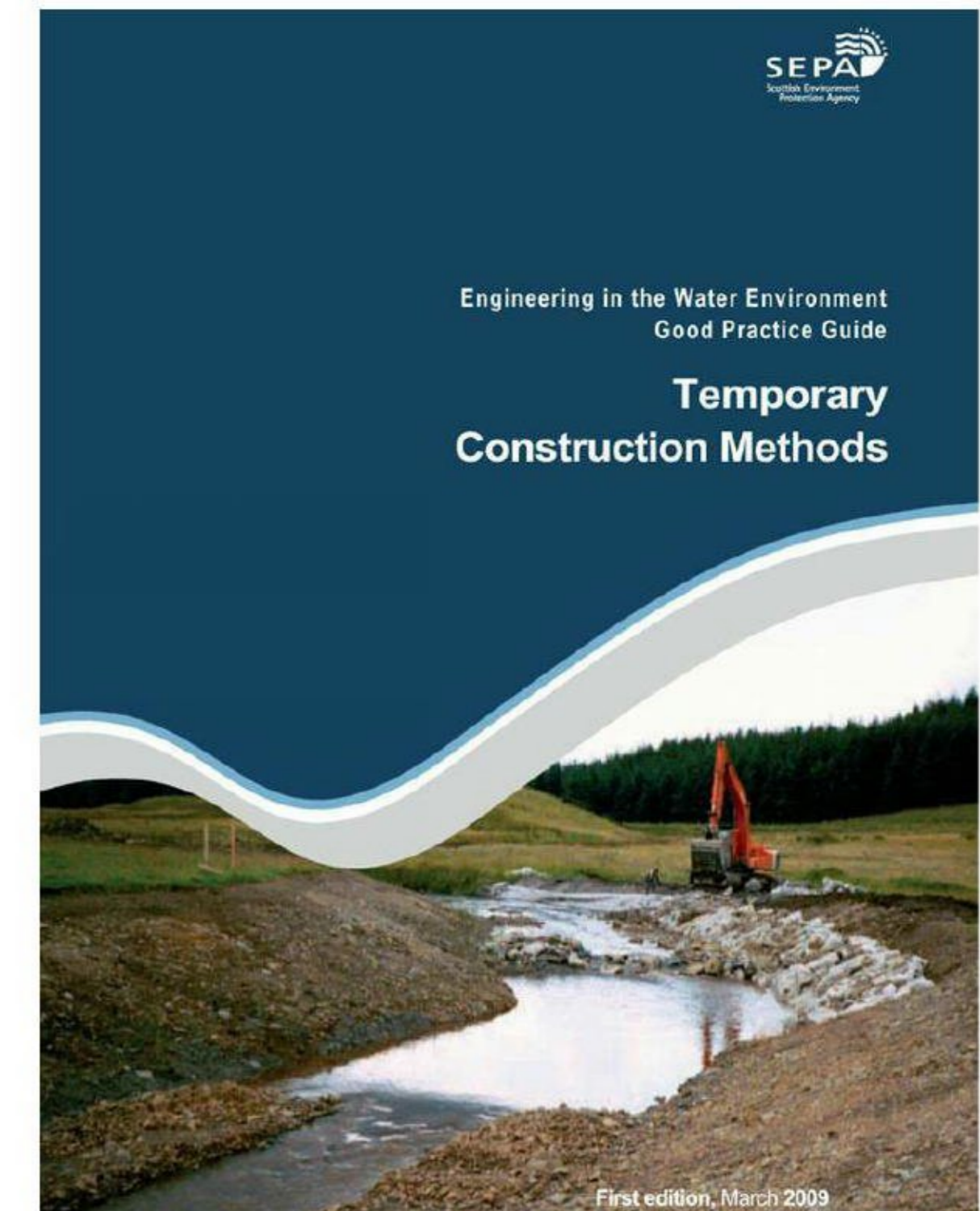
- (i) Temporary foul drainage to serve the contractors welfare facilities to be provided;
- (ii) Hazardous and environmentally damaging chemicals and other materials should be managed and stored to ensure that they do not enter the existing drainage systems or cause local soil contamination. Storage areas to be provided should be located away from the site perimeter. Chemical or fuel storage shall comprise of impermeable boxes and appropriate bunding. Guidance on the handling and storage of materials on site is available from SEPA. Materials which fall into this category include:
  - Petrochemicals (E.g. fuel, lubricants)
  - Building materials (e.g. cement)
  - General (e.g. excavation arising, mud, litter, site waste materials)
- (iii) Refueling and maintenance of machines shall be strictly controlled, and oil storage tanks confined to locations remote from the perimeter of the site. All leaking or empty oil drums shall be immediately removed from site.
- (iv) Washing out of any concrete mixing plant or cleaning of ready-mix concrete tankers shall be strictly controlled. The effluent from such cleaning shall be tankered off site or suitably treated using sedimentation tanks before the run-off is discharged.
- (v) A strict waste management system will be incorporated to prevent the disposal of construction or domestic rubbish entering the adjacent marshland areas. Waste materials will be properly stored on site.

### 5.2 SEPA Authorisation

SEPA authorisation is not required provided that the contractor operates the site in accordance with the general binding rules specified in the Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended (CAR) and the construction site does not:

- exceed 4 hectares in area;
- contain a road or track length in excess of 5km; or
- include any area of more than 1 hectares or any length of more than 500 metres on ground with a slope in excess of 25 degrees.

If construction site exceeds above thresholds, then the contractor must apply to SEPA for authorisation of a construction site licence and adhere to an approved pollution prevention plan.





## 6.0 Summary & Conclusions

### 6.1 Project Description

The proposed site is located in Govan, Glasgow adjacent to Ibrox Stadium.

The proposed development of Edmiston House consists of a new retail, museum, café, and event hub located beside Ibrox Stadium.

### 6.2 Existing Drainage

Scottish Water record plans show that the existing site is served by a series of combined sewers, located in all directions around the perimeter as well as a 525mm diameter combined sewer which bisects the proposed site.

A CCTV survey is being carried out to clarify the routes and conditions of the existing sewers within the development.

Drainage proposals include the diversion of a 525mm sewer, the proposed route is shown on the Proposed Drainage Layout within Appendix A.

### 6.3 Surface Water Drainage

The surface water drainage strategy has been developed with reference to Glasgow City Council's 'Flood Risk Assessment and Drainage Impact Assessment Planning Guidance for Developers' and aims to maximise the benefits of surface water management including controlling the quantity of runoff; managing the quality of runoff and prevent pollution; creation of better places for nature; and creation of beautiful places for people.

The initial SuDS strategy has been developed and this seeks store and re-use the groundwater which falls on the building by including rainwater harvesting – coupled with below ground conveyance and attenuation features.

#### Surface Water Quantity

The surface water drainage system will be designed to accommodate the 1:30 year critical storm (plus climate change allowance) below ground; and checked to ensure that the 1:200 year critical storm (plus climate change allowance) remains on site and does not pose a flood risk to property.

It is proposed that attenuated surface water is discharged at a controlled rate to the existing combined sewer network adjacent to the site, subject to Scottish Water approval.

#### Surface Water Quality

SuDS components will be designed in accordance with the Simple Index Approach.

#### Exceedance:

In event of blockage of surface water drainage system, or rainfall event in excess of design capacities then surface water will flow overland. Levels will be set to direct overland flow away from and around buildings.

### 6.4 Foul Drainage

Foul flows from the development will discharge to the existing public sewers which run adjacent to the site, subject to Scottish Water approval.

### 6.5 Maintenance

All new drainage will remain private until the proposed disconnection point.

Copies of recommended maintenance schedules for the proposed SuDS features are provided in Appendix C.

### 6.6 Conclusion

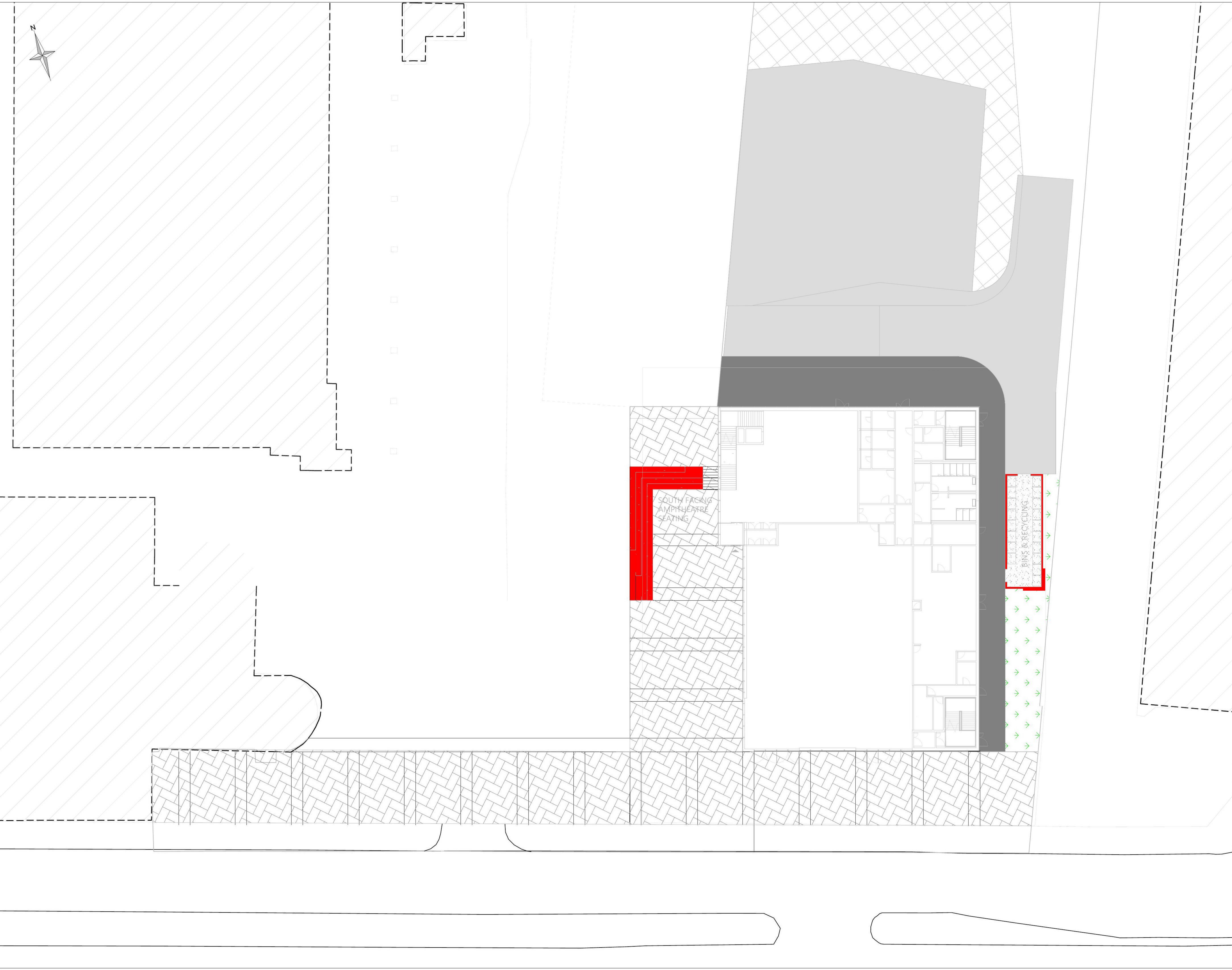
This report has been prepared in accordance with the requirements set out in the 'Water Assessment and Drainage Assessment Guide' and associated local Planning authority guidance.

Accordingly, compliance certification is provided in Appendix D.



# Appendix A Drawings





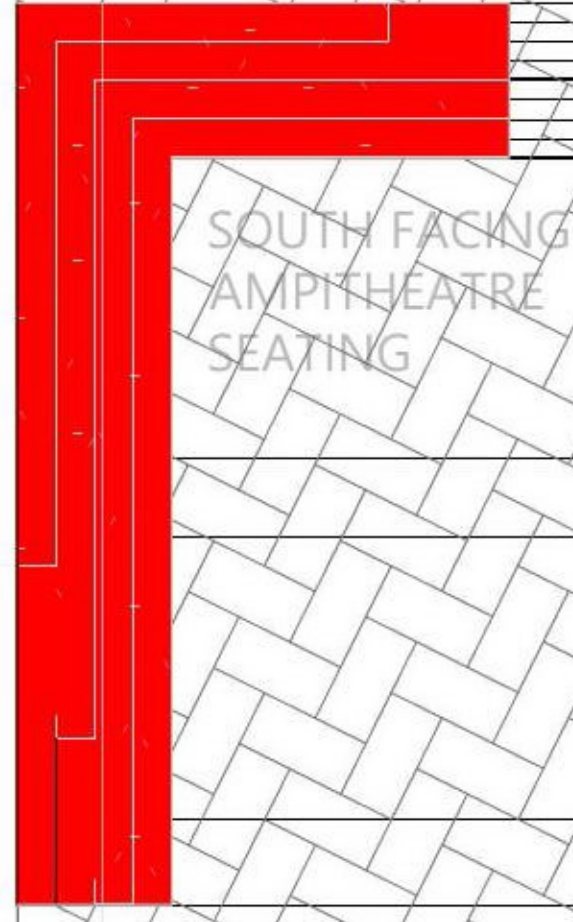
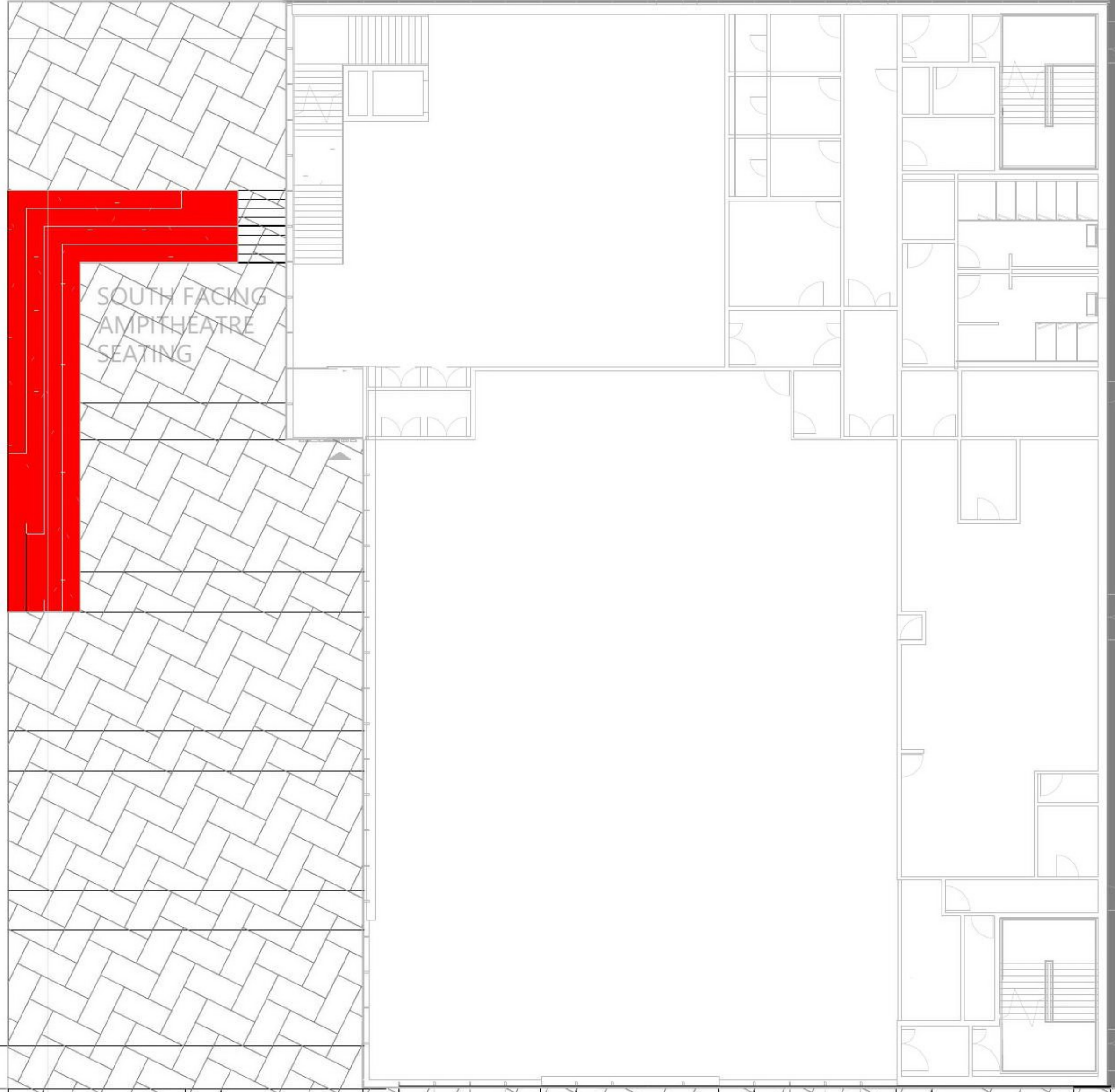
This drawing is based on Landscape Architect site layout:  
 Landscape Architect:  
 Drawing Number: A-5020\_Proposed Site Plan  
 Revision: N/A Date: 08.07.20

**Notes**

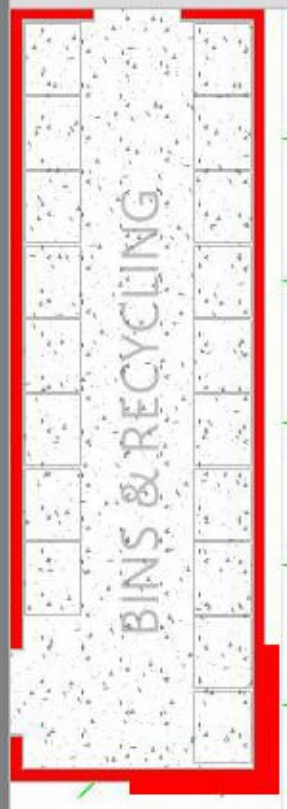
- All Woolgar Hunter drawings are to be read in conjunction with the relevant Woolgar Hunter specification and all relevant Architects and Service Engineers drawings and specifications.
- All dimensions are in millimetres unless stated otherwise. All levels are in metres and relate to ordnance datum.
- Do not scale from any drawing. Work to figured dimensions only. Any discrepancies in dimensions are to be referred to the Designer before work is put to hand.
- Drawing to be read in colour.

**Legend**

- Proposed asphalt road construction
- Existing asphalt road construction
- Proposed asphalt footpath construction
- Proposed impermeable vehicular paving, finish to Landscape Architect's specification
- Proposed concrete slab to Structural Engineer's specification
- Proposed soft landscaping to Landscape Architect's specification
- Proposed retaining wall to Structural Engineer's specification



SOUTH FACING AMPHITHEATRE SEATING



BINS & RECYCLING

|     |               |          |    |     |
|-----|---------------|----------|----|-----|
| P01 | Initial Issue | 28.07.20 | GS | CC  |
| REV | AMENDMENTS    | DATE     | BY | CHK |

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**STAGE 3**

CONTRACT No: 181065 SCALE: 1/100 @ A1

EDMISTON HOUSE

RANGERS FOOTBALL CLUB

PROPOSED SCOPE OF WORKS

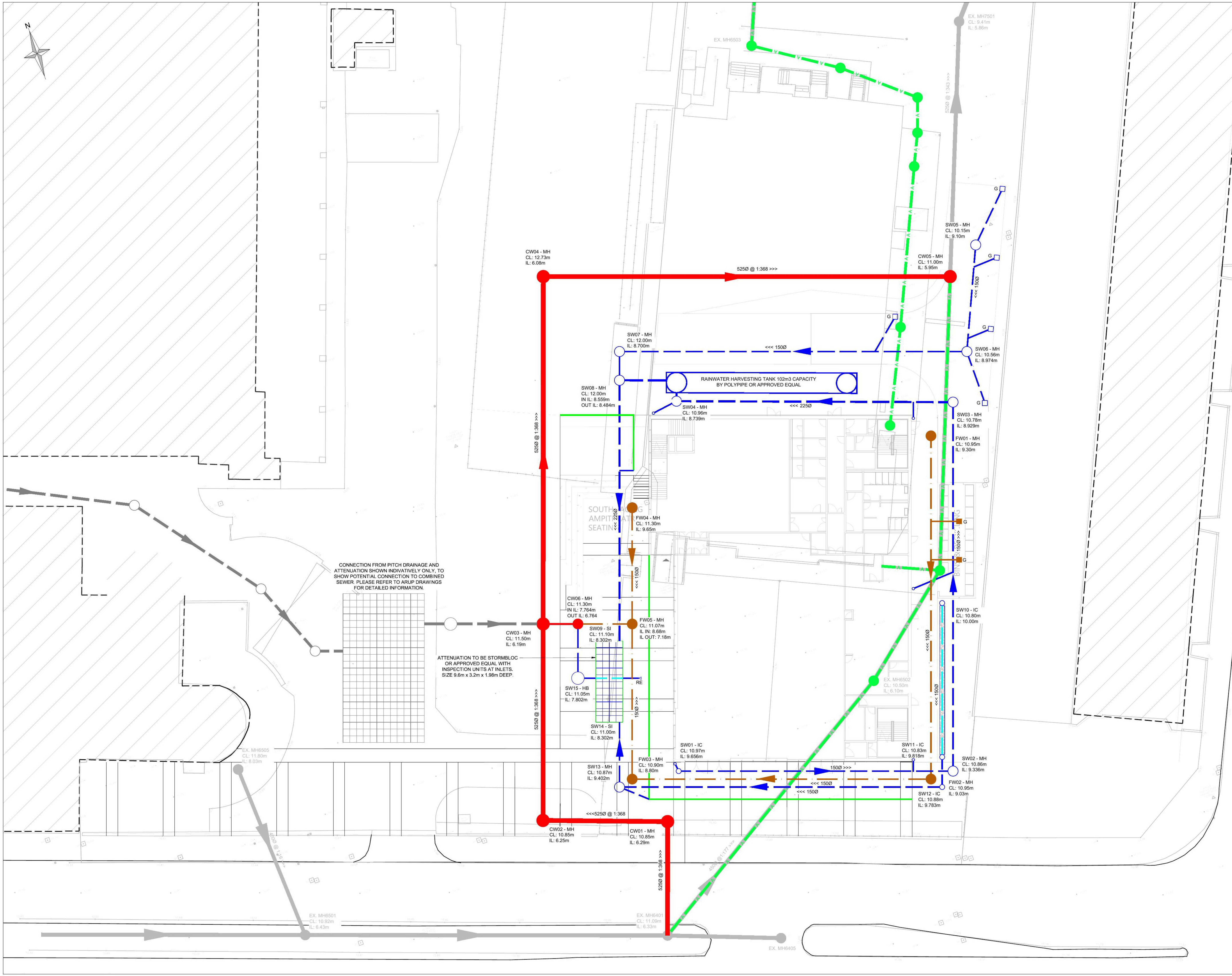
**WoolgarHunter**  
engineers

|             |                              |      |     |
|-------------|------------------------------|------|-----|
| DRAWING No: | EDMIN-WHL-XX-XX-DR-C-90-9100 | REV: | P01 |
|-------------|------------------------------|------|-----|









CONNECTION FROM PITCH DRAINAGE AND ATTENUATION SHOWN INDICATIVELY ONLY. TO SHOW POTENTIAL CONNECTION TO COMBINED SEWER PLEASE REFER TO ARUP DRAWINGS FOR DETAILED INFORMATION.

ATTENUATION TO BE STORMBLOC OR APPROVED EQUAL WITH INSPECTION UNITS AT INLETS. SIZE 9.6m x 3.2m x 1.98m DEEP.

RAINWATER HARVESTING TANK 102m3 CAPACITY BY POLYPIPE OR APPROVED EQUAL

**This drawing is based on Architect site layout:**

Architect: KEPPIE DESIGN  
 Drawing Number: A-5020\_Proposed Site Plan  
 Revision: N/A Date: 08.07.20

**Notes**

- All Woolgar Hunter drawings are to be read in conjunction with the relevant Woolgar Hunter specification and all relevant Architects and Service Engineers drawings and specifications.
- Do not scale from any drawing. Work to figured dimensions only. Any discrepancies in dimensions are to be referred to the Designer before work is put to hand.

**Legend**

- Proposed uPVC surface water sewer
- Proposed uPVC perforated surface water sewer
- Proposed uPVC foul water sewer
- Proposed concrete combined sewer diversion
- Proposed slot drain
- Existing sewer
- Existing sewer to be abandoned
- Proposed surface water manhole
- Proposed inspection chamber
- Proposed Rodding Eye
- Proposed Gully
- Proposed foul water manhole
- Proposed combined manhole
- Existing manhole
- Existing manhole to be abandoned
- Proposed attenuation tank
- Proposed filter trench

- Drainage Notes**
- All works, unless noted otherwise, to be carried out in accordance with 'Sewers for Scotland' (current edition) and to the approval of the local authority.
  - Inspection procedures during construction shall be in accordance with the local authority.
  - This drawing is to be read in conjunction with all relevant Architects & Engineers drawings and specifications.
  - All dimensions and levels are in metres unless noted otherwise.
  - Any discrepancies noted on site are to be reported to the Engineer immediately.
  - The depths of all existing manholes which are being incorporated into the design are to be confirmed by the Contractor and reported to the Engineer prior to any drainage works commencing on site.
  - The Contractor must verify the location and level of the existing drainage affected by the new works and confirm their acceptance or otherwise of the information shown on the drawings prior to the commencement of the construction works.
  - Existing drainage routes indicated on this drawing are indicative only, exact location to be determined on site. Uncharted services may exist in this area.
  - The location & level of existing services are to be verified on site.
  - No machine excavations allowed in the vicinity of existing services.
  - For design flow rates and setting out of soil stacks & rainwater pipes refer to M&E and Architects drawings. Any locations shown are indicative only.
  - Where a pipe crosses through or below a foundation or tie-beam, the trench to be backfilled with mass concrete. All pipes to be surrounded with 50mm compressible material. A rocker pipe to be provided both sides of the crossing as close as practical to the foundation.
  - Where clearance is less than 150mm between surface and foul water pipe line cross over, a suitable compressible material shall be used.
  - No below slab drainage has been shown yet, as no pop-up information is available at this time, allowance should be for this within costing.
  - The proposed combined sewer diversion is yet to be agreed with Scottish Water and therefore remains a risk.
  - The drainage proposals are based on discharge to the combined sewer. A PDE has been submitted to Scottish Water, however until approval is given this remains a risk.
  - We have carried out an initial calculation to size the rainwater harvesting system, however this is a CPD item and therefore detailed design and sizing is yet to be carried out.

|                   |          |    |     |
|-------------------|----------|----|-----|
| P01 Initial Issue | 28.07.20 | GS | CC  |
| REV AMENDMENTS    | DATE     | BY | CHK |

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**STAGE 3**

CONTRACT No: 181065 SCALE: 1/200 @ A1

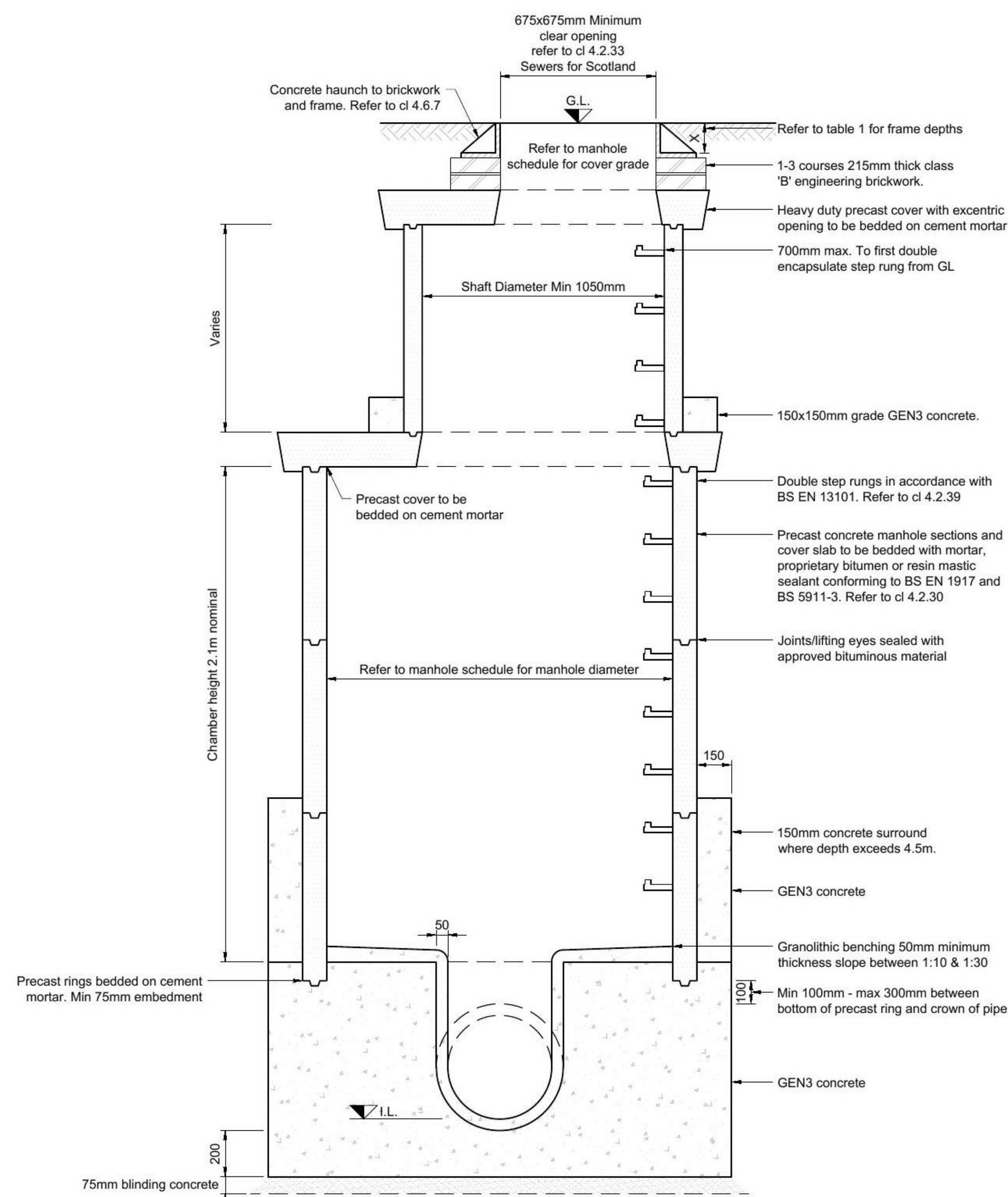
EDMISTON HOUSE  
 RANGERS FOOTBALL CLUB

PROPOSED DRAINAGE LAYOUT

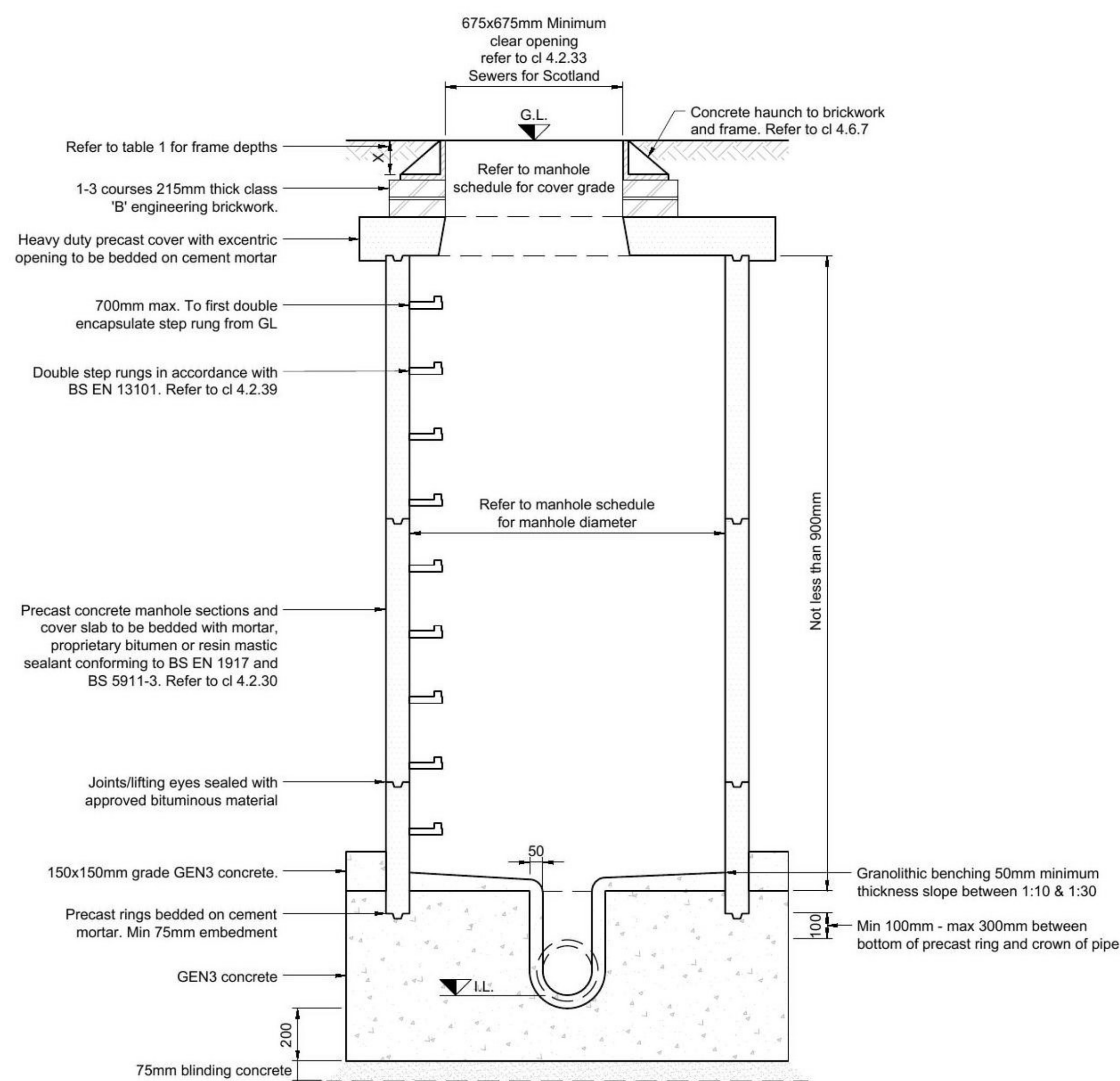
**WoolgarHunter**  
engineers

DRAWING No: EDMIN-WHL-XX-XX-DR-C-52-9400 REV: P01

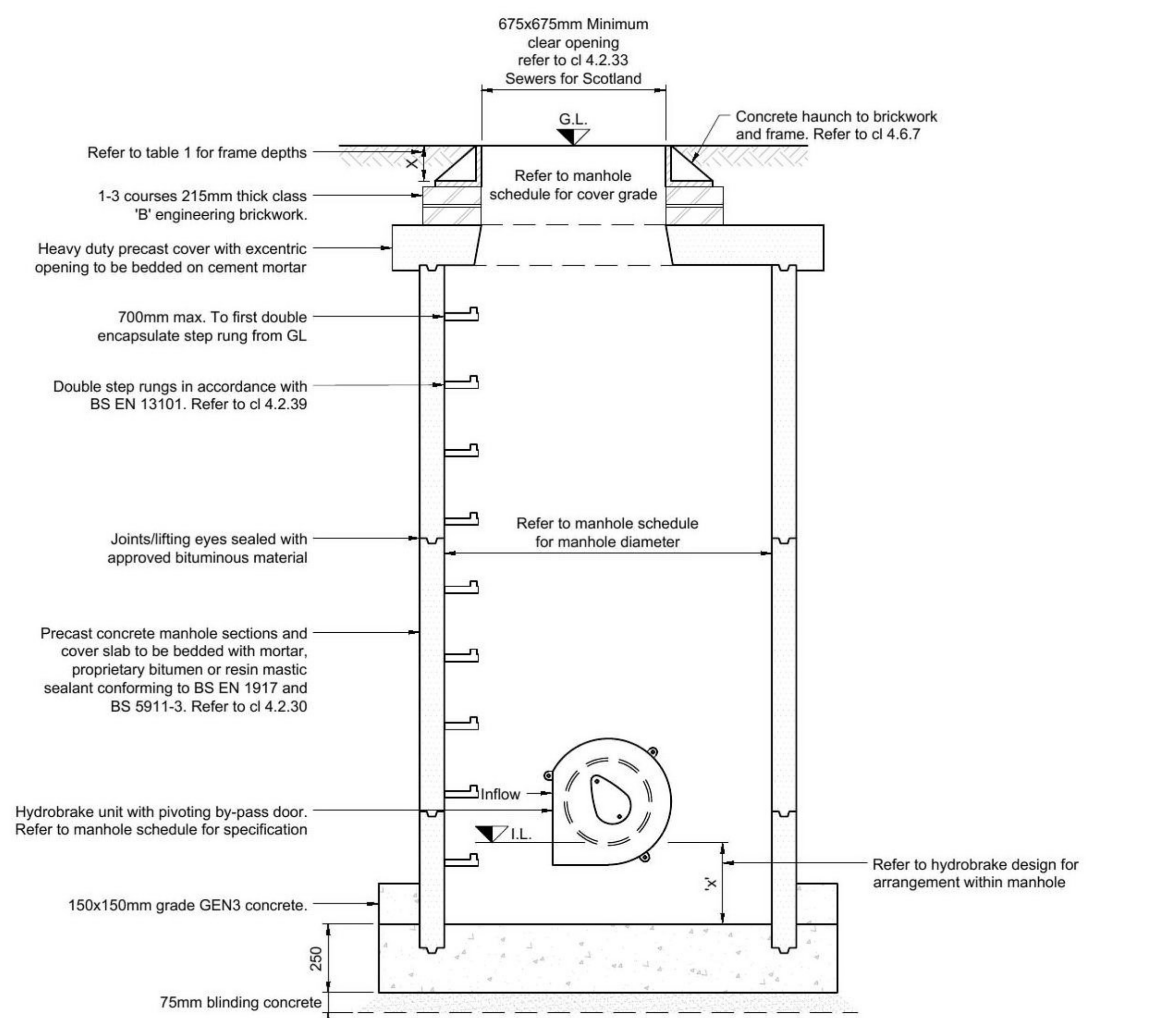




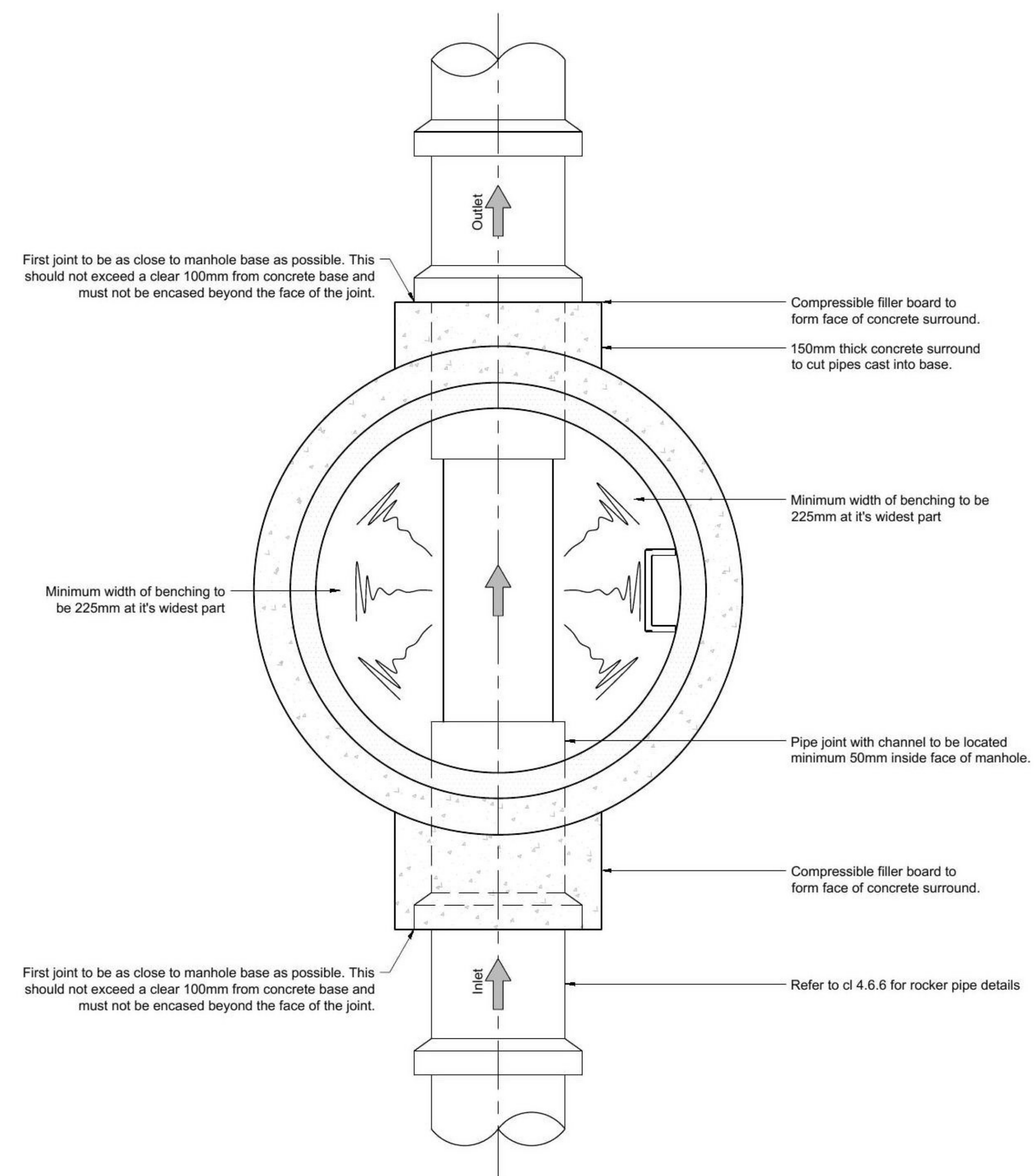
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SCALE: 1:20



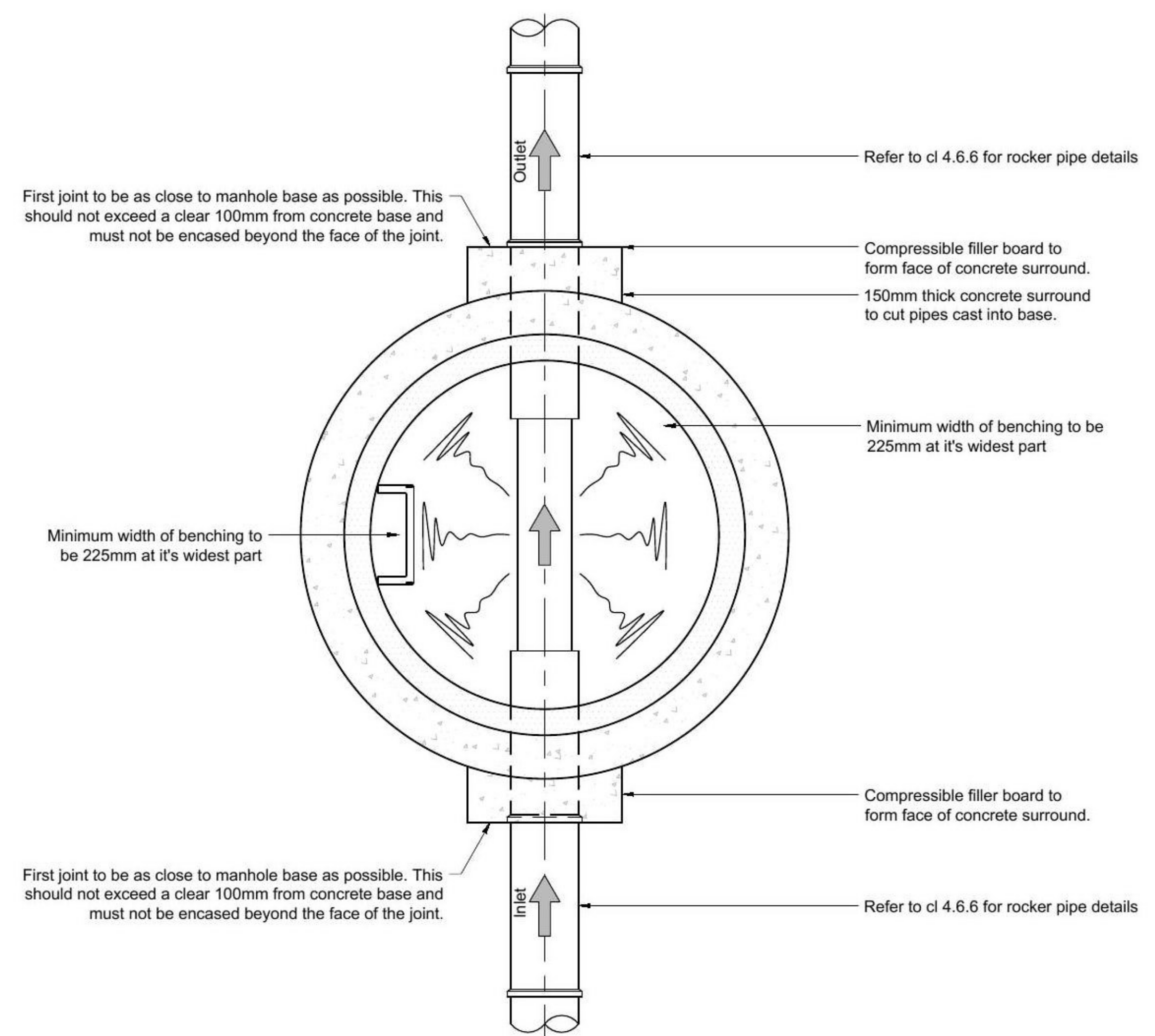
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SCALE: 1:20



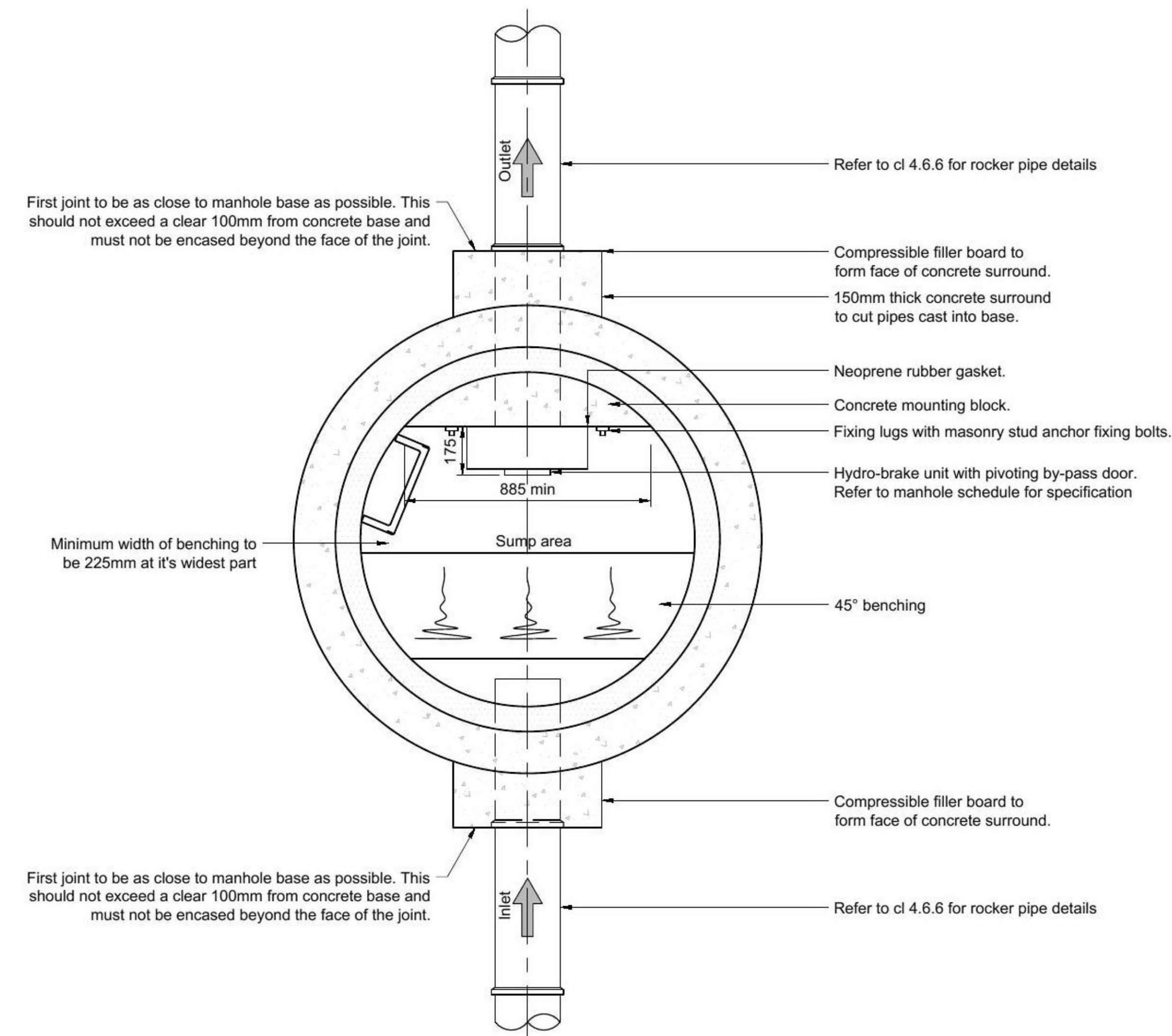
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SCALE: 1:20



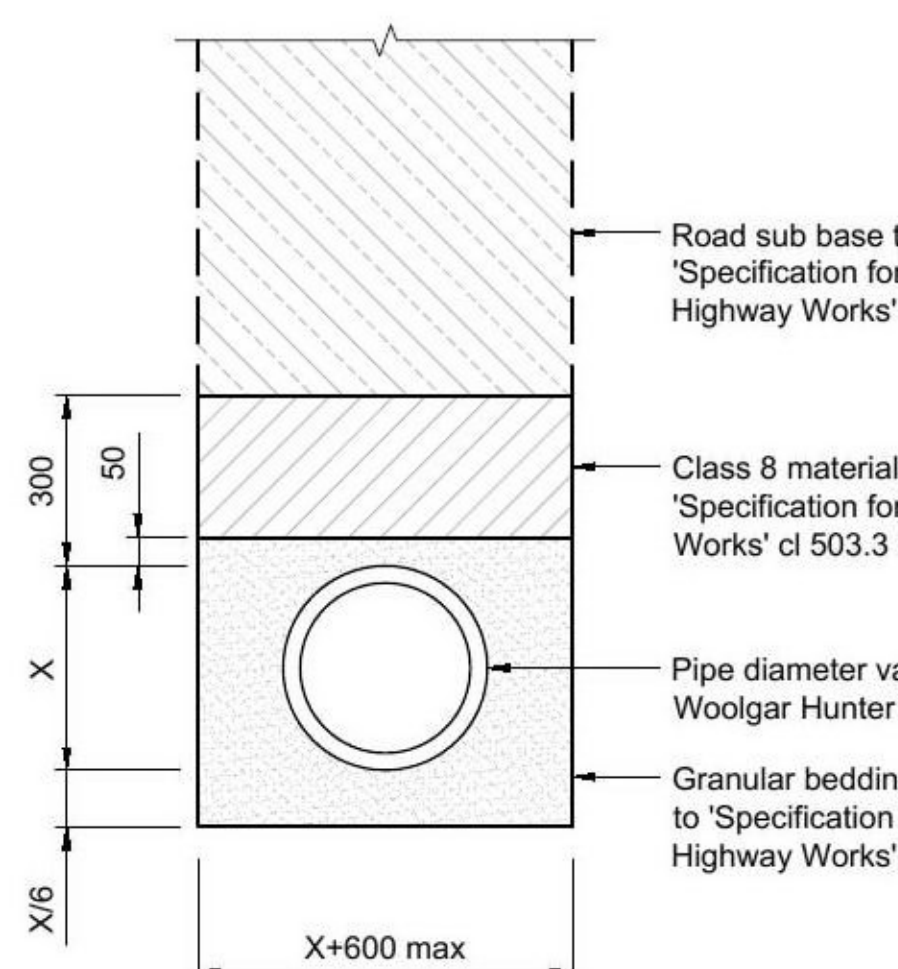
01 TYPICAL MANHOLE TYPE A PLAN DETAIL - GL TO PIPE SOFFIT 3-6m  
SCALE: 1:20



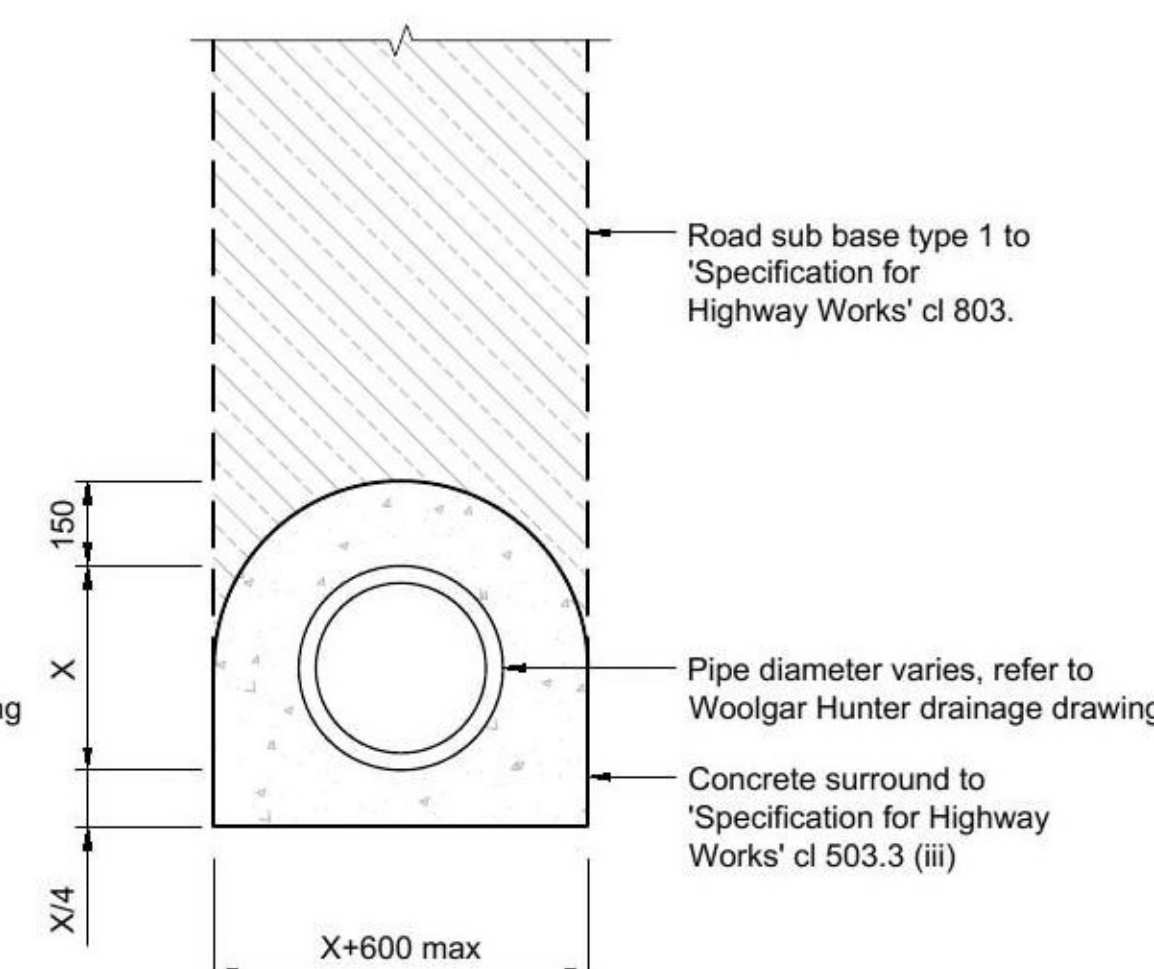
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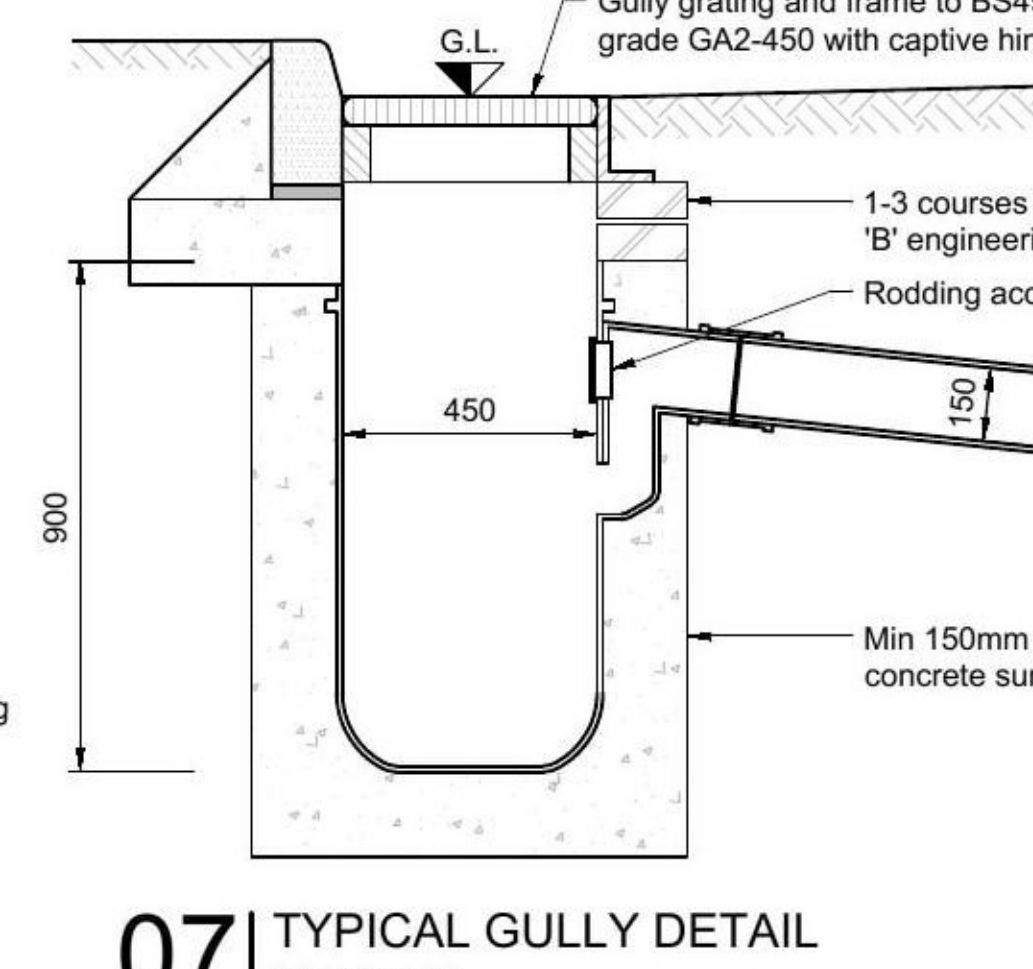
03 TYPICAL HYDROBRAKE MANHOLE PLAN DETAIL  
SCALE: 1:20



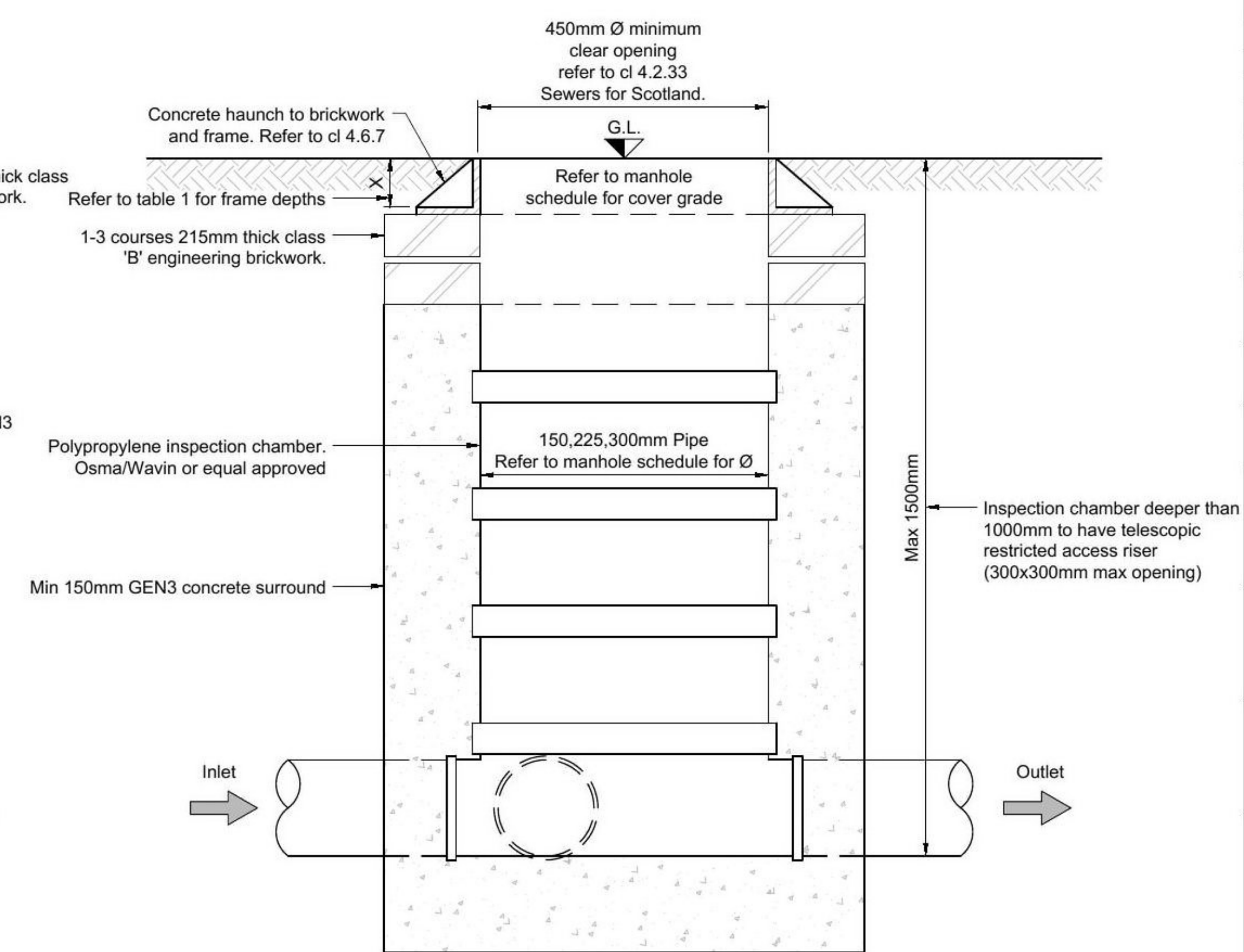
04 TYPE 'S' TRENCH & BEDDING  
SCALE: 1:20



06 TYPE 'Z' TRENCH & BEDDING  
SCALE: 1:20



07 TYPICAL GULLY DETAIL  
SCALE: 1:20



08 POLYPROPYLENE 600mm Ø INSPECTION CHAMBER  
SCALE: 1:10

**General notes to bedding types S and Z**

- Details are to be read in conjunction with 'Specification for Highway Works' appendix 5/1.
- Dimension x is external diameter of pipe.
- The concrete bed or surround may extend to the side of the trench or be of minimum width. Class 8 material is to be used to fill any voids so formed.
- For type z trench the concrete cover may be formed to a radius, batter or horizontal surface. Min. cover of concrete shall be 150mm.

**Gully pot notes**

- The gully frame is to be laid flat, with the rear edge flush with the wearing course. The crossfall will ensure a slight lip to the front and sides.
- The centre lines of the gully pot and frame shall coincide as far as possible. Absolute maximum out of tolerance - 50mm
- Trapped gully pots to be either-
  - BS5911, part 2, 1992
  - Vitrified clay to BS65,1981
  - Polypropylene pots - Hepworth or equivalent fitted with an integral but external trap
- Minimum storage capacity - 100 litres

- Notes**
- All Woolgar Hunter drawings are to be read in conjunction with the relevant Woolgar Hunter specification and all relevant Architects and Service Engineers drawings and specifications.
  - All dimensions are in millimetres unless stated otherwise. All levels are in metres and relate to ordnance datum.
  - Do not scale from any drawing. Work to figured dimensions only. Any discrepancies in dimensions are to be referred to the Designer before work is put to hand.
- Manhole notes**
- All works, unless noted otherwise, are to be carried out in accordance with Sewers for Scotland (current edition) and to the approval of the local authority.
  - All dimensions on this drawing are given in millimetres and all levels are given in metres.
  - Manhole covers are to be:
    - Within trafficked areas:** Saint-Gobain, Inter-A32 D400-n, heavy duty, double triangular, ductile iron to BS EN 124, 675x675 clear opening, non-rock, or equal approved.
    - Within pedestrian areas only:** Saint-Gobain, Trojan medium duty B125, single piece, ductile iron to BS EN 124, 675x675 clear opening, screw down cover or equal approved.
    - Within building footprint:** Doubled sealed. Refer to manhole schedule for grade.
  - All manhole & access covers in open spaces to be ventilated. Refer to manhole schedule for cover grade and location.
  - First flexible joints in pipes adjacent to a manhole shall be a maximum of 600mm from inside face of manhole, connecting to rocker pipe. Refer to Sewers for Scotland (current edition) for rocker pipe length.
  - Manhole chamber rings shall be precast units to BS:8911; part 200 (cl.4.2.28).
  - Manhole chamber rings to be bedded with mortar, proprietary bitumen or resin mastic sealant, or equal approved material. Bedding to be applied in accordance with the manufacturer's instructions.
  - Bottom chamber ring bearing on base slab to have minimum 75mm embedment.
  - Manhole access hole and step rungs positions to be located to give greatest free areas of benching immediately below.
  - Double step rungs to protrude into 675mm square access opening shaft cover slab.
  - Double step rungs in accordance with BS EN 13101.
  - Top step rung to be located not less than 700mm from the finished manhole cover level.
  - Concrete base slab to be scrubbed before placing benching
  - Where outlet pipe diameter is greater than inlet, pipe soffits to be the same level unless noted otherwise. A minimum fall of 50mm should be achieved across the manhole in the direction of flow
  - Granolithic concrete topping to be brought up to a dense smooth face neatly shaped & finished to all branch connections (minimum thickness 50mm).
  - Benching to be trowel smooth and sloped towards channel at between 1:10 & 1:30
  - Self-cleaning toe holes to be provided where channels exceed 600mm wide.
  - Branch bends and benching to be curved in the direction of flow and formed from granolithic concrete, high strength concrete topping or with grade c20 concrete trowelled smooth monolithically with the base slab.
  - Manholes with outgoing pipes greater than 450mm diameter shall be fitted with guard bars, safety chains or other safety devices.
  - All precast concrete parts (i.e. Pipes, manhole rings etc.) are to be design sulphate class ds-2 and chemical design dc-3, in accordance with BRE special digest 1 and BS:5911.
  - Refer to site investigation report or structural foundation drawings for in-situ concrete sulphate classification.

| Table 1: Manhole cover frame depths - Sewers for Scotland 4th Edition |  |                     |
|---|--|---------------------|
| NRSWA Road Category   | Description                                    | Min frame depth (X) |
| I   | Trunk roads and dual carriageways              | 150mm               |
| II  | All other A roads                              | 150mm               |
| III   | Bus services                                   | 150mm               |
| IV  | All other roads except residential cul-de-sacs | 150mm               |
|   | Residential cul-de-sacs                        | 100mm               |

P01 Initial Issue 28.07.20 GS CC  
REV AMENDMENTS DATE BY CHK

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STATUS: **STAGE 3**

CONTRACT No: 181065 AS NOTED @ A1

EDMISTON HOUSE

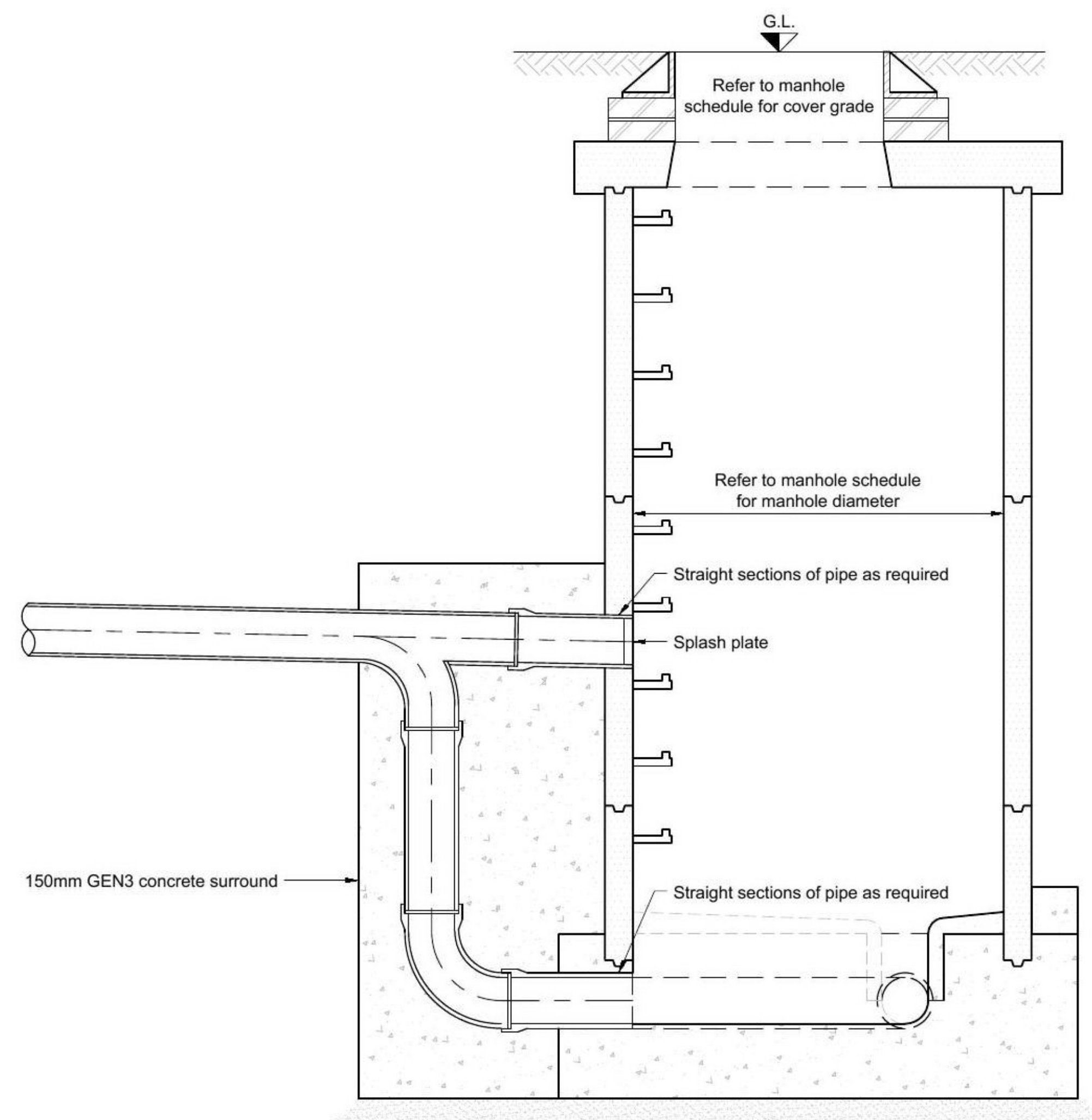
RANGERS FOOTBALL CLUB

DRAINAGE DETAILS

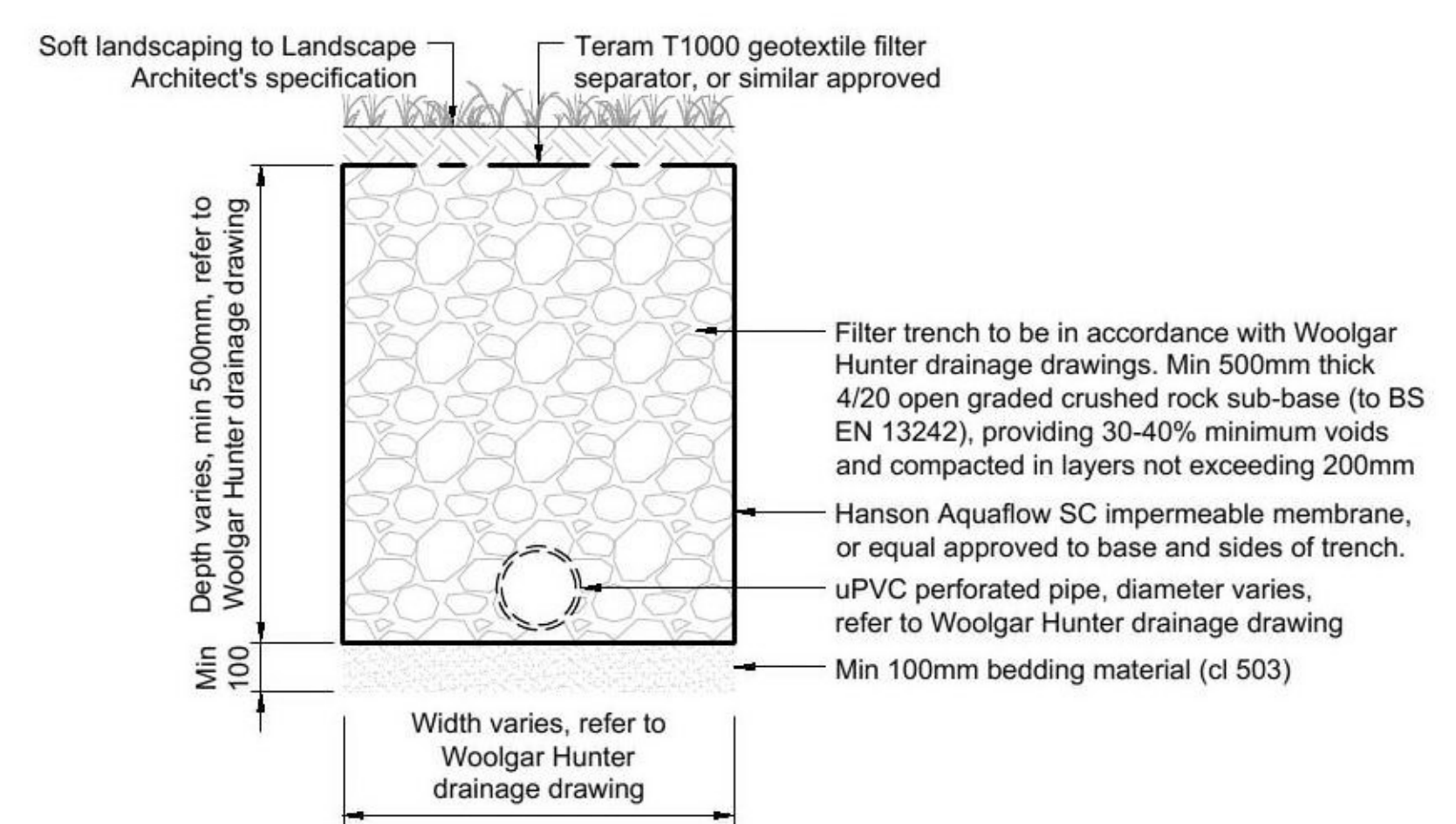
**Woolgar Hunter**  
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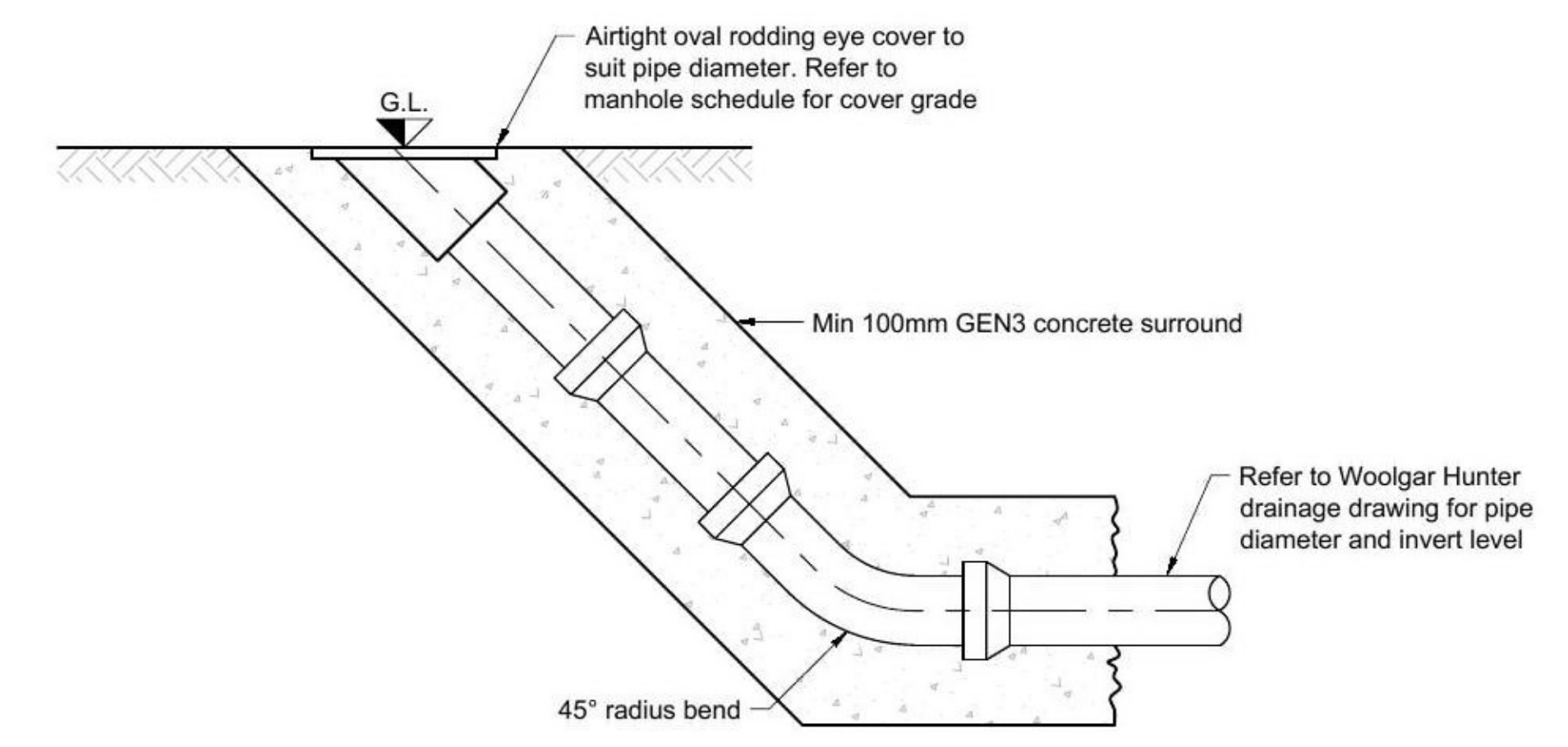




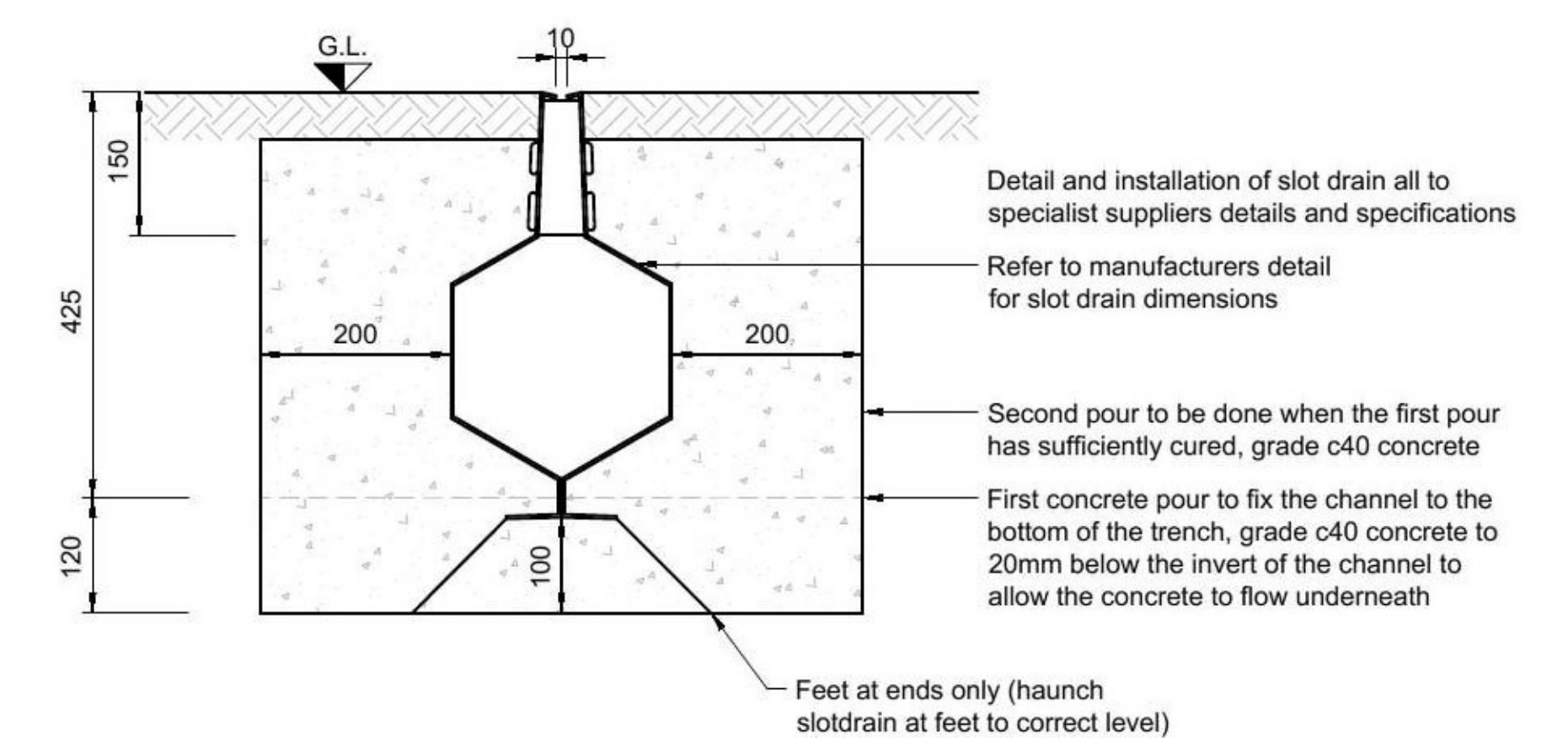
09 | TYPICAL BACKDROP MANHOLE DETAIL  
SCALE: 1:20



10 | PERMEABLE SOFT LANDSCAPING FILTER TRENCH DETAIL  
SCALE: 1:20



11 | RODDING EYE DETAIL  
SCALE: 1:20



12 | FULL SLOT DRAIN DETAIL  
SCALE: 1:10

- Notes**
- All Woolgar Hunter drawings are to be read in conjunction with the relevant Woolgar Hunter specification and all relevant Architects and Service Engineers drawings and specifications.
  - All dimensions are in millimetres unless stated otherwise. All levels are in metres and relate to ordnance datum.
  - Do not scale from any drawing. Work to figured dimensions only. Any discrepancies in dimensions are to be referred to the Designer before work is put to hand.
- Manhole notes**
- All works, unless noted otherwise, are to be carried out in accordance with Sewers for Scotland (current edition) and to the approval of the local authority.
  - All dimensions on this drawing are given in millimetres and all levels are given in meters.
  - Manhole covers are to be:  
**Within trafficked areas:**  
Saint-Gobain, Inter-A32 D400-n, heavy duty, double triangular, ductile iron to BS EN 124, 675x675 clear opening, non-rock, or equal approved.  
**Within pedestrians areas only:**  
Saint-Gobain, Trojan medium duty B125, single piece, ductile iron to BS EN 124, 675x675 clear opening, screw down cover or equal approved.  
**Within building footprint:**  
Doubled sealed. Refer to manhole schedule for grade.
  - All manhole & access covers in open spaces to be ventilated. Refer to manhole schedule for cover grade and location.
  - First flexible joints in pipes adjacent to a manhole shall be a maximum of 600mm from inside face of manhole, connecting to rocker pipe. Refer to Sewers for Scotland (current edition) for rocker pipe length.
  - Manhole chamber rings shall be precast units to BS:8911; part 200 (cl-4.2.28).
  - Manhole chamber rings to be bedded with mortar, proprietary bitumen or resin mastic sealant, or equal approved material. Bedding to be applied in accordance with the manufacturer's instructions.
  - Bottom chamber ring bearing on base slab to have minimum 75mm embedment.
  - Manhole access hole and step rungs positions to be located to give greatest free areas of benching immediately below.
  - Double step rungs to protrude into 675mm square access opening shaft cover slab.
  - Double step rungs in accordance with BS EN 13101.
  - Top step rung to be located not less than 700mm from the finished manhole cover level.
  - Concrete base slab to be scrubbed before placing benching.
  - Where outlet pipe diameter is greater than inlet, pipe soffits to be the same level unless noted otherwise. A minimum fall of 50mm should be achieved across the manhole in the direction of flow.
  - Granolithic concrete topping to be brought up to a dense smooth face neatly shaped & finished to all branch connections (minimum thickness 50mm).
  - Benching to be trowel smooth and sloped towards channel at between 1:10 & 1:30.
  - Self-cleaning toe holes to be provided where channels exceed 600mm wide.
  - Branch bends and benching to be curved in the direction of flow and formed from granolithic concrete, high strength concrete topping or with grade c20 concrete trowelled smooth monolithically with the base slab.
  - Manholes with outgoing pipes greater than 450mm diameter shall be fitted with guard bars, safety chains or other safety devices.
  - All precast concrete parts (i.e. Pipes, manhole rings etc.) are to be design sulphate class ds-2 and chemical design dc-3, in accordance with BRE special digest 1 and BS:5911.
  - Refer to site investigation report or structural foundation drawings for in-situ concrete sulphate classification.

Table 1: Manhole cover frame depths - Sewers for Scotland 4th Edition

| NRSWA Road Category | Description                                    | Min frame depth (X) |
|---------------------|--|---------------------|
| I                   | Trunk roads and dual carriageways              | 150mm               |
| II                  | All other A roads                              | 150mm               |
| III                 | Bus services                                   | 150mm               |
| IV                  | All other roads except residential cul-de-sacs | 150mm               |
|                     | Residential cul-de-sacs                        | 100mm               |

|     |               |          |    |     |
|-----|---------------|----------|----|-----|
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| REV | AMENDMENTS    | DATE     | BY | CHK |

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STATUS:

**STAGE 3**

CONTRACT No: 181065 | SCALE: AS NOTED @ A1

EDMISTON HOUSE

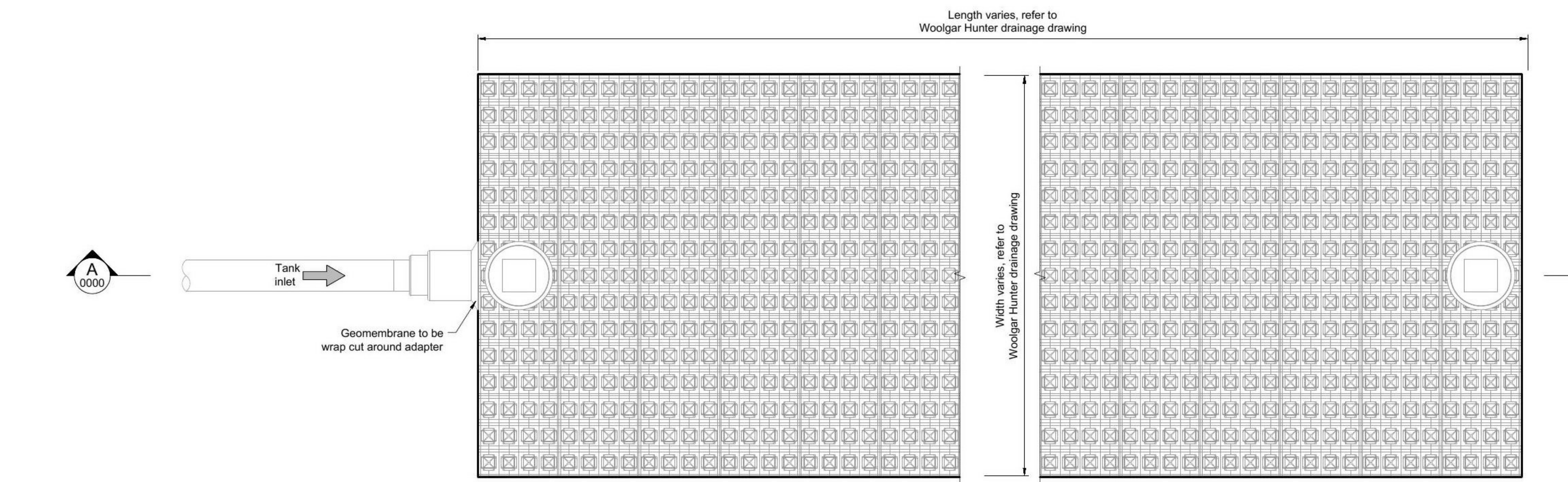
RANGERS FOOTBALL CLUB

DRAINAGE DETAILS SHEET 2

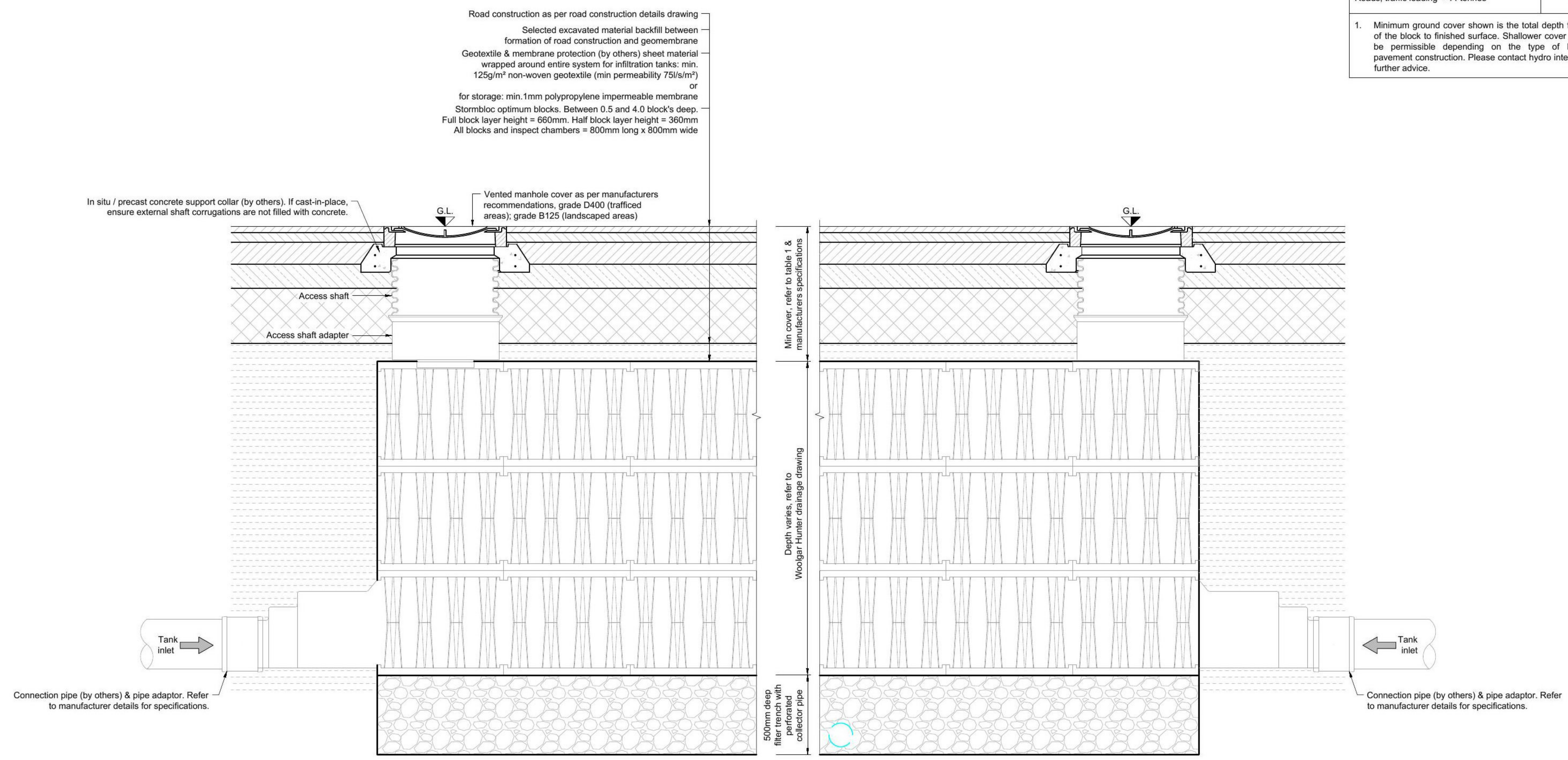
**Woolgar Hunter**  
engineers

|             |                              |      |     |
|-------------|------------------------------|------|-----|
| DRAWING No: | EDMIN-WHL-XX-XX-DR-C-52-9451 | REV: | P01 |
|-------------|------------------------------|------|-----|





**01** PLAN OF TYPICAL STORMBLOC OPTIMUM ATTENUATION TANK  
SCALE: 1:20



**01** SECTION A TYPICAL STORMBLOC OPTIMUM ATTENUATION TANK  
SCALE: 1:20

**Table 1: minimum cover depths <sup>(1)</sup> to the top of hydro international stormbloc optimum attenuation**

| Location                                     | Minimum cover depth (m) |
|--|-------------------------|
| Landscaped areas (non-trafficked)            | 0.4m                    |
| Car parks, vehicle mass ≤ 2500 kg            | 0.6m                    |
| Car parks, occasional vehicle mass > 2500 kg | 0.8m                    |
| Roads, traffic loading < 44 tonnes           | 0.8m                    |

1. Minimum ground cover shown is the total depth from the top of the block to finished surface. Shallower cover depths may be permissible depending on the type of backfill and pavement construction. Please contact hydro international for further advice.

- Notes**
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  - All dimensions are in millimetres unless stated otherwise. All levels are in metres and relate to ordnance datum.
  - Do not scale from any drawing. Work to figured dimensions only. Any discrepancies in dimensions are to be referred to the Designer before work is put to hand.
  - Detail and installation of attenuation tank all to specialist suppliers details and specifications.
- Manhole notes**
- All works, unless noted otherwise, are to be carried out in accordance with Sewers for Scotland (current edition) and to the approval of the local authority.
  - All dimensions on this drawing are given in millimetres and all levels are given in meters.
  - Manhole covers are to be:  
**Within trafficked areas:**  
Saint-Gobain, Inter-AX2 D400-n, heavy duty, double triangular, ductile iron to BS EN 124, 675x675 clear opening, non-rock, or equal approved.  
**Within pedestrians areas only:**  
Saint-Gobain, Trojan medium duty B125, single piece, ductile iron to BS EN 124, 675x675 clear opening, screw down cover or equal approved.  
**Within building footprint:**  
Doubled sealed. Refer to manhole schedule for grade.
  - All manhole & access covers in open spaces to be ventilated. Refer to manhole schedule for cover grade and location.
  - First flexible joints in pipes adjacent to a manhole shall be a maximum of 600mm from inside face of manhole, connecting to rocker pipe. Refer to Sewers for Scotland (current edition) for rocker pipe length.
  - Manhole chamber rings shall be precast units to BS-8911; part 200 (cl.4.2.28).
  - Manhole chamber rings to be bedded with mortar, proprietary blumen or resin mastic sealant, or equal approved material. Bedding to be applied in accordance with the manufacturer's instructions.
  - Bottom chamber ring bearing on base slab to have minimum 75mm embedment.
  - Manhole access hole and step rungs positions to be located to give greatest free areas of benching immediately below.
  - Double step rungs to protrude into 675mm square access opening shaft cover slab.
  - Double step rungs in accordance with BS EN 13101.
  - Top step rung to be located not less than 700mm from the finished manhole cover level.
  - Concrete base slab to be scabbled before placing benching.
  - Where outlet pipe diameter is greater than inlet, pipe soffits to be the same level unless noted otherwise. A minimum fall of 50mm should be achieved across the manhole in the direction of flow.
  - Granolithic concrete topping to be brought up to a dense smooth face neatly shaped & finished to all branch connections (minimum thickness 50mm).
  - Benching to be trowel smooth and sloped towards channel at between 1:10 & 1:30.
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  - Branch bends and benching to be curved in the direction of flow and formed from granolithic concrete, high strength concrete topping or with grade c20 concrete towelled smooth monolithically with the base slab.
  - Manholes with outgoing pipes greater than 450mm diameter shall be fitted with guard bars, safety chains or other safety devices.
  - All precast concrete parts (i.e. Pipes, manhole rings etc.) are to be design sulphate class ds-2 and chemical design dc-3, in accordance with bre special digest 1 and BS-5911.
  - Refer to site investigation report or structural foundation drawings for in-situ concrete sulphate classification.

|                   |          |    |     |
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**STAGE 3**

CONTRACT No: 181065 | SCALE: AS NOTED @ A1

EDMISTON HOUSE

RANGERS FOOTBALL CLUB

DRAINAGE DETAILS SHEET 3  
CELLULAR STORAGE





This drawing is based on Architect site layout:

Architect: KEPPIE DESIGN  
 Drawing Number: KEP-XX-00-DR-A-7060-0001  
 Revision: 6 Date: 27.05.20

- Notes**
1. All Woolgar Hunter drawings are to be read in conjunction with the relevant Woolgar Hunter specification and all relevant Architects and Service Engineers drawings and specifications.
  2. All dimensions are in millimetres unless stated otherwise. All levels are in metres and relate to ordnance datum.
  3. Do not scale from any drawing. Work to figured dimensions only. Any discrepancies in dimensions are to be referred to the Designer before work is put to hand.

**Legend**

← Direction of overland flow

|                   |          |    |     |
|-------------------|----------|----|-----|
| P01 Initial issue | 07.08.20 | CC | CC  |
| REV AMENDMENTS    | DATE     | BY | CHK |

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STATUS: **STAGE 3**

CONTRACT No: 181065 SCALE: 1/500 @ A1

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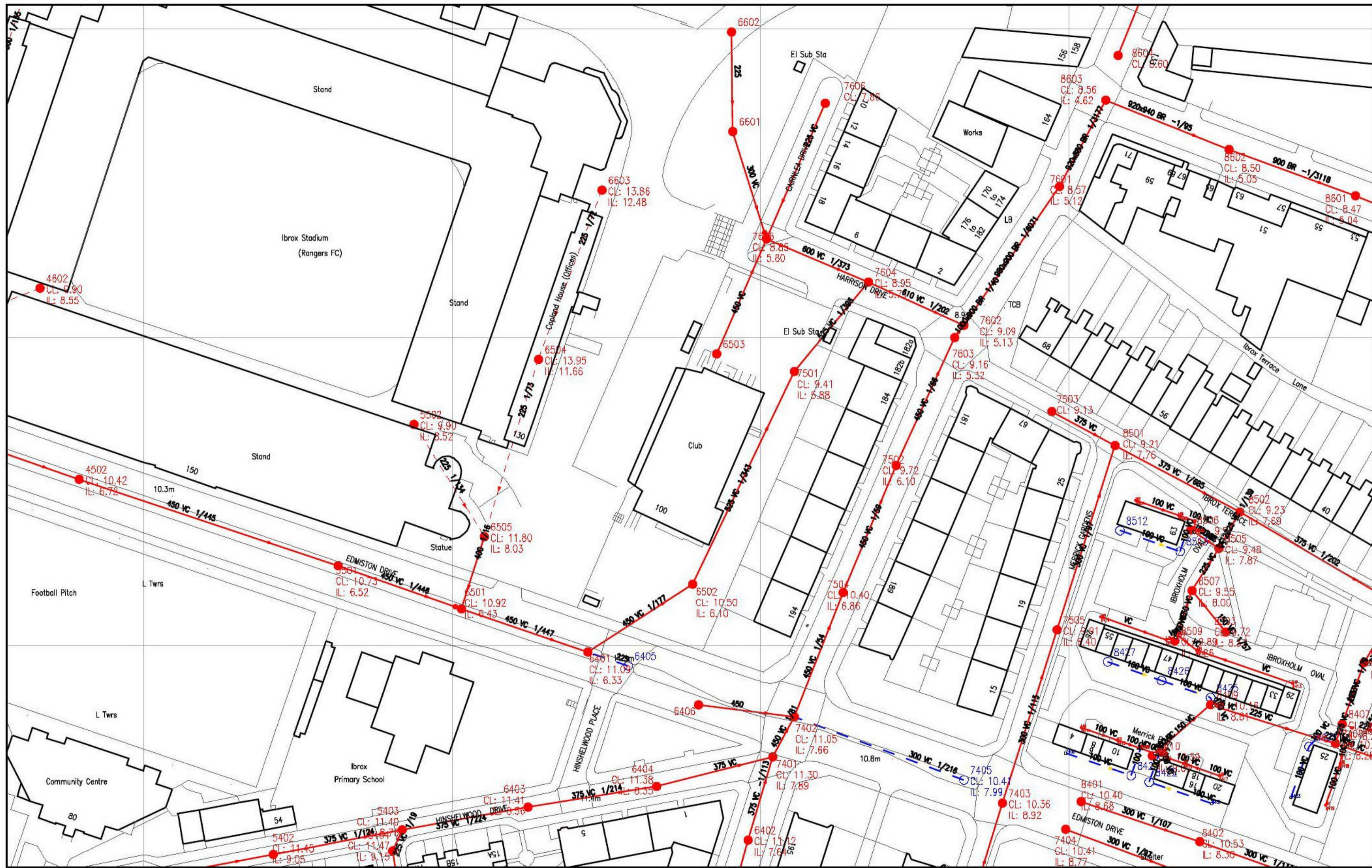
RANGERS FOOTBALL CLUB

PROPOSED OVERLAND FLOW ROUTE

**WoolgarHunter**  
engineers

DRAWING No: EDMIN-WHL-XX-XX-DR-C-90-9600 REV: P01





The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true positions. For further details contact the appropriate District Office.

Date Plotted: 02/06/2020

### Edmiston House Drainage Asset Plan



Scale: 1:1250

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# Appendix B Design Calculations









### Surface Water Discharge

#### Pre-Development:

The surface water discharges to a Scotts Water's combined sewer as shown on the attached asset plan.

For small hardstanding areas less than 4000m<sup>2</sup>, using the simple rational method, rainfall intensity can be taken as 0.014 l/s/m<sup>2</sup> (50 mm/hr).

As the site is fully developed with no soft landscaping areas, all rainfall on the site will be discharged into the existing combined system.

Peak Flow Rate = 0.014 l/s/m<sup>2</sup> x 3919m<sup>2</sup> = 54.9 l/s

#### Post-Development:

We would typically aim to reduce the discharge rate to the equivalent of greenfield runoff, however as this would result in an orifice size which would be prone to blockage we are proposing to restrict the flow rate to 3.0 l/s, which should result in an orifice size of circa 75mm. This would provide significant betterment to the existing situation.

### Site Information

Overall Site Area = 3,046m<sup>2</sup> (0.305 ha)

Existing Hardstanding Area = 3,919m<sup>2</sup> (0.392 ha)

Proposed hardstanding Area = 3,046m<sup>2</sup> (0.305 ha)





|  |   |   |
|--|---|---|
| Woolgar Hunter Ltd                                       |   | Page 1  |
| 226 West George Street<br>Glasgow<br>G2 2PQ              | Edmiston House<br>Rangers Football Club |  |
| Date 04/08/2020 11:13<br>File Surface Water Network V... | Designed by Craig Colvin<br>Checked by  |   |
| Micro Drainage   |   | Network 2019.1  |

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm







Pipe Sizes STANDARD Manhole Sizes STANDARD

|   |        |
|---|--------|
| FEH Rainfall Model                            |        |
| Return Period (years)                         | 2      |
| FEH Rainfall Version                          | 2013   |
| Site Location GB 255672 664552 NS 55672 64552 |        |
| Data Type                                     | Point  |
| Maximum Rainfall (mm/hr)                      | 50     |
| Maximum Time of Concentration (mins)          | 30     |
| Foul Sewage (l/s/ha)                          | 0.000  |
| Volumetric Runoff Coeff.                      | 0.750  |
| PIMP (%)                                      | 100    |
| Add Flow / Climate Change (%)                 | 10     |
| Minimum Backdrop Height (m)                   | 0.000  |
| Maximum Backdrop Height (m)                   | 20.000 |
| Min Design Depth for Optimisation (m)         | 1.200  |
| Min Vel for Auto Design only (m/s)            | 1.00   |
| Min Slope for Optimisation (1:X)              | 500    |

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

| 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 | 40.704     | 0.407    | 100.0       | 0.074       | 5.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S1.001 | 32.669     | 0.327    | 100.0       | 0.046       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S1.002 | 2.200      | 0.000    | 0.0         | 0.000       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S1.003 | 6.746      | 0.067    | 100.0       | 0.000       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S2.000 | 12.626     | 0.126    | 100.0       | 0.032       | 5.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S2.001 | 41.037     | 0.274    | 149.8       | 0.035       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |











Network Results Table

| PN     | Rain (mm/hr) | T.C. (mins) | US/IL E (m) | 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 | 49.63        | 5.68        | 9.510       | 0.074       | 0.0               | 0.0        | 1.0            | 1.00      | 17.8      | 10.9       |
| S1.001 | 47.71        | 6.22        | 9.103       | 0.120       | 0.0               | 0.0        | 1.6            | 1.00      | 17.8      | 17.1       |
| S1.002 | 46.41        | 6.61        | 8.776       | 0.120       | 0.0               | 0.0        | 1.6            | 0.09      | 1.6«      | 17.1       |
| S1.003 | 46.06        | 6.72        | 8.626       | 0.120       | 0.0               | 0.0        | 1.6            | 1.00      | 17.8      | 17.1       |
| S2.000 | 50.00        | 5.21        | 9.100       | 0.032       | 0.0               | 0.0        | 0.4            | 1.00      | 17.8      | 4.8        |
| S2.001 | 48.30        | 6.04        | 8.974       | 0.067       | 0.0               | 0.0        | 0.9            | 0.82      | 14.5      | 9.7        |



|  |   |   |
|--|---|---|
| Woolgar Hunter Ltd                                       |   | Page 2  |
| 226 West George Street<br>Glasgow<br>G2 2PQ              | Edmiston House<br>Rangers Football Club |  |
| Date 04/08/2020 11:13<br>File Surface Water Network V... | Designed by Craig Colvin<br>Checked by  |   |
| Micro Drainage   |   | Network 2019.1  |

Network Design Table for Storm

| 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   |
|--------|------------|----------|-------------|-------------|-------------|-----------------|--------|----------|----------|--------------|---|
| S2.002 | 3.395      | 0.141    | 24.1        | 0.000       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |    |
| S1.004 | 30.777     | 0.181    | 170.0       | 0.034       | 0.00        | 0.0             | 0.600  | o        | 225      | Pipe/Conduit |    |
| S1.005 | 6.594      | 0.000    | 0.0         | 0.000       | 0.00        | 0.0             | 0.600  | o        | 225      | Pipe/Conduit |    |
| S3.000 | 18.183     | 0.182    | 99.9        | 0.008       | 5.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S3.001 | 3.543      | 0.035    | 101.2       | 0.000       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S3.002 | 38.120     | 0.381    | 100.1       | 0.036       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S3.003 | 7.660      | 1.100    | 7.0         | 0.022       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S3.004 | 7.153      | 0.000    | 0.0         | 0.000       | 0.00        | 0.0             | 0.600  | o        | 150      | Pipe/Conduit |  |
| S1.006 | 6.400      | 0.038    | 168.4       | 0.000       | 0.00        | 0.0             | 0.600  | o        | 225      | Pipe/Conduit |  |
| S1.007 | 4.109      | 0.574    | 7.2         | 0.000       | 0.00        | 0.0             | 0.600  | o        | 225      | Pipe/Conduit |  |

Network Results Table

| PN     | Rain (mm/hr) | T.C. (mins) | US/IL (m) | E I.Area (ha) | E Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|--------|--------------|-------------|-----------|---------------|-------------------|------------|----------------|-----------|-----------|------------|
| S2.002 | 48.21        | 6.07        | 8.700     | 0.067         | 0.0               | 0.0        | 0.9            | 2.06      | 36.4      | 9.7        |
| S1.004 | 44.52        | 7.24        | 8.484     | 0.221         | 0.0               | 0.0        | 2.7            | 1.00      | 39.8      | 29.4       |
| S1.005 | 42.11        | 8.13        | 8.302     | 0.221         | 0.0               | 0.0        | 2.7            | 0.12      | 4.9«      | 29.4       |
| S3.000 | 50.00        | 5.30        | 10.000    | 0.008         | 0.0               | 0.0        | 0.1            | 1.01      | 17.8      | 1.2        |
| S3.001 | 50.00        | 5.36        | 9.818     | 0.008         | 0.0               | 0.0        | 0.1            | 1.00      | 17.6      | 1.2        |
| S3.002 | 48.49        | 5.99        | 9.783     | 0.044         | 0.0               | 0.0        | 0.6            | 1.00      | 17.8      | 6.4        |
| S3.003 | 48.37        | 6.03        | 9.402     | 0.066         | 0.0               | 0.0        | 0.9            | 3.84      | 67.9      | 9.6        |
| S3.004 | 44.31        | 7.31        | 8.302     | 0.066         | 0.0               | 0.0        | 0.9            | 0.09      | 1.6«      | 9.6        |
| S1.006 | 41.85        | 8.24        | 7.802     | 0.288         | 0.0               | 0.0        | 3.3            | 1.00      | 39.9      | 35.9       |
| S1.007 | 41.81        | 8.25        | 6.764     | 0.288         | 0.0               | 0.0        | 3.3            | 4.92      | 195.7     | 35.9       |

Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---------------------|--------------|--------------|--------------|------------------|----------|--------|
| S1.007              | SCW03-MH     | 11.500       | 6.190        | 0.000            | 1800     | 0      |



|  |   |   |
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| Micro Drainage   | Network 2019.1                          |   |

Simulation Criteria for Storm

|                                 |       |  |       |
|---------------------------------|-------|--|-------|
| Volumetric Runoff Coeff         | 0.750 | Additional Flow - % of Total Flow          | 0.000 |
| Areal Reduction Factor          | 1.000 | MADD Factor * 10m <sup>3</sup> /ha Storage | 5.000 |
| 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 | 3 |
| Number of Online Controls   | 1 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls  | 0 | Number of Real Time Controls | 0 |

Synthetic Rainfall Details

|                       |                                 |
|-----------------------|---------------------------------|
| Rainfall Model        | FEH                             |
| Return Period (years) | 2                               |
| FEH Rainfall Version  | 2013                            |
| Site Location         | GB 255672 664552 NS 55672 64552 |
| Data Type             | Point                           |
| Summer Storms         | Yes                             |
| Winter Storms         | No                              |
| Cv (Summer)           | 0.750                           |
| Cv (Winter)           | 0.840                           |
| Storm Duration (mins) | 30                              |



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| Micro Drainage   | Network 2019.1                          |   |

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SSW14-HB, DS/PN: S1.006, Volume (m³): 6.1

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0075-3000-1500-3000 |
| Design Head (m)                   | 1.500                      |
| Design Flow (l/s)                 | 3.0                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 75                         |
| Invert Level (m)                  | 7.802                      |
| Minimum Outlet Pipe Diameter (mm) | 100                        |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 1.500    | 3.0        |
| Flush-Flo™                | 0.329    | 2.6        |
| Kick-Flo®                 | 0.671    | 2.1        |
| Mean Flow over Head Range | -        | 2.4        |

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

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 2.1        | 1.200     | 2.7        | 3.000     | 4.1        | 7.000     | 6.1        |
| 0.200     | 2.5        | 1.400     | 2.9        | 3.500     | 4.4        | 7.500     | 6.3        |
| 0.300     | 2.6        | 1.600     | 3.1        | 4.000     | 4.7        | 8.000     | 6.5        |
| 0.400     | 2.6        | 1.800     | 3.3        | 4.500     | 5.0        | 8.500     | 6.7        |
| 0.500     | 2.5        | 2.000     | 3.4        | 5.000     | 5.2        | 9.000     | 6.9        |
| 0.600     | 2.3        | 2.200     | 3.6        | 5.500     | 5.5        | 9.500     | 7.1        |
| 0.800     | 2.2        | 2.400     | 3.7        | 6.000     | 5.7        |           |            |
| 1.000     | 2.5        | 2.600     | 3.9        | 6.500     | 5.9        |           |            |



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| Micro Drainage   | Network 2019.1                          |   |

Storage Structures for Storm

Cellular Storage Manhole: SRWH, DS/PN: S1.003

Invert Level (m) 8.626 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 1.00  
 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------------------------|-----------|------------------------|-----------------------------|
| 0.000     | 55.0                   | 55.0                        | 1.001     | 0.0                    | 84.7                        |
| 1.000     | 55.0                   | 84.7                        |           |                        |                             |

Infiltration Trench Manhole: SSW10-IC, DS/PN: S3.001

Infiltration Coefficient Base (m/hr) 0.00000 Trench Width (m) 0.6  
 Infiltration Coefficient Side (m/hr) 0.00000 Trench Length (m) 18.0  
 Safety Factor 2.0 Slope (1:X) 100.0  
 Porosity 0.30 Cap Volume Depth (m) 1.000  
 Invert Level (m) 9.818 Cap Infiltration Depth (m) 0.000

Complex Manhole: SSW14-HB, DS/PN: S1.006

Infiltration Blanket

Infiltration Coefficient Base (m/hr) 0.00000 Diameter/Width (m) 3.2  
 Safety Factor 2.0 Length (m) 9.6  
 Porosity 0.30 Cap Volume Depth (m) 0.500  
 Invert Level (m) 7.802

Cellular Storage

Invert Level (m) 8.302 Safety Factor 2.0  
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95  
 Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------------------------|-----------|------------------------|-----------------------------|
| 0.000     | 30.7                   | 30.7                        | 1.981     | 0.0                    | 74.6                        |
| 1.980     | 30.7                   | 74.6                        |           |                        |                             |



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| Micro Drainage   | Network 2019.1                          |   |

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

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 5.000  
Hot Start Level (mm) 0      Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0      Number of Storage Structures 3  
Number of Online Controls 1      Number of Time/Area Diagrams 0  
Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 255672 664552 NS 55672 64552  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0  
Analysis Timestep 2.5 Second Increment (Extended)  
DTS Status ON  
DVD Status OFF  
Inertia Status OFF

Profile(s) Summer and Winter  
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720,  
960, 1440  
Return Period(s) (years) 2, 30, 200  
Climate Change (%) 30, 30, 30

| PN     | US/MH Name | Storm      | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. |
|--------|------------|------------|---------------|----------------|---------------------|-----------------|--------------------|---------------|
| S1.000 | SSW01-MH   | 30 Winter  | 30            | +30%           | 30/30 Summer        | 200/30 Summer   |                    |               |
| S1.001 | SSW02-MH   | 30 Winter  | 30            | +30%           | 2/30 Summer         |                 |                    |               |
| S1.002 | SSW03-MH   | 180 Winter | 30            | +30%           | 2/30 Summer         |                 |                    |               |
| S1.003 | SRWH       | 180 Winter | 30            | +30%           | 2/60 Winter         |                 |                    |               |
| S2.000 | SSW04-MH   | 180 Winter | 30            | +30%           | 30/30 Summer        | 200/30 Summer   |                    |               |
| S2.001 | SSW05-MH   | 180 Winter | 30            | +30%           | 30/30 Summer        |                 |                    |               |
| S2.002 | SSW06-MH   | 180 Winter | 30            | +30%           | 2/120 Winter        |                 |                    |               |
| S1.004 | SSW07-MH   | 180 Winter | 30            | +30%           | 2/30 Winter         |                 |                    |               |
| S1.005 | SSW08-SI   | 180 Winter | 30            | +30%           | 2/30 Summer         |                 |                    |               |
| S3.000 | SSW09-IC   | 30 Summer  | 30            | +30%           | 200/30 Summer       |                 |                    |               |
| S3.001 | SSW10-IC   | 30 Summer  | 30            | +30%           | 200/30 Summer       |                 |                    |               |
| S3.002 | SSW11-IC   | 30 Summer  | 30            | +30%           | 30/30 Summer        |                 |                    |               |
| S3.003 | SSW12-MH   | 180 Winter | 30            | +30%           | 30/180 Winter       |                 |                    |               |
| S3.004 | SSW13-SI   | 180 Winter | 30            | +30%           | 2/30 Summer         |                 |                    |               |
| S1.006 | SSW14-HB   | 180 Winter | 30            | +30%           | 2/30 Summer         |                 |                    |               |



|  |   |   |
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| Micro Drainage   | Network 2019.1                          |   |

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

| PN     | US/MH Name | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m <sup>3</sup> ) | Flow / Cap. (l/s) | Overflow (l/s) | Pipe Flow (l/s) | Status     | Level Exceeded |
|--------|------------|-----------------|----------------------|----------------------------------|-------------------|----------------|-----------------|------------|----------------|
| S1.000 | SSW01-MH   | 10.611          | 0.951                | 0.000                            | 1.09              |                | 18.7            | FLOOD RISK | 4              |
| S1.001 | SSW02-MH   | 10.123          | 0.870                | 0.000                            | 1.73              |                | 29.6            | SURCHARGED |                |
| S1.002 | SSW03-MH   | 9.575           | 0.649                | 0.000                            | 1.14              |                | 12.4            | SURCHARGED |                |
| S1.003 | SRWH       | 9.573           | 0.797                | 0.000                            | 0.41              |                | 6.1             | SURCHARGED |                |
| S2.000 | SSW04-MH   | 9.579           | 0.329                | 0.000                            | 0.22              |                | 3.6             | SURCHARGED | 14             |
| S2.001 | SSW05-MH   | 9.578           | 0.454                | 0.000                            | 0.51              |                | 7.2             | SURCHARGED |                |
| S2.002 | SSW06-MH   | 9.571           | 0.721                | 0.000                            | 0.26              |                | 6.1             | SURCHARGED |                |
| S1.004 | SSW07-MH   | 9.570           | 0.861                | 0.000                            | 0.31              |                | 11.7            | SURCHARGED |                |
| S1.005 | SSW08-SI   | 9.564           | 1.037                | 0.000                            | 0.52              |                | 11.0            | SURCHARGED |                |
| S3.000 | SSW09-IC   | 10.046          | -0.104               | 0.000                            | 0.20              |                | 3.4             | OK         |                |
| S3.001 | SSW10-IC   | 9.947           | -0.021               | 0.000                            | 0.41              |                | 4.8             | OK         |                |
| S3.002 | SSW11-IC   | 9.943           | 0.010                | 0.000                            | 1.01              |                | 17.4            | SURCHARGED |                |
| S3.003 | SSW12-MH   | 9.566           | 0.014                | 0.000                            | 0.13              |                | 7.5             | SURCHARGED |                |
| S3.004 | SSW13-SI   | 9.563           | 1.111                | 0.000                            | 1.00              |                | 7.3             | SURCHARGED |                |
| S1.006 | SSW14-HB   | 9.561           | 1.534                | 0.000                            | 0.11              |                | 3.2             | SURCHARGED |                |



|  |   |   |
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| Micro Drainage   | Network 2019.1                          |   |

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

| PN     | US/MH Name | Storm      | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|--------|------------|------------|---------------|----------------|---------------------|-----------------|--------------------|---------------|-----------------|
| S1.007 | SCW06-MH   | 180 Winter | 30            | +30%           |                     |                 |                    |               | 6.790           |

| PN     | US/MH Name | Surcharged Depth (m) | Flooded Volume (m <sup>3</sup> ) | Flow / Cap. (l/s) | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|--------|------------|----------------------|----------------------------------|-------------------|----------------|-----------------|--------|----------------|
| S1.007 | SCW06-MH   | -0.199               | 0.000                            | 0.03              |                | 3.2             | OK     |                |



Recommended

## Appendix C SuDS Recommended Maintenance





Recommended Maintenance Requirements for Filter Drains



| Maintenance Schedule   | Required Action   | Frequency                  |
|------------------------|---|----------------------------|
| Regular Maintenance    | Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices.                              | Monthly or as required     |
|                        | Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage.              | Monthly                    |
|                        | Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies.            | Six monthly                |
|                        | Remove sediment from pre-treatment devices.   | Six monthly or as required |
| Occasional Maintenance | Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. N.J.G. 2007 or BS 3998:2010) | As required                |
|                        | At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium.                         | Five yearly or as required |
|                        | Clear perforated pipework of blockages.   | As required                |

Recommended Maintenance Requirements for Cellular Storage



| Maintenance Schedule | Required Action  | Frequency                             |
|----------------------|--|---------------------------------------|
| Monitoring           | Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.  | Annually.                             |
|                      | Survey inside of tank for sediment build-up and remove if necessary.   | Every 3 Years or as required          |
| Regular Maintenance  | Inspect and identify any areas that are not operating correctly. If Required, take remedial action.  | Monthly for 3 months, then annually.  |
|                      | Remove debris from the catchment surface (where it may cause risks to performance)   | Monthly.                              |
|                      | For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter, remove and replace surface infiltration medium as necessary. | Monthly (at start, then as required). |
|                      | Remove sediment from pre-treatment structures and/or internal forebays.  | Annually, or as required              |
| Remedial Actions     | Repair/rehabilitate inlets, outlet, overflows and vents.   | As required.                          |



# Appendix D Certification





## 7. Appendix C

### Assessment Compliance Certificate

I certify that all reasonable skill, care and attention to be expected of a qualified and experienced professional in this field has been exercised in carrying out the attached ~~Flood Risk Assessment~~ / Drainage Impact Assessment\* (delete if applicable). The report/s have been prepared for the below named development in accordance with the reporting requirements issued by Glasgow City Council.

|   |   |
|---|---|
| Name of Development   | Edmiston House  |
| Address of Development  | 150 Edmiston Drive  |
|   | Glasgow   |
|   | G51 2XD   |
| Name of Developer   | Rangers Football Club   |
| Planning Application No.  |   |
| Name and Address of Organisation preparing this Assessment                    | Woolgar Hunter  |
|   | 226 West George St, Glasgow   |
| Signed  |  |
| Name  | Craig Colvin  |
| Position Held   | Project Director  |
| Engineering Qualification of person responsible for preparing this Assessment | Ceng MICE (1)   |
| Date  | 04.08.2020  |

Note: 1 – C.Eng from an appropriate Chartered Engineering Institution.



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